RAND AFRIKAANS UNIVERSITY

THE LEARNING STRATEGIES OF FIRST YEAR UNIVERSITY STUDENTS IN SOUTH AFRICA AND THE REPUBLIC OF CHINA - A COMPARATIVE STUDY

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ABSTRACT

The purpose of this study was to apply the "Learning and Study Strategies Inventory" (LASSI) on first year students in South Africa and Taiwan, Republic of China, in order to identify possible differences in their respective learning strategies. It was attempted to identify effective learning strategies for both groups. The sample consisted of 1489 first year students at the Rand Afrikaans University and 2053 first year students at the Chengchi University in Taiwan, the Republic of China.

The following statistical package programmes were used in the study:

** The BMDP3D and BMDP4M programmes for factor analysis to determine cross culture comparability.

** The Kuder-Richardson 20 formula in the NP50 programme for item analysis and the concomitant determination of involvement.

** Hotelling's T-square and Student's t-tests for independent groups of programmes with the view of identifying possible differences between the two experimental groups.

The statistical results showed that:

** The two experimental groups are comparable cross culturally;

** significant differences exist in respect of the learning strategies of the two student groups.

Distinction was made between the merits and problems regarding the learning strategies in the respective countries. The most common problems in the two groups are:

1. The learning content dealt with in class is regarded as worthless.
2. Students spend too much time with friends.
3. Students experience problems with identifying the central idea when reading.
4. When writing a test they often realize that in their studies they have placed the emphasis on the less important study content.

The following recommendations are made:

1. Students should receive instruction in study strategies at the beginning of their first year at university.
2. The personal problems of students should receive attention to ensure effective learning.
3. Educational or university authorities should ensure that the content of subjects remain relevant in practice.
4. Educational exchanges between teachers and students of the two countries could be beneficial to the learning and study skills of students in both countries.

OPSOMMING

Die doel van hierdie studie was om die "Learning and Study Strategies Inventory" (LASSI) toe te pas op eerstejaarstudente in Suid-Afrika en Taiwan, Republiek van China, ten einde moontlike verskille in hulle onderskeie leerstrategieë te identifiseer. Daar is gepoog om doeltreffende leerstrategieë te identifiseer vir albei groepe studente. Die steekproef het bestaan uit 1489 eerstejaarstudente verbonde aan die Randse Afrikaanse Universiteit in Suid-Afrika en 2053 eerstejaarstudente aan die Chengchi Universiteit in Taiwan, Republiek van China.

In die studie is gebruik gemaak van statistiese pakketprogramme wat onder andere die volgende ingesluit het:

** Die BMDP3D en BMDP4M-programme vir faktorontleding ten einde kruiskulturele vergelykbaarheid te bepaal.

** Die Kuder-Richardson 20 formule in die NP50-program vir die doeleindes van itemanalise en die gepaardgaande bepaling van betrokkenheid.

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Die statistiese resultate het aan die lig gebring dat:

** die twee steekproefgroepe kruiskultureel vergelykbaar is;

** daar betekenisvolle verskille tussen die ter sake twee studentegroepe se leerstrategieë bestaan.

Onderskeid is gemaak tussen die meriete en probleme ten opsigte van leerstrategieë van die stdudente van die twee lande. Die mees algemene probleme van die twee groepe is: (1) Die leerinhoud wat in die klas behandel word, word as waardeloos beskou. (2) Studente bestee te veel tyd saam met hul vriende. (3) Die studente ondervind probleme om die kernidees te identifiseer wanneer hulle lees. (4) Wanneer 'n toets geskryf word besef hulle dikwels dat hulle die klem tydens studie op minder belangrike leerinhoude geplaas het.

Die volgende aanbevelings word gemaak: (1) Die leerstrategieë moet aan die studente onderrig word aan die begin van hul eerstejaar by 'n universiteit. (2) Om effektiewe leer te verseker, moet studente se persoonlike probleme opgelos word. (3) Opvoedkundige- of universiteits-gesagsdraers moet let op die inhoude van vakke sodat dit relevant is in die praktyk. (4) Opvoedkundige uitruilgeleenthede tussen dosente en studente van die twee verskillende lande kan voordelig wees vir studente van albei lande se leer- en studievaardighede.

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CHAPTER 1

PROBLEM DESCRIPTION, AIM OF STUDY, AND METHOD OF RESEARCH

1.1 INTRODUCTION

Learning and learning strategies are very important to all human beings. Learning begins during infancy with the baby's acquisition of a few simple skills, such as holding his/her own bottle and recognizing his/her mother. During childhood and adolescence, a number of attitudes, values, and social interaction skills are acquired as well as competencies in various subject areas. In adulthood, the individual is expected to have mastered specific job tasks and other functional skills, for example: driving a car, balancing a checkbook, and getting along with others.

The human capacity for learning is an important characteristic that sets the human species apart from all others. It provides benefits for both the individual and society. For the individual in our culture, the capacity for continued learning contributes to the development of highly diverse life-styles. For society, learning plays a key role in transmitting the culture's accumulated knowledge to new generations. New discoveries and inventions that build on past developments are made possible (Bell-Gredler, 1986:1-2).

Edward L. Thorndike (1874-1948) said:

> Man's power to change himself, that is, to learn, is perhaps the most impressive thing about him (Thorndike, 1931:3).

According to Thorndike, most of the accomplishments of human civilization will disappear from the face of the earth soon, if they do not learn a half more than the previous civilization (Bell-Gredler, 1986:2). To learn efficiently, the learner must make use of effective learning strategies. Baker and Brown (<u>in</u> Bartlett & Knoblock, 1988:362) mention that students must be aware of their learning strategies to meet the demands of prescribed tasks. Once strategies are brought to the metacognitive level, university students are more likely to monitor, evaluate, and revise them according to task demands.

Weinstein (<u>in</u> McKeachie, 1988:3) states that individual differences in learning strategies are related to differences in achievement. Kulick and Schwalb (1983:397-409) add that effective learning strategies usually result in better learning. This is demonstrated by a number of studies in which students were taught to use more effective learning strategies with the result of improving their achievement. Due to the increased text related demands of university courses, students require updated learning strategies if they want to be successful learners. Fortunately, "learning strategies" can be described and taught to students (Weinstein and Mayer, 1986:325).

The first year is an important year for a university student. If he succeeds, he will have more confidence in himself to study. The lectures in the university are quite different from those in the secondary school. Class size also increases and individual attention no longer exists. Time management becomes his own responsibility and he often experiences problems planning his social, academic, sport, and free time. University education demands a more rapid imparting of knowledge compared to secondary school. There are lots of club activities, etc. to distract students. They can enjoy their life freely. For some students it is their first experience to live on their own outside their families.

First year university students are confronted with learning situations that are vastly different from previous settings. They probably had some type of instruction on study-skill during secondary school (<u>in</u> Simpson, 1984:137). These study skills are usually, however, not sufficient nor sophisticated enough to teach them how to become effective students at university level.

It is difficult for freshmen to adjust their study skills to the new requirements that differ from those in the secondary school. Van Dyk (1978:104-107) mentions that students often have problems in managing time for planning social, sport, personal relationships, and study. In his research on the study habits of first year students at University of Durban Westville, Behr (1981:14) found that areas of weakness could be detected in reading skills, note-taking, time-planning, preparation, and techniques for taking university examinations. Monteith (1988:23-24) indicates that many high-risk first year students are inadequately prepared for the required standards set at university. These students need remediation of their study strategies so that they will be in a position to achieve according to their potential ability. What is required in this remediation is the teaching of new learning strategies. This could result in effective learning and retention skills.

Sieborger (1982:27-28) considers possible academic problems, such as not knowing how to study classnotes, handouts and textbooks effectively as well as inadequate usage and knowledge of library facilities. An inability to summarize important points and an uncertainty as to how to approach tasks and tests are other problem areas.

Many university students lack mature learning strategies, which causes them to fail to survive beyond the first year of university. Many talented freshmen are underachievers; they never realize their academic potential and consequently fail. Simpson (1984:136-42) suggests three possible reasons why university students fail to use effective learning strategies. In the first place, many students have received insufficient instruction in strategies that are appropriate for university coursework. Secondly, students may be unable to monitor and revise their study strategies. In the third place, they may be familiar with appropriate learning strategies, but still neglect to apply them.

According to Simpson's (1984:136) study, data suggested that university students: (a) had a restricted range of strategies, (b) could rarely explain why a strategy was important to their own learning process, (c) had one set of learning strategies for most learning tasks, regardless of the content area, and (d) had little idea how to know or check when they were ready for a test.

The reasons why students lack mature learning strategies are (Simpson, 1984:137):

(a) Students have not been taught the strategies.

A lack of systematic instruction is the most obvious reason why first year university students lack efficient independent learning strategies. Bartlett (1958) and Brown et al. (1982) (in Simpson 1984:137) state that it might be more accurate to suggest that university freshmen have not yet received enough direct instruction to enable them to replace the strategies learned in grade school with more mature and efficient strategies.

(b) Students cannot self-regulate the learning strategies.

Self-regulation of learning includes being able to plan activities prior to understanding a problem, to monitor and revise strategies of activities, and evaluate the strategies' outcome for effectiveness.

According to extensive research by Brown and her associates (in Simpson 1984:138) students are unable to regulate their own learning strategies because they are victims of blind training or instruction. Blind training occurs when instructors do not explain the when, where how, or why in employing a new strategy.

The students' lack of control over a strategy appears to be another well supported explanation of why so many university students are not yet effective and efficient independent learners.

(c) Students do not think to apply learning strategies.

Students often do not adopt appropriate learning strategies because they do not know how to apply a learned strategy to a new task. They lack this ability to apply because they have been trained a generic approach to study strategies. (Armbruster & Anderson, 1981:154-156).

In early school years, students were taught from basals, workbooks, or kits that contained abbreviated and decontextualized exercises that ignored the fact that each content area has its own type of criterial tasks aims, texts, and preferred learning strategies. Consequently, when students first enter college and confront textbooks from several different content areas, they either approach each reading assignment in the same manner or do not employ strategies at all.

1.2 PROBLEM DESCRIPTION

The education system of the Republic of China is different from South Africa. In Taiwan, there is a severe competition from the 9th grade of secondary school to enter an advanced school. In particular, the university entrance examination is very critical. According to the 1992 Educational Statistics of the Republic of China, complied by the R.O.C. Ministry of Education, only 40.09% (day session) and 12.76% (evening session) of the applicants can enter the university.

In South Africa, there is a high failure rate amongst first year students, as reported by the Committee of University Principles, in 1978 (Bubb, 1991:1-2). Also, in the United States four out of ten beginning freshmen fail to survive beyond the first year of university and only four of the remaining ten ever receive the bachelor's degree (Brown & Holtzman, 1972:25).

In a study of first year students at Rand Afrikaans University at the beginning of 1990, Van Tonder (1990:32-

37) found that 24.4% felt that they had inadequate reading skills; 37% indicated that they did not study according to the correct study methods; 20.1% signified that they had problems concentrating in class. And even though 76.1% said that they studied before tests, only 23.9% revised their work regularly after classes. These figures indicate that many students on entering university feel that they possess inadequate knowledge of learning strategies. What is of particular note is that 40.9% of the students studied by rote learning. These results signify a definite need for the teaching of effective learning strategies.

In Taiwan, the Republic of China, failure or drop-out at the university is not such a problematic issue. There is an already strict selecting-process in the junior high school. Only the best students can enter the university. However, one of the biggest problem is still the lacking of effective learning strategies by students.

Dunbar (1988:12) had a comment for Asian students generally:

> Learning is seen as possessing the ability to reproduce exactly what is taught in identical form. This "reproductive orientation" manifests in rote memorization of fact, formulae, rules, tracts, and schema. Unifying principles are usually overlooked, and emphasis on detail is encouraged. Learners are

conditioned to accept and respect what the teacher presents as correct. The focus is on acquiring propositional knowledge and demonstrating acquisition by outright recall.

Chinese students rely heavily on rote-learning and memorization, with the result that they have problems with creative and critical thinking as well as problem solving.

In the light of the above, it is very clear that the first year university students' problems conclusively are:

(1) A high failure rate due to the lack of effective learning strategies, and lack of taking responsibility for their own learning.

(2) A tendency to study by rote-learning and memorization, and to be weak in creative thinking and problem solving.

1.3 AIM OF STUDY

The aim of this study is:

To compare the learning strategies of first year South African university students to those of students from the Republic of China.

The Learning and Study Strategies Inventory (LASSI: Weintein) will be used for this purpose.

1.4 METHODS OF RESEARCH

Information for this research project will be obtained by ways of literature study and empirical statistical methods. The procedure in the application of these methods can briefly be summarized as follows:

(1) extensive inquiry into learning styles and learning strategies among university students.
(2) translating the LASSI into Chinese and vice versa.
(3) collecting 150 LASSI questionnaires from first year college students in Taiwan for a pilot study.
(4) selecting at random first year students from the Rand Afrikaans University and from Chengchi University and having them complete the questionnaires.
(5) analyzing obtained data by means of statistical techniques.

1.5 HYPOTHESES

In connection with the overall aim of this study, the two following hypotheses are posed:

1.5.1 Null Hypotheses

Ho : South African and Chinese students do not differ significantly between sex (male and female), and faculty (law, commerce, literature & arts) on the LASSI in terms of:

* attitude
* motivation
* time management
* anxiety
* concentration
* information processing
* selecting main ideas
* study aids
* self testing
* test strategies

1.5.2 Alternative Hypotheses

Ha : South African and Chinese students do differ significantly between sex (male and female), and faculty (law, commerce, literature & arts) on the LASSI in terms of:

* attitude
* motivation

* time management
* anxiety
* concentration
* information processing
* selecting main ideas
* study aids
* self testing
* test strategies

1.6 SUMMARY

For the purpose of this study, the following contents will be discussed:

The learning theories and learning styles will be elaborated on in chapter 2. Chapter 3 will focus on the learning strategies, including assessment of learning strategies and variables for successful learning.

The research design will be stated in chapter 4, and in chapter 5 statistical analyses will be discussed. Then in chapter 6 the findings of this study will be clarified, followed by conclusions and recommendations.

CHAPTER 2

LEARNING THEORIES

2.1 THE CONCEPT--LEARNING

Before considering student learning strategies, it is necessary to review the literature on learning, learning strategies, and learning styles. The following concepts will be discussed.

2.1.1 Learning

In the Shorter Oxford English Dictionary (Onions, 1987: 1191), the word "learn" is defined as "To get knowledge of (a subject) or skill in (an art, etc.) by studying, experience, or teaching." Learning is therefore a process by which human beings acquire a vast variety of competencies, skills, and attitudes (Bell-Gredler, 1986: 1). The teacher is the "manager" of creating learning opportunities, and the learner constructs his own knowledge.

It can also construct one's own understanding from a combination of formal knowledge and personal experience (Entwistle, 1988:23-24). A person's ways of learning represent the relation between him and certain aspects of the world around him (Marton, 1988:53).

Learning can be described from three various perspectives: the experiential, the behavioral, and the neurological (Schmeck, 1988a:3-5). From the experiential (or phenomenological) perspective, learning is described in terms of learners (students) engaged in the learning process. Learning, described in this fashion, can be categorized in several ways. Some learners might describe learning as the verbatim retention of knowledge, often achieved through repetition, while others might describe it as an interpretative process aimed at understanding and giving meaning to reality.

From the behavioural perspective, learning can be described as an an observable change in a person's reaction to an equally observable stimulus situation. The change in a person's reaction (i.e., in behavior) is traditionally said to be relatively permanent once it has been learned. The cognitive view of learning is included in this perspective.

From the neurological perspective, learning is the process whereby the nervous system is transformed by its own activity. It is the "tracks" left behind by thoughts, which is neural activity (e.g., thinking and problem solving). It changes the neurons that are active, and that change provides the structural basis of learning. The change occurs as a direct result of the neural activity itself, namely processing information (Schmeck, 1988a:4-5).

Apparently, "learning" is to construct knowledge, skills, and attitudes. It is not only to study from teaching (or instruction) but also includes personal internal encoding activities and prior experiences. It includes integration of mental content and functions to promote versatility and the formation of individuality and personal identity.

2.1.2 Learning Strategies

In the Oxford Advanced Learner's dictionary of Current English (Hornby AS & Chang FJ, 1991:1163), "strategy" is defined as "the act of playing operations in war, especially the movements of armies and navies into favourable positions for fighting; skill in managing any affair." Strategies are ways of handling particular tasks (Biggs, 1988:185), and the means of selecting, combining, or redesigning cognitive routines. This involves choice and decision making (Kirby, 1988:230).

A learning strategy is a pattern of information-processing activities used to prepare for an anticipated test of memory (Schmeck, 1983:234). It represents a sequence of procedures for accomplishing learning (Schmeck, 1988a:5). Learning strategies are combinations of cognitive (thinking) skills implemented when a learning situation is perceived (Schmeck, 1988a:17). These strategies can also be defined as learner's behaviours intended to influence how the learner processes information. Examples of learning strategies include the underlining of key ideas in a passage, outlining the ideas in a lecture, or trying to put some newly learned information into one's own words (Mayer, 1988:11).

According to Weinstein (1988:291), learning strategies are considered to be any behaviours or thoughts that facilitate encoding in such a way that knowledge integration and retrieval are enhanced. These thoughts and behaviours constitute organized plans of action designed to achieve a goal. Examples of learning strategies include active rehearsing, summarizing, paraphrasing, imagining, elaborating, outlining, drawing concept maps, and doing the questions outlined in the learning aims at the end of each chapter in the study guide.

2.1.3 Learning Styles

A style is any pattern that a person follows in order to accomplish particular type of task. (The "task" is to utilize and transfer knowledge to real life situations (Schmeck, 1988c:ix).) Styles are stable ways of approaching tasks and are characteristic of individuals (Biggs, 1988:185). "Styles" refer to the habitual use of a class of similar strategies; for example, an analytical style includes the use of strategies such as breaking a problem into sections, writing down known information, and using algebra and arithmetic (Kirby, 1988:231).

The term "learning styles" emerged in the 1970s (Semple, 1982:15). Schmeck (1983:233-234) indicates that a learning style is a predisposition on the part of some students to adapt a particular learning strategy regardless of the specific demands of a learning task. Learning style consists of distinctive behaviours which serve as indicators of how a person learns from and adapts to his environment. It also gives clues as to how a person's mind operates (Gregorc, 1979:234).

A "Learning style" is an attribute of an individual which interacts with instructional circumstances in such a way as to produce differential learning achievement (Tallmadge and Shearer, 1969:222). Therefore, learning styles are personal ways in which individuals process information in the course of learning new concepts and principles (DeCecco, 1968:75). Learning styles refer to an individual's characteristic pattern of behaviour when confronted with a problem. If a person is observed in a number of different problem-solving situations, a pattern of behaviour can usually be ascertained. It is this pattern of his behaviour that is referred to as his learning style (Rosenberg, 1968:22).

Learning styles are also the modes of thought which an individual employs persistently in a variety of different cognitive tasks. These cognitive tasks, for example, would include selecting a basis for grouping objects, determining how to categorize what he sees and how to organize the various aspects of his environment (Taba, Levine, and Elzey, 1964:8). Therefore, learning styles may provide measures of some relevant and new educationally personal attributes that can moderate either the effectiveness of certain learning strategies or the procedures used to teach those strategies to students (Schmeck, 1988b:172).

Dunn (1980:1) describes a learning style as "the manner in which many different elements from five basic stimuli affect a person's ability to absorb and retain." These stimuli are environmental emotional, psychological, physical and sociological stimuli.

Basically, there are two different learning styles: comprehension learning and operation learning. Comprehension learners use the holist learning strategy, while operation learners use the serialist learning strategy. Pask identifies the two different strategies and associated learning styles in several studies. (Pask, 1976a:12-24, 1976b:128-146; Pask & Scott, 1972:217-253). These two learning styles will be elaborated on as follows:

2.1.3.1 Holist strategy

The students who use the holist strategy take a global approach to the task, liberally using anecdotes, illustrations, and analogies to arrive at an overall description. They tend to look further ahead than other subjects when working through a hierarchy of topics, they have a wider focus of attention, and first try to build up the "big picture" before determining where any of the details fit in. The associated pathology resulting from rigid adherence to this style is labeled "globe trotting". It involves coming to conclusions with too little evidence and using inappropriate analogies. They also tend to overgeneralize (Schmeck, 1983:236).

2.1.3.2 Serialist strategy

The students who use the serialist strategy progress linearly from one topic to the next. They are routinely concerned with operational details and procedures, working step by step through a series of topics, attending carefully to sequential details. The pathology associated with overuse or misuse of this strategy is lacking foresight. It involves the failure to use analogies and to build up overall maps. Such an individual "sees the trees but misses the forest." However, if pathologies are avoided, both the comprehension and operational learners can arrive at comparable levels of understanding (Dillon & Schmeck, 1983:120-121). Pask (1976b:128-146) notes that very consistent operational learners and comprehension learners are, in fact, likely to fall into the pathologies of either improvidence or "globetrotting". Thus, the most competent student is the one who Pask describes as having a versatile learning style. The versatile student uses a higher-order metacognitive strategy based on both the serialist and holist strategies, alternately employing analogy to get an overall model and then testing its applicability by examining details. The versatile learning style leads to a very high level of understanding.

2.2 DEEP AND SHALLOW APPROACHES TO READING

The approaches to reading can be divided into the deep approach and the shallow (or surface) approach (Schmeck, 1983:236-237). Marton and Säljö's (1976a:4-10) analysis of transcriptions of interviews revealed two general types of learning outcome: conclusion-oriented, and description-oriented. The relationship of the approaches and learning outcomes will be explained in the following sections.

2.2.1 Conclusion-oriented Learning Outcome

The conclusion-oriented learning outcome summarizes the main argument and supporting evidence. This outcome resulted when the student's intent was to understand and when a deep-level approach was employed. This deep-level approach involves an evaluation of the relationship between the argument and the evidence and an attempt to relate the ideas to the student's past experience (Schmeck, 1983:237).

2.2.2 Description-oriented Learning Outcome

The description-oriented learning outcome is a listing of the main points covered in the article. This outcome is the result of an intent to memorize and a surface-level approach. A surface-level approach focuses attention on specific facts and pieces of disconnected information which are rote learned (Schmeck, 1983:237).

Svensson (1977:233-243) noted deep- and surface-level approaches in students' normal studying and found superior examination performance by those who were using a deep-level approach. Marton and Säljö (1976b:115-126) noted that low-level examination questions encourage a shallow-level approach. Furthermore, Fransson (1977:244-257) demonstrated that students are more likely to use a shallow-level approach when the content of an article is not of interest to them, and this also raises their level of anxiety.

2.3 ORIENTATIONS TO LEARNING SITUATION

Entwistle et al. (1979:365-380) identified three major orientations of students by factor analyzing the responses of 767 subjects obtained from three different universities. They labeled the three orientations as follows: meaning (search for personal understanding), reproducing (memorization), and achieving (doing whatever is necessary to earn high grades). Each of these orientations involves a different source of motivation and predisposes the student to adopt a certain approach to studying.

2.3.1 Meaning Orientation

The meaning orientation not only contains an inclination to learn out of interest, as a form of personal development which is inspired by an interest but it may also be seen as an indication of how the intention to understand is empirically and logically linked to subsequent learning processes necessitated by that intention (Entwistle, 1988:42).

The student seeking meaning is intrinsically motivated and is somewhat autonomous and independent in his or her study efforts. He or she tends to adopt a deep-level approach (Marton's concept) or a holist strategy (Pask's concept). However, the student with a meaning orientation who uses only the holist strategy is likely to achieve only a limited understanding because of his or her proneness to the "globetrotting" pathology (Schmeck, 1983:238).

2.3.2 Reproducing Orientation

The reproducing orientation has fewer components, perhaps because the requirements of rote learning have not been articulated as fully. However, it is clear that the perception of learning as something imposed by an external authority, completely changes the nature of the learning carried out. The learning is seen narrowly in terms of the prescribed syllabus and the specific task requirements. What is to be learned is limited to the knowledge presented, and so the processes of learning become altogether more mechanical, concentrating on over-learning and verbatim recall. Although considerable effort may still be put into this type of learning, there is less chance of the details being remembered for any length of time (Marton, 1975:32-34). Even facts have to be embedded within a semantic framework if they are to be readily recalled out of the immediate context in which they were initially learned.

The student with a reproducing orientation is extrinsically motivated by fear of failure, dependent on course syllabi, and prone to memorize information verbatim. The individual with a reproducing orientation tends to adopt either a surface-level approach (Marton) or a serialist strategy (Pask). The former leads to memorization and over-learning without true understanding. On the other hand, the serialist strategy can produce a greater degree of understanding; more frequently, it leads to the pathology of improvidence and a very incomplete level of understanding (Entwistle, 1988:43).

2.3.3 Achieving Orientation

The achieving orientation is distinct from the other two orientations, as it does not describe learning processes directly. Also, the forms of motivation it contains are more mixed, perhaps explaining its tendency to split into two. The strategic approach, linked to competitive achievement motivation, describes the tactics used by students mainly concerned with reinforcing their academic self-concept through "repeated demonstrations of intellectual mastery" (Entwistle & Wilson, 1977:123). However, the other component of what was initially the achieving orientation describes a combination of careful planning, systematic study methods, positive attitudes, and conscientiousness which can be allied with deep, surface, or strategic approaches, depending on the student's individual conceptions of learning and purposes in studying.

The achieving student is extrinsically motivated by hope for success and is said to be "stable, self-confident, and ruthless" (Schmeck, 1983:239). The achieving orientation leads the individual to use any approach or strategy that earns high grades. Such an individual is very sensitive to the contingencies present in the situation. If the instructor wants understanding, the achieving student will use a deep-level approach. If the instructor rewards reproduction, the achieving student will use a shallow-level approach (Schmeck, 1983:239).

2.4 APPROACHES TO LEARNING

Biggs (1988:186) defined an approach to learning as "the learning processes that emerge from students' perceptions of the academic task, as influenced by their personal characteristics." Later he said, "approaches to learning stem from the interaction, mediated by metalearning, between the general orientations that an individual displays across particular learning situations and over time, on the other."

In Biggs' view, an approach to learning represents the deployment of a learning strategy based upon metacognitive knowledge. Biggs (1988:186-187) notes, "a self-conscious and planful approach to learning thus requires, first, that students are aware of their motives and intentions, of their own cognitive resources, and of the demands of academic tasks; and second, that they are able to control those resources and monitor their consequent performance. Three major approaches are postulated: surface, deep, and achieving. They will be discussed in the next two sections.

2.4.1 Surface Approach

Marton (in Schmeck, 1988d:321) notes that a surface approach to learning leads to a learning outcome that is essentially a literal reproduction of the words of textbook authors or instructors. Furthermore, the surface approach does not include perception of the holistic structure of information but instead atomizes it into disconnected bits and pieces that are memorized through repetition. Thus, individuals taking a surface approach are likely to have a quantitative conception of the process. If the outcome is organized at all, it is merely a stringing together of the memorized bits and pieces of information.

Marton (in Schmeck, 1988d:321) suggests that individuals taking a surface approach fail to derive full meaning, including implications and connections, from information because they fail to perceive the structure of the information in the first place. The learner taking a surface approach often doesn't perceive that two things are related, much less that they are hierarchically related.

Students adopting a surface approach are instrumentally or pragmatically motivated; for example, they are at university in order to obtain a qualification with minimal effort. A task, such as an essay, is then seen as a demand to be met, a necessary imposition if the longer-term goal is to be achieved. This set of aspirations is frequently accompanied by worries about the time the task is taking, and the converse of that, namely fear of failure if too little time is spent on the task. The general strategy to which this orientation gives rise is to focus on what is seen to be "essentials'--usually factual data and the ways they are represented symbolically--and to reproduce them as accurately as possible (Biggs, 1988:186). In the case of reading from text, Marton and Säljö (1976a:4-11) state that this strategy focuses on the signs of learning, the words and sentences used by the author, rather than what is signified, that is, meanings the author intended to convey. The reproductive nature of the surface strategy thus omits or avoids the interrelations that may exist between components of the task, so that it is not seen as a unified whole.

Ramsden (1988:167) states that surface approaches, involving students in collecting large quantities of notes which were later reproduced in the examinations, were effective--as far as grades were concerned--in the tests which focused on the lower cognitive levels.

2.4.2 Deep Approach

Deep approach produces an outcome that represents the "communicative intent" of the author or instructor rather than a literal reproduction of his or her strings of words. A deep approach, according to Marton (in Schmeck, 1988d:321), includes perception of the holistic organization of material studied, and the components of the learning outcome are hierarchically tested rather than simply being strung together sequentially. The person who takes a deep approach to learning has a qualitative conception of the process, including the interpretation and reinterpretation of experience leading ultimately to self-actualization (Schmeck, 1988d:321).

Students adopting a deep approach start with an intrinsic interest in the task and the expectation of enjoyment in carrying it out. Consequently, they adopt strategies that are likely to help satisfy their curiosity by searching for meanings inherent in the task. It may be appropriate to personalize the task, by making it coherent with their own experience, to integrate it with existing formal knowledge, or to theorize about it, forming hypotheses. In Marton and Säljö's (1976a:4-11) terms, they focus on what the text signifies, on what meanings the author intended to convey, which requires that the parts of the task are seen as making up a whole.

A deep approach to learning is the only way to accomplish understanding, and tests which signal to students that understanding will be assessed also encourage them to take deep approaches to learning (Schmeck, 1988d:337). Schmeck and Grove (1979:43-49) provided evidence that the most successful college students were deep, elaborative, fact retainers.

2.4.3 Achieving Approach

Students adopting an achieving approach are concerned to manifest their excellence relative to other students, specifically in obtaining grades that are as high as possible. The associated strategy is rather different from the deep and surface ones in that it is not concerned with how the task content is engaged so much as with self-organization, particularly on the matter of time management(e.g., allocating fixed time slots for studying related activities, assiduously submitting assignments on time, etc.). The achieving approach may, therefore, be used in conjunction with either of the two: the deep-achieving composite is in fact characteristic of many high-achieving students (Biggs, 1988:187).

2.5 LEARNING THEORIES

A theory is a set of organized principles about particular events in the real world. Popper (1968:59) indicates that:

> "Theories are nets to catch what we call the world to rationalize, to explain, and to master it. We endeavor to make the mesh ever finer and finer."

One important characteristic of a theory is that it "rescues the individual research finding from the momentary circumstance of time and place to give it a place in a broader world" (McKeachie, 1976:829).

Theories provide two advantages: One is that their principles are testable. Experiments may be conducted to determine whether a principle is verified by actual events. An example is the statement: After performing a task, "Practice with corrective feedback on this performance facilitates the learning of motor skills." One way of testing this principle is to compare the performance of learners that have been given practice and feedback with the performance of learners taught in other ways.

The second advantage is that unlike isolated observations, theories include generalizations about events which can be applied to several situations. The statement about the relationship between the learning of motor skills and practice with feedback, for example, is a generalization that applies both to simple skills, such as balancing on a beam, and to complex skills, such as playing tennis or fencing (Bell-Gredler, 1986:4).

2.5.1 Functions of Learning Theory

Patrick Suppes (1974:3-10) identifies four general functions of learning theories. He suggested that these theories: (1) serve as a framework for conducting research, (2) provide an organizing framework for specific items of information, (3) reveal the complexity of apparently simple events, and (4) reorganize prior experience.

The importance of serving as a framework for research is to prevent the practice of data collection that does not contribute to an understanding of events. Suppes (1974:6) notes that bare empiricism is a mental form of streaking, and nudity of body is much more appealing than nudity of thought.

The second function of theory is that it provides an organized framework for specific items of information. All the contemporary learning theories fulfil this function. An example is the set of learning conditions developed by Gagné (1970). He proposes that more than one type of learning exists, for instance, learning the letters of the alphabet is one type that requires the establishment of an association between each of the letters and the learner's mental or verbal response. In contrast, learning to solve algebraic equations is another type. Learning to solve problems requires that the learner reorganizes the situation presented and applies several operations correctly and in the right sequence. The former type of learning is referred to as verbal information, whereas the later is an intellectual skill (Gagné, 1970). Using theories, each of these types of information will fit into their own framework.

The third general function is that theory often reveals the complexity and subtlety of apparently simple events. A specific example is the nature and variety of factors that influence learning from models (Bandura, 1971b). For the most part, early explanations were confined to the mimicry aspects of modeling. That is, the learner imitates the model and is rewarded for the behaviour.

The fourth and related function of theory is that it reorganizes prior experience (Suppes, 1974:3-10). An example in physics that reorganized intuitive beliefs is the law of inertia: a body continues in its direction of motion until some external force acts on it. The commonly accepted belief that originated with Aristotle, however, was the opposite. His analysis described a body as being in motion only if it is acted on by force. Thus the discovery of the law of inertia required a reorganization of the commonsense belief (Suppes, 1974:5).

The function of reorganizing prior beliefs is particularly important with regard to classroom learning. Such learning occurs in a social context. Sometimes variables that were of little consequence a few decades ago may become important factors in the management of learning. For example, in the early twentieth century, many students did not continue their education beyond the elementary grades. The effects of students' perceptions of their academic successes and failures were not of vital concern to the educational system. At that time a large segment of the potential student population selected themselves out of the system for the world of work. Today, however, students are expected to pursue the study of academic subjects in a formal structured setting for secondary students throughout their formative years. The effects of the students' beliefs about their successes and failures therefore influence their learning (Bell-Gredler, 1986:6). A reasonable expectation for theories is that they serve as working models for particular phenomena until new theories are needed. As new information is discovered and new questions are raised, early theories give way to redefined relationships and new generalizations. Therefore, at one point in time, a generalization may adequately describe a particular system, but at a later point in time, it may be valid only as history (Cronbach, 1975:116-127).

2.5.2 Theory Development and the Dynamics of Learning

The first phase in the development of learning theories was, to a very large extent, dominated by behaviourist theories. Although these theories have been harshly criticised (especially animal experiment based theories), the fact remains that the impact of Behaviourism on teaching and learning, was meaningful and cannot be ignored.

Edward L. Thorndike (1874-1949) developed the first learning theory. He was the first person who did learning experiments with animals. The puzzle-box experiment was conducted as part of his doctoral dissertation, published in 1898 (Bolles, 1979:3). This was a landmark experiment. It initiated the laboratory study of animal subjects. According to Thorndike (1911:22), the major purpose for studying the animal mind was to discover the development of mental life in different species, and particularly, the origin of human intelligence.

Thorndike's research was the first experimental analysis of the sequence of stimulus situation, behaviors, and consequences. His learning theory established major and minor laws that govern learning in both animals and human beings. It therefore demonstrated the feasibility of behavioural research in generating laws about mental events (Bell-Gredler, 1986:23).

By 1930, three learning theories had been developed. They were Edward Thorndike's connectionism, classical conditioning, and Gestalt theory. Each of the three theories developed in the early twentieth century differed from philosophical views of learning in three ways. Firstly, the learning theories were developed from experimental observations of behaviour. Secondly, they established, even if in rudimentary form, laws and principles that were testable. Thirdly, they applied the principles to real-world situations (Bell-Gredler, 1986:32). Each of the three descriptions of learning was derived from a particular set of assumptions and a particular experimental procedure.

Classical conditioning applied stimulus substitution in their learning (Bolles, 1979:24). Existing responses became associated with new stimuli by procedures that substituted one stimulus for another. The conditions established in Thorndike's experiments favoured the selection of one response over the others in repeated trial and errors (Bolles, 1979:6). The Gestalt theorists (Bell-Gredler, 1986:39), on the other hand, presented the subjects with elements that could be rearranged or manipulated in various ways. Learning was therefore described as the result of perceptual reorganization.

Classical conditioning, Thorndike's connectionism, and Gestalt psychology each raised new questions about the process of learning and each provided a basis for future developments. The laboratory conditioning of fear reactions and avoidance behaviours developed from the classical conditioning model, whereas Thorndike's instrumental-response model became the nucleus for B F. Skinner's operant conditioning. Gestalt psychology kept alive the research on mental activities and contributed to the later development of cognitive psychology (Bell-Gredler, 1986:44).

The development of connectionism, classical conditioning, and Gestalt theory in the early twentieth century presented psychologists and educators with competing explanations of learning. The next two decades, from 1930 to approximately 1950, were dominated by further laboratory research by proponents of each perspective. The ultimate goal was to develop the one comprehensive theory that could explain all learning. These efforts have been described as psychology's period of self-consciousness and concern about the nature of the science (Mueller, 1979:9)- 1920 to 1930 has also been described as a change in focus from the issue of coverage to that of consistency (Boring, 1963).

During the period from 1930 to World War II laboratory research played a dominant role. The dichotomy between behaviourism and Gestalt psychology continued, and each group attempted to explain learning from their viewpoint. The behaviourist theories during this period were referred to as the S-R theories because of their attempt to link between a stimulus and a specific response. Other theories during this period were Clark Hull's hypotheticodeductive system theories (Bolles, 1979:90-113), Edwin Guthrie's contiguity learning (Bolles, 1979:54-72), and B. F. Skinner's operant conditioning (Bolles, 1979:114-134). These theorists are also referred to as neobehaviourists, in order to distinguish their work from that of Thorndike, Pavlov, and Watson. Although Hull's system was dominant during the 1940s, it was overshadowed by Skinner's principles in the 1950s.

In contrast to the S-R theorists, the Gestalt psychologists failed to develop a systematic set of learning principles. Their research focused on the phenomenon of insight; included were Max Wertheimer's investigations of children's problem solving, Karl Duncker's identification of functional fixedness, and

Abraham Luchins' investigations of problems set. The Gestalt perspective also influenced the work of two other theorists: Edward Tolman and Kurt Lewin. Tolman (Bell-Gredler, 1986:54) described the study of behavior within a Gestalt framework and added the terms "latent learning" and "cognitive structure" to psychology. Lewin (Bell-Gredler, 1986:57) developed a dynamic theory of motivation that described psychological forces as the key to understanding behavior.

Efforts in the 1940s to build a "pure" comprehensive theory were reaching a dead end when the need to solve other educational problems became a national priority in the American context. Designing effective instruction for military training needs became a priority in World War II. This event, as well as Soviet Union's launch of "Sputnik", redirected attention to the classroom, and the redesigning of the curriculum followed.

Skinner's behaviourism, developed in the 1930s, was the only neobehaviourist theory to make the transition from the laboratory to classroom practice. Although dominant in the late 1950's and 1960's, Skinner's principles were gradually overtaken by cognitive issues in the 1970s. In the 1980s, instructional psychology is primarily cognitive (Resnick, 1981:660) and experimental psychology is almost synonymous with cognitive psychology (Hilgard, 1980, in Bell-Gredler, 1986:63).

2.6 THE CONTEMPORARY LEARNING THEORIES

Since the mid-twentieth century, six learning theories have influenced both psychology and education. These theories are Skinner's operant conditioning, Robert Gagné's conditions of learning, information-processing theory, Jean Piaget's cognitive-development theory, Albert Bandura's social learning theory, and Bernard Weiner's attribution theory (Bell-Gredler, 1986:71).

The details of the six theories above will be discussed in the following sections.

2.6.1 Skinner's Operant Conditioning

Skinner's principles of operant conditioning were initiated in the 1930s, during the period of the S-R theories. At that time, Pavlov's model of classical conditioning (Bolles, 1979:24) had exerted a strong influence on research. Skinner disagreed with the S-R position and the conditioned-reflex description in which "the stimulus retains the character of an inexorable force" (Skinner, 1966b:214). According to Skinner (1938), the S-R accounting of behavioural change is an incomplete account of the organism's interaction with the environment. Instead, many behaviours produce some change or consequence in the environment that affects the organism and thereby alters the likelihood of future responding. For example, in a laboratory, experiments with animals like key pecking or lever pressing typically "resulted" in the release of food. In the classroom, solving a problem leads to confirmation of one's skill. Therefore, the key to understanding the majority of executed behaviours lies in an understanding of the interrelationships between a stimulus situation, the organism's response, and the response consequences.

Skinner agrees with the position that psychology can become a science only through the study of behaviour. Learning, therefore, is defined by Skinner as the process of behavioural change. His principles of operant conditioning redirected the study and analysis of behaviour. His work began with an analysis of the differences between reflexes and other behaviours and resulted in his principles of operant conditioning (Skinner, 1935:66-67).

2.6.1.1 Basic assumptions

Skinner established rigorous procedures for the study of behaviour. The cornerstone of Skinner's principles of operant conditioning is his beliefs of the nature of behavioural science and the characteristics of learned behaviour.

According to Skinner (1953), the goal of any science is to discover the lawful relationships among natural events in the environment. Therefore, a science of behaviour must discover the lawful or "functional" relationships among physical conditions or events in the environment and behaviour. The challenge is to determine which changes in independent variables (conditions or events) lead to changes in the dependent variable (behavior). For example, what are the conditions or events responsible for one student's attending to academic tasks and another's avoidance of it? To refer to the one student as "motivated" and the other as "unmotivated" does not, in Skinner's view, answer the question.

The development of a science of behaviour is by no means an easy task, cautions Skinner (1953). Behaviour is both complex and varied. Further, the difficulty in study behaviour is compounded by the fact that it is a temporal, fluid, and changing process (Skinner, 1953:15). However, the monumental task for the scientist, according to Skinner, is to discover its order and uniformity.

Skinner (1950, 1966b) cautions that neither theories nor discussions of inner states should be the basis for behavioural research. The problem with theories is that they explain one statement by means of another, thereby creating an artificial world of order and lawfulness. Theories, however, obscure the lawful relationships yet to be discovered. In addition, they may stifle the scientist's sense of curiosity, thereby terminating the search for clarification (Skinner, 1950).

In Skinner's view, learning is behaviour. As the subject learns, response increases and when no learning occurs, the rate of responding falls (Skinner, 1950:193-216). Learning is therefore formally defined as a change in the likelihood or probability of a response.

The probability or likelihood of responding is difficult to measure. Therefore, Skinner suggests that learning should be measured by the rate or frequency of responding. Although it does not predict precise future performance, it is an initial step in the analysis of behavioural change (Skinner, 1963b:503-515).

Rate of responding provides three advantages over other learning measures, according to Skinner (1950). Firstly, it provides an orderly and continuous record of behavioural change, free from arbitrary criteria. Typical learning measures, for example, include a number of trials, ratio of right to wrong responses, lapsed time, and reaction time. "Quickness" of response, like the other examples, is also a measure of learning (Skinner, 1950:193-216, 1969).

The second important characteristic of response rate is that behavioural change is clearly specified. In contrast, such terms as "adjustment," "improvement," and "problem solving" does not answer the basic question of what is learned.

Thirdly, response rate may be applied to a variety of behaviours, from student responses in the classroom to the behaviours of pigeons in the laboratory. Furthermore, minor modifications in the rate brought about by different combinations of stimuli are easily studied (Bell-Gredler, 1986:80).

In summary, six assumptions form the foundation of operant conditioning. They are as follows:

1. Learning is behaviour.
2. Behavioural change (learning) is functionally related to changes in environmental events or conditions.
3. The lawful relationships between behaviour and the environment can be determined only if behavioural properties and experimental conditions are defined in physical terms and observed under carefully controlled conditions.
4. Data from the experimental study of behaviour are the only acceptable sources of information about the causes of behaviour.
5. The behaviour of the individual organism is the appropriate data source.
6. The dynamics of an organism's interaction with the environment is the same for all species.

2.6.1.2 The components of learning

Development of Skinner's principles of operant conditioning began with his analysis of Pavlov's classical conditioning (Bolles, 1979:24-30). According to Skinner (1938), Pavlov's model is appropriate for those responses that are already associated with a particular stimulus. Examples are the leg jerk that follows the hammer tap to the knee and the eye blink that follows the insertion of a foreign object in the eye. Skinner referred to such reflexes as elicited responses or respondent behaviour. Because the method of conditioning these responses depend on stimulus substitution, Skinner designated Pavlov's model as Type S conditioning.

The problem with Type S conditioning is that it only accounts for a limited range of behaviour. The associated stimuli for complex behaviours, such as painting a picture or singing a song, could not be found (Skinner, 1935:66). Because such behaviours were not elicited by particular stimuli, they were named "emitted responses." These responses also act on the environment to produce consequences. Singing a song, for example, may produce the consequences of praise, applause, or money, among others. Such responses operate on the environment and were named "operants" (Skinner, 1935:66-77).

The key to understanding operant behaviours, in Skinner's view (1953,1963b:503-515), was Edward Thorndike's law of effect. Thorndike's experiments were characterized by the almost simultaneous occurrence of a response and certain enviromental events generated by the subject that also changed the subject (Bolles, 1979:6). The likelihood of the recurrence of the behaviour was thereby increased. Especially, when an animal's escape behaviour resulted in food, the escape response was repeated in similar confinement conditions.

However, Skinner noted (1963b) that Thorndike's law of effect includes some terms that do not describe behavioural properties, leading to misunderstandings about behavioural change. According to Skinner (1953), the law of effect identified the three components necessary in the interaction between the organism and the environment. They are (1) the occasion in which the response occurs, (2) the subject's response, and (3) the reinforcing consequences. These three components of learning are described by Skinner (1953) as the discriminative stimulus (Sd), the response (R), and the reinforcing stimulus (Sr). The sequence of learning therefore is (Sd) - (R) - (Sr).

2.6.1.2.1 The discriminative stimulus.

A discriminative stimulus is any stimulus that is consistently present when a response is reinforced. For example, a pigeon may receive reinforcement only for pecking a red key. The red key in this situation is the discriminative stimulus.

Operant conditioning can be explained without reference to the stimulus that precedes the subject's response (Skinner, 1953). An example is neck-stretching behaviour in the pigeon, which typically occurs without discriminative stimulus. Like other behaviours, neck stretching will increase in rate as a result of continued reinforcement. However, if neck-stretching behaviour is reinforced only when a signal light is on, then eventually the behaviour will occur only in the presence of the light (Skinner, 1953:107).

The probability that a response will be repeated is maximized by the presence of discriminative stimuli. Examples that exercise control over behaviour in everyday life include red and green traffic lights, stop signs, and other signals (Skinner, 1953). Also included are countless verbal commands, such as "take out your pencils" and "please pass the salt." However, signals, verbal commands, and other discriminative stimuli do not elicit operant behaviours. They rather acquire behavioural control as a result of prior reinforcements for particular responses in their presence.

Discriminative stimuli for human behaviour are not restricted to those to which the individual responds. In many situations, human beings construct discriminative stimuli to which they can respond. People construct such stimuli when they make resolutions, announce expectations or intentions, and develop plans (Skinner, 1963b:513).

2.6.1.2.2 Operant reinforcement.

Skinner's analysis of reinforcing stimuli was derived from Edward Thorndike's law of effect. The importance of Thorndike's research, according to Skinner (1963b:503-515), is that it included the effects of the subject's action among the causes of behaviour. Therefore, concepts such as purpose, intention, expectancy, and others were not needed to explain future behaviour (Skinner, 1963b: 503).

2.6.1.2.2.1 A definition of reinforcement

Thorndike's law of effect (Bolles, 1979:3-18), however, emphasized the terms "rewarding," "satisfying," and "trial-and-error learning," and these terms do not describe behavioural properties. Furthermore, the use of the term "reward" suggests some form of compensation for behaving in a particular way. It also carries the connotation of a contractual arrangement (Skinner, 1963b:505).

The terms "reinforcing consequence" and "reinforcement" were substituted for the term "reward." The term "reinforcement" is defined as any behavioural consequence that strengthens behaviour.

The reinforcing consequence increases the likelihood of the recurrence of a particular type of response. If a pigeon receives food for key pecking, then these key-pecking responses will increase in frequency. The particular response that occurs immediately prior to the reinforcement has passed into history and cannot be changed. "What is changed is the future probability of a response in the same class" (Skinner, 1953:87).

2.6.1.2.2.2 The dynamics of reinforcement

To determine whether or not a particular event is reinforcing, a direct test is needed (Skinner, 1953:73). The frequency of a selected response is first observed and then a particular event is made contingent on the response. The rate of responding with the added consequence is observed next. If the response frequency increases, the selected event is therefore reinforced in the given condition.

To be effective in altering behaviour in a particular way, reinforcement must be made contingent on the execution of appropriate responses. The use of accidental contingencies leads to the development of superstitious behaviour (Skinner, 1953:85). Behaviour that is accidentally reinforced will be strengthened. It will increase in frequency and very likely receive accidental reinforcement again.

Reinforcement increases the rate of responding; however, elimination of the reinforcing consequence decreases the rate. This decreased rate in the absence of a reinforcing consequence is referred to as extinction (Skinner, 1938, 1963b). If reinforcement is withdrawn completely, behaviour will gradually cease. Thus, an important function of reinforcement in everyday life is to prevent the extinction of certain behaviour.

2.6.1.2.3 Primary and secondary (conditioned) reinforcers

Primary reinforcers are so designated because they increase response rate without the necessity of training. Given the appropriate state of deprivation, primary reinforcers will alter the probability of responding. Food, for example, is a definite reinforcing element for a food-deprived pigeon. Liquid, sleep, and sexual contact are also examples of primary reinforcers.

In addition to primary reinforcers, behaviour may be altered by secondary or conditioned reinforcers, this group influences behaviour through training (conditioning). Particularly, by association with a primary reinforcer, an event may acquire reinforcing power of its own. A typical example in the laboratory is the sound of someone paging through a recipe book prior to the delivery of food. Through repeated associations with food (the primary reinforcer), the click of the mechanism acquires reinforcing power (Bell-Gredler, 1986:84).

2.6.1.2.4 Positive and negative reinforcers

The previous examples of reinforcing stimuli strengthened behaviour by adjoining the situation. Food, money, approval, and other reinforcers accompany certain responses and the appearance of these stimuli increases the frequency. Any reinforcing stimulus that strengthens behaviour in this way is referred to as a positive reinforcer (Skinner, 1953).

Some reinforcers, however, strengthen behaviour by their removal. That is, termination of the reinforcing stimulus increases response frequency. Examples include stimuli such as electric shock, nagging, and extreme cold or heat. They function as reinforcers because the organism engages in escape behaviour in order to terminate the stimulus. For example, a teenager may complete his or her chores promptly so that the parent's nagging will stop. The initial stimulus is the nagging, which is followed by the teenager's work. When the nagging stops (withdrawal of the stimulus), and the teenager's work habits still continue, the nagging has functioned as a response strengthener or a source of reinforcement (Bell-Gredler, 1986:85).

2.6.1.2.5 Punishment

Punishment involves either the withdrawal of a positive reinforcer or the addition of a negative reinforcer. The privilege of watching television (withdrawal of a positive reinforcer) and confining a child to his room (addition of a negative reinforcer) are good examples in this instance.

In terms of effect, Skinner (1953) maintains that punishment is not the opposite of reinforcement. According to Skinner (1953), the use of punishment leads to three undesirable side effects. Firstly, punishment only temporarily suppresses behaviour. Punishment responses may cease temporarily but are likely to reappear later. Secondly, emotional predispositions, commonly referred to as guilt or shame, may be conditioned through the use of punishment. Thirdly, any behaviour that reduces the aversive stimulation accompanying the punishment will be reinforced. For example, a child may pretend to be ill to avoid going to school to write a test. Successful avoidance of the test (aversive stimulus) reinforces the behaviour of lying in order to stay home.

The major shortcoming of punishment is that the contingencies in punishment are defective, because punishment does not generate positive behaviour. Interest in schoolwork does not result from the punishing of indifference to schoolwork (Skinner, 1968b:149). Therefore, reinforcement for appropriate behaviour rather than punishment for inappropriate behavior is recommended.

2.6.1.3 The nature of complex learning

According to Skinner (1953, 1963b), the law of effect specifies the temporal relationship between a response and a consequence. The development of new and complex patterns or "topographies" of behaviour, however, results from complex and subtle contingencies of reinforcement. A child learns to pull himself up, to stand, to walk, and to move about through the reinforcement of slightly exceptional instances of behaviour (Skinner, 1953). Later, the same process is responsible for his or her learning to sing, to dance, and to play games, as well as all the other behaviours found in the normal adult repertoire (Skinner, 1953:9).

Reinforcement in the improvement of skills, for example, requires differentiation because the responses has particular properties. Types of skills that depend on differential reinforcement for maximum development include sports activities, artistic performances, and certain games and other activities that require timing (Skinner, 1953).

Often, the differential reinforcement is provided by the natural events in the environment subsequent to a response. For example, a ball thrown with the appropriate force and at the correct angle will cover a greater distance than others (Skinner, 1953:95), and these consequences reinforce the musculature involved in the response execution.

2.6.1.3.1 Shaping

The acquisition of complex behaviours--such as pigeons playing ping pong and human beings solving problems--is the result of the process referred to as "shaping" (Skinner, 1954, 1963b). This process involves a carefully designed program of discriminative stimuli and reinforcement topographies of behaviour. An example is that of swiping a wooden ball with a sideways movement of the beak so that the ball is sent down a miniature alley toward a set of toy pins.

The importance of shaping is that it can generate complex behaviours that have an almost zero probability of occurring naturally in the final form (Skinner, 1963a, 951-958). A complex behaviour is shaped by a series of changing contingencies, referred to as a program (Skinner, 1963b:506). Each stage of the program evokes a response and also serves to prepare the organism to respond at a later point.

2.6.1.3.2 Contingencies of reinforcement

Behaviour that acts on the immediate physical environment, in general, is reinforced consistently (Skinner, 1953:99). Standing and walking are examples. However, a large part of behaviour generates only intermittent reinforcement. Sometimes a given consequence depends on a series of events that are difficult to predict with precision. Winning at cards and roulette are examples of this (Skinner, 1953).

Intermittent reinforcement for a particular response can sustain behaviour for long periods of time. Reinforcement may be frequent at first, but then it is gradually reduced. For example, a television program may become less reinforcing as jokes or story lines become less interesting. Someone who has followed the program from the beginning, however, may continue to watch the program for a long time (Skinner, 1966a:164).

2.6.1.3.3 Rule-governed behaviour

The process referred to as shaping exposes the subject to changing contingencies of reinforcement for the performance of progressively more accurate behaviours. This method of developing complex behaviours is referred to as contingency-governed behaviour (Skinner, 1969). However, for the human learner, not all behaviours are acquired through direct exposure to response consequences. "Few people drive a car at moderate speed and keep their seat belts fastened because they have actually avoided or escaped from serious accidents by doing so" (Skinner, 1953:168). Instead, rules for behaviour have been derived from the contingencies and these descriptions of contingencies are often transmitted verbally to the individual. Rules of grammar and spelling are an example (Skinner, 1969). Also, many proverbs and maxims are examples of social reinforcement by the culture (Skinner, 1969:123). The legal, ethical, and religious practices of a society are compiled into laws and other codified procedures so that the individual may emit appropriate behaviour without direct exposure to response contingencies.

The behaviour emitted in the contingency-governed condition differs from the emitted behaviour in the rule-governed condition (Skinner, 1953:151). For example, an actor's behaviour begins with a memorized script and prescribed actions. However, the behaviour is influenced by the reactions of other cast members during emission so that it becomes shaped in subtly different ways.

Rule-governed behaviour differs from contingency-governed behaviour in another way. The consequences of a response alter the probability of future occurrence of the response. The topography of response may however be controlled by a maxim, rule, or other verbal statement of contingencies. In spite if this, the probability of response execution remains undetermined (Skinner, 1953:147). The rule functions as a discriminative stimulus, and may or may not be followed by the appropriate behaviour.

2.6.2 Robert Gagné's Conditions of learning

Robert Gagné's (1977:2) states that human skills, appreciations, and reasonings in all their great variety, as well as human hopes, aspirations, attitudes, and values, are generally recognized to depend on the events called learning for their development.

Gagné's learning principles are the result of his search for the factors that account for the complex nature of human learning. His analyses began with the identification of the concept of learning hierarchies, that is, the particular skills that contribute to the learning of more complex skills (Gagné, 1968a:177-191, 1968b:1-9). He also identified five unique categories of learning (Gagné, 1972:1-8) and described both the environmental events and the stages of information processing required for each learning category (Gagné, 1977, 1980:6-9).

The key to the development of a comprehensive learning theory, according to Gagné (1974, 1977) is to identify the factors that account for the complex nature of human learning. Other theorists typically begin with a particular explanation of the learning process and then attempt to fit that process to human learning. Gagné, in contrast, began with the analysis of the variety of performances and skills executed by human beings and then provided an explanation for this variety.

2.6.2.1 Basic assumptions

The assumptions on which Gagné bases his work are derived from the general nature of human learning and the particular characteristics of the learning process.

2.6.2.1.1 The nature of human learning.

Several elements are included in Gagné's conception of learning. Key factors are the relationship of learning to development and the diversity of human learning. His view of the role of learning in development differs from both the growth-readiness model and the Piagetian cognitive-development model. According to the growth-readiness model, certain growth patterns must occur before learning can be beneficial. Some followers of this model, for example, recommend that reading should not be taught to the child until a particular age is reached, such as 6 or 7 (Bell-Gredler, 1986:117).

In contrast, the Piagetian model describes intellectual development as the internalization of progressively more complex forms of logical thinking. In this model, learning contributes to the cognitive adaptation required for the development of logical thought processes.

The model described by Gagné, however, assigns a primary role to learning. In his view, learning is an important causal factor in the individual's development (Gagné, 1968a:177-191). Within the broad parameters established by growth, "behavioural development results from the cumulative effects of learning" (Gagné, 1968a:178).

The characteristics of learning account for its importance in development, for example, much of human learning generalizes to a variety of situations. The skill of writing is a good example. Writing can be used for complaining, advertising, communicating love, describing an event and testing knowledge.

Another important contribution of learning to development is that learning is cumulative. That is, many skills that are learned contribute to the learning of even more complex ones. The skill of writing becomes more complex, as the child advances from writing sentences, to writing a story or a letter. Again, addition serves as an example. The skill of adding numbers contributes to the learning of long division. The child does not need to learn to add all over again when learning to divide. Instead, addition is incorporated into the new skill (Bell-Gredler,1986:118).

The importance of the cumulative model is demonstrated by applying it to the analysis of Piagetian conservation tasks. Typically, experiments have used training on one or two prior tasks, with the result that children have not attained conservation. The task "conservation of liquid," for example, may first be defined as a complex rule. The rule is "judging equalities and inequalities of volumes of liquids in rectangular containers" (Gagné, 1968a:184).

The cumulative learning model provides several sequentially ordered skills that provide concrete knowledge of containers, volumes, areas, lengths, and liquids. Performance on these prerequistites makes possible the learning of the complex rule, or conservation task (Bell-Gredler, 1986:118).

In summary, intellectual development "may be conceived as the building of increasingly complex and interesting structures of learned capabilities" (Gagné, 1968a:190). These learned capabilities contribute to the learning of more complex skills and they also generalize to other situations. The result is that an ever-increasing intellectual competence is generated.

2.6.2.1.2 The diversity of human learning

In Gagné's view, prior theories presented limited views of the nature of human learning. Examples are the theories derived from laboratory studies of learning. Included are the theories of Pavlov, Thorndike, Hull, and Skinner. According to Gagné (1977), these models do not account for the human capacity to learn complex skills and abilities. Some of them do describe subcomponents of human learning. These subskills are, however, not the major objectives of learning. Examples are signal learning (Pavlov's model), S-R associations and chainlike skills.

Although the S-R model has been used to characterize human learning, Gagné (1977) observes that "pure" examples of S-R learning are difficult to find, and are rapidly becoming a part of decoding words.

2.6.2.1.3 A definition of learning

The human capacity for learning makes possible an almost infinite variety of behavioural patterns (Gagné, 1977). Given this diversity, no one set of characteristics can account for such varied activities as learning to define a word, to write an essay, or to lace a shoe (Gagné, 1972:2). Therefore, the task of learning theory is to identify the principles that account for the complex nature of human learning in all its variety.

If human learning is indeed a complex, multifaceted process, it can be defined in two ways. Firstly, learning is the mechanism by which an individual becomes a competently functioning member of society (Gagné, 1977). The importance of learning is that it is responsible for all the skills, knowledges, attitudes, and values that are acquired by human beings. Learning, therefore, results in a variety of different kinds of behaviours, referred to by Gagné (1972, 1977) as capabilities. They are all the outcomes of learning.

Secondly, these capabilities are acquired by human beings from (1) the stimulation from the environment, and (2) the cognitive processing undertaken by the learner. Formally defined, learning is the set of cognitive processes that transforms the stimulation from the environment into the several phases of information processing required for acquiring a new capability (Gagné & Briggs, 1979:43).

2.6.2.2 The components of learning

Gagné's analysis of human learning identified five categories or varieties of learning. They are verbal information, intellectual skills, motor skills, attitudes, and cognitive strategies. Each of the five varieties of learning is acquired in a different way. Each one requires a different set of prerequisite skills and a different set of cognitive-processing steps. These requirements are referred to by Gagné (1977) as the internal conditions of learning.

2.6.2.2.1 Verbal information

The capability represented by this category is that of acquiring labels, facts, and organized bodies of knowledge. In learning labels, a consistent verbal response or "name" is applied to an object or an object class, such as "rose" or "tiger." In learning facts, the relationships between two or more objects or events can be stated orally or in writing. Verbal information involves only the restatement of information by stating, paraphrasing, or reporting on learned information (Bell-

Gredler, 1986:122).

2.6.2.2.2 Intellectual skills

These capabilities are the skills that make human beings competently functioning members of society. The range of capabilities includes everyday skills such as using a checkbook and analyzing the evening news. Also included are the use of language and mathematic concepts. Intellectual skills may be described as including "the basic and (at the same time) the most pervasive structures of formal education" (Gagné & Briggs, 1979:24).

Unlike factual information, however, intellectual skills cannot be learned by simply hearing them or looking them up (Gagné, 1977:11). The major difference between information and intellectual skills is the difference between knowing **that** and knowing **how** (Gagné, 1974:55). The student learns how to add integers, how to make the verbs and subjects of sentences agree, and countless other skills (Gagné, 1974). Each skill interacting with symbols, such as numbers, letters, words, and pictorial diagrams.

2.6.2.2.3 Motor skills

The capabilities that underlie the smooth execution of bodily performances are motor skills. Included are simple skills learned early in life, such as fastening clothing and executing communicable speech sounds (Gagné, 1977). In the early years of schooling, important motor skills include printing and writing letters and symbols, skipping rope, balancing on a beam, and others. Later, motor skills include learning separate skills such as playing tennis, basketball, and other sports.

The common characteristic of all these skills is the requirement to develop smoothness of action, precision, and timing (Gagné, 1977). The performances executed by the novice and the expert differ in these qualities.

The distinguishing feature of motor skills is that they improve through practice. Repetition of the basic movements with feedback from the environment is a requirement. It leads to the identification of the kinesthetic cues that signal the differences between inaccurate and error-free performance (Gagné, 1977:19).

2.6.2.2.4 Attitudes

Capabilities that influence an individual's choices about the kinds of actions to take are attitudes. An important characteristic is that attitudes do not determine specified acts. They rather categorize individual actions (Gagné, 1977:231). For example, the student develops attitudes toward reading books or constructing art objects (Gagné, 1979:86).

2.6.2.2.5 Cognitive strategies

Capabilities that control the learner's management of learning, remembering, and thinking are cognitive strategies; they are the learner's executive control processes. Cognitive strategies influence the learner's attending to stimuli, the encoding schemes undertaken by the learner, and the size of the "chunks" of information stored in memory. They also influence the learner's search and retrieval strategies and the organization of the learner's responses.

An example of a cognitive strategy is the process of influence or induction (Gagné & Briggs, 1974:52). Experiences with objects or events in which the individual attempts to explain a particular phenomenon lead to induction. The object of cognitive strategies is the learner's own thought processes. Another important characteristic of cognitive strategies is that, unlike intellectual skills, they are not critically influenced by minute-by-minute instruction. Instead, they develop over relatively long periods of time (Gagné & Briggs, 1979). To the extent that such skills can be improved by formal education, the individual becomes a self-learner and an independent thinker (Gagne, 1974:64).

2.6.2.3 The nature of complex learning

An important contribution of Gagné's work is his description of the cumulative nature of human learning. His early work (Gagné, 1962b:355-365) describes organizations of intellectual skills that build from simple to complex. Referred to as "hierarchies," these sets of capabilities provide a mechanism for designing instruction in school subjects.

At the present time, Gagné's analysis includes two organizations of capabilities that progress from simple to complex. The two organizations are procedures and learning hierarchies.

2.6.2.3.1 Procedures

Examples of procedures are writing a check, using a checkbook, parking a car, and changing a tire. Procedures are sequential organizations of skills that include both motor and intellectual skills.

The motor skills in parallel parking, for example, include positioning the vehicle appropriately, backing at low speed in a certain direction, and turning wheels straight from the turn (Gagné, 1977:215). The intellectual skills include identifying the angle of approach, identifying alignment with the other car, and so on. Learning the procedure involves learning to perform the discrete motor skills as well as the essential concepts and rules.

2.6.2.3.2 Learning hierarchies

Procedures are organizations of motor as well as intellectual skills. Learning hierarchies, in contrast, are organized sets of intellectual skills only. Each capability in a hierarchy is an essential prerequisite to the next most complex skill. A hierarchy, in other words, is a psychological organization of skills. It is neither a logical ordering of information, concepts, and rules, nor is it a set of skills that simply supports learning (Gagné, 1977). Instead, skills are linked when the higher element cannot be learned without first learning the lower element.

Four kinds of discrete intellectual skills are organized from simple to complex into a hierarchy. They are discrimination learning, the learning of concepts, rule learning, and higher-order rule learning (problem solving). Each of these skills is an essential prerequisite to the next higher order skill. (Bell-

Gredler, 1986:131). Discrimination learning indicates that a child responds differentially to characteristics that distinguish objects, such as shape, size, and colour.

Conceptual learning can be divided into concrete concepts and defined concepts. Concrete concepts state that a child identifies an object as a member of a concept class; learned through direct encounters with concrete examples, such as triangles. Defined concepts state that a child identifies an object or event as a member of a concept class; these cannot be learned through concrete examples but are acquired by learning a classifying rule, such as "liberty," "patriotism."

Rule learning indicates that a student can respond to a group of situations with a group of performances that represents a relationship; for example, a student responds to 5+2, 6+1, and 9+4 by adding each set of integers.

High-order rule learning (problem solving) indicates that a student combines subordinate rules in order to solve a problem. This seems to be a very effective learning strategy because the students are guided into discovery of knowledge (Bell-Gredler, 1986:129).

2.6.3 Information-Processing Theories

"The brain is not a passive consumer of information.

[Rather] it actively selects, attends to, organizes, perceives, encodes, stores, and retrieves information. Sometimes it generates a whole picture from one-half of a chimerical stimulus. Other times, it analyzes complex spatial patterns into simpler imbedded ones.... A multiplicity of operations, interpretations and inferences characterizes the complex reality constructed by the brain." (Wittrock, 1978:99, 101).

Research into the ways that the human brain processes information gained impetus primarily from the communications research initiated in World War II and the advent of high-speed computers. The modern computer, which has the capabilities of receiving, storing, and retrieving information as well as solving problems, provides an analogy for human mental functions.

Information processing is currently one area of research within the larger domain of cognitive psychology. Anderson (1980) describes cognitive psychology as the efforts to understand the basic mechanisms that govern human thought. Information-processing research focuses on tracing and describing sequences of mental operations and their products (i.e., information in the execution of particular cognitive tasks) (Anderson, 1980:13).

The term "information processing" connotes a particular perspective toward the study of individuals. The primary focus of study is the ways in which human beings perceive, organize, and remember vast amounts of information received daily from the surrounding environment. Listening to the morning news, studying the stock market report, deciphering class notes, and diagnosing a car's engine troubles are all daily activities that depend on the processing of data from the environment.

2.6.3.1 Basic assumptions

The assumptions on which the information-processing theories are based describe (1) the nature of the human memory system, and (2) the ways in which knowledge is represented and stored in memory.

2.6.3.1.1 The nature of human memory

The early conception of human memory was that it served simply as a repository for retaining information over long periods of time. Thus it served as a collection of isolated or unrelated bits of information. In the 1960s, however, human memory began to be viewed as a complex structure that processes and organizes all our knowledge (see Neisser, 1967). It is not seen as a passive repository; instead, it is a system that is both organized and active. That is, the human memory actively selects the sensory data that are to be processed, transforms the data into meaningful information, and stores much of the information for later use. The development of information-processing theories has been described as the "direct result of an attempt to view memory as a complex system with many interacting stages" (Norman, 1970:1).

2.6.3.1.1.1 The multistage concept

The conceptualization of an active memory system was influenced by Broadbent's (1958) initial description of a multistage memory. For the most part, the early models developed in the 1960s proposed three memory structures. They are (1) a sensory register, (2) a short-term store, and (3) a long-term store (see Atkinson and Shiffrin, 1968).

Information is processed in sequential stages, and each stage occurs in a particular structure in the memory system. That is, the sensory registers, primarily visual and auditory, receive a vast array of physical signals from the environment. Many of these signals are lost or are not processed further. Some, however, are retained briefly (0.5 to 2.0 seconds) in the sensory registers. However, unless selected for further processing, data are lost from the system (Bell-Gredler, 1986:153).

Information that is selected for further processing, enters short-term or working memory. Here much of the information is encoded into some meaningful form and transferred to long-term memory for permanent storage, In Gagné's theory (1977:6), the encoding of information and the transfer and the consolidation to long-term memory are the core phases of learning.

Some information in short-term memory is only present for immediate utilization and is not processed further. An example is a telephone number that is looked up and retained only until the call is completed, because it is not used often.

2.6.3.1.1.2 The "state" concept

The current view of human memory is that information is in either an inactive or active state, The active state is temporary and is referred to as short-term or working memory.

The conception of short-term memory as the active state of information accounts for such activities as looking up a telephone number and memorizing a poem. The digits of the telephone number have already been learned, and looking up and repeating the number establishes new connections among the digits. This information is active until the call is completed, then the sequence is forgotten. The digits, however, remain in long-term memory, while only the particular set of connections between them is lost.

In memorizing a poem, however, new connections are established between many already learned words in the short-term memory. In contrast to the telephone number, the words and their new connections are retained in an inactive state from which they may be later recalled (Bell-Gredler, 1986:155).

Two classes of information stored in long-term memory are described by Tulving (1972:382-403). One class includes general information that is available in the environment. Examples are the words of a poem, telephone numbers, formulas for chemical compounds, and how to build a house. This type of memory is referred to as semantic memory.

In contrast, episodic memory includes personal or autobiographical information (i.e., events experienced by the individual). Personal memories are distinguished by the characteristic of vividness and typically include visual scenes.

2.6.3.1.2 The representation of knowledge

The record of information that is stored is not an exact copy of the stimulus input because (1) the physical signals received by the senses are not perfect representations of the world, and (2) to be remembered, the physical signals must be transformed in some way. The transformation or recording process increases the probability of later recall of the information at the expense of remembering detail (Lachman, Lachman & Butterfield, 1979).

Two major views on the form of stored information have been proposed. One is the dual-code model proposed by Paivio (1969, 1970). The other perspective maintains that information is stored in verbal form only. Although several organizational forms of verbal information have been proposed, the current predominant models are network models (or conceptual-propositional models).

2.6.3.1.2.1 The dual-code model

The essential characteristic of the dual-code model is that information may be stored in long-term memory in either visual or verbal form. The model describes two functionally independent, although interconnected systems for the processing and storing of information. Concrete objects or events, such as a dog house, or a trip to the zoo, are stored in the imagery system. Abstract objects and events such as "soul," "truth," and linguistic structures are stored in the verbal system. Some objects, such as "house," which have both concrete and abstract characteristics, may be coded in both systems; however, one code is likely to be activated more easily than the other. Another characteristic of the model is that the processing of verbal stimuli occurs serially, while the visual processing of concrete stimuli seems to occur all at one time (Paivio, 1969:241-263).

2.6.3.1.2.2 The verbal network models

The theorists that advocate network models are those that support the concept of a verbal storage system. They do not question the importance of imagery in the processing of information for later recall. However, they maintain that the ultimate representation of information is in verbal form and that images are reconstructed from verbal codes.

Three general types of verbal models have been developed (Bell-Gredler, 1986:157). The current perspective, semantic-network models, has been preceded by two earlier perspectives: clustering models and propositional models. Clustering models illustrate words grouped in memory in particular clusters. For example, eagle, wren, and canary are clustered in terms of their characteristics (e.g., "have feathers").

In contrast, propositional models identify propositions rather than isolated words as the building blocks of memory structure. These models describe stored information as base strings (Tom is tall) plus related comparative information. The concept was later revised to include visual processing (Clark and Chase, 1972:472-517). Propositions are perhaps more easily understood in Kintsch's representation (1972:249-305). He used a list format to portray the propositions derived from the analysis of sentences and paragraphs. An example is the sentence "the old man smiled," which includes the two propositions of "old, man" and "smiled, man."

The currently accepted network models, like the propositional models, also make use of verbal relationships. However, the word relationships are not restricted to propositions, and they are diagrammed in the form of nodes and their connecting links. The links are labeled lines that indicate the meaningful connections between the nodes (Bell-Gredler, 1986:157).

2.6.3.1.3 Semantic network models

The first model, developed by Quillian (Collins and Quillian, 1969:240-247), used nodes to portray concepts and superordinate concepts in a hierarchical relationship. Deficiencies in Quillian's model in accounting for retrieval times as well as other problems led to the development of other network models.

Three semantic network models have been identified. They are (1) the propositional network proposed by Anderson (1980), (2) the "active structural networks" proposed by Norman and Rumelhart (1975), and (3) the "production systems" proposed by Newell and Simon (1972). All the models describe both declarative knowledge and procedural knowledge. However, Anderson (1980) maintains that procedural knowledge cannot be represented verbally with accuracy.

According to Norman and Rumelhart (1975), the representation of knowledge is no different for propositions and procedures. On the other hand, Newell and Simon state that both declarative and procedural knowledge are stored in the form of condition-action pairs referred to as "productions." They are stored in long-term memory and are applied to symbols in short-term memory in order to generate actions or behaviours. An example is a physician who identifies symptoms that lead to the recall of appropriate treatments (Simon, 1980:81-96).

Posner (1978:15) suggests that the different representations of information in long-term memory are the result of the study of different phenomena by researchers. That is, different types of data place different demands on the representational system. Therefore, researchers investigating a knowledge of stories, faces, procedural steps, class concepts, and so on, identify different modes of memory storage.

2.6.3.1.4 Schemas

The dual-code and propositional or semantic network models describe the representation of specific items of knowledge in memory. However, cognitive operations appear to be governed by larger organizations of knowledge. These knowledge structures are referred to as schemas.

The term "schema" was first defined by Bartlett (1932:201) as "an active organization of past reactions which must always be supposed to be operating in any well-adapted organic response." Rumelhart and Ortony (1977:99-136) describe schemas as data structures that represent the generic concepts underlying objects, events and actions. Anderson (1980:133) notes that although the definitions of schemas vary, these knowledge structures may be thought of as "equivalent to a set of propositions and images."

The importance of schemas is that they reflect functions for long-term memory other than that of serving as a store of information (Posner, 1978). These functions are: (1) providing a format into which new data must fit in order to be comprehended, (2) serving as a guide for directing attention and for undertaking goal-oriented searches of the environment, and (3) filling in gaps in information received from the environment (Neisser, 1967; Posner, 1978).

In summary, the basic assumption underlying the information-processing theories is that human memory is an active, complex organizer and processor of information. Within the theoretical framework, two major views about the representation of knowledge in memory exist. They are the dual-code representation, which includes verbal and visual images, and the verbal code perspective. The theorists that advocate the verbal code perspective use circles and lines to represent the linkages between the verbal codes stored in long-term memory. These schematic representations are referred to as network models. Furthermore, cognitive operations are governed by larger organizations of knowledge known as schemas.

2.6.3.2 The Components of learning

The research on information processing has included a range of tasks and various descriptions of subjects' activities during the acquisition of information. For the purpose of generating applications to learning and of simplifying an understanding of the findings, the process of learning is described in three stages. They are: (1) attending to stimuli, (2) encoding stimuli, and (3) the storage and retrieval of information.

2.6.3.2.1 Attending to stimuli

The processing of information by the human memory system begins when physical signals (visual, accoustical, or tactile) are received by sensory registers in the eyes, ears, and skin. These physical signals are retained briefly, allowing the memory system to begin processing data. The visual input that is briefly retained is an icon and the auditory memory is an echo (Neisser, 1967). The third type of signal retention is referred to as tactile or haptic, though little research has been conducted on the physical stimulus of touch (Neisser, 1967).

The importance of the brief retention of physical signals in the sensory registers is that it permits identification of some of the input. Understanding speech in a newly learned foreign language, for example, is dependent to a large extent on echoic memory (Neisser, 1976).

Some of the vast array of physical signals impinging on the senses are selected for further processing. Two views have been expressed on the nature of the selection process. Some theorists, following Broadbent's model (1958), maintain that initial processing of all stimuli occurs, but that unwanted stimuli are "filtered out" of the system. Neisser (1976) maintains that only information for which the system has a schema in long-term memory will be attended to. That is, the system selects only what it will use; it does not receive everything and then filter out some of it. Neisser's analogy is that of apple picking. We pick only the apples we want; we do not pick all the apples and then reject some of them.

2.6.3.2.2 The encoding of stimuli

The process of feature detection names the incoming stimuli. For example, in looking up a telephone number, a particular string of digits is identified, such as 894-3450. The stimuli may or may not be processed for later recall. The information may simply remain active only until the call is completed. When it becomes inactive, it is forgotten.

If the number is to be retained in long-term memory in an inactive state, further processing is required. This process, referred to as "encoding," transforms stimuli so that they may be stored and later recalled with ease (Bell-Gredler, 1986:162).

There are two major strategies of encoding: maintenance or primary rehearsal and elaborative rehearsal. Reciting a telephone number over and over is an example of maintenance rehearsal. In other words, this strategy is simply one of repetition of the information to be remembered (see Woodward, Bjork, and Jongewood, 1973:608-

617).

In contrast, elaborative rehearsal transforms the information in some way. It may be: (1) modified so that it relates to information already stored, (2) replaced by another symbol (referred to as substitution by Tulving & Madigan, 1970:437), or (3) supplemented by additional information to aid in recall. Associating the name of a new acquaintance "Webb" with a spider web is an example of elaborative rehearsal (see Reder, 1980:5).

2.6.3.2.3 Storing and retrieving information

The purpose of the encoding process is to prepare information for storage in long-term memory. Later access and recall depends to a large extent on the form in which information is stored and the relationship of information to the prior contents of long-term memory. Chess masters and beginners, for example, differ greatly in their ability to recall the board positions of several chess pieces after visual exposure for a few seconds (Chase & Simon, 1973). The master can reconstruct 80%-90% of the board positions, but the beginner can place only a few pieces.

In contrast to chess skill, many tasks, such as remembering a shopping list, place only moderate demands on long-term memory. For such tasks, both maintenance and elaborative rehearsal can assist in the later recall of information. Of the two processes, elaborative rehearsal is the more effective for later recall. Repetition (maintenance rehearsal) maintains the immediate availability of an item but does little to improve long-term retention. Instead, subsequent recall is enhanced by active processing of the item through elaboration, transformation, and so on (Posner, 1973:167-174).

The success of elaborative rehearsal may be related to the nature of the recall process. Neisser (1976) indicates that the permanent store of information is not some "written tablet" of what is learned. Instead, it is a summary code that comprises information into a label. Thus the process of recall is not the revival of an existing relationship. Instead, it is the construction of a relationship, much as sentences are constructed. In fact, the model implemented by paleontologists to reconstruct animals that once walked the earth describes this model of memory: from a few available bone fragments, a dinosaur evolves (Neisser, 1967:285).

2.6.3.3 The nature of complex learning

The complex cognitive processes studied by information-processing theorists are those of problem solving. A problem may be defined as "a situation in which an individual is called upon to perform a task not previously encountered and for which externally provided instructions do not specify completely the mode of solution. The particular task, in other words, is new for the individual, although processes or knowledge already available can be called upon for solution" (Resnick & Glaser, 1976:209). This general definition refers to a range of problems, including riddles, puzzles, chess, and subject-matter problems such as algebra and geometry.

2.6.3.3.1 Types of problems

Coupled with the studies of the processes of problem solving are efforts to identify different types of problems. Greeno (1975:239-270) has identified four basic types that differ in both the knowledge and the particular skills required for solution. The four types are: (1) induction of structure, (2) transformation, (3) arrangement, and (4) hybrid arrangement problems.

2.6.3.3.1.1 Problems of structure induction

This type of task is represented by analogy problems and series-completion problems. Examples include: "merchant" is to "sell" as "customer" is to "buy" and " 1 2 8 3 4 5 6 ?:(Greeno, 1975:242). In this type of problem, a pattern structure is identified from the analysis of the relationship among the given elements.

2.6.3.3.1.2 Transformation problems

The group includes "move" problems and "change" problems. The nature of the task is illustrated by the well-known problem referred to as the Tower of Hanoi. The task is to move a set of different-sized discs from one peg to another, one at a time. However, a large disc may never be placed on top of smaller one. Solution of the problem requires means-ends analysis. Originally identified by Newell and Simon (1972), this process involves representing the given situation (state A), the goal situation (state B), and the situations needed to progress from A to B as the problem solving proceeds.

An example of a change problem is the typical proof-of-theorem problem (Greeno, 1975:245). In such a problem, one or more statements are given and a new statement must be derived according to particular inferential rules.

2.6.3.3.1.3 Arrangement problems

Jigsaw puzzles, anagrams, and cryptarithmetic are examples of arrangement problems. In each of these tasks, some problem components are provided. The goal is to find a combination of them that fulfills a specified criterion (Greeno, 1975:255).

2.6.3.3.1.4 Hybrid arrangement problems

The foregoing arrangement problems provide clues about overall structure, and the task is to rearrange the elements to fit that structure. Hybrid arrangement problems, in contrast, are of two types. One type requires a transformation from one structure to another. Greeno (1975) includes in this category the matchstick problems investigated by Katona (1940). In one such problem, the task is to change an arrangement of seven squares to only five squares by moving no more than three matches.

Included in the hybrid arrangement of invention problems are practical problems in engineering designs inventions, composition in the arts (music, sculpture, painting), and theory development (Greeno, 1975). Each of these activities requires imposing a new structure in the rearrangement of basic elements.

2.6.3.3.2 Problem-solving processes

The problems researched most extensively in the classical literature are the invention problems, such as the pendulum and the candle problems (Resnick & Glaser, 1976). Two major areas of contemporary research are computer simulations of problem-solving processes and specific subject-matter investigations using students. Computer programs have been developed that solve logic problems and algebra word problems, play chess, diagnose medical problems, and so on.

The landmark effort that initiated computer simulations of problem solving is the General Problem Solver (GPS) developed by Newell and Simon (1972). The steps, briefly summarized, are: (1) represent the problem, the givens, and legal operators; (2) establish goals and subgoals and begin solving toward the subgoals; and (3) use means-ends analysis to assess progress, redefining subgoals if necessary.

A somewhat different model of problem solving has been developed by Resnick and Glaser (1976:205-230). It applies to the invention or hybrid arrangement problems described earlier. The three general steps in the model are: (1) problem detection, (2) feature scanning, and (3) goal analysis. Of importance in this model is that the individual often moves back and forth between problem detection and feature selection in the identification and testing of partial or complete solutions.

2.6.4 Jean Piaget's Cognitive-Development Theory

Jean Piaget indicates (in Bringuier, 1980:110) that knowledge is neither a copy of the object nor the making consciousness of a priori forms predetermined in the subject. Knowledge is a perceptual construction, made by exchanges between the organism and the environment from the biological point of view, and between thought and its object from the cognitive point of view.

Piaget's investigations of human thought processes introduced to American psychology the issue of the nature of knowledge. Operant conditioning avoided the issue completely by describing complex achievements as repertoires of behaviour. Taking a different approach, the cognitive theorists tacitly accepted knowledge as a given. They then proceeded to describe the ways in which physical signals received by the sensory registers are transformed into knowledge.

The work of Jean Piaget places the issue of the nature of knowledge at the forefront of any consideration of human mental activity. For Piaget, the continuous interaction between the individual and the environment is knowledge. That is, knowledge is a process, not a "thing." An understanding of knowledge therefore requires the identification and description of the various ways that the individual interacts with a capital K, as a state in its higher forms, but seeks the processes of formation: how one passes from a lesser degree of knowledge to a greater one" (Piaget, in Bringuier, 1980:7).

A conception of knowledge as change, and a focus on the qualitative differences in the individual's interaction with the environment, are two unique perspectives of the theory. The third unique characteristic is the scope of the subject matter under study. That is, in order to explain qualitative changes in thinking, intellectual functioning at every stage of human life must be analyzed. Thus Piaget's theory is developmental in that it traces intellectual life from the activities of the infant to the reasoning processes of the adult (Piaget, 1975:5-10).

The forth major distinction of Piaget's approach is its interdisciplinary nature. The framework for the theory began with the three disciplines of philosophy, psychology, and biology. From philosophy came the initial questions about the nature of knowledge to be answered. Although these questions traditionally lie in the domain of philosophy (i.e., epistemology), Piaget turned to psychology for the method of study. In his view, the questions are factual ones that can be answered only through psychological research (Piaget, 1972:9). Specifically, the transition from one level of knowledge to another can be determined only through psychological observation.

The contribution of biology is in the framework that describes the nature of intellectual development. Intelligence, like the biological organism, is a living system that grows and develops. Biological organisms and intelligence are both composed of structures and both have mechanisms for regulating activity (Piaget, in Bringuier, 1980:3). Therefore, the adaptation and growth of organisms provide an explanation of the problems and processes involved in the adaptation of intelligence or "knowledge" (Piaget, 1980).

The focus of Piaget's theory is the development of natural thought from birth to adulthood. Understanding the theory depends on an understanding of both the biological assumptions from which it is derived and the implications of those assumptions for defining knowledge (Piaget, 1970b:703).

2.6.4.1 Basic assumptions

The goal of the theory is to explain the mechanisms and processes by which the infant and then the child develops into an individual who can reason and think using hypotheses. The basic assumptions on which these descriptions are based are Piaget's definition of cognitive development and his conception of the nature of intelligence.

2.6.4.1.1 A definition of cognitive development

Jean Piaget's conception of cognitive development is derived from his analysis of the biological development of certain organisms. According to Piaget, cognitive structures, like biological structures, " are not given in advance, neither in the human mind nor in the external world as we perceive and organize it" (Piaget, in Bringuier, 1980:37).

Furthermore, intelligence also constructs the cognitive structures necessary for adapting to the environment. For example, young children often maintain that two rows of objects are unequal in number if one row is longer than the other. Realization of the true nature of the situation (number of objects is independent of spatial arrangement) requires a reconstruction of the child's thinking. The child must give up his or her dependence on perceptual cues, such as length of the row, as an indicator of number equality. The result is the construction by the child of a new internal structure about the numbering of objects.

The function of cognitive growth is to produce these powerful cognitive structures that permit the individual to act on the environment with greater flexibility and in more ways (Gruber & Voneche, 1977).

Four factors are necessary for the development of cognitive functions: the physical environment, maturation, social influences, and the learner's self-regulatory processes, referred to as "equilibration" (Piaget, 1977:3-13). Each one is essential for development, but none is sufficient by itself.

Contact with the physical environment is indispensable since the interaction between the individual and the world is the source of new knowledge. However, contact with the physical world is insufficient for developing knowledge unless the individual's intelligence can make use of the experience. Maturation of the nervous system is therefore important because it permits the child to realize maximum benefit from physical experience. In other words maturation opens up possibilities for development, whereas the lack of it establishes broad limits on cognitive achievement.

The social environment includes the role of language and education. The importance of the social environment is that such experiences, like physical experience, can accelerate or retard the development of cognitive structures (Inhelder, Sinclair & Bovet, 1974).

The foregoing three factors are the classical factors that influence development as described by other theorists. In addition, Piaget describes a fourth factor, equilibration. This factor is the learner's self-regulatory and self-correcting processes that function throughout development.

However, equilibration is not an "add-on" to the other three factors. Instead, equilibration regulates the individual's specific interactions with the environment as well as physical experience, social experience, and physical development. Equilibration permits cognitive development to proceed in a coherent and organized fashion (Piaget, 1977:3-13).

2.6.4.1.2 The nature of intelligence

Theories of learning have traditionally defined "learning" and "intelligence" as two separate, although related, entities. Intelligence is viewed as a broad enduring trait that can be measured quantitatively. Learning is considered to be a specific process that occurs within the broad parameters established by intelligence.

2.6.4.1.2.1 Intelligence as process

For Piaget, intelligence is not a static trait that can be quantitatively assessed. Instead, intelligence is an ongoing and changing process. It is the mechanism by which the individual interacts with the environment at any given moment and a process that continually constructs itself. Intelligence, like a biological system, takes certain basics from the environment and builds the structures it needs in order to function. Thus intelligence is always active and dynamic, for it seeks explanations and understandings in order both to construct itself and to function effectively (Bell-Gredler, 1986:196).

The perspective that intelligence is a dynamic and developing process has important implications for the definition of the term "knowledge." Piaget rejects the traditional view that learning is a matter of acquiring static objective knowledge about a "real" world that existed prior to and independent of the learner. That traditional view, according to Piaget (1970b:703-732) is based on two erroneous assumptions. One is that objective knowledge is some entity "out there" in objects and events that can be identified. The second assumption is that external environment and the individual can be separated into two entities in any definition of knowledge.

2.6.4.1.2.2 Knowledge as process

Piaget's unique view of knowledge is that in the creation of knowledge, the individual and the object are fused and cannot be separated. Knowledge also contains many subjective components; therefore, it is a relationship and not some a priority given.

The relationship between the learner and the object is not static; it is always undergoing transformation. The relationship between subject (knower) and objects is in no way determined beforehand, and more importantly, it is not stable (Piaget, 1970b:704).

Therefore, according to Piaget (1970b), to attempt to describe the acquisition of knowledge as though it were a particular type of unchanging event between a subject and the environment is in error. The characteristics of the act of knowing are not constant and the identification of the different ways in which the individual constructs knowledge is of fundamental importance in understanding cognitive development.

In summary, Piaget's theory is supported by three major assumptions. Firstly, that knowledge is not an objective entity in the environment. Instead, it is the interaction between the individual and the environment, and it includes both subjective and objective components. Since the individual and the object in the environment cannot be separated in terms of defining knowledge, the task for genetic epistemology is to determine the characteristics of this ever-changing interaction.

Secondly, that the growth of intelligence, like biological development, is dependent on the construction of new structures from prior structures. New structures are constructed as a part of the adaptation of intelligence to the environment. Thirdly, that the factors which influence cognitive development are the physical environment, the social environment, maturation, and the individual's self-regulation processes. All these factors are essential for cognitive growth.

2.6.4.2 The components of cognitive development

The focal point of the theory is the means by which individuals progress from one level of mental development or knowledge to higher levels. Central to the theory is the belief that knowledge is constructed by the individual in continual and ever-changing interactions with the environment.

In seeking to understand the mechanisms of cognitive development, Piaget described intellectual functioning from three perspectives: (1) the fundamental processes involved in interactions with the environment (assimilation, accommodation, and equilibration), (2) the ways in which knowledge is constructed (physical and logico-mathematical experience), and (3) the qualitative differences in thinking at different stages of development (the action schemes of the infant, preoperational thought, concrete and formal operations) (Bell-Gredler, 1986:198).

2.6.4.2.1 The fundamental processes

Cognitive development, according to Piaget (1977:3), is effected by three basic processes: assimilation, accommodation, and equilibration. Briefly summarized, assimilation is the integration of new data with existing cognitive structures, accommodation is the adjustment of cognitive structures to the new situation, and equilibration is the continuing readjustment between assimilation and accommodation.

2.6.4.2.1.1 Assimilation

This process is primarily a biological concept (Piaget, in Bringuier, 1980:42). It is the integration of external elements into the organism's structures, similar to the digestion of food and the incorporation of chlorophyll in a plant's growth (Piaget, 1970b:307).

In intellectual life, as in biological life, assimilation involves the integration of new data with already existing internal structures. A child who identifies a three-sided figure as a triangle is assimilating that figure into his or her schema. Assimilation, however, is not the process of passively registering a copy of reality, nor is it an association between some environmental stimulus and a response. Instead, it is the filtering of the stimulus through an action structure so that the structures are themselves enriched (Piaget & Inhelder, 1969:6).

Assimilation in the cognitive level is roughly analogous to a rabbit eating a cabbage (Piaget, *in* Bringuier, 1980). The rabbit does not become the cabbage; instead, the cabbage becomes part of the rabbit. An important requirement for the occurrence of assimilation is an internal structure that can make use of the information.

2.6.4.2.1.2 Accommodation

In the individual's encounters with the environment, accommodation accompanies assimilation. Accommodation is the adjustment of internal structures to the particular characteristics of specific situations. For example, biological structures adjust to the type and quantity of food at the same time that the food is being assimilated.

Assimilation and accommodation function together in encounters with the environment at all levels of cognitive functioning. When the infant has discovered that he or she can grasp everything he or she sees, everything becomes an object to grasp (i.e., assimilation) (Piaget, *in* Bringuier, 1980:43). For a large object, however, both hands may be needed, and the same holds for the scientist and the scholar whose theory is an assimilatory scheme which can be adapted to diverse situations (Piaget, in Bringuier, 1980:43).

2.6.4.1.2.3 Equilibration

Like assimilation and accommodation, equilibration also has a biological parallel. In biological functioning, the organism must maintain a steady state within itself while at the same time remaining open to the environmental events necessary for growth and survival.

In cognitive development, equilibration is the continuing self-regulation that permits the individual to grow, develop, and change while maintaining stability. Equilibration, however, is not a balance of forces (which would be an immobile state). Instead, it is a dynamic process that continuously regulates behaviour (Piaget, in Bringuier, 1980:41).

Equilibration regulates the individual's thinking processes at three different levels of cognitive functioning. They are the relationships between: (1) assimilation and accommodation in the individual's daily encounters, (2) emerging subsystems of the individual's knowledge, and (3) parts of the individual's knowledge and total knowledge system. Equilibration is the factor that maintains stability during a process of continuous interactions and continuous change. Without equilibration, cognitive development would lack continuity and cohesiveness, but instead, would become fragmented and disorganized (Bell-Gredler, 1986:200-201).

2.6.4.2.2 The construction of knowledge

The fundamental processes operating in the construction of knowledge are assimilation and accommodation regulated by equilibration. In addition, Piaget (1980) has described the construction of knowledge in terms of the types of knowledge experiences in which the learner engages. They are physical experience and logico-mathematical experience.

2.6.4.2.2.1 Physical experience

Any direct encounter with the environment in which the individual abstracts the physical properties of objects is referred to as physical experience. Examples include the infant's taking note of the sound of its rattle and a child's noticing the softness of velvet. In physical experience, a particular property such as colour or shape is assimilated into the learner's existing mental structure. At the same time, however, accommodation is occurring. The individual's mental structure may be adjusting to the intensity of the colour (bright or dull), the particular shade (light or dark), and so on. Thus physical experience involves both the processes of assimilation and accommodation (Bell-Gredler, 1986:202).

2.6.4.2.2.2 Logico-mathematical experience

The physical properties of objects are abstracted and integrated into the child's mental framework through physical experience. It is characterized by direct encounters with the environment in which the source of knowledge is some object external to the learner. In contrast, the source of knowledge in logico-mathematical experience is the learner's own thought processes being reorganized on a higher level, for example.

In a logico-mathematical experience, the activity is one of reflecting on current actions and reorganizing them on a more logical level. This activity is therefore referred to as "reflective abstraction" because it involves thought processes "reflecting on themselves" (Bell-Gredler, 1986:202).

The terms physical experience and logico-mathematical experience signify different ways of developing new knowledge. However, in the child's interactions with the environment, they are inseparable (DeVries, 1978:84). A child who is looking at six blue blocks and two yellow ones may be thinking about the specific properties;

however, a whole network of relationships could also be activated by the experience (DeVries, 1978).

2.6.4.2.3 The stages of cognitive development

The descriptions of empirical and reflective abstraction indicate different ways by which the individual develops knowledge. During the early years of the child's life the processes of empirical and reflective abstraction in the child's actions are largely undifferentiated. However, the process of empirical abstraction (i.e., physical experience) dominates the child's thinking (DeVries, 1978). During the later childhood years, the logico-mathematical aspect of thinking becomes more fully capable of making logical decisions. Finally, the attainment of "true" logical thinking is characterized by the dominance of the process of reflective abstraction (i.e., logico-mathematical experience).

The early research conducted by Piaget (1967, 1970a) established the framework for the foregoing analysis of thinking processes. Specifically, four broad periods or stages of cognitive development were identified in Piaget's early investigations of children's thinking. They are the sensorimotor (1.5–2 years), preoperational (2-3 to 7-8 years), concrete operational (7-8 to 12–14 years), and formal operational stages (older than 14).

Each one "extends the preceding period, reconstructs it on a new level, and later surpasses it to an even greater degree" (Piaget & Inhelder, 1969:152).

For example, the infant's attainment of the notion of object permanence sets the stage for the preoperational development of qualitative identities. Specifically, a= a; that is, the water poured from a tall container is the same water. Similarly, the development of both part-whole relationships (classification) and of seriation in the concrete operational period is essential for the later development of formal operational thinking. Although individuals move from one stage to another at different ages, the stages occur in a sequential order. Like the embryological stages in the biological organism, each stage in cognitive development is necessary for the following one to occur (Bell-Gredler, 1986:204).

2.6.4.3 The nature of complex thought

A major contribution of Piaget's analyses is the identification of the qualitative differences in modes of reasoning from infancy to adulthood. The infant's action schemes gradually give way to the semilogical thought of the young child. This, in turn, develops into the logical thought structures referred to as concrete operations, and later, formal operations.

The term "operations" refers to the cognitive structures that govern logical reasoning in the broad sense (Piaget, 1980). Like other cognitive structures, operations can be carried out both physically and mentally.

Operations differ from other actions in at least two important ways. An operation includes both a transformation and a constant that does not change. Operations are also reversible; they may be returned to the starting point. The act of smoking a pipe is not an operation. When completed, it cannot be reversed (Piaget, 1970a:21).

2.6.4.3.1 Concrete operational structures

Concrete operations include class inclusion operations, seriation, and the conservation constructs of number, length, matter, weight, and volume. The child's construction of these cognitive structures is a gradual process that first includes cognitive conflict, then vacillation among possible choices, and finally, logical resolution of the conflict. The preoperational child focuses on perceptual cues and static states. The concrete operational child focuses on the transformations and can identify the constant characteristic (that which is conserved).

An understanding of part-whole relationships is the essential characteristic of class inclusion operations. Seriation is characterized by transitivity, or the "transfer" relations (Bell-Gredler, 1986:206 -207).

2.6.4.3.2 Formal operational structures

The reflected abstractions referred to as formal operations differ from concrete operations in several ways. The major difference is that formal operational thinkers can develop and test hypotheses about complex multifactor situations. Concrete operational thinking is restricted to two-factor situations. One reason for the difference is that the concrete operational thinker, given four characteristics, such as red and white and circles and squares, is only able to generate the four subclasses (red circle, red squares, white circles, and white squares). In contrast, the formal operational thinker can also generate the 16 possible combinations of these characteristics. For example, among the possibilities are white squares + red circles, red squares + red circles, and red squares + white circles. Piaget (1970a) refers to this capability as combinatorial operations. It is essential for formal operational thinking because it makes possible the analysis of relationships in multifactor situations (Inhelder & Piaget, 1958:313).

The important characteristic that distinguishes formal operations from concrete operations is that the subject begins with a theoretical synthesis that implies certain relationships and then proceeds to test the hypothesized relationships (Karmiloff-Smith & Inhelder, 1975:195-212). In contrast, concrete operational thought reasons from the empirical data in developing an explanation (Inhelder & Piaget, 1958:251).

2.6.5 Albert Bandura's Social Learning Theory

In the social learning view, people are neither driven by inner forces nor buffeted by environmental stimuli. Rather, psychological functioning is explained in terms of a continuous reciprocal interaction of personal and environmental determinants (Bandura, 1977b:11). Early in the twentieth century, functionalism advocated the study of mental functioning and human experience in terms of the organism's adaptation to the environment. From the functionalist perspective, the total organism in all its complexity should be the focus of study.

The functionalist emphasis on the individual's adjustment to the environment and the importance of mental process is particularly reflected in social learning theory. Originally referred to as observational learning (Bandura & Walters, 1963), social learning theory began with the belief that important psychological processes and issues had either been overlooked or only partially studied by other theories. Of major importance, according to social learning theory, is the ability of individuals to abstract information from the behaviours of others, make decisions about which behaviours to adopt, and later, to enact the selected behaviours. Thus, to exclude the premise that thought can regulate action is to limit a theory's ability to explain complex human behaviour (Bandura, 1977b).

Albert Bandura's social learning theory seeks to explain learning in the natural setting. Unlike the laboratory setting, the social milieu provides numerous opportunities for individuals to acquire complex skills and abilities through the observation of modeled behaviours and their behavioural consequences.

2.6.5.1 Basic assumptions

The assumptions on which social learning theory is based describe: (1) the nature of the learning process in the naturalistic setting, (2) the relationship of the learner to the environment, and (3) a definition of what is learned (Bell-Gredler, 1986:235).

2.6.5.1.1 The nature of the learning process

Social learning theory began with an analysis of imitative learning as it was described by prior theories. Included in this analysis are: (1) the behaviouristic theories developed in the laboratory setting, and (2) theories that address the socialization of the child.

In general, the behaviourists treat imitative learning as an association between a particular type of stimulus and a particular type of response. Three limitations of these approaches have been identified by Bandura (1972:35-61). Firstly, the research has led to an exploration of a narrow learning situation that does not adequately represent learning in the natural setting. Specifically, only the learner's imitation of a specific set of responses (mimicry) has been researched, the range of social variables that operate in most situations excluded (Bandura & Walters, 1963:43).

Secondly, and partly as a result of the experimental approach, these theories are unable to account for the acquisition of novel responses. In the natural setting, observers do more than mimic an observed behaviour. They often imitate a variety of behaviours and abstract a behavioural repertoire from the activities of several models. For example, children exposed to multiple models who demonstrated diverse aggressive behaviours performed novel responses that were new combinations of observed elements (Bandura, Ross & Ross, 1963b:3-11).

The third limitation of the behaviourist position is that it includes only the phenomenon referred to by Bandura (1971b) as direct learning. The learner performed a response and experiences the consequences. This type of imitation is "instantaneous matching" (Bandura, 1971b).

The explanations offered by the behaviourist theories were restricted by the S-R paradigm. In contrast, other theories maintained that an interpersonal relationship between the child and an adult was responsible for the child's acquisition of social behaviours (Bandura, 1969; Bandura & Walters, 1963). Complex sets of reference events were proposed to account for the child's patterning of the adult's thoughts and actions, referred to as "identification with the model" (Bandura, 1969:213-262).

2.6.5.1.2 The relationship between the learner and the environment

In the social learning perspective, both behaviour and the environment are modifiable, and neither is the primary determinant of behavioural change. "Books do not influence people unless someone writes them and others select and read them. Rewards and punishments remain in abeyance until prompted by appropriate performances" (Bandura, 1974:866).

The acquisition of complex behaviours is not explained by a simple bidirectional relationship between the environment and the individual. Instead, most environmental influences on behaviour are mediated by a variety of internal personal factors. These personal factors, such as the selection of events to be observed and the ways in which events are perceived and judged, intervene between environmental influences and behaviour.

Bandura (1978) proposes a three-way interlocking relationship between behaviour, the environment, and the internal events that influence perceptions and actions. The relationships between the environment, internal events, and behaviours are often complex and subtle. Certain personal attributes, such as sex or race, often activate differential social treatment. The individual's selfconcept, in turn, is influenced by the treatment in such a way that biases are either altered or maintained.

2.6.5.1.3 The outcomes of learning

The three-way relationship between the environment, internal factors, and behaviour specifies that cognitive processes and other personal factors influence behaviour. Consistent with this view, learning and performance are differentiated in social learning theory. Individuals acquire symbolic representations of behaviour that may or may not be performed later. Observational learning without performance has been documented in situations in which performance by the observers was not the criterion for learning (Bandura, 1965a, 1971a). After observation of models that enacted novel behaviours, observers who did not enact the particular behaviours were able to describe them. Further more, accurate performance by the observers was forthcoming through the use of appropriate inducements (Bandura, 1965a, 1971a).

Symbolic representations that are learned are retained in the form of memory codes; their function is to serve as guidelines for future performance. The memory codes of observed behaviours are symbolic codes referred to as representational systems (Bandura, 1971b:13). The two types of systems are visual and verbal. The visual system includes vivid images of absent physical stimuli (Bandura, 1971b). Included are activities, places, and objects. As a result of repeated exposure to these types of stimuli, they are eventually produced as retrievable visual images (Bandura, 1977b).

Some events are coded in verbal form. Details of a particular procedure, such as checking the oil level in one's car, may be remembered more easily through conversion to a verbal code.

Language symbols are the verbal codes most used in everyday life. However, the system also includes numbers, musical notation, Morse code, and others (Bandura, 1971b). The importance of symbolic codes, both visual and verbal, is that they include a great deal of information in easily stored form (Bandura, 1977b:26).

2.6.5.2 The components of learning

In the natural setting, individuals learn new behaviours through the observation of models and through observing the effects of their own actions. The learner's cognitive processes abstract information from a large variety of observed behaviours that are enacted in numerous settings. This information is stored in memory and may be performed by the learner at a later stage.

The elements that are present in every act of learning are the behaviours enacted by models, the environmental factors that contribute to the learning of the observed behaviours, and the individual's internal processes. The components of the learning are therefore: (1) the behavioural model, (2) the consequences of the modeled behaviour, and (3) the learner's internal processes (Bell-Gredler, 1986:241).

2.3.5.2.1 The behavioural model

The primary role of the modelled behaviour is to transmit information to the observer. This role is exemplified in three ways. One is that modeled behaviour serves as a social prompt to initiate similar behaviour in others.

The second effect of modeling is to strengthen or weaken the learner's existing restraints against the performance of particular behaviours. The third influence of modeling is to transmit new patterns of behaviour. A vast range of human behaviour, from the baby's first goodbye wave to complex cognitive, motor, and affective repertoires, may be acquired from models (Bell-Gredler, 1986:241-242).

2.3.5.2.2 The consequences of behaviour

Like operant conditioning, behavioural consequences are important elements in social learning theory. Two major differences exist between the two theories. Firstly, in the operant conditioning theory, reinforcement is a necessary condition for learning. In social learning theory, reinforcement is only one of the factors that influence learning, and it is a facilitating condition.

Secondly, operant conditioning includes only consequences that impinge directly on the performer of the response.

Social learning theory, in contrast, includes three types of reinforcement. One is the reinforcement described above, referred to by Bandura (1971b) as direct reinforcement. The two other types are vicarious reinforcement and self-reinforcement (Bandura, 1971b).

2.6.5.2.2.1 Vicarious reinforcement

For vicarious reinforcement to occur: (1) a model is reinforced for the execution of a particular behaviour, and (2) the observer's performance of the behaviour increases in frequency. There are three effects of vicarious reinforcement: (1) Information is conveyed about which behaviours are appropriate in which settings. (2) Emotional responses of pleasure and satisfaction are aroused in the observer. (3) After repeated reinforcements, incentive-motivational effects are generated; behaviour acquires functional value (Bell-Gredler, 1986:244).

2.6.5.2.2.2 Self-reinforcement

Direct and vicarious reinforcement both involve consequences delivered by the environment. Gold stars awarded for attendance, prizes won on television quiz shows, and minimal prison terms imposed for heinous crimes are dispensed to individuals by some member or agent of society, and they may influence the behaviour of others. Self-reinforcement, on the other hand, is independent of the consequences delivered by society. Furthermore, it must be consciously cultivated by the individual. Young children respond to immediate physical consequences (food and physical contact) and other material rewards. Then symbolic consequences, including social reactions of approval and disapproval, become means of reinforcing or punishing. Next are social contracting arrangements, and finally, individuals become capable of establishing self-evaluative and self-produced consequences (Bandura, 1978:103).

2.6.5.2.3 The learner's cognitive processes

In the social learning theory, cognitive processes play a central role. The learner's ability to code and store transitory experiences in symbolic form and to represent future consequences in thought are essential to the acquisition and modification of human behaviour. Four component processes are responsible for learning and performance. They are attention, retention, motor production, and motivational processes (Bandura, 1971a, 1977b).

The importance of the learner's attention is that new behaviours cannot be acquired unless they are attended to and accurately perceived (Bandura, 1977b). The learner's attentional processes are influenced by a variety of factors. Included are the model's characteristics, characteristics and functional value of the behaviour, and the observer's characteristics.

The retention processes are responsible for the symbolic coding of the behaviour into visual or verbal codes and the storage of the codes in memory. The importance of these processes is that the learner cannot benefit from the observed behaviours in the model's absence unless the behaviours are coded and retained for later use (Bandura, 1977b).

An important retention process is rehearsal. Both mental rehearsal, in which individuals imagine themselves enacting the behaviour, and motor rehearsal serve as important memory aids.

After the observer has acquired a symbolic code, performance of the acquired behaviours depends on the learner's motor reproduction and motivational processes. Motor reproduction includes the selection and organization of responses at the cognitive level, followed by their execution (Bandura, 1977b).

The three processes that function as motivators are direct (external) reinforcement, vicarious reinforcement, and self-reinforcement. Anticipation of reinforcement for a particular behaviour motivates the observer's performance.

The complexity of the processes involved in observational learning merely indicates that the provision of models alone, however prominent, will not automatically lead to the same behaviour in observers (Bandura, 1977b:29). Careful consideration must be given to the four processes in the analysis of any learning situation. Also, since many of the subprocesses involved in observational learning change as a result of maturation and/or experience, developmental level is a major factor in learning. The learner's skill in selective observation, memory encoding, coordination of sensorimotor and ideomotor systems, as well as the capability to identify probable consequences for imitative behaviour are all important factors (Bandura, 1977b:29).

2.6.5.3 The nature of complex learning

The acquisition of complex skills and abilities depends on more than the processes of attention, retention, motor reproduction, and motivation. Accomplished performance, according to Bandura (1982:122-147), requires two other components. They are the learner's sense of self-efficacy and the learner's self-regulatory system.

2.6.5.3.1 Perceived self-efficacy

A sense of efficacy is the conviction that one can successfully execute the behaviour required to produce a particular outcome (Bandura, 1977b). Efficacy involves a sense of mastery. Perceived self-efficacy influences behaviour in at least three ways. It influences: (1) the choice of activities to be engaged in, (2) the quality of an individual's performance, and (3) persistence in difficult tasks. It also helps a person withstand failure. Individuals who do not possess a sense of efficacy typically dwell on personal deficiencies and believe that potential obstacles are formidable (Bandura, 1982:123).

Perceived self-efficacy involves self-appraisal; it is "not a fixed act or simply a matter of knowing what to do" (Bandura, 1982:122). For example, men consider themselves efficacious for occupations traditionally held by both men and women. In contrast, women typically consider themselves efficacious only for occupations traditionally held by women (Bandura, 1982). However, in the groups tested, the men and women college students did not differ in their verbal and quantitative abilities in standardized tests (Betz & Hackett, 1981:399-410). Furthermore, the level of perceived self-efficacy was associated with the careers considered by the students as well as the extent of their interest.

Quality of performance and persistence in difficult tasks are also influenced by efficacy beliefs. Research into the development and maintenance of various coping behaviours indicates perceived self-efficacy to be an important factor in long-term behavioural change (Bandura, 1982). For smokers, perceived self-efficacy in resisting smoking in stressful situations was related to relapses. The highly self-efficacious individuals reinstated control after a relapse, whereas the less self-efficacious relapsed completely (Bandura, 1982:131). Perceived self-efficacy is also related to persistence in subtraction problems for children with serious deficits in subtraction (Bandura & Schunk, 1981) and for division problems (Schunk, 1981:93-105). The importance of the efficacy-persistence relationship is that persistence was also related to the children's success.

2.6.5.3.2 The self-regulatory system

Perceived self-efficacy, when fully developed, exercises considerable influence over behaviour. However, this self-regulatory influence is not some psychic agent that exercises behavioural control, nor does it occur simply by an act of will (Bandura, 1978, 1982). Instead, the self system refers to: (1) the cognitive structures that provide referents for behaviour and its outcomes, and (2) the cognitive subprocesses that perceive, evaluate, and regulate behaviour (Bandura, 1978:348). Thus, the self system includes standards for one's behaviour, and the capabilities of self-observation, self-judgment, and self-response. The response may be either a reward for behaviour judged acceptable, or negative reactions for behaviour that does not meet the individual's standards.

The development of these self-evaluative functions opens up a range of possibilities for the individual (Bandura, 1974:861). Specifically, these processes make self-direction possible. Individuals can pursue activities that promote satisfaction and self-worth, while avoiding activities that lead to self-punishment.

Self-established standards of performance are not based on absolute measures of adequate performance (Bandura, 1977b, 1978). A score on an achievement test or the time required to run a race provides insufficient information. Instead, the evaluative standard is derived from the performance of other individuals, the performance of identified reference groups, or more interestingly, one's own past performance record. Often, comparisons with one's own past performance lead to the setting of higher standards. After a particular level of performance is reached the challenge is gone and new self-satisfaction is sought through additional improvement (Bandura, 1977b, 1978).

2.6.6 Bernard Weiner's Attribution Theory

The attribution theory developed by Bernard Weiner (1972, 1980) links two major areas of interest in psychological theory: motivation and attribution research. Early theories of motivation, like theories of learning, were developed primarily from the stimulus-response perspective that was dominant from the the mid-1930s to the mid-1950s. The major motivational construct during that period was the concept of drive. However, the drive construct, although interpreted in a variety of ways, proved inadequate to account for the complexities of human motivation (Bell-Gredler, 1986:274).

The shift from a stimulus-response perspective to a cognitive perspective began after World War II. Among other developments discussed in the last section, this shift ushered in the perspective referred to as attribution theory. The term "attribution" refers to an individual's perceived causes of an event or an outcome. The research focuses on the ways in which individuals arrive at causal explanations and the implications of those explanations. In other words, the theories focus on the ways in which people answer the question "Why?" (Kelley, 1973:107-128).

The theory developed by Bernard Weiner (1972, 1980b) began with the variables identified in John W. Atkinson's theory of achievement motivation (1958, 1964). According to Atkinson, motivation is a function of task variables and the individual's disposition to strive for success or to avoid failure. Weiner (1972) maintains that internal events mediate the relationship between the task stimulus and the individual's subsequent behaviour. Individuals high in achievement motivation, for example, perceive themselves as more able than those low in achievement motivation, and they also expend more effort on achievement tasks (Weiner & Kukla, 1970). In addition, Weiner and Kukla found that the effects of task variables are not uniform. That is, success in a difficult task generates more pride than success in an easy task.

2.6.6.1 Basic assumptions

Bernard Weiner (1979:3) states that a central assumption of attribution theory is that the search for understanding is a basic "spring of action." The basic assumptions of this theory relate to two general concepts: the nature of causal inferences (attributions) and the relationship of those inferences to behaviour.

2.6.6.1.1 The nature of causal inferences

An important characteristic of causal inferences is that they occur in a broad range of human activities. Attributions are developed for achievement outcomes, such as why a test was failed or why a poor grade was received on a term paper. In addition, attributions are developed in the affiliative and power domains. Examples are: "Why was I rejected for a date?" and "Why did I lose the election?" (Weiner, 1982:186).

Much of the prior attributional research was based on the assumption that the perceived causes of behaviour vary on a single dimension. Events are attributed either to the individual (the self) or to a characteristic of the environment. A well-known example is the locus of control construct developed by Julian Rotter (1966, in Bell-Gredler, 1986:276). In his view, the perceived causes of behaviour lie on a continuum between the two extremes of internal and external loci of control. Individuals who believe that reinforcements (positive consequences) are contingent on their own behaviour also believe that they control their own destiny. They are, therefore, inner-directed. Such individuals believe that positive events typically are the result of hard work, careful planning, and so on. They also take responsibility for events in their lives. Arriving late for class is likely to be acknowledged as leaving home too late to find a parking place, rather than some vague external condition.

In contrast, individuals who are outer-directed perceive no relationship between their behaviour and reinforcements. Instead, luck, fate, or powerful others are in control. Therefore, the student may believe that a D on a test is the result of lack of ability (internal locus) or the result of teacher bias (external locus).

The major difficulty with the one-dimensional analysis of attributions is that it does not adequately account for subsequent effects. Thus, several outcomes may result from attributions that occur in the same dimension, either internal or external (Weiner, 1972; Weiner et al., 1971). For example, different expectancies for future outcomes follow the attributions of lack of ability and lack of effort, both of which are internal. A poor grade attributed to lack of ability will be expected to occur again. However, a poor grade attributed to lack of effort may not be expected in the future since the student's expenditure of effort is subject to change (see Eswara, 1972; McMahan, 1973; Rosenbaum, 1972; Weiner, Neirenberg, & Goldstein, 1976).

2.6.6.1.2 The relationship of causal inferences to behaviour

A primary assumption of attribution theories is that the search for understanding is a major source of human motivation (Weiner, 1979:3-25). The pleasure-pain principle is not discounted as a source of human motivation. However, information seeking and verification are undertaken independent of the pleasure-pain principle. That is, as a motivator of action, comprehension ranks along with hedonism as a primary influence on behaviour (Weiner, 1979:3).

Another major assumption is that future behaviour is influenced by people's belief systems and their cognitive analyses of the causes of positive and negative outcomes. For example, the student who attributes failure to low ability is likely to expect future failures and to believe that he or she has no behavioural response that can alter subsequent events (Weiner, 1979:3-25). Therefore, little or no effort will be expended on achievement-related tasks. In contrast, a student who attributes success to ability expects continued success. An occasional failure for such a student is likely to be attributed to a temporary cause, and future effort is not jeopardized.

In summary, three major assumptions support the theory. They are: (1) the search for understanding is a primary motivator of action, (2) attributions are complex sources of information about outcomes, they vary on more than a single dimension, and (3) future behaviour is determined, in part, by perceived causes of prior outcomes.

2.6.6.2 The components of the attributional process

The attributional model of motivation includes several components. One important aspect of the model is the relationship between attributions, feelings, and behaviour. The logical sequence of psychological linkages, according to Weiner (1972), is that feelings are the outcomes of attributions or cognitions. Feelings do not determine cognitions. For example, to first experience gratitude for a positive outcome and then to decide that help from others is responsible for the success is an illogical sequence (Weiner, 1982:204). Furthermore, feelings can be changed by new information (altered cognitions). Anger toward others can be dissipated, for example, by the information that some other agent is the cause of the problem.

The attributional model identifies the relationships among outcomes, attributions, and subsequent consequences. There are three important components that contribute to an understanding of these relationships. They are: (1) the kinds of antecedent information used by the individual in the selection of a causal attribution, (2) the properties of causal attributions, and (3) the role of emotional reactions with regard to behaviour.

2.6.6.2.1 Antecedents of causal inferences

The sources of information available to the individual prior to the attribution for an outcome are referred to as antecedents. The three types of antecedents are: (1) specific informational cues (such as one's past success history); (2) the individual's internal cognitive structure, referred to as causal schema; and (3) individual predispositions.

2.6.6.2.1.1 Specific informational cues

The primary antecedent cues are past success history, social norms, performance patterns, and time spent at the task (Weiner, 1977:181). These cues lead to different causal inferences about success or failure.

The individual's past success history is the primary determinant for the selection of ability or lack of it as an attribution (Weiner, 1974). A consistent record of prior achievements leads to ability as a selected cause for success. A moderate success record indicates that goal attainment cannot be expected consistently. However, success has occurred fairly often; it is not random. In this case, success is likely to be attributed to effort rather than to either ability (consistent success record) or luck (random success record).

On the other hand, a consistently poor achievement record is associated with lack of ability. Given such a history, the causal inference for current failure is more likely to be lack of ability (stable, internal cause) than luck (unstable, external cause). Similarly, success for the individual with a poor achievement record is likely to be attributed to luck.

Social norms and the performance records of others also provide information about ability. If one succeeds at a task at which others fail, then the individual will likely decide that he or she is able (Weiner, 1974:53). Similarly, failure on a task at which others succeed is viewed as the result of lack of ability. The percentage of others who succeed is viewed as the result of lack of ability. The percentage of others who succeed or fail at a particular task, however, contributes to the use of task ease or difficulty as a casual belief. The higher the percentage of others who succeed at a task, the greater is the likelihood of ease of task as a causal inference for success. The higher the percentage of task failures, the more likely that the inference for failure will be task difficulty (Weiner, 1974:53).

Finally, effort is determined primarily by length of time at the task, extent of fatigue, and perceived degree of muscle tension, whereas luck is associated with lack of personal control in the outcome and perceived randomness of the outcome.

2.6.6.2.1.2 Causal schemas

Causal schemas are the relatively permanent cognitive structures that represent the individual's general beliefs about events and associated causes (Weiner, 1977). Research has identified some fairly common belief systems. One is the belief that success is produced by either ability or effort. Each cause is by itself sufficient to yield success; therefore, this belief is referred to as sufficient causal schema (Weiner, 1974:53). This schema is often elicited by a typical success (Kun & Weiner, 1973).

Another causal schema is that success depends on both ability and effort. Since neither cause can by itself yield success, this combination of causes is referred to as a necessary causal schema (Weiner, 1977). This combination is often the explanation selected for success on a difficult task. Consistent with these beliefs, failure at a difficult task is ascribed to lack of ability and lack of effort (Kun & Weiner, 1973:197-203).

2.6.6.2.1.3 Individual predisposition

In addition to antecedent cues and causal schema, individual characteristics also influence causal attributions. One such characteristic is the need for achievement. Individuals who are high in achievement needs tend to attribute their success outcomes to themselves, that is, to skill or effort. Individuals low in achievement needs, however, tend to identify external factors as responsible for success (Weiner & Kukla, 1970). In addition, persons with high achievement needs tend to attribute initial failure to lack of effort (rather than lack of ability). Their persistence therefore increases, since they believe that increased effort will lead to success. In contrast, persons low in achievement needs often do not attribute the initial failure to lack of effort and therefore they tend to cease trying (Weiner & Kukla, 1970:1-20).

2.6.6.2.2 The properties of causal inferences

The antecedents of causal inferences are sources of information that influence the individual's choice of reasons for particular success or failure outcomes. Once such an inference is made, the next question to be asked about human behaviour is: What are the consequences of this choice? An important contribution of the present model to an understanding of motivation is the identification of attributional characteristics that lead to dissimilar reactions. Weiner (1979, 1982) has identified three such dimensions: locus of causality, stability, and controllability.

2.6.6.2.2.1 Locus of causality

This dimension refers to the internal/external nature of attributions. Ability, effort, and physical beauty are internal, whereas task difficulty and help (or hindrance) from others are external attributions. This dimension has been associated for the most part with Rotter's concept of locus of control. However, it has also been referred to as the origin/pawn distinction and as intrinsic/extrinsic motivation (Weiner, 1982).

The importance of the internality dimension is the relationship to the individual's sense of self-worth and self-esteem. Positive outcomes attributed to internal causes, such as ability or effort, generate pride and the individual experiences positive self-esteem. However, success attributed to external causes, such as luck or help from others, is not a source of self-esteem (Weiner, 1982). An example is receiving an A grade from a teacher who awards only good grades (external cause); pride is not experienced for the success. In contrast, receiving an A from a teacher who awards few good grades is a source of pride because a personal characteristic (ability or effort) is likely to be cited as the cause (Weiner et al., 1978).

Internal attributions for success also enhance the likelihood of future engagement in achievement-related tasks (Weiner et al., 1976). This consequence occurs whether the cause is controllable, such as effort, or is uncontrollable, such as intelligence (Weiner, 1982:190).

2.6.6.2.2.2 Stability

The primary influence of the stability dimension is on the expectancy of future outcomes. If a particular outcome is believed to be the result of stable factors (such as ability), the prior outcome will be predicted. However, attributions to unstable causes (such as luck or effort) raise some doubt about recurrence of the outcome (Weiner, 1979). In other words, test failure ascribed to ability or task difficulty leads to continued expectations for failure. However, a low score attributed to luck does not decrease expectancies for future success. Similarly, success attributed to unstable causes leads to lesser increments in success expectancies than success attributions to stable causes.

The stability dimension influences expectancies independently of the other two dimensions of attributions. Subjects' expectations of future success after prior success experiences indicated that expectancy increments were positively associated only with the stability property (Weiner et al., 1976:64).

The secondary association for the stability characteristic is the influence on the magnitude of emotional reactions. Failure attributed to the two stable causes (ability and task difficulty) contributes to apathy, resignation, and depression. Emotions generated by unstable attributions, however, are unlikely to be extended to future events.

In addition, the feelings generated in others by a particular attribution also tend to be exacerbated when the attribution is stable (Weiner, 1982). Pity toward a blind person is expected to be greater than that extended to someone with a temporary eyesight problem (Weiner, 1982:191).

2.6.6.2.2.3 Controllability

This dimension was first described as intentionality by Rosenbaum (1972). Mood was described as unintentional, and effort was designated as intentional. However, Weiner (1979) redefined the critical difference as that of controllability. That is, failure from lack of effort does not imply an intent to fail. The difference between effort and mood is one of volitional control rather than intent (Weiner, 1979:6).

The second important aspect of the controllability dimension is the emotional reactions of others. For example, some students were presented with a situation in which an unknown classmate asked to borrow notes for a missed class (Weiner, 1980). Forty percent of the respondents expressed negative reactions toward the potential borrower who had missed class to go the beach (controllable cause). However, only 4% expressed negative reactions toward loaning notes to an unknown classmate with a temporary eye disability (uncontrollable cause).

The importance of the reactions of others is that they are associated with particular behaviours. Pity and helping behaviour are usually precipitated by infirmities or conditions that are not under an individual's control. Included are serious illnesses and accidents (Weiner, 1982).

2.6.6.2.3 The role of affective reactions

Three sources of affect are identified in the attributional model (Weiner, 1979:14). One is the result of the type of outcome, success or failure. Another includes the distinct emotions that are associated with particular attributions. Included are gratitude, hostility, surprise, and others. A third source of affect is generated by the properties of the attributions and these affective reactions are associated with self-esteem. Examples include pride, competence and shame.

An important function of the emotional reactions that are generated is that they serve as motivators of subsequent behaviour. "Attributions tell us what to feel, and feelings tell us what to do" (Weiner, 1983b:69). An individual who has experienced apathy, resignation, and feelings of incompetence will cease trying in achievement-related situations. On the other hand, one who feels gratitude and relief is motivated to enact expressions of thankfulness. The individual who experiences a feeling of competence, however, will approach achievement-related situations with confidence.

A second function of affective reactions is that the reactions of others can serve as cues for people's self-perceptions. Such reactions serve as subtle cues that can convey attributional information following achievement performance (Weiner, Graham et al., 1982). Specifically, pity and anger are two affective reactions elicited in observers for perceived uncontrollable and controllable causes of achievement.

The hypothesis that the affective reactions of others can serve as the basis for causal inferences has been tested with several age groups. In one experiment, adults were given descriptions of failure situations and the teacher's affective reactions. The subjects accurately perceived the relationships between anger/lack of effort and pity/lack of ability (Weiner, Graham et al., 1982).

In another study, females conveyed sympathy, anger, or no affective reactions to three different groups of sixthgrade children following failure on novel problem-solving tasks (Graham & Weiner, 1983). The children systematically inferred that the angry "teacher" thought they did not try hard enough and that the sympathetic "teacher" believed that they lacked ability. Also, the children's beliefs about the reasons for their failures were influenced by the experimenter's affective reactions. The teacher's affective reaction may also influence his or her subsequent actions, which in themselves convey messages about ability. An example described by Weiner (1983a:173) is the Little League baseball coach who perceives that Johnny is low in playing ability. In deciding who to put in the game, the coach sends in Johnny with the comment that he can play now and that the rules require everyone to play. Johnny is also placed on the field where the balls are rarely hit, such as right field.

2.6.6.3 The cumulative effects of attributions for success or failure

Over a period of time, the individual's history of success or failure history and the accompanying attributions exert a continuing influence on the individual's self-esteem, goal expectancies, and causal attributions in achievement situations. As mentioned earlier, students with a moderate success record have experienced success inconsistently fairly often. Therefore, the stable internal attribution, ability, is unlikely to be selected as a cause for success. Nevertheless, success has not been a random outcome for the student. Therefore, luck is unlikely to be the attribution for success. Effort or ease of the task are more probable selections (Bell-Gredler, 1986:290).

In contrast, individuals with a consistent record of success in social and achievement situations have expectations for continued success. In addition, competence is a major component in self-esteem and self-concept. Conversely, individuals who have experienced a fairly consistent record of failures are low in self-esteem. For these two groups, success and failure outcomes have different meanings. The individual with the consistent success record expects continued success. Therefore, he or she is likely to attribute failure (unexpected outcome) to an unstable and/or external cause, such as illness, mood, or luck (Weiner, 1977, 1979). Such an attribution maintains the expectancy for the recurrence of success which is consistent with past history and also maintains a positive self-image.

Individuals who have a low self-concept of ability tend to ascribe success to unstable factors and to ascribe failure to internal, stable causes. They also have low expectancy of success in the future. According to Ames's study (1978:345-355), the fifth-graders who were low in self-concept did not respond favourably to their own successful outcomes.

2.7 SUMMARY

A theory is a set of organized principles about particular events in the real world. Learning theories have general functions (Suppes 1974:3-10), they serve as a framework for conducting research, provide an organizing framework for specific items of information, reveal the complexity of apparently simple events, and reorganize prior experience.

Thorndike developed the first learning theory (Thorndike, 1911:22), he was the first person to do learning experiments on animal (Bolles, 1979:3). From the mid-twentieth century the six contemporary learning theories have influenced both psychology and education. They are: Skinner's operant conditioning, Robert Gagné's conditions of learning, Information-processing theories, Jean Piaget's cognitive-development theory, Albert Bandura's social learning theory, and Bernard Weiner's attribution theory.

From the basic assumptions, components and nature of complex learning of the six theories, different ways of learning can be seen clearly. All of them has their respective advantages respectively and are beneficial for learning how to learn.

CHAPTER 3

LEARNING STRATEGIES

3.1 TYPES OF LEARNING STRATEGIES

In recent years increasing attention has been focused on the role of the learner as an active participant in the teaching-learning act. This view suggests that the effects of teaching depend partly on what the learner knows, such as the learner's prior knowledge and what the learner thinks about during learning, such as the learner's active cognitive processes (Anderson, Spiro, & Montague, 1977; Cook & Mayer,1983; Dansereau, 1985; Jones, Amiran & Katims, 1985; Mayer, 1984; Ryan, 1981; Weinstein & Underwood, 1985; Wittrock, 1974, 1978 in Weinstein & Mayer, 1986:315).

An interest in learning strategies is the natural outgrowth of a change in orientation from behaviourist theories to cognitive theories of learning. The behaviourist (or S-R) approach to learning--as developed from the work of Hull and Spence and Skinner--focuses on how presentation of material influences behaviour. This S-R approach is based on the idea that "a stimulus goes in, a response comes out, and what happens in between is summarized by a hyphen" (Farnham-Diggory, 1977:128). In contrast, the cognitive approach to learning seeks to understand how incoming information is processed and structured in memory.

The cognitive approach has changed our conception of the teaching-learning process in several ways. Instead of viewing learners as passively taking in the stimuli that the teacher presents, learning is viewed as an active process that occurs within the learner and which can be influenced by the learner. Instead of viewing the outcome of learning as depending mainly on what the teacher presents, the outcome of learning is supposed to depend jointly on what information is presented and on how the learner processes that information (Wittrock, 1986:316).

Good teaching includes teaching students how to learn, how to remember, how to think, and how to motivate themselves. Norman (1980:97) summarizes this argument as follows:

> It is strange that we expect students to learn yet seldom teach them about learning. We expect students to solve problems yet seldom teach them about problem solving. And, similarly, we sometimes require students to remember a considerable body of material yet seldom teach them the art of memory. It is time we made up for this lack, time that we developed the applied disciplines of learning and problem solving and memory. We need to develop the general principles of how to learn, how to remember,

how to solve problems, and then to develop applied courses, and then to establish the place of these methods in an academic curriculum.

From this argument, the importance of teaching learning strategies can be seen. Helping students to develop effective ways to handle the barrage of information coming from the environment, as well as their own thinking process, is a major goal of our educational system nowadays. The instruction in learning strategies (i.e., training in how to learn) can affect learner characteristics by making specific strategies and methods available to the learner. The use of particular learning strategies during learning can affect the encoding process, which in turn affects the learning outcome and performance.

Weinstein and Mayer (1986:316) classify learning strategies in eight major categories: (1) basic rehearsal strategies, (2) complex rehearsal strategies, (3) basic elaboration strategies, (4) complex elaboration strategies, (5) basic organizational strategies, (6) complex organizational strategies, (7) comprehension monitoring strategies, and (8) affective and motivational strategies. Each separate category is composed of methods that can be used by learners to influence one or more aspects of the encoding process to facilitate learning outcome and performance. These eight strategies will be elaborated upon in the following sections.

3.1.1 Rehearsal Strategies for Basic Learning Tasks

Rehearsing refers to the process where the learner is actively reciting or naming the presented items during learning. There are a number of different educational tasks that require simple recall. Especially at the lower educational levels and in introductory courses at the postsecondary level. It may not be possible for even the highly intelligent students to engage in deeper forms of information processing until they acquire this knowledge base. The common school tasks in this category include remembering the order of the planets from the sun and the order in which Shakespeare introduces the characters in the play Hamlet (Schmeck, 1983:234). In a training study, Kenney, Cannizzo and Flavell (1967:953-966) found that the "rehearsers" performed better on memory test than the "non-rehearsers."

3.1.2 Rehearsal Strategies for Complex Learning Tasks

The learning tasks in this category are more complex and tend to involve knowledge that extends beyond the superficial learning of lists or unrelated bits of information. Strategies in this category include copying and underlining material presented in a lecture. These activities are particularly effective when they provide further opportunities for more meaningful processing to take place. Students who are asked to underline sentences in a passage were able to recall substantially more information than students who simply read the passage without underlining (Rickards and August, 1975:860). Howe (1970:61-63) found that the facts which students copy correctly into their notes are far more likely to be learned than facts that are not copied into notes.

3.1.3 Elaboration Strategies for Basic Learning Tasks

Basic learning tasks include paired-associate learning, such as learning foreign language vocabulary; serial list learning, such as learning to recite the alphabet; and free recall list learning, such as learning to name all of the parts of the brain (Wittrock, 1986:319). Elaboration involves adding some sort of symbolic construction to what one is trying to learn as a way to make it more meaningful. This can be accomplished using either verbal or imaginal constructions. For example, the use of mental imagery to help remember the action sequence described in a play and the use of a sentence to relate a country and its major industrial product. These are both elaborations. The creation of effective elaborations requires that the learner be actively involved in processing the to-be-learned information (Weinstein, 1988:293).

The keyword method for acquiring a foreign language vocabulary is one of the most popular attempts to teach a type of imaging strategy that uses verbal elaboration. In a typical experiment of Raugh and Atkinson (1975:1), the experimental group was given training in the use of the keyword method; during learning the keywords were provided but subjects had to generate their own images. The result was that the experimental group scored 88% on a recall test compared to 28% for the control group. Levin (1981:65-82) points out that in addition to teaching a foreign language vocabulary and English vocabulary, the key-word method has been successfully applied to memorizing unfamiliar medical terms, functions of various biochemicals, cities and their products, famous people and their accomplishments, states and capitals, and U.S. presidents by number.

3.1.4 Elaboration Strategies for Complex Learning Tasks

Activities in this category include creating analogies, paraphrasing, and using prior knowledge, experiences, attitudes, and beliefs to help make the new information more meaningful. The goals of these techniques include integration of presented information with prior knowledge- i.e., translating knowledge from long-term memory into working memory and integrating the incoming information with this knowledge (Wittrock, 1986:320).

In a model of learning as a generative process, developed by Wittrock (1974:87-95; 1978:15-29), the integrative process was used by the learner to relate new information to either concepts or schemas already in semantic memory, or distinctive memories of experience. These are the key determinants of new learning and subsequent performance. Creating connections, or elaborations, between to-be-learned information and already established content and procedural knowledge is a major component of most knowledge acquisition frameworks based on schema theory (Schallert, 1982, in Weinstein & Mayer, 1986:320).

The most common form of complex rehearsal strategy involves notetaking. Peper and Mayer (1978:514-522) studied notetaking as a generative activity. Mayer (1980:770) asked college students to read a manual on a computer programming language. After each section in the manual, some subjects were asked to explain how the material related to material in another section of the manual (or to a similar situation). These subjects performed better on tests of creative problem solving using the new language, as compared to subjects who simply read the manual without answering elaboration questions.

3.1.5 Organizational Strategies for Basic Learning Tasks

One strategy for remembering a list of items is to sort them into some larger organizational framework, such as grouping items into taxonomic categories. The strategy in this category focuses on methods used to translate information into another form that will make it easier to understand. Examples of methods in this category include grouping the battles of World War II by geographic location, organizing animals by their taxonomic category, and listing foreign vocabulary words by their parts of speech. In each of these examples an existing or created scheme is used to impose organization on an unordered set of items (Weinstein, 1988:294).

Moely, Olsen, Hawles, and Flavell (1969:26-34) conducted an instructional study and found that--when children were taught how to apply the organizing strategy to list learning, the students were able to do so and their recall performance were boosted. Another study of Rossi and Wittrock (1971:331-338) also demonstrated that children can be trained in the use of organizational techniques to aid recall.

3.1.6 Organizational Strategies for Complex Learning Tasks

Organizational strategies can also be very useful for more complex tasks. Common examples of the use of this method with complex tasks include outlining a chapter of a textbook, creating a conceptual diagram of cause-effect interrelationships, and creating a hierarchy of sources to use in writing a term paper (Weinstein, 1988:294). Two cognitive goals served by organizational strategies are the selection of information to be transferred into working memory and the construction of relations among ideas in working memory (Wittrock, 1986:322).

The encoding process is like "building internal connections." The building of internal connections may be enhanced by explicit training in strategies for outlining and organizing items in meaningful learning tasks (Mayer, 1984:30-42). Hansell (1978:248-252) found that seventh graders could be taught to outline a text passage effectively using either a topic outline or an array.

3.1.7 Comprehension Monitoring Strategies

The term "metacognition" is used to refer to individuals' knowledge about their own cognitive processes as well as their abilities to control these processes by organizing, monitoring, and modifying them as a function of learning outcomes and feedback (Brown, 1975, 1978; Brown et al., 1983; Cavanaugh & Perlmutter, 1982; Flavell, 1970, 1981 in Weinstein, 1988:294). The use of metacognitive strategies is most often operationalized as comprehension monitoring. Comprehension monitoring requires the student to establish learning goals for an instructional unit or activity, to access the degree to which these goals are being met, and, if necessary , to modify the strategies being used to meet the goals. Common school tasks in this category include using self-questioning to check understanding of the material presented in class and using the questions at the beginning of a section to guide one's reading behaviour while studying a textbook. According to Wong and Jones (1980:228-240) and Malamuth (1979:279-289), comprehension monitoring can be taught by using relatively brief educational programs, and the results seem to be stable over a period of time.

3.1.8 Affective Strategies

Affective strategies help to create and maintain suitable internal and external climates for learning (Dansereau et al., 1979:64; McCombs, 1988:141; Palmer & Goetz, 1988:41). Many current approaches to classroom learning emphasize the role of the learner in creating, monitoring, and controlling a suitable learning environment. Research in this area has focused on the strategies learners use to focus attention, maintain concentration, manage performance anxiety, establish and maintain motivation, and manage time effectively. Examples of affective strategies include using relaxation and positive self-talk to reduce performance anxiety, finding a quiet place to study to reduce external distractions, and establishing priorities and setting a time schedule as a way to reduce procrastination.

Goldfried, Linehan, and Smith (1978:32-39) made a study to investigate the effects of a rational restructuring strategy on the reduction of test anxiety for college students. The results of the study indicated that participants in the rational restructuring strategy training program reported greater reductions on several different measures of test anxiety than did the participants in either of the two control groups. It appears that training designed to enhance a student's repertoire of the strategies needed to cope effectively with stress can help to reduce self-reported levels of anxiety.

3.2 ASSESSING LEARNING STRATEGIES

The method of student assessment is the most critical influence on learning strategies (Ramsden, 1988:164). The evaluation process provides a signal to students about the kind of learning they are expected to carry out; they adapt by choosing strategies that will apparently maximize success. Students' study habits are less influenced by the theory test, and the form of assessment is seen to be relevant to subsequent practice. With an accurate diagnosis of students, entry-level learning strategies deficits can be identified to create individualized prescriptions for training, and subsequent assessments can be used to evaluate the effectiveness of the training.

A successful implementation and evaluation of training programs and courses designed to teach learning strategies requires reliable and valid means for measuring. The approaches to assessments, issues in the assessment of learning strategies, and the Learning and Study Strategies Inventory (LASSI) will be elaborated on in this section.

3.2.1 Approaches to Assessment

The rapidly expanding interest in learning strategies assessment is the result of several causes. Among them is the increasingly large number of academically underprepared or disadvantaged students entering postsecondary institutions. In response to this influx of students with special needs, many institutions have created special programs to address academic deficits (Noel & Levitz, 1982; Weinstein & Underwood, 1985 in Weinstein, 1988:297).

Another reason for the increasing interest in the area of assessment relate to both basic and applied research interests in information processing. The issue of measurement in cognitive research is a major stumbling block in the way to progress (Garner, 1988:63-74). Since cognitive researchers focus on topics that reflect processes that are usually not available to direct measurement, indirect forms of assessment must be developed for more precise research hypotheses to be amenable to study. In response to this need there has been a renewed focus on variations of self-report methodologies that could be used to help gather data about covert strategies.

One result of the pressures for the creation of useful assessment methods has been the development of a number of instruments designed to measure varying aspects of learning strategy. Those who use many of these instruments build on the measures that were created to assess students' study practices. Several of these measures are available commercially. A review of a subset of both commercially published as well as developmental or research instruments indicated that many of them concentrate on such traditional areas of study skills as note taking, study attitudes toward school and learning, text marking, and test taking (Weinstein, Zimmermann, and Palmer, 1988:25-26).

According to Svensson (1977:233-243), there are two approaches to assessment: the correlational approach and the functional approach.

3.2.1.1 Correlational approach

The item selection and instrument design of the correlational approach emphasizes behaviours, thoughts, and activities that correlate with successful studying which however may not be the direct causes of successful learning achievement. (For example, many successful students may keep their desk tops clean but that does not necessarily mean that students can raise their grades by cleaning their desks.) Thus, many of the items on these inventories have little use for someone interested in using them as a basis for remedial proposes or for forming the basis for experimental interventions. Many of the authors of these measures selected or created items depending on how well they distinguished between students with high and low grade average with similar IQ and achievement test scores (Brown, 1964; Brown & Holtzman, 1967; Carter, 1985; Christensen, 1968 <u>in</u> Weinstein, 1988:298).

3.2.1.2 Functional approach

The functional approach stresses the identification of differences in the way that students learn which directly seem to affect learning outcomes and academic achievement. This approach guided the development of the Learning and

Study Strategies Inventory (Weinstein et al., 1988:25-26).

3.2.2 Issues in the Assessment of Learning Strategies

Traditionally, most of the programs established to remedy academic deficiencies focused on basic skills in mathematics, reading, communication, study habits and attitudes as discussed in previous sections. However, there is another set of competencies necessary for effective learning, which includes the strategies and skills students need to manage and monitor their own learning in various contexts (Weinstein et al., 1988:25).

Current research demonstrates that one way to influence the manner in which students process new information and acquire new skills, is to instruct them in the use of learning strategies (Dansereau, 1988:103-118; Dansereau et al., 1979:64-73; Jones, 1988: 233-256; Mayer, 1988:11-22; McCombs, 1988:141-165; McKeachie, 1988:103-118; Weinstein & Mayer, 1986:315-317; Wittrock, 1978:15-29; 1988:287-296). A number of issues emerge when applying the findings from these research studies to the purpose of improving an individual's ability to benefit from instruction. One major issue in this area is assessment.

The majority of instruments available for assessing learning strategies focus on the individual's study practices. These instruments are generally used in high school or post-secondary educational or training institutions for the purposes of: (1) prediction of academic performance; (2) counseling students concerning their study practices; (3) screening or criterion measures for study skills courses (Weinstein et al., 1988:26).

Several study skills instruments are available commercially. The reliability of these instruments is generally in the acceptable range of 0,80 and above, but the subscales are often found to have somewhat lower reliability (0,46 to 0,93) (Anastasi, 1976).

Most of these inventories used what Svensson terms as a "correlational" approach (see 3.2.1.1). In other words, they seek to find behaviours or activities that are correlated with successful learning. Such a correlational approach is reflected by the manner in which study skills inventories are typically constructed and validated. For example, Carter (1985) constructed his California Study Methods Survey by evaluating items on the basis of how well they distinguished between students with high and low grade point averages who had similar IQ and achievement test scores. A similar procedure was used in selecting items for the Survey of Study Habits and Attitudes (Brown & Holtzman, 1967), the Effective Study Test (Brown, 1964) and the College Adjustment and Study Skills Inventory (Christensen, 1968).

All of these inventories predict grade-point average from a low to moderate degree(0,19 to 0,60). They do not yield information about how the student learns, but rather the conditions under which he or she learns best (Weinstein et al., 1988:26-27).

After an extensive review of both commercially available and experimental instruments, the Cognitive Learning Strategies Project conducted by the Department of Educational Psychology, University of Texas at Austin come to the following six conclusions: (1) Across study skills inventories, no consistent definition of study skills could be found. (2) Low reliabilities of subscales (e.g. note taking, scheduling) precluded their use as separate measures. (3) Most of the recommended or "good" study practices in study skills inventories had not been empirically validated. (4) No instrument had been validated as a diagnostic instrument. (5) Most inventories could be easily faked. (6) Most inventories dealt with only the first of the two components for effective study namely consistent study and regular study. (The second component is an active learning style.) (Kochenderfer, 1988:18; Weinstein et al, 1988:27).

Given these problems the Cognitive Learning Strategies Project at the University of Texas, developed an instrument after nine years of research to help educators and trainers diagnose strengths and weaknesses in students' learning and study strategies in order to provide individualized remedial training. An instrument was needed which could: (1) Assess a broad range of topics within the area of learning strategies in a reliable and valid manner; (2) Assess covert and overt behaviours that are related to learning and that can be altered through training; (3) Reflect the current state of the art in learning strategy research and cognitive psychology; (4) Be validated for use as a diagnostic instrument. This instrument was named "the Learning and Study Strategies Inventory (LASSI) (Weinstein et al., 1988:27-28).

More information concerning this instrument will be explained in section 3.2.3.

3.2.3 The Learning and Study Strategies Inventory

The Learning and Study Strategies Inventory was developed as part of the Cognitive Learning Strategies Project at the University of Texas at Austin. The initial item pool for the LASSI consisted of 645 items. Sources for the initial item pool included published, unpublished, and experimental instruments, researchers and practitioners in the area of learning strategies, staff members on the project, and psychometric consultants (Weinstein, 1988:299). Over several years, items were eliminated or added, based on research literature in cognitive psychology and responses from students on post-experimental questionnaires.

Items not highly correlated with social desirability were chosen for the LASSI, to reduce the possibility of the students' falsifying their answers. Items address only those attitudes and practices which were thought to be amenable to change through intervention.

Preliminary norms were developed using the Fall 1982 incoming freshmen class at a small private college in the eastern United States (n=780). Item analysis data were used to create the current 77-item form. Norms were developed using a sample of 880 incoming freshmen from a large southern university. Test-retest correlations (3-week interval) were computed on a sample of 209 students from an introductory course in communication at the same school (Weinstein, 1987b:5). The reliability values ranged from a low of 0,64 to a high of 0,81 (Weinstein, 1988:302).

The validity of the LASSI was examined by using a variety of approaches. The scale scores were compared to other measures, or scales, assessing similar factors or constructs. For example, scores on Information Processing Scale of the LASSI were correlated with scores on the Elaborative Processing Scale of Schmeck's Inventory of Learning Processes (Schmeck, 1988b:176-186; Schmeck, Ribich et al., 1977:413-431). The correlation was 0,60. Another approach was compared to scores on some of the LASSI scales tc appropriate performance measures. For example, scores on the Select Main Idea scale were compared to scores on classroom tasks involving the identification of the main ideas in a series of textbook and reading selections. Correlation coefficients of 0,40 and above were obtained (Weinstein, 1988:302).

The final approach used to obtain validity data relates to the purposes for which the LASSI was originally designed. This approach has concentrated on how successfully the LASSI could be used by practitioners and teachers in postsecondary settings. Professors, counselors, advisors, and developmental specialists at more than 30 colleges and universities in the United States of America and Mexico have used the LASSI on a trial basis. Thus far, the results have been very encouraging. Users report few, if any, administration problems and a high degree of usefulness (Weinstein, 1987b:6; 1988:303).

The final LASSI consists of self-report items, classified in ten scales. The Scales were determined by a panel of experts, using several iterations of a modified Delphi technique, and were then checked statistically with alpha correlations (Weinstein, 1988:299). The panel comprised of (1) psychometricians from the American College Testing, the psychological corporation, and the University of Texas, and (2) experts including professors, practitioners, and two advanced graduate students at the University of Texas. The ten scales are: Attitude, Motivation, Time Management, Anxiety, Concentration, Information Processing, Selecting Main Ideas, Study Aids, Self Testing, and Test Strategies (Weinstein, 1987b:2).

The Attitude scale contains items addressing attitude and interest in college. The Motivation scale addresses the students' diligence, self-discipline, and willingness to work hard. The Time Management Scale examines students' use of time management principles for academic tasks. The Anxiety scale addresses the degree to which students worry about their studies and their performance. The Concentration scale focuses on students' ability to pay close attention to academic tasks. The Information Processing scale contains items addressing several sub-areas. These include the use of imaginal and verbal elaboration, comprehension monitoring, and reasoning. The Selecting Main Ideas items addresses students' ability to pick out important information for further study. The Study Aids scale examines the degree in which students use support techniques or materials to help them learn and remember new information. The Self-Testing scale concentrates on how students review and prepare for classes and tests. Most of the items deal with some aspect of comprehension monitoring. The last scale, Test Strategies, focuses on students' approach in preparing for and taking of examinations (Weinstein, 1988:299-301).

The Coefficient Alphas for the scales ranges from a low of 0,68 to a high of 0,86 and test-retest correlation coefficients for the scales range from a low of 0,72 to a high of 0,85, demonstrating a high degree of stability for the scale scores (Weinstein, 1987b:3).

The LASSI is meant to be used as: (1) a diagnostic measure to help identify areas in which students could benefit most from educational interventions; (2) a basis for planning individual prescriptions for both remediation and enrichment; (3) a pre-post achievement measure for students participating in programs or courses focusing on learning strategies and study skills; (4) an evaluation tool to assess the degree of success of intervention courses or programs; and (5) a counseling tool for college orientation programs, developmental educational programs, learning assistance programs, and learning centres (Weinstein, 1987b:2; Mealey, 1988:383).

3.3 VARIABLES FOR SUCCESSFUL LEARNING

The discussion of variables for successful learning in this section is intended to be a synopsis of the theory underlying the Learning and Study Strategies Inventory (LASSI). There are certain skills, behaviours and attitudes that distinguish successful learners from those who are not so successful. Knowledge of the characteristics of a successful learner can aid students in dealing effectively with academic problems. They include the following variables: attitude, motivation, time management, test anxiety, concentration, information processing, selecting main ideas, study aids, self testing, and test strategies (Weinstein, 1987b:6-10). The details will be elaborated upon in the following sections.

3.3.1 Attitude

Attitudes influence how well students learn and how they behave. Teaching attitudes is especially important today, since many students do not have positive attitudes toward school. If individuals have a positive attitude toward something, they approach it, or are supportive of it. Conversely, an unfavourable attitude leads to avoidance of conflict (Klausmeier, 1985:375-376). For example, students with favourable attitudes toward law take elective courses in law. Those with negative attitudes complete only the required courses and manifest their dislike of the subject matter while taking the courses.

Students' general attitudes towards study and their general motivation for succeeding in school have a great impact on their diligence in study, particularly in autonomous situations in which they have to study on their own. If the relationships between school and their life goals, and attitudes about themselves and the world are not clear, then it is difficult to maintain a mind-set which promotes good work habits, concentration, and attention to studies and its related tasks (Weinstein, 1987b:6).

If study is not seen as relevant to the student's life goals and attitudes, then it will be difficult, if not impossible, to generate the level of motivation needed to help the student take responsibility for his or her own learning and for helping to manage his or her own study activities (Weinstein, 1987b:6).

3.3.2 Motivation

Weinstein et al. (1988), define motivation as the learners' attitude and degree of stimulus to succeed in and accept responsibility for their performance in an academic setting. According to Lamprecht (1989:7), motivation acts like an extra dose of plant food given to a potted plant. With the required sunlight and water, a plant will be reasonably happy and healthy, but if you give it that extra bit of nourishment, you may witness rapid growth. A student is no different - he will be reasonably happy with the normal daily dose of attention, but with purposeful motivation on the educator's part he can really blossom and his previously hidden potential may surprise you.

Research on motivation suggests that students who have high expectancies for success and value the task are more likely to perform well (Atkinson, 1964; Covington & Omelich, 1979; Eccles, 1993; in Pokay & Blumenfeld, 1990:41), and shows that low-ability perceptions are related to low motivation and achievement (Licht & Kidyner, 1986:225-255). Important educational goals are for students to be motivated to learn, to value learning for its own sake, and to engage in tasks in order to master the content (Brophy, 1983:200-215; Corno & Mandinach, 1983:88-108). According to Schunk's research (1990:3-6), motivation and efficacy are interacting mechanisms in view of educational achievement.

Uguroglu and Walberg (1979:375-389) analyzed 232 correlations of motivation and academic learning reported in 40 studies with a combined sample size of approximately 637,000 students in the first grade through to the twelfth grade. Ninety-eight percent of the correlations between motivation and academic achievement were positive; and the mean correlation across all samples was 0,338. These figures indicated that motivation was a highly consistent positive correlate of achievement.

In general, a student with high achievement motivation is an individual who is self-confident, is a moderate risk-taker, wants immediate concrete feedback on his/her efforts, knows how to utilize his/her environment, and can tolerate delayed gratification for personal goals. Weiner and Kukla (1970:1-20) present evidence that individuals high in achievement motivation will also persist longer than those low in achievement motivation, even when experiencing failure. Even in groups of students with comparable IQ scores, those with high achievement motivation have been found to achieve better grades (Atkinson et al., 1974).

Schwartz (1983) indicates that academic motivation must be addressed in addition to study skills, in order to improve student achievement. Young (1986) includes the development of motivation in a strategy for improving retention and graduation rates of culturally diverse students in college. Academic motivation was cited by Nettles (1984) as a significant predictor of GPA for students from thirty universities.

It can, therefore, be said that a student's motivation to perform the specific tasks is related to his achievement. The degree to which students accept responsibility for studying and for their performance is reflected in the everyday behaviours they exhibit related to studies and study tasks. These behaviours include reading the textbook, preparing for class, finishing assignments on time, and being diligent in studying even if the topic is not particularly interesting to them (or even trying to figure out ways to make it more interesting) (Weinstein, 1987b:6).

Accepting more responsibility for studying and achievement outcomes requires that students learn to attribute much of what happens to them in class to their own efforts rather than to outside forces such as luck or poor teachers or to uncontrollable forces such as innate ability. Accepting more responsibility and attributing success to one's own efforts result in more effective studying and performance.

3.3.3 Time Management

Students' time is a limited resource. Like other limited resources, time can be more or less effectively managed. In empirical studies of self-regulated learning, researchers have often measured time-management variables in the context of other variables such as self-monitoring, self-judgment, and alertness (Corno & Mandinach, 1983; McCombs, 1986; Zimmerman, 1990; Zimmerman & Schunk, 1989).

A survey showed that 67% of the undergraduates at a specific university reported that their greatest personal need (there were 40 needs on a checklist) was "to manage my time more effectively" (Weissberg, Berentsen, Cote, Cravey, & Heath, 1982:115-122).

In a study of "Effects of time-management practices on college grades", Britton and Tesser (1991:405-410) conclude that time-management practices may influence college achievement. Their results show an encouraging relationship between time-management attitudes and skills and grade point average.

Managing time effectively is an important support strategy for learning. Most students have various demands on their time and only by creating realistic schedules and sticking to them can they fit in everything. Creating and using schedules also encourages students to take more responsibility for their own conduct. It also requires some knowledge about themselves as students and learners. What are their best and worst times of day? Which subjects are easier or harder for them? What are their preferences for learning methods? This type of knowledge and self-awareness helps students to create workable schedules, and perhaps even more important, helps to create the motivation to use them (Weinstein, 1987b:7).

Accepting more responsibility for studying and achievement outcomes requires that students set realistic study goals and create plans that will facilitate goal achievement. These activities are enhanced by effective time management. "Study time-tables (Cassie & Constantine, 1978:18-20; Lamprecht, 1989:71)" and "daily activity schedules (Brown & Holtzman, 1972:56) are examples of aids in using time efficiently.

3.3.4 Test Anxiety

Test anxiety has been defined as a situation-specific personality trait (Spielberger, 1972). The research of Sarason (1960, 1972, 1975), Wine (1971), and others who have worked in this area for a number of years (e.g., Alpert & Haber, 1960; Mandler & S. Sarason, 1952, 1953; Suinn, 1969) suggest that the concept of test anxiety refers to individual differences in anxiety proneness in test situations. In responding to examination stress, test-anxious persons are more likely to experience (a) emotional reactions characterized by feelings of tension, apprehension, and nervousness; (b) self-centered worry cognitions that interfere with attention; and (c) activation or arousal of the autonomic nervous system (Spielberger, Gonzalez & Fletcher, 1979:112).

According to Brown (1938:30-31), students who become excited before examinations tend, on the whole, to do little poorer in the examination than those students who are calm before the examination.

In the Yale studies, S. Sarason, Mandler, and their colleagues (Doris & S. Sarason, 1955; Mandler & S. Sarason, 1952; S. Sarason, Davidson, Lighthall, Waite & Ruebush, 1960; S. Sarason & Mandler, 1952; S. Sarason, Mandler & Craighill, 1952) observed that evaluative situations have differential effects on the examination performance of high and low test-anxious students. These investigators demonstrated that failure feed-back and other stressful instructions interfered with the performance of high test-anxious students compared with students low in test anxiety, and that high test-anxious subjects did better under conditions in which evaluative stress was minimized.

Sarason (1958, 1960, 1961, 1965) is concerned with identifying situational factors that contribute to the differential performance of high and low test-anxious persons in evaluative situations. In a series of studies, he has demonstrated that (a) high test-anxious persons perform more poorly than individuals who are low in test anxiety when achievement is emphasized (Sarason, 1960, 1961); and (b) high test-anxious subjects show improved performance and low test-anxious subjects perform more poorly on tasks with instructions designed to allay anxiety (Sarason, 1958). On the basis of his research, Sarason concludes that test-anxious persons are more self-centered and self-critical than individuals low in test anxiety, and are more likely in examination situations to emit personalized, derogatory, self-critical anxiety responses that interfere with attention and test performance (Sarason & Stoops, 1978:102-109).

High-test-anxious children functioned poorly when expected to achieve, but low-anxious children did well in this environment. Similar findings were reported at the college level by I. Sarason (as reviewed by Spielberger, Anton & Bedell, 1976:317-345). Test-anxious college students possessed a lower sense of well-being, less self-acceptance, less self-control, less acceptance of responsibility, lower capacity for status, less tolerance, and lower intellectual efficiency than low-test-anxious students.

According to Hembree's research (1988), test anxiety was greater for average students than those with high ability and, with nearly the same proportion, greater for low- than for average-ability students. At risk students possessed higher levels of test anxiety. The high-test-anxious students spent more time in study, but their expectation of success remained lower, and their state of anxiety during tests was higher than that of low-test-anxious students.

Wine (1971:92-104) proposed an attentional theory to explain how test anxiety harms performance: Test-anxious persons divide their attention between task-relevant activities and preoccupations with worry, self-criticism, and somatic concerns. With less attention available for task-directed efforts, their performance is depressed.

Current conceptions of anxiety emphasize effects of our own thought processes and how it affects study performance. Cognitive worry, a major component of anxiety, is manifested in negative self-reference statements. These negative thoughts about one's abilities and intelligence, furnish interactions with others, or likelihood of success divert a student's attention away from the task at hand, such as studying or taking a test. The student is worried that he will not have the time to finish a test, which is just making matters worse because of the time wasted to worry about his performance. This type of self-defeating behavior often sabotages a student's efforts. If students are tense, anxious, or fearful about studying or performing in academic situations, it will divert their attention away from the academic task and direct it inward to self-criticism or irrational fears (Weinstein, 1987b:7).

In the light of the above mentioned, it is clear that many very capable students are often incapable of demonstrating their true level of knowledge and skill because they are paralyzed or distracted by debilitating anxiety. Therefore, helping some students to learn how to reduce their anxiety is sufficient to help them improve their performance. Once the obstructions in the way of attention are removed, they are able to do well.

3.3.5 Concentration

Concentration helps students to focus their attention on academically-related activities, such as studying and listening in class, rather than on distraction of thoughts, emotions, feelings, or situations. People have a limited capacity to process what is going on around them and in their own thoughts; if they are distracted there will be less capacity to focus on the task at hand. For students this means that distractions, or anything else that interferes with concentration, will divert attention away from academically-related tasks (Weinstein, 1987b:8).

In "Student's Guide to Success" Cassie & Constantine (1978:14-16) state:

> Strong concentrating is the key to effective study. You can then work closer to your real ability -- twice or three times what you did before.... Lack of concentration is a serious handicap to the professional person, whether young or old.... Concentration is a skill you must develop if you are to work at high efficiency.

The habit of concentration can be developed through self-discipline and practice in becoming actively involved in studying and learning (Weinstein, 1988:310). Therefore, learning techniques for focusing attention and maintaining concentration help students to implement effective learning strategies and can make learning and studying both more effective and more efficient.

3.3.6 Information Processing

"Information processing" is currently one area of research within the larger domain of cognitive psychology. Two areas of particular importance to learning are included in the information-processing approach. They are the investigations into the processes by which the individual acquires and remembers information, and the research into the strategies implemented in problem solving (Bell-Gredler, 1986:151-153). The "information processing theory" has been discussed in section 2.6.3.

Weinstein (1987b:8) mentions that meaningful learning is enhanced by the use of elaboration and organization strategies. These strategies help to build bridges between what a student knows and what he or she is trying to learn and remember. Using what one already knows (i.e., prior knowledge, experiences, attitudes, beliefs and study strategies) is critical to success in classroom learning. The way knowledge is organized, not just the sheer amount of knowledge, makes a difference in students' performance (Weinstein et al., 1988). In other words, information-processing ability is how well one cognitively acts on new and existing knowledge. Information-processing ability directly affects one's learning and performance (Sinkavich, 1991).

Information processing methods range from simple paraphrasing and summarizing to creating analogies, the use of applications, creating organizational schemes and outlining, and the use of inferential, analytical, and synthetic reasoning skills. A student who does not have a repertoire of these strategies and skills will find it difficult to incorporate new knowledge and understanding in such a way that acquisition and recall will be effective, often despite the large amount of time spent studying. The effectiveness and efficiency of both autonomous and classroom learning are facilitated by use of information processing strategies (Weinstein, 1987b:8).

3.3.7 Selecting Main Ideas

Effective and efficient studying requires that the student must be able to select the important material for in-depth attention. Most lectures, discussions, and textbooks contain redundant material, extra examples, and many supporting details to help explain what is being taught or presented. A major study task involves distinguishing between the important and the unimportant or simple didactic information that does not have to be remembered. If a student cannot select the critical information, the learning task becomes complicated by the huge amount of material the individual is trying to acquire. If a student lacks this skill, it also increases the likelihood that the student will not have enough time to study everything that must be covered (Weinstein, 1987a, 1988; Weinstein et al., 1988).

3.3.8 Study Aids

Students need to know how to use study aids created by others and how to create their own. Textbook authors or publishers will often use headings, special type, white space, special markings, summaries, and statements of objectives to help students learn from these materials. However, unless students know how to recognize and use these hints and aids they will not benefit from them. It is also important for students to know how to generate their own aids by methods such as the creation of diagrams, text markings, creating charts or summary sheets, and underlining. There are other supplementary activities that also support and enhance meaningful learning, such as attending group review sessions, comparing notes with another student to either check accuracy or completeness. Using and creating study aids improve both the effectiveness and efficiency of learning, particularly in autonomous learning situations (Weinstein, 1987a, 1988; Weinstein et al., 1988).

3.3.9 Self Testing

Reviewing and testing one's level of understanding is important for knowledge acquisition (i.e.,learning) and comprehension monitoring (e.g., metacognition). These strategies support and contribute to meaningful learning and effective performance. Without them learning could be incomplete and errors might pass undetected. Self-testing also contributes to knowledge consolidation and integration (i.e., accommodation and assimilation) across topics. For example, the use of mental reviews, reviewing class notes, and thinking of possible test questions are all methods for checking one's understanding of new and existing knowledge (Weinstein et al., 1988). The degree to which students use their self-testing ability is an important factor in classroom learning and performance.

These methods include structured reviews of large amounts of material; mental reviews of individual study segments; asking questions before, during and after reading, studying or going to class; trying to use new information in novel ways; trying to apply a principle or method; and using a systematic approach to study (Weinstein, 1987b: 10).

3.3.10 Test Strategies

Exams are an integral part of academic life. Many students face them with a do-or-die attitude with not much else to help them through (Weinstein, 1988:313). Most failures are due not to a deficiency of knowledge but chiefly to the lack of familiarity with the techniques of playing the examination game (Cassie & Constantine, 1978:92-93).

Effective test performance depends on both preparation strategies and test-taking strategies. A student needs to know how to prepare for the type of performance that will be required and how to maximize that performance. Test preparation includes knowing about the type of test. For example, is it going to be a short-answer or a multiple-choice exam? Will performance require simple recall or will concepts, principles, and ideas need to be applied? Test preparation also includes knowing about methods for studying and learning the material in a way that will facilitate remembering and later use. Test-taking strategies include knowing about the characteristics of tests and test items, and how to create an effective test-taking plan (Weinstein, 1987b:10).

Often, students' performance on a test is not an accurate indicator of what they have learned. Knowing about test-taking and preparation strategies and how to use them help students target their study activities, set up study goals, implement an effective study plan, and demonstrate their knowledge and skill acquisition so that it can be accurately evaluated.

3.4 SUMMARY

Good teaching includes teaching students how to learn, how to remember, how to think, and how to motivate themselves. Helping students to develop effective ways to handle the barrage of information coming from the environment, as well as their own thinking process , is a major goal of our educational system today. The use of particular learning strategies during learning can affect the encoding process, which in turn affects the learning outcome and performance.

Learning styles and learning strategies can be assessed and taught to students. There are certain skills, behaviours and attitudes that distinguish successful learners from those who are not so successful. The ten variables: attitude, motivation, time management, test anxiety, concentration, information processing, selection of main ideas, study aids, self testing, and test strategies are essential to students successful in learning.

CHAPTER 4

RESEARCH DESIGN

4.1 SUBJECTS

Subjects for this study were all 1992 first year students of Rand Afrikaans University in the Republic of South Africa and Chengchi University in Taiwan, the Republic of China.

4.1.1 Cross-Cultural Factors in Comparison

Cross-cultural research is one of the most exciting developments in the social sciences in the last few decades. Traditionally the cross-cultural study is one in which Western industrial cultures are compared with pre-literate tribal ones. But nowadays hardly any culture has remained unaffected by Western ideas and technologies (Frijda & Johada, 1966:110). One of the most important aspects of this, as Bruner emphasized (1965:1007-1017), has been the rapid introduction of formal education.

In this thesis, the subjects are South African university students and Chinese university students. Several "cross-cultural" factors were considered. The following studies show that the subjects are worth comparing, and can be compared.

From a cross-cultural Piagetion research, Goodnow, in Hong Kong, found that Chinese children with English schooling performed as well as or better than Europeans (Dasen 1972:412). Tuddenham (1968, 1969, in Dasen, 1972:414), when applying a battery of fifteen concrete operational tests to European, Negro, and Oriental children in California, found that the Oriental children were superior to the white children on at least half of the items.

Although Ramirez and Castaneda (1979, in Jalali, 1988:11) proposed that culturally-determined learning styles created differences among intellectual patterns, in a study of "Relationship between acculturation, cognitive style, and intelligence", Ricardo R. Gonzales & Samuel Roll found that there are no significant correlations between the Multidimensional Scale of Culture Difference (MSCD) and Group Embedded Figures Test (GEFT) as well as the CFIT (Cattell's Culture Fair Intelligence Test) for twelfth grade and freshmen college students of Anglo-American and Mexican-American origin (Gonzales & Roll, 1985:195).

In "Psychological testing of American minorities", Samuda (1975) found evidence that both achievement and nonverbal test intelligence are influenced by such factors as health, self-concept, anxiety level, test experience, and motivation. Lesley Clark and Graeme S. Halford (1983:279) found that psychometric intelligence was clearly a more powerful predictor of the effects of culture and location on school achievement than was cognitive style.

Research conducted in Japan (Holloway, Kashiwagi, Hess & Azuma, 1986:269-286) and in South Africa (Louw & Louw-Potgieter, 1986:269-282) revealed that effort was perceived as the primary causes of achievement-related success and failure.

From the examples above, it is obvious that evidence of cross-cultural research on learning and study strategies was not found in existing research reports. This fact emphasizes the relevance of the present study.

4.2 INSTRUMENT

The Learning and Study Strategies Inventory (LASSI) (Weinstein, 1987b) was selected for this study for the following reasons: Firstly, LASSI Scale reliabilities are high (0,72 to 0,85); secondly, LASSI includes a broader range of attitudes and practices than other instruments reviewed; thirdly, the LASSI Scales are both predictive and diagnostic.

The LASSI consists of ten scales, listed here with two indices of reliability:

	Coefficient Alpha	Test-Retest
Attitude	.72	.75
Motivation	.81	.84
Time Management	.86	.85
Anxiety	.81	.83
Concentration	.84	.85
Information Processing	.83	.72
Selecting Main Ideas	.74	.78
Study Aids	.68	.78
Self Testing	.75	.78
Test Strategies	.83	.81

In chapter 3 it was mentioned that validity has been examined in several ways (Weinstein, 1987b, 1988). Firstly, the scale scores have been compared to other tests or subscales measuring similar factors. For example, the scale on the Information Processing Scale was correlated with scores on the Elaborative Processing Scale of Schmeck's Inventory of Learning Processes (0,60). Secondly, several scales have been validated against performance measures. Scores on the Selecting Main Idea Scale were compared with scores on classroom tasks of identifying the main ideas in textbook and reading selections, with correlation coefficients of 0,40 and above. The final approach to validity relates to the purposes for which the instrument was originally designed

--how successfully it can be used by practitioners and teachers in post-secondary settings.

The authors checked user validity with professors, advisors, developmental educators, counselors and learning centre specialists at 30 colleges and universities. In addition, a post-test LASSI is used as one outcome measure in a 3-credit elective psychology course in learning-to-learn which enrolls approximately 1,000 students per year in sections of about 30 each, at the University of Texas at Austin. On the post-test LASSI, increase in effective use of the learning and study strategies and reduction of anxiety were reported (Weinstein & Underwood, 1985).

4.3 PROCEDURE

The LASSI questionnaires from South Africa were collected when students enrolled at the Rand Afrikaans University, while the LASSI questionnaire was conducted and collected in Taiwan, the Republic of China as follows:

4.3.1 Pilot Study

For the purpose of testing the reliability of LASSI for the Chinese students, the English version LASSI was translated into Chinese and answers were collected from the first year college students at Shi-Jian College, in Taiwan for a pilot study.

The responses were scored and analyzed via the Kuder Richardson formula. The reliability coefficients were acceptable, with a range from 0,84 to 0,90. It was high enough to justify using LASSI for this study.

4.3.2 Preliminaries

For the purpose of confirming the accuracy of the Chinese LASSI, it was translated back to English and compared to the original one. After modifying the Chinese LASSI, these translations were then checked by a second person knowledgeable in the two languages and all outstanding discrepancies were resolved.

4.3.3 Data collection

The Chinese LASSI was administered to all first year students of Chengchi University during the first week of their enrollment in October 1992.

4.4 SCORING AND DATA ANALYSIS

While the LASSI is a self scored instrument, it was not self scored for this study because of the additional class time it would have required. For this project, LASSI responses were keyed into a computer and analyzed through the statistical computer program. Hotelling's T-Square was used to test the hypothesis, and Student's t-test for differences in independent means.

The following statistical packages were employed:

* BMDP (factor analyses)
* SPSS (Hotelling's T square and t-tests)
* NP50 program (item analyses)

CHAPTER 5

STATISTICAL ANALYSIS

5.1 INTRODUCTION

The aim of this study is to apply the Learning and Study Strategies Inventory (LASSI) to identify the differences between the university students of Taiwan, Republic of China and the Republic of South Africa. In this chapter the statistical techniques will be implemented and the results will be tabulated and analyzed.

5.2 VALIDITY AND RELIABILITY

Validity was investigated with a first and second order factor analysis (Schepers, 1992:140). The response format was in the form of a five point intensity scale. In order to determine the dimensionality of the testspace the items were subjected to a principal component analysis (PCA). In the first order analysis a principal component analysis (PCA) was followed by a principal factor analysis (PFA). Both these applied orthogonal axes and varimax rotation. Kaiser's criterion was used to determine the number of factors (Eigenvalues greater than unity) and a varimax rotation was used to rotate the factor matrix. The items were subsequently grouped in terms of their loadings on the respective factors. New subtest scores were calculated for each respondent by summating his or her scores in respect of items with high rating on each factor. Each item was used once only, namely on the factor where it had it's highest loading. The subscores were then intercorrelated and a second order factor analysis was done.

The result from the first order analysis was utilized as input for the execution of the second order analysis. The second order analysis consisted of a further PCA (orthogonal axes and varimax rotation) followed by a PFA (Doblimin Rotation). Sixteen items (Q 4,5,11,17,18,24,26, 30,36,38,42,44,49,55,70 & 73) were deleted, the main reason being that these items did not appear in the same factors for the two groups.

From this analysis three factors resulted, both of the two groups got the same three factors with the same 61 items from the questionnaires of 77 items. The Eigenvalues of the intercorrelated matrices of the three factors of the two groups are given in Table 5.2.1. They indicate that the two independent groups can be compared. These three factors were further investigated for reliability. A separate iterative items analysis (NP50 program) was done in respect of all the items associated with each of the second order factors. They reveal high Cronbach alpha reliability coefficients (Table 5.2.2).

Factor 1 (Z1) was identified as <u>study anxiety-test strategies</u>, factor 2 (Z2) was identified as mindedness and factor 3(Z3) was identified as study involvement (See appendix 3, 4 and 5).

Table 5.2.1

Eigenvalues of the three factors Z1, Z2, Z3.

Factor	Eigenvalues
Factor 1	RAU 4,0830 CCU 3,9063
Factor 2	RAU 1,2060 CCU 1,0774
Factor 3	RAU 0,5729 CCU 0,5795

Table 5.2.2

The Cronbach alpha reliability coefficients of the three factors Z1, Z2, Z3.

Factor	Group	Coefficient alpha	Items
Factor 1 (Z1)	RAU CCU	0,891 0,897	Q1,2,9,14,20,25,27,29,31,34,35,52, 54,57,59,60,63,64,71,72,75 & 77 (Number of items:22)
Factor 2 (Z2)	RAU CCU	0,907 0,867	Q3,6,10,13,16,22,28,33,39,41,43,45, 46,48,51,56,58,61,66,68,69 & 74 (Number of items:22)
Factor 3 (Z3)	RAU CCU	0,878 0,853	Q7,8,12,15,19,21,23,32,37,40,47,50, 53,62,65,67 & 76 (Number of items:17)

5.3 HYPOTHESES AND ANALYSES

Hypotheses are formulated with regard to the following 10 LASSI subscales:

* attitude (ATT)
* motivation (MOT)
* time management (TMT)
* anxiety (ANX)
* concentration (CON)
* information processing (INP)
* selecting main ideas (SMI)
* study aids (STA)
* self testing (SFT)
* test strategies (TST)

The questionnaires are answered according to 5 point intensity scales as follows:

1. Not at all like me
2. Not very much like me
3. Somewhat like me
4. Fairly much like me
5. Very much like me

The target groups are South African and Taiwan, Republic of China first year university students.

Hotelling's T square test is used to test for the differences between the vector of mean test score of the two groups in respect of all variables combined. Student's t-test is used to test for the differences between the mean test scores of the two groups in respect of each variable.

5.3.1 Hypotheses and analyses for All Students

HoT1.1 There is no statistically significant difference between the vector of means of South African students' test scores and that of Chinese students in respect of the variables Z1, Z2, Z3 combined.

HaT1.1 There is a statistically significant difference between the vector of means of South African students' test scores and that of Chinese students in respect of the variables Z1, Z2, Z3 combined.

Table 5.3.1.1

Hotelling's T square test for the differences between the vector of mean test scores of the two student groups in respect of Z1, Z2, Z3 variables combined.

Hotelling's T square value	F-value	D.F.	P
239,6706	79,8451	3; 3538	0,0000**

D.F. : Degrees of freedom

P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two student groups. The null hypothesis HoT1.1 is rejected and the alternative hypothesis HaT1.1 is supported.

Hot1.1 There is no statistically significant difference between the mean test scores of South African students and that of Chinese students in respect of each of the following variables taken separately, viz.:

Hot1.1.1: Z1

Hot1.1.2: Z2

Hot1.1.2: Z3

Hat1.1 There is a statistically significant difference between the mean test scores of South African students and that of Chinese students in respect of each of the following variables taken separately, viz.:

Hat1.1.1: Z1

Hat1.1.2: Z2

Hat1.1.2: Z3

Table 5.3.1.2

Student's t-test for the difference between the mean test scores of the two student groups in respect of each of Z1, Z2, Z3 variables.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P
Z1	RAU	1489	81,5340	12,4287	−10,58	34508	0,0000 **
	CCU	2053	77,0566	12,4333			
Z2	RAU	1487	80,5259	12,9419	−6,82	2894,8	0,0000 **
	CCU	2053	77,6932	11,0933			
Z3	RAU	1489	62,7495	10,1037	−14,14	3069,3	0,0000 **
	CCU	2053	58,0234	9,4138			

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There are statistically significant differences (p=0,0000) on the 3 variables between the two student groups. The null hypotheses Hot1.1.1, Hot1.1.2 and Hot1.1.3 are rejected and the alternative hypotheses Hat1.1.1, Hat1.1.2 and Hat1.1.3 are supported.

HoT1.2 There is no statistically significant difference between the vector of means of South African students' test scores and that of Chinese students in respect of the 10 LASSI subscales combined.

HaT1.2 There is a statistically significant difference between the vector of means of South African students' test scores and that of Chinese students in respect of the 10 LASSI subscales combined.

Table 5.3.1.3

Hotelling's T square test for the differences between the vector of mean test scores of the two student groups in respect of the 10 LASSI subscales combined.

Hotelling's T square value	F-value	D.F.	P
147,3669	147,2613	10; 3531	0,0000**

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two student groups. The null hypothesis HoT1.2 is rejected and the alternative hypothesis HaT1.2 is supported.

Hot1.2 There is no statistically significant difference between the mean test scores of South African students and that of Chinese students in respect of each of the following 10 LASSI subscales taken separately, viz.:

Hot1.2.1 : ATT (Attitude)

Hot1.2.2 : MOT (Motivation)

Hot1.2.3 : TMT (Time Management)

Hot1.2.4 : ANX (Anxiety)

Hot1.2.5 : CON (Concentration)

Hot1.2.6 : INP (Information Processing)

Hot1.2.7 : SMI (Selection Main Idea)

Hot1.2.8 : STA (Study Aids)

Hot1.2.9 : SFT (Self Testing)

Hot1.2.10: TST (Test Strategies)

Hat1.2 There is a statistically significant difference between the mean test scores of South African students and that of Chinese students in respect of each of the 10 LASSI subscales taken separately, viz.:

Hat1.2.1 : ATT (Attitude)

Hat1.2.2 : MOT (Motivation)

Hat1.2.3 : TMT (Time Management)

Hat1.2.4 : ANX (Anxiety)

Hat1.2.5 : CON (Concentration)

Hat1.2.6 : INP (Information Processing)

Hat1.2.7 : SMI (Selection Main Idea)

Hat1.2.8 : STA (Study Aids)

Hat1.2.9 : SFT (Self Testing)

Hat1.2.10: TST (Test Strategies)

Table 5.3.1.4

Student's t-test for the difference between the mean test scores of the two student groups in respect of each of the 10 LASSI subscales.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P
ATT	RAU	1489	20,1565	2,9003	-18,68	3540	0,0000 **
	CCU	2053	18,2591	3,0440			

MOT	RAU	1489	26,6295	4,3656	-9,78	3121,3	0,0000	**
	CCU	2053	25,1992	4,1756				
TMT	RAU	1487	19,4311	4,7484	7,91	2552	0,0000	**
	CCU	2053	20,5743	3,4211				
ANX	RAU	1489	27,6105	5,7317	-8,29	3540	0,0000	**
	CCU	2053	26,0209	5,5573				
CON	RAU	1489	22,1760	4,5490	-12,55	3118,0	0,0000	**
	CCU	2053	20,2684	4,3438				
INP	RAU	1489	29,5809	5,2072	-9,07	3540	0,0000	**
	CCU	2053	27,9679	5,2419				
SMI	RAU	1489	18,8502	3,4129	-5,87	3540	0,0000	**
	CCU	2053	18,1773	3,3358				
STA	RAU	1489	18,5373	3,7496	-18,27	3078,6	0,0000	**
	CCU	2053	16,2669	3,5098				
SFT	RAU	1489	10,7911	2,3527	-11,27	2900,6	0,0000	**
	CCU	2053	9,9406	2,0178				
TST	RAU	1489	31,0403	4,7404	-5,90	3540	0,0000	**
	CCU	2053	30,0984	4,6465				

ATT=Attitude
MOT=Motivation
TMT=Time Management
ANX=Anxiety
CON=Concentration

INP=Information Processing
SMI=Selecting Main Ideas
STA=Study Aids
SFT=Self Testing
TST=Test Strategies

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There are statistically significant differences (p=0,0000) on all the 10 subscales between the two student groups. The null hypotheses Ho1.2.1 to Ho1.2.10 are rejected and the alternative hypotheses Ha1.2.1 to Hat1.2.10 are supported.

Hot1.3 There is no statistically significant difference between the mean test scores of South African students and that of Chinese students in respect of the Z variable (Z=Z1+Z2+Z3).

Hat1.3 There is a statistically significant difference between the mean test scores of South African students and that of Chinese students in respect of the Z variable (Z=Z1+Z2+Z3).

Table 5.3.1.5

Student's t-test for the difference between the mean test scores of the two student groups in respect of the Z variable.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P
Z	RAU	1487	224,8354	28,4883	-12,76	3076,6	0,0000 **
	CCU	2053	212,7729	26,7008			

There is a statistically significant difference (p=0,0000) between the mean test scores of the two student groups in respect of the Z variable. The null hypothesis Hot1.3 is rejected and the alternative hypothesis Hat1.3 is supported.

HoT1.3 There is no statistically significant difference between the vector of means of South African students' test scores and that of Chinese students in respect of the 61 items combined.

HaT1.3 There is a statistically significant difference between the vector of means of South African students' test scores and that of Chinese students in respect of the 61 items combined.

The items are:

Q1 Q2 Q3 Q6 Q7 Q8 Q9 Q10 Q12 Q13 Q14 Q15 Q16
Q19 Q20 Q21 Q22 Q23 Q25 Q27 Q28 Q29 Q31 Q32 Q33 Q34
Q35 Q37 Q39 Q40 Q41 Q43 Q45 Q46 Q47 Q48 Q50 Q51 Q52
Q53 Q54 Q56 Q57 Q58 Q59 Q60 Q61 Q62 Q63 Q64 Q65 Q66
Q67 Q68 Q69 Q71 Q72 Q74 Q75 Q76 Q77

Table 5.3.1.6

Hotelling's T square test for the differences between the vector of mean test scores of the two student groups in respect of the 61 items combined.

Hotelling's T square value	F-value	D.F.	P
7687,2588	123,8847	61; 3480	0,0000 **

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two student groups. The null hypothesis HoT1.3 is rejected and the alternative hypothesis HaT1.3 is supported.

Hot1.4 There is no statistically significant difference between the mean test scores of South African students and that of Chinese students in respect of each of the 61 items taken separately.

Hat1.4 There is a statistically significant difference between the mean test scores of South African students and that of Chinese students in respect of each of the 61 items taken separately.

Table 5.3.1.7

Student's t-test for the difference between the mean test scores of the two student groups in respect of each of the following 61 items.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P	
Q1	RAU	1489	4,3606	1,1154	-34,62	3377,1	0,0000	**
	CCU	2053	2,9844	1,2365				
Q2	RAU	1489	3,8986	0,8667	-14,21	3206,8	0,0000	**
	CCU	2053	3,4793	0,8670				
Q3	RAU	1489	2,9946	1,2137	-7,55	3540	0,0000	**
	CCU	2053	2,6951	1,1306				
Q6	RAU	1489	3,9019	0,9375	-11,69	3186,3	0,0000	**
	CCU	2053	3,5304	0,9275				
Q7	RAU	1489	3,7576	1,1064	-9,74	3540	0,0000	**
	CCU	2053	3,3950	1,0843				
Q8	RAU	1489	3,8402	0,9390	0,25	3540	0,8043	
	CCU	2053	3,8480	0,9273				
Q9	RAU	1489	2,8294	1,1266	2,95	3540	0,0032	**
	CCU	2053	2,9430	1,1356				
Q10	RAU	1489	4,1323	0,8695	-10,47	3418,3	0,0000	**
	CCU	2053	3,8032	0,9938				
Q12	RAU	1489	3,4144	1,0138	-3,48	3540	0,0005	**
	CCU	2053	3,2937	1,0217				
Q13	RAU	1489	3,4520	1,0123	-1,48	3540	0,1388	
	CCU	2053	3,4014	0,9984				

Q14	RAU	1489	4,0242	1,0438	-19,24	3399,1	0,0000	**
	CCU	2053	3,3030	1,1755				
Q15	RAU	1489	3,7005	1,0448	-10,94	3319,2	0,0000	**
	CCU	2053	3,3000	1,1150				
Q16	RAU	1489	3,8381	1,0027	-23,96	3318,7	0,0000	**
	CCU	2053	2,9971	1,0697				
Q19	RAU	1489	3,9940	0,9564	-15,09	3393,2	0,0000	**
	CCU	2053	3,4769	1,0725				
Q20	RAU	1489	3,9443	0,9974	-8,83	3207,5	0,0000	**
	CCU	2053	3,6444	0,9982				
Q21	RAU	1489	3,4909	1,1294	-3,34	3062,3	0,0008	**
	CCU	2053	3,3663	1,0487				
Q22	RAU	1489	2,7119	1,1262	17,38	3104,6	0,0000	**
	CCU	2053	3,3639	1,0681				
Q23	RAU	1489	3,8146	0,9799	-12,45	3241,8	0,0000	**
	CCU	2053	3,3960	0,9993				
Q25	RAU	1489	3,6844	1,0744	3,29	3173,6	0,0010	**
	CCU	2053	3,8037	1,0559				
Q27	RAU	1489	3,9980	0,9479	-9,59	3188,6	0,0000	**
	CCU	2053	3,6897	0,9390				
Q28	RAU	1489	3,8475	1,0102	-7,81	3303,3	0,0000	**
	CCU	2053	3,5732	1,0675				
Q29	RAU	1489	3,8489	0,9970	-15,69	3292,7	0,0000	**
	CCU	2053	3,3049	1,0469				
Q31	RAU	1489	2,9120	1,2208	13,22	3004,5	0,0000	**
	CCU	2053	3,4394	1,1015				
Q32	RAU	1489	4,1068	0,8464	-14,55	3381,5	0,0000	**
	CCU	2053	3,6673	0,9412				
Q33	RAU	1489	3,7112	1,0619	9,39	3066,3	0,0000	**
	CCU	2053	4,0409	0,9879				
Q34	RAU	1489	3,7945	0,9508	-3,48	3540	0,0005	**
	CCU	2053	3,6824	0,9425				
Q35	RAU	1489	3,4976	0,9708	-22,42	3540	0,0000	**
	CCU	2053	2,7389	1,0112				
Q37	RAU	1489	3,3627	1,0180	7,74	2999,9	0,0000	**
	CCU	2053	3,6201	0,9165				

Q39	RAU	1489	3,7616	1,0702	-20,20	3540	0,0000	**
	CCU	2053	2,9985	1,1379				
Q40	RAU	1489	3,8664	0,9233	-6,17	3198,1	0,0000	**
	CCU	2053	3,6727	0,9193				
Q41	RAU	1489	3,9537	0,9664	-8,84	3239,7	0,0000	**
	CCU	2053	3,6605	0,9844				
Q43	RAU	1489	3,7441	0,9733	-4,98	3540	0,0000	**
	CCU	2053	3,5792	0,9729				
Q45	RAU	1489	4,1807	0,9138	-12,67	3540	0,0000	**
	CCU	2053	3,7813	0,9342				
Q46	RAU	1489	3,5541	1,0720	-9,63	3540	0,0000	**
	CCU	2053	3,2007	1,0827				
Q47	RAU	1489	3,5447	1,0483	2,67	3005,1	0,0076	**
	CCU	2053	3,6361	0,9462				
Q48	RAU	1487	3,1742	1,0664	-9,78	2921,0	0,0000	**
	CCU	2053	2,8378	0,9259				
Q50	RAU	1489	3,6132	1,1597	-20,40	3540	0,0000	**
	CCU	2053	2,7930	1,1964				
Q51	RAU	1489	4,0154	0,7840	-10,64	3415,7	0,0000	**
	CCU	2053	3,7141	0,8943				
Q52	RAU	1489	3,8563	0,9126	1,55	2943,9	0,1205	
	CCU	2053	3,9021	0,7994				
Q53	RAU	1489	3,1598	1,2214	-4,67	3023,1	0,0000	**
	CCU	2053	2,9727	1,1122				
Q54	RAU	1489	3,5131	1,1180	6,72	2951,2	0,0000	**
	CCU	2053	3,7565	0,9829				
Q56	RAU	1489	3,6911	1,0245	1,00	2904,5	0,3195	
	CCU	2053	3,7238	0,8804				
Q57	RAU	1489	3,0416	1,2024	-0,74	3127,5	0,4567	
	CCU	2053	3,0117	1,1538				
Q58	RAU	1489	3,2928	1,1565	14,38	2777,0	0,0000	**
	CCU	2053	3,8159	0,9336				
Q59	RAU	1489	4,2821	0,8229	-7,73	3278,7	0,0000	**
	CCU	2053	4,0619	0,8570				
Q60	RAU	1489	3,7401	1,0095	-0,96	3097,0	0,3353	
	CCU	2053	3,7077	0,9538				
Q61	RAU	1489	3,7488	0,9693	-13,65	3259,3	0,0000	**

	CCU	2053	3,2927	0,9983				
Q62	RAU	1489	4,0128	0,8655	-12,45	3371,7	0,0000	**
	CCU	2053	3,6293	0,9559				
Q63	RAU	1489	3,7717	1,0802	-11,77	3540	0,0000	**
	CCU	2053	3,3434	1,0608				
Q64	RAU	1489	3,7461	1,0588	5,24	2962,1	0,0000	**
	CCU	2053	3,9260	0,9357				
Q65	RAU	1489	3,9375	0,9773	-28,75	3316,9	0,0000	**
	CCU	2053	2,9542	1,0415				
Q66	RAU	1489	3,2572	1,1449	17,49	2718,5	0,0000	**
	CCU	2053	3,8811	0,8975				
Q67	RAU	1489	3,4849	1,0663	-2,30	2995,3	0,0213	*
	CCU	2053	3,4048	0,9578				
Q68	RAU	1489	3,4654	1,0175	6,06	3006,0	0,0000	**
	CCU	2053	3,6668	0,9188				
Q69	RAU	1489	4,0873	0,8233	2,39	3296,1	0,0167	*
	CCU	2053	4,1559	0,8663				
Q71	RAU	1489	3,6125	0,9808	-2,18	3034,7	0,0291	*
	CCU	2053	3,5421	0,8982				
Q72	RAU	1489	3,5332	1,0267	-3,17	3093,4	0,0016	**
	CCU	2053	3,4252	0,9683				
Q74	RAU	1489	3,9960	0,9114	-0,51	3070,4	0,6083	
	CCU	2053	3,9805	0,8496				
Q75	RAU	1489	3,8066	0,9362	-5,04	3540	0,0000	**
	CCU	2053	3,6498	0,8976				
Q76	RAU	1489	3,6488	0,9690	-1,60	3084,2	0,1086	
	CCU	2053	3,5972	0,9096				
Q77	RAU	1489	3,8381	0,9817	-3,70	3540	0,0002	**
	CCU	2053	3,7170	0,9476				

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level
* : Significant at the 5% significance level

There are statistically significant differences in respect of 54 items (51 at 1% level, 3 at 5% level) between the two student groups. There are no significant differences for the items Q8, Q52, Q56, Q57, Q60, Q74, and Q76.

5.3.2 Hypotheses and analyses for Male Students

HoT2.1 There is no statistically significant difference between the vector of means of South African male students' test scores and that of Chinese male students in respect of the variables Z1, Z2, Z3 combined.

HaT2.1 There is a statistically significant difference between the vector of means of South African male students' test scores and that of Chinese male students in respect of the variables Z1, Z2, Z3 combined.

Table 5.3.2.1

Hotelling's T square test for the differences between the vector of mean test scores of the two male student groups in respect of Z1, Z2, Z3 variables combined.

Hotelling's T square value	F-value	D.F.	P
133,2585	44,3645	3; 1614	0,0000**

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two groups. The null hypothesis HoT2.1 is rejected and the alternative hypothesis HaT2.1 is supported.

Hot2.1 There is no statistically significant difference between the mean test scores of South African male students and that of Chinese male students in respect of each of the variables Z1, Z2, Z3 taken separately, viz.:

Hot2.1.1: Z1

Hot2.1.2: Z2

Hot2.1.3: Z3

Hat2.1 There is a statistically significant difference between the mean test scores of South African male students and that of Chinese male students in respect of each of the variables Z1, Z2, Z3 taken separately.

Hat2.1.1: Z1

Hat2.1.2: Z2

Hat2.1.3: Z3

Table 5.3.2.2

Student's t-test for the difference between the mean test scores of the two male student groups in respect of each of Z1, Z2, Z3 variables.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P
Z1	RAU	739	81,6395	12,0721	-10,31	1602,8	0,0000 **
	CCU	879	75,1707	13,1181			
Z2	RAU	739	78,2977	12,7376	-4,70	1512,1	0,0000 **
	CCU	879	75,4221	11,6462			
Z3	RAU	739	61,1732	10,0133	-7,96	1526,4	0,0000 **
	CCU	879	57,3128	9,3433			

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There are statistically significant differences (p=0,0000) on the 3 variables between the two groups. The null hypotheses Hot2.1.1, Hot2.1.2 and Hot2.1.3 are rejected and the alternative hypotheses Hat2.1.1, Hat2.1.2 and Hat2.1.3 are supported.

HoT2.2 There is no statistically significant difference between the vector of means of South African male students' test scores and that of Chinese male students in respect of 10 LASSI subscales combined.

HaT2.2 There is a statistically significant difference between the vector of means of South African male students' test scores and that of Chinese male students in respect of 10 LASSI subscales combined.

Table 5.3.2.3

Hotelling's T square test for the differences between the vector of mean test scores of the two male student groups in respect of the 10 LASSI subscales combined.

Hotelling's T square value	F-value	D.F.	P
713,2333	70,9261	10; 1607	0,0000**

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two male student groups. The null hypothesis HoT2.2 is rejected and the alternative hypothesis HaT2.2 is supported.

Hot2.2 There is no statistically significant difference between the mean test scores of South African male students and that of Chinese male students in respect of each of the 10 LASSI subscales taken separately, viz.:

Hot2.2.1 : ATT (Attitude)

Hot2.2.2 : MOT (Motivation)

Hot2.2.3 : TMT (Time Management)

Hot2.2.4 : ANX (Anxiety)

Hot2.2.5 : CON (Concentration)

Hot2.2.6 : INP (Information Processing)

Hot2.2.7 : SMI (Selection Main Idea)

Hot2.2.8 : STA (Study Aids)

Hot2.2.9 : SFT (Self Testing)

Hot2.2.10: TST (Test Strategies)

Hat2.2 There is a statistically significant difference between the mean test scores of South African male students and that of Chinese male students in respect of each of the 10 LASSI subscales taken separately, viz.:

Hat2.2.1 : ATT (Attitude)

Hat2.2.2 : MOT (Motivation)

Hat2.2.3 : TMT (Time Management)

Hat2.2.4 : ANX (Anxiety)

Hat2.2.5 : CON (Concentration)

Hat2.2.6 : INP (Information Processing)

Hat2.2.7 : SMI (Selection Main Idea)

Hat2.2.8 : STA (Study Aids)

Hat2.2.9 : SFT (Self Testing)

Hat2.2.10: TST (Test Strategies)

Table 5.3.2.4

Student's t-test for the difference between the mean test scores of the two male student groups in respect of each of the 10 LASSI subscales.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P	
ATT	RAU	739	19,7267	2,8869	-12,88	1609,9	0,0000	**
	CCU	879	17,7679	3,2290				
MOT	RAU	739	25,6536	4,2873	-5,32	1616	0,0000	**
	CCU	879	24,5085	4,3279				
TMT	RAU	739	18,7551	4,7046	6,40	1359,6	0,0000	**

	CCU	879	20,1047	3,5764				
ANX	RAU	739	28,1800	5,5491	-8,98	1616	0,0000	**
	CCU	879	25,6541	5,7023				
CON	RAU	739	21,9580	4,5284	-10,75	1616	0,0000	**
	CCU	879	19,5393	4,4895				
INP	RAU	739	29,1686	5,1232	-4,90	1616	0,0000	**
	CCU	879	27,9147	5,2698				
SMI	RAU	739	18,7483	3,2881	-6,53	1616	0,0000	**
	CCU	879	17,6462	3,4629				
STA	RAU	739	17,6658	3,7627	-10,88	1507,7	0,0000	**
	CCU	879	15,7053	3,4195				
SFT	RAU	739	10,5589	2,3357	-6,34	1505,2	0,0000	**
	CCU	879	9,8510	2,1155				
TST	RAU	739	30,6739	4,6496	-6,08	1616	0,0000	**
	CCU	879	29,2139	4,9464				

ATT=Attitude
MOT=Motivation
TMT=Time Management
ANX=Anxiety
CON=Concentration
INP=Information Processing
SMI=Selecting Main Ideas
STA=Study Aids
SFT=Self Testing
TST=Test Strategies

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There are statistically significant differences (p=0,0000) on all the 10 subscales between the two male student groups. The null hypotheses Hot2.2.1 to Hot2.2.10 are rejected and the alternative hypotheses Hat2.2.1 to Hat2.2.10 are supported.

Hot2.3 There is no statistically significant difference between the mean test scores of South African male students and that of Chinese male students in respect of the Z variable (Z=Z1+Z2+Z3).

Hat2.3 There is a statistically significant difference between the mean test scores of South African male students and that of Chinese male students in respect of the Z variable (Z=Z1+Z2+Z3).

Table 5.3.2.5

Student's t-test for the difference between the mean test scores of the two male student groups in respect of the Z variable.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P
Z	RAU	739	221,1070	28,4067	-9,35	1616	0,0000 **
	CCU	879	207,9056	28,2037			

There is a statistically significant difference (p=0,0000) on Z variable between the two male student groups. The null hypothesis Hot2.3 is rejected and the alternative hypothesis Hat2.3 is supported.

HoT2.3 There is no statistically significant difference between the vector of means of South African male students' test scores and that of Chinese male students in respect of the 61 items combined.

HaT2.3 There is a statistically significant difference between the vector of means of South African male students' test scores and that of Chinese male students in respect of the 61 items combined.

The items are:

Q1 Q2 Q3 Q6 Q7 Q8 Q9 Q10 Q12 Q13 Q14 Q15 Q16
Q19 Q20 Q21 Q22 Q23 Q25 Q27 Q28 Q29 Q31 Q32 Q33 Q34
Q35 Q37 Q39 Q40 Q41 Q43 Q45 Q46 Q47 Q48 Q50 Q51 Q52
Q53 Q54 Q56 Q57 Q58 Q59 Q60 Q61 Q62 Q63 Q64 Q65 Q66
Q67 Q68 Q69 Q71 Q72 Q74 Q75 Q76 Q77

Table 5.3.2.6

Hotelling's T square test for the differences between the vector of mean test scores of the two male student groups in respect of the 61 items combined.

Hotelling's T square value	F-value	D.F.	P
3410,9827	53,8416	61; 1556	0,0000**

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two male student groups. The null hypothesis HoT2.3 is rejected and the alternative hypothesis HaT2.3 is supported.

Hot2.4 There is no statistically significant difference between the mean test scores of South African male students and that of Chinese male students in respect of each of the 61 items taken separately.

HaT2.4 There is a statistically significant difference between the mean test scores of South African male students and that of Chinese male students in respect of each of the 61 items taken separately.

Table 5.3.2.7

Student's t-test for the difference between the mean test scores of the two male students groups in respect of each of the following 61 items.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P	
Q1	RAU	739	4,3532	1,1097	-25,18	1612,8	0,0000	**
	CCU	879	2,8680	1,2622				
Q2	RAU	739	3,9118	0,8547	-11,63	1588,2	0,0000	**
	CCU	879	3,4130	0,8910				
Q3	RAU	739	2,9878	1,2169	-4,62	1616	0,0000	**
	CCU	879	2,7156	1,1489				
Q6	RAU	739	3,8701	0,9496	-9,01	1581,5	0,0000	**
	CCU	879	3,4380	0,9748				
Q7	RAU	739	3,5467	1,1364	-3,63	1616	0,0003	**
	CCU	879	3,3470	1,0742				
Q8	RAU	739	3,7618	0,9429	1,73	1545,8	0,0837	
	CCU	879	3,8419	0,9062				
Q9	RAU	739	2,9093	1,1219	2,99	1616	0,0028	**
	CCU	879	3,0808	1,1687				
Q10	RAU	739	3,9770	0,8685	-7,18	1615,8	0,0000	**
	CCU	879	3,6394	1,0229				
Q12	RAU	739	3,4438	0,9853	-2,21	1616	0,0272	*
	CCU	879	3,3311	1,0525				
Q13	RAU	739	3,3586	1,0027	-1,33	1616	0,1834	
	CCU	879	3,2912	1,0233				
Q14	RAU	739	3,9946	1,0346	-13,52	1615,7	0,0000	**
	CCU	879	3,3289	1,2139				
Q15	RAU	739	3,5913	1,0467	-5,77	1600,8	0,0000	**
	CCU	879	3,2787	1,1298				
Q16	RAU	739	3,7199	1,0379	-14,58	1616	0,0000	**

	CCU	879	2,9352	1,1108				
Q19	RAU	739	3,8336	1,0004	-10,49	1609,7	0,0000	**
	CCU	879	3,2810	1,1181				
Q20	RAU	739	3,9310	0,9777	-8,06	1604.0	0,0000	**
	CCU	879	3,5210	1,0669				
Q21	RAU	739	3,4506	1,1541	-1,43	1518,4	0,1518	
	CCU	879	3,3709	1,0646				
Q22	RAU	739	2,5981	1,0955	13,11	1616	0,0000	**
	CCU	879	3,3185	1,1054				
Q23	RAU	739	3,7659	0,9729	-7,62	1587,7	0,0000	**
	CCU	879	3,3891	1,0130				
Q25	RAU	739	3,7618	1,0451	-0,23	1616	0,8181	
	CCU	879	3,7497	1,0656				
Q27	RAU	739	3,9905	0,9158	-9,20	1608,3	0,0000	**
	CCU	879	3,5484	1,0168				
Q28	RAU	739	3,7158	0,9934	-4,34	1610,9	0,0000	**
	CCU	879	3,4881	1,1171				
Q29	RAU	739	3,8011	0,9862	-10,67	1597,2	0,0000	**
	CCU	8793	3,2594	1,0526				
Q31	RAU	739	3,0392	1,1847	4,82	1616	0,0000	**
	CCU	879	3,3208	1,1581				
Q32	RAU	739	4,0731	0,8297	-9,66	1615,0	0,0000	**
	CCU	879	3,6428	0,9628				
Q33	RAU	739	3,5859	1,0588	5,48	1561,5	0,0000	**
	CCU	879	3,8737	1,0451				
Q34	RAU	739	3,7240	0,9134	-3,26	1600,8	0,0011	**
	CCU	879	3,5700	0,9859				
Q35	RAU	739	3,6184	0,9169	-15,32	1616	0,0000	**
	CCU	879	2,8601	1,0510				
Q37	RAU	739	3,2747	1,0062	6,04	1616	0,0000	**
	CCU	879	3,5700	0,9566				
Q39	RAU	739	3,7402	1,0360	-15,65	1607,3	0,0000	**
	CCU	879	2,8908	1,1452				
Q40	RAU	739	3,8011	0,9252	-3,40	1616	0,0007	**
	CCU	879	3,6248	0,9376				
Q41	RAU	739	3,8078	1,0072	-4,54	1616	0,0000	**
	CCU	879	3,5802	1,0012				

Q43	RAU	739	3,7158	0,9672	-5,54	1596,6	0,0000	**
	CCU	879	3,4403	1,0306				
Q45	RAU	739	4,0623	0,9422	-7,92	1593,3	0,0000	**
	CCU	879	3,6803	0,9950				
Q46	RAU	739	3,5061	1,0610	-8,08	1616	0,0000	**
	CCU	879	3,0705	1,0965				
Q47	RAU	739	3,5034	1,0455	2,78	1510,0	0,0055	**
	CCU	879	3,6428	0,9533				
Q48	RAU	737	3,0216	1,0692	-3,84	1497,4	0,0001	**
	CCU	879	2,8259	0,9583				
Q50	RAU	739	3,3924	1,1513	-11,56	1616	0,0000	**
	CCU	879	2,7201	1,1774				
Q51	RAU	739	3,8755	0,8036	-6,69	1615,6	0,0000	**
	CCU	879	3,5802	0,9712				
Q52	RAU	739	3,8309	0,8879	-0,03	1616	0,9725	
	CCU	879	3,8294	0,8594				
Q53	RAU	739	2,9729	1,2038	-2,19	1508,2	0,0284	*
	CCU	879	2,8464	1,0948				
Q54	RAU	739	3,4926	1,1157	1,78	1521,0	0,0759	
	CCU	879	3,5882	1,0330				
Q56	RAU	739	3,4885	1,0219	4,39	1486,7	0,0000	**
	CCU	879	3,7008	0,9032				
Q57	RAU	739	3,2111	1,1728	-4,21	1616	0,0000	**
	CCU	879	2,9670	1,1514				
Q58	RAU	739	3,1962	1,1361	9,29	1450,5	0,0000	**
	CCU	879	3,6871	0,9599				
Q59	RAU	739	4,2219	0,8145	-6,17	1616	0,0000	**
	CCU	879	3,9534	0,9175				
Q60	RAU	739	3,7442	0,9618	-4,23	1604,0	0,0000	**
	CCU	879	3,5324	1,0494				
Q61	RAU	739	3,7050	0,9540	-9,82	1598,5	0,0000	**
	CCU	879	3,2218	1,0224				
Q62	RAU	739	3,9202	0,8821	-8,89	1605,7	0,0000	**
	CCU	879	3,5180	0,9686				
Q63	RAU	739	3,7943	1,0610	-10,71	1616	0,0000	**
	CCU	879	3,2196	1,0866				

Q64	RAU	739	3,7361	1,0653	2,04	1513,3	0,0411	*
	CCU	879	3,8407	0,9756				
Q65	RAU	739	3,8336	0,9701	-18,18	1607,1	0,0000	**
	CCU	879	2,9101	1,0714				
Q66	RAU	739	3,1407	1,1002	11,37	1649,1	0,0000	**
	CCU	879	3,7281	0,9510				
Q67	RAU	739	3,4371	1,0514	-0,84	1516,8	0,4032	
	CCU	879	3,3948	0,9676				
Q68	RAU	739	3,4208	1,0189	1,15	1616	0,2519	
	CCU	879	3,4778	0,9766				
Q69	RAU	739	3,9932	0,8255	0,36	1612,6	0,7175	
	CCU	879	4,0091	0,9376				
Q71	RAU	739	3,4993	0,9548	-0,88	1616	0,3809	
	CCU	879	3,4573	0,9641				
Q72	RAU	739	3,5223	0,9825	-4,54	1616	0,0000	**
	CCU	879	3,2969	1,0043				
Q74	RAU	739	3,8106	0,9595	0,40	1530,5	0,6866	
	CCU	879	3,8294	0,9008				
Q75	RAU	739	3,7402	0,9429	-5,22	1616	0,0000	**
	CCU	879	3,4937	0,9472				
Q76	RAU	739	3,5710	0,9774	0,45	1616	0,6506	
	CCU	879	3,5927	0,9427				
Q77	RAU	739	3,8011	0,9710	-4,78	1597,4	0,0000	**
	CCU	879	3,5620	1,0371				

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level
* : Significant at the 5% significance level

There are statistically significant differences in respect of the 49 items (46 at 1% level, 3 at 5% level) between the two male student groups. There are no significant differences for the items Q8, Q13, Q21, Q25, Q52, Q54, Q67, Q68, Q69, Q71, Q74, and Q76.

5.3.3 Hypotheses and analyses for Female Students

HoT3.1 There is no statistically significant difference between the vector of means of South African female students' test scores and that of Chinese female students in respect of the variables Z1, Z2, Z3 combined.

HaT3.1 There is a statistically significant difference between the vector of means of South African female students' test scores and that of Chinese female students in respect of the variables Z1, Z2, Z3 combined.

Table 5.3.3.1

Hotelling's T square test for the differences between the vector of mean test scores of the two female student groups in respect of Z1, Z2, Z3 variables combined.

Hotelling's T square value	F-value	D.F.	P
163,1003	54,3102	3; 1920	0,0000**

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two female student groups. The null hypothesis HoT3.1 is rejected and the alternative hypothesis HaT3.1 is supported.

Hot3.1 There is no statistically significant difference between the mean test scores of South African female students and that of Chinese female students in respect of each of the variables Z1, Z2, Z3 taken separately, viz.:

Hot3.1.1: Z1

Hot3.1.2: Z2

Hot3.1.3: Z3

Hat3.1 There is a statistically significant difference between the mean test scores of South African female students and that of Chinese female students in respect of each of the variables Z1, Z2, Z3 taken separately, viz.:

Hat3.1.1: Z1

Hat3.1.2: Z2

Hat3.1.3: Z3

Table 5.3.3.2

Student's t-test for the difference between the mean test scores of the two female student groups in respect of each of Z1, Z2, Z3 variables.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P
Z1	RAU	750	81,4333	12,7776	-5,13	1493	0,0000 **
	CCU	1174	78,4685	11,7030			

Z2	RAU	748	82,7273	12,7725	-6,00	1311,5	0,0000	**
	CCU	1174	79,3935	10,3439				
Z3	RAU	750	64,3026	9,9572	-12,75	1922	0,0000	**
	CCU	1174	58,5554	9,4353				

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There are statistically significant differences (p=0,0000) on the 3 variables between the two female student groups. The null hypotheses HoT3.1.1, Hot3.1.2 and Hot3.1.3 are rejected and the alternative hypotheses HaT3.1.1, Hat3.1.2 and Hat3.1.3 are supported.

HoT3.2 There is no statistically significant difference between the vector of means of South African female students' test scores and that of Chinese female students in respect of the 10 LASSI subscales combined.

HaT3.2 There is a statistically significant difference between the vector of means of South African female students' test scores and that of Chinese female students in respect of the 10 LASSI subscales combined.

Table 5.3.3.3

Hotelling's T square test for the differences between the vector of mean test scores of the two female student groups in respect of the 10 LASSI subscales combined.

Hotelling's T square value	F-value	D.F.	P
880,5640	87,6441	10; 1913	0,0000**

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two female student groups. The null hypothesis HoT3.2 is rejected and the alternative hypothesis HaT3.2 is supported.

Hot3.2 There is no statistically significant difference between the mean test scores of South African female students and that of Chinese female students in respect of each of the 10 LASSI variables taken separately, viz.:

Hot3.2.1 : ATT (Attitude)

Hot3.2.2 : MOT (Motivation)

Hot3.2.3 : TMT (Time Management)

Hot3.2.4 : ANX (Anxiety)

Hot3.2.5 : CON (Concentration)

Hot3.2.6 : INP (Information Processing)

Hot3.2.7 : SMI (Selection Main Idea)

Hot3.2.8 : STA (Study Aids)

Hot3.2.9 : SFT (Self Testing)

Hot3.2.10: TST (Test Strategies)

Hat3.2 There is a statistically significant difference between the mean test scores of South African female students and that of Chinese female students in respect of each of the 10 LASSI subscales taken separately, viz.:

Hat3.2.1 : ATT (Attitude)

Hat3.2.2 : MOT (Motivation)

Hat3.2.3 : TMT (Time Management)

Hat3.2.4 : ANX (Anxiety)

Hat3.2.5 : CON (Concentration)

Hat3.2.6 : INP (Information Processing)

Hat3.2.7 : SMI (Selection Main Idea)

Hat3.2.8 : STA (Study Aids)

Hat3.2.9 : SFT (Self Testing)

Hat3.2.10: TST (Test Strategies)

Table 5.3.3.4

Student's t-test for the difference between the mean test scores of the two female student groups in respect of each of the 10 LASSI subscales.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P
ATT	RAU	750	20,5800	2,8526	-14,67	1922	0,0000 **
	CCU	1174	18,6269	2,8441			
MOT	RAU	750	27,5840	4,2307	-9,66	1524,8	0,0000 **
	CCU	1174	25,7164	3,9819			
TMT	RAU	748	20,0989	4,6996	4,21	1202,5	0,0000 **
	CCU	1174	20,9259	3,2574			
ANX	RAU	750	27,0493	5,8558	-2,83	1508,0	0,0047 **
	CCU	1174	26,2956	5,4324			

CON	RAU	750	22,3907	4,5621	-7,65	1485,3	0,0000	**
	CCU	1174	20,8143	4,1504				
INP	RAU	750	29,9693	5,2632	-8,01	1922	0,0000	**
	CCU	1174	28,0077	5,2228				
SMI	RAU	750	18,9507	3,5307	-2,36	1474,2	0,0182	*
	CCU	1174	18,5750	3,1812				
STA	RAU	750	19,3960	3,5346	-16,44	1922	0,0000	**
	CCU	1174	16,6874	3,5191				
SFT	RAU	750	11,0200	2,3484	-9,85	1377,1	0,0000	**
	CCU	1174	10,0077	1,9396				
TST	RAU	750	31,4013	4,8041	-2,97	1464,7	0,0030	**
	CCU	1174	30,7606	4,2930				

ATT=Attitude
MOT=Motivation
TMT=Time Management
ANX=Anxiety
CON=Concentration
INP=Information Processing
SMI=Selecting Main Ideas
STA=Study Aids
SFT=Self Testing
TST=Test Strategies
D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level
* : Significant at the 5% significance level

There are statistically significant differences (p=0,0000;0,0047;0,0182;0,0030) on all the 10 LASSI subscales between the two female student groups. The null hypotheses Hot3.2.1 to Hot3.2.10 are rejected and the alternative hypotheses Hat3.2.1 to Hat3.2.10 are supported.

Hot3.3 There is no statistically significant difference between the mean test scores of South African female students and that of Chinese female students in respect of the Z variable (Z=Z1+Z2+Z3).

Hat3.3 There is a statistically significant difference between the mean test scores of South African female students and that of Chinese female students in respect of the Z variable (Z=Z1+Z2+Z3).

Table 5.3.3.5

Student's t-test for the difference between the mean test scores of the two female student groups in respect of Z variable.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P
Z	RAU	748	228,5188	28,1055	-9,61	1450,7	0,0000 **
	CCU	1174	216,4173	24,9144			

There is a statistically significant difference (p=0,0000) between the mean test scores of the two female student groups in respect of Z variable. The null hypothesis Hot3.3 is rejected and the alternative hypothesis Hat3.3 is supported.

HoT3.3 There is no statistically significant difference between the vector of means of South African female students' test scores and that of Chinese female students in respect of the 61 items combined.

HaT3.3 There is a statistically significant difference between the vector of means of South African female students' test scores and that of Chinese female students in respect of the 61 items combined.

The items are:

Q1 Q2 Q3 Q6 Q7 Q8 Q9 Q10 Q12 Q13 Q14 Q15 Q16

Q19 Q20 Q21 Q22 Q23 Q25 Q27 Q28 Q29 Q31 Q32 Q33 Q34

Q35 Q37 Q39 Q40 Q41 Q43 Q45 Q46 Q47 Q48 Q50 Q51 Q52

Q53 Q54 Q56 Q57 Q58 Q59 Q60 Q61 Q62 Q63 Q64 Q65 Q66

Q67 Q68 Q69 Q71 Q72 Q74 Q75 Q76 Q77

Table 5.3.3.6

Hotelling's T square test for the differences between the vector of mean test scores of the two female student groups in respect of the 61 items combined.

Hotelling's T square value	F-value	D.F.	P
4635,5229	73,6199	61; 1862	0,0000 **

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two female student groups. The null hypothesis HoT3.3 is rejected and the alternative hypothesis HaT3.3 is supported.

Hot3.4 There is no statistically significant difference between the mean test scores of South African female students and that of Chinese female students in respect of each of the 61 items taken separately.

Hat3.4 There is a statistically significant difference between the mean test scores of South African female students and that of Chinese female students in respect of each of the 61 items taken separately.

Table 5.3.3.7

Student's t-test for the difference between the mean test scores of the two female student groups in respect of each of the following 61 items.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P	
Q1	RAU	750	4,3680	1,1217	-23,97	1682,9	0,0000	**
	CCU	1174	3,0715	1,2102				
Q2	RAU	750	3,8787	0,8784	-8,64	1551,0	0,0000	**
	CCU	1174	3,5290	0,8455				
Q3	RAU	750	3,0013	1,2113	-5,96	1922	0,0000	**
	CCU	1174	2,6797	1,1170				
Q6	RAU	750	3,9333	0,9249	-7,85	1543,6	0,0000	**
	CCU	1174	3,5997	0,8846				
Q7	RAU	750	3,9653	1,0355	-10,81	1656,1	0,0000	**
	CCU	1174	3,4310	1,0909				
Q8	RAU	750	3,9173	0,9293	-1,48	1922	0,1402	
	CCU	1174	3,8526	0,9432				
Q9	RAU	750	2,7507	1,1264	1,72	1922	0,0858	
	CCU	1174	2,8399	1,0994				
Q10	RAU	750	4,2853	0,8435	-8,43	1922	0,0000	**
	CCU	1174	3,9259	0,9535				
Q12	RAU	750	3,3853	1,0410	-2,52	1922	0,0118	*
	CCU	1174	3,2658	0,9975				
Q13	RAU	750	3,5440	1,0140	-1,30	1922	0,1928	
	CCU	1174	3,4838	0,9715				

Q14	RAU	750	4,0533	1,0526	-13,80	1691,1	0,0000	**
	CCU	1174	3,3509	1,1441				
Q15	RAU	750	3,8080	1,0324	-9,92	1673,0	0,0000	**
	CCU	1174	3,3160	1,1040				
Q16	RAU	750	3,9547	0,9531	-19,77	1691,0	0,0000	**
	CCU	1174	3.0434	1,0359				
Q19	RAU	750	4,1520	0,8835	-12,08	1748,0	0,0000	**
	CCU	1174	3,6235	1,0130				
Q20	RAU	750	3,9537	1,0170	-4,88	1922	0,0000	**
	CCU	1174	3,7368	0,9333				
Q21	RAU	750	3,5307	1,1039	-3,33	1522,5	0,0009	**
	CCU	1174	3,3629	1,0370				
Q22	RAU	750	2,8240	1,1455	11,11	1481,4	0,0000	**
	CCU	1174	3,3978	1,0386				
Q23	RAU	750	3,8627	0,9851	-10,00	1922	0,0000	**
	CCU	1174	3,4012	0,9893				
Q25	RAU	750	3,6080	1,0979	4,68	1540,5	0,0000	**
	CCU	1174	3,8441	1,0473				
Q27	RAU	750	4,0053	0,9791	-4,94	1922	0,0000	**
	CCU	1174	3,7956	0,8617				
Q28	RAU	750	3,9773	1,0104	-7,20	1612,4	0,0000	**
	CCU	1174	3,6354	1,0248				
Q29	RAU	750	3,8960	1,0059	-11,68	1636,5	0,0000	**
	CCU	1174	3,3390	1,0418				
Q31	RAU	750	2,7867	1,2433	13,54	1400,1	0,0000	**
	CCU	1174	3,5281	1,0489				
Q32	RAU	750	4,1400	0,8618	-10,96	1676,8	0,0000	**
	CCU	1174	3,6857	0,9247				
Q33	RAU	750	3,8347	1,0511	7,07	1445,6	0,0000	**
	CCU	1174	4,1661	0,9236				
Q34	RAU	750	3,8640	0,9819	-2,23	1922	0,0256	*
	CCU	1174	3,7666	0,9000				
Q35	RAU	750	3,3787	1,0076	-15,86	1922	0,0000	**
	CCU	1174	2,6482	0,9709				
Q37	RAU	750	3,4493	1,0228	4,59	1426,7	0,0000	**
	CCU	1174	3,6576	0,8839				

Q39	RAU	750	3,7827	1,1032	-13,47	1922	0,0000	**
	CCU	1174	3,0792	1,1262				
Q40	RAU	750	3,9307	0,9174	-5,52	1579,9	0,0000	**
	CCU	1174	3,6591	0,9051				
Q41	RAU	750	4,0973	0,9024	-8,68	1676 1	0,0000	**
	CCU	1174	3,7206	0,9677				
Q43	RAU	750	3,7720	0,9791	-2,02	1922	0,0433	*
	CCU	1174	3,6831	0,9141				
Q45	RAU	750	4,2973	0,8698	-10,76	1922	0,0000	**
	CCU	1174	3,8569	0,8788				
Q46	RAU	750	3,6013	1,0813	-6,06	1922	0,0000	**
	CCU	1174	3,2918	1,0623				
Q47	RAU	750	3,5853	1,0502	0,97	1468,2	0,3313	
	CCU	1174	3,6312	0,9413				
Q48	RAU	748	3,3249	1,0426	-10,33	1422,0	0,0000	**
	CCU	1174	2,8467	0,9011				
Q50	RAU	750	3,8307	1,1271	-18,14	1675,5	0,0000	**
	CCU	1174	2,8475	1,2080				
Q51	RAU	750	4,1533	0,7393	-9,20	1922	0,0000	**
	CCU	1174	3,8143	0,8183				
Q52	RAU	750	3,8813	0,9362	1,86	1340,8	0,0638	
	CCU	1174	3,9566	0,7471				
Q53	RAU	750	3,3440	1,2115	-5,04	1500,1	0,0000	**
	CCU	1174	3,0673	1,1163				
Q54	RAU	750	3,5333	1,1207	7,12	1375,4	0,0000	**
	CCU	1174	3,8825	0,9241				
Q56	RAU	750	3,8907	0,9879	-3,40	1438,7	0,0007	**
	CCU	1174	3,7411	0,8628				
Q57	RAU	750	2,8747	1,2087	3,07	1452,5	0,0022	**
	CCU	1174	3,0451	1,1549				
Q58	RAU	750	3,3880	1,1693	10,45	1306	0,0000	**
	CCU	1174	3,9123	0,9018				
Q59	RAU	750	4,4313	0,8273	-5,19	1555,9	0,0000	**
	CCU	1174	4,1431	0,7996				
Q60	RAU	750	3,7360	1,0550	2,25	1353,8	0,0249	*
	CCU	1174	3,8390	0,8525				
Q61	RAU	750	3,7920	0,9829	-9,73	1588,8	0,0000	**

	CCU	1174	3,3458	0,9770				
Q62	RAU	750	4,1040	0,8395	-9,40	1719,9	0,0000	**
	CCU	1174	3,7181	0,9369				
Q63	RAU	750	3,7493	1,0991	-6,33	1922	0,0000	**
	CCU	1174	3,4361	1,0318				
Q64	RAU	750	3,7560	1,0529	5,02	1414,5	0,0000	**
	CCU	1174	3,9898	0,8999				
Q65	RAU	750	4,0400	0,9742	-22,50	1922	0,0000	**
	CCU	1174	2,9872	1,0177				
Q66	RAU	750	3,3720	1,1768	12,62	1230,0	0,0000	**
	CCU	1174	3,9957	0,8376				
Q67	RAU	750	3,5320	1,0794	-2,48	1448,3	0,0131	*
	CCU	1174	3,4123	0,9508				
Q68	RAU	750	3,5093	1,1049	6,71	1387,3	0,0000	**
	CCU	1174	3,8083	0,8462				
Q69	RAU	750	4,1800	0,8111	2,30	1922	0,0218	*
	CCU	1174	4,2658	0,7916				
Q71	RAU	750	3,7240	0,9939	-2,70	1402,6	0,0070	**
	CCU	1174	3,6506	0,8404				
Q72	RAU	750	3,5440	1,0691	-0,48	1433,3	0,6330	
	CCU	1174	3,5213	0,9293				
Q74	RAU	750	4,1787	0,8220	-2,24	1550,6	0,0250	*
	CCU	1174	4,0937	0,7909				
Q75	RAU	750	3,8720	0,9256	-2,52	1482,7	0,0117	*
	CCU	1174	3,7666	0,8402				
Q76	RAU	750	3,7253	0,9552	-2,88	1505 7	0,0041	**
	CCU	1174	3,6005	0,8845				
Q77	RAU	750	3,8747	0,9914	-0,95	1426,9	0,3444	
	CCU	1174	3,8330	0,8569				

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level
* : Significant at the 5% significance level

There are statistically significant differences in respect of 54 items (47 at 1% level, 7 at 5% level) between the two female student groups. There are no significant differences for Q8, Q9, Q13, Q47, Q52, Q72, and Q77.

5.3.4 Hypotheses and Analyses for Commercial Students

HoT4.1 There is no statistically significant difference between the vector of means of South African commercial students' test scores and that of Chinese commercial students in respect of the variables Z1, Z2, Z3 combined.

HaT4.1 There is a statistically significant difference between the vector of means of South African commercial students' test scores and that of Chinese commercial students in respect of the variables Z1, Z2, Z3 combined.

Table 5.3.4.1

Hotelling's T square test for the differences between the vector of mean test scores of the two commercial student groups in respect of Z1, Z2, Z3 variables combined.

Hotelling's T square value	F-value	D.F.	P
79,3232	26,4008	3; 1313	0,0000**

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two commercial student groups. The null hypothesis HoT4.1 is rejected and the alternative hypothesis HaT4.1 is supported.

Hot4.1 There is no statistically significant difference between the mean test scores of South African commercial students and that of Chinese commercial students in respect of each of the following variables taken separately, viz.:

Hot4.1.1: Z1

Hot4.1.2: Z2

Hot4.1.3: Z3

Hat4.1 There is a statistically significant difference between the mean test scores of South African commercial students and that of Chinese commercial students in respect of each of the following variables taken separately, viz.:

Hat4.1.1: Z1

Hat4.1.2: Z2

Hat4.1.3: Z3

Table 5.3.4.2

Student's t-test for the difference between the mean test scores of the two commercial student groups in respect of each of Z1, Z2, Z3 variables.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P
Z1	RAU	709	81,1213	12,3700	-6,16	1315	0,0000 **
	CCU	608	76,9786	11,9142			
Z2	RAU	708	80,1031	12,9020	-3,77	1313,7	0,0002 **
	CCU	608	77,5954	11,2367			
Z3	RAU	709	61,9859	10,2642	-8,10	1311,8	0,0000 **
	CCU	608	57,6299	9,2441			

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There are statistically significant differences (p=0,0000) on the 3 variables between the two commercial student groups. The null hypotheses Hot4.1.1, Hot4.1.2 and Hot4.1.3 are rejected and the alternative hypotheses Hat4.1.1, Hat4.1.2 and Hat4.1.3 are supported.

HoT4.2 There is no statistically significant difference between the vector of means of South African commercial students' test scores and that of Chinese commercial students in respect of the 10 LASSI subscales combined.

HaT4.2 There is a statistically significant difference between the vector of means of South African commercial students' test scores and that of Chinese commercial students in respect of the 10 LASSI subscales combined.

Table 5.3.4.3

Hotelling's T square test for the differences between the vector of mean test scores of the two commercial student groups in respect of the 10 LASSI subscales combined.

Hotelling's T square value	F-value	D.F.	P
543,8771	54,0115	10; 1306	0,0000**

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two commercial student groups. The null hypothesis HoT4.2 is rejected and the alternative hypothesis HaT4.2 is supported.

Hot4.2 There is no statistically significant difference between the mean test scores of South African commercial students and that of Chinese commercial students in respect of each of the following 10 LASSI subscales taken separately, viz.:

Hot4.2.1 : ATT (Attitude)

Hot4.2.2 : MOT (Motivation)

Hot4.2.3 : TMT (Time Management)

Hot4.2.4 : ANX (Anxiety)

Hot4.2.5 : CON (Concentration)

Hot4.2.6 : INP (Information Processing)

Hot4.2.7 : SMI (Selection Main Idea)

Hot4.2.8 : STA (Study Aids)

Hot4.2.9 : SFT (Self Testing)

Hot4.2.10: TST (Test Strategies)

Hat4.2 There is a statistically significant difference between the mean test scores of South African commercial students and that of Chinese commercial students in respect of each of the following 10 LASSI subscales taken separately, viz.:

Hat4.2.1 : ATT (Attitude)

Hat4.2.2 : MOT (Motivation)

Hat4.2.3 : TMT (Time Management)

Hat4.2.4 : ANX (Anxiety)

Hat4.2.5 : CON (Concentration)

Hat4.2.6 : INP (Information Processing)

Hat4.2.7 : SMI (Selection Main Idea)

Hat4.2.8 : STA (Study Aids)

Hat4.2.9 : SFT (Self Testing)

Hat4.2.10: TST (Test Strategies)

Table 5.3.4.4

Student's t-test for the difference between the mean test scores of the two commercial student groups in respect of each of the 10 LASSI subscales.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P
ATT	RAU	709	20,0860	2,8921	-10,42	1315	0,0000 **
	CCU	608	18,3832	3,0292			
MOT	RAU	709	26,3075	4,4138	-5,25	1315	0,0000 **
	CCU	608	25,0395	4,3114			

TMT	RAU	708	19,3319	4,7308	5,22	1283,7	0,0000	**
	CCU	608	20,5148	3,4712				
ANX	RAU	709	27,6530	5,6432	-5,57	1315	0,0000	**
	CCU	608	25,9342	5,5068				
CON	RAU	709	22,2313	4,4709	-8,05	1315	0,0000	**
	CCU	608	20,2813	4,2765				
INP	RAU	709	29,1410	5,3396	-4,93	1315	0,0000	**
	CCU	608	27,7023	5,2171				
SMI	RAU	709	18,6573	3,3382	-2,99	1315	0,0029	**
	CCU	608	18,1086	3,3026				
STA	RAU	709	18,3117	3,7307	-10,78	1307,0	0,0000	**
	CCU	608	16,1744	3,4592				
SFT	RAU	709	10,7377	2,3359	-6,54	1315,0	0,0000	**
	CCU	608	9,9556	2,0016				
TST	RAU	709	30,7377	4,7504	-2,50	1308 6	0,0127	*
	CCU	608	30,1102	4,3692				

ATT=Attitude
MOT=Motivation
TMT=Time Management
ANX=Anxiety
CON=Concentration
INP=Information Processing
SMI=Selecting Main Ideas
STA=Study Aids
SFT=Self Testing
TST=Test Strategies

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level
* : Significant at the 5% significance level

There are statistically significant differences (p=0,0000;0,0029;0,0127) on all the 10 LASSI subscales between the two commercial student groups. The null hypotheses Hot4.2.1 to Hot4.2.10 are rejected and the alternative hypotheses Hat4.2.1 to Hat4.2.10 are supported.

Hot4.3 There is no statistically significant difference between the mean test scores of South African commercial students and that of Chinese commercial students in respect of the Z variable(Z=Z1+Z2+Z3).

Hat4.3 There is a statistically significant difference between the mean test scores of South African commercial students and that of Chinese commercial students in respect of the Z variable (Z=Z1+Z2+Z3).

Table 5.3.4.5

Student's t-test for the difference between the mean test scores of the two commercial student groups in respect of Z variable.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P
Z	RAU	708	223,2388	28,5870	-7,32	1309,1	0,0000 **
	CCU	608	212,2309	26,0902			

There is a statistically significant difference (p=0,0000) between mean test scores of the two commercial student groups in respect of Z variable. The null hypothesis Hot4.3 is rejected and the alternative hypothesis Hat4.3 is supported.

HoT4.3 There is no statistically significant difference between the vector of means of South African commercial students' test scores and that of Chinese commercial students in respect of the

61 items combined.

HaT4.3 There is a statistically significant difference between the vector of means of South African commercial students' test scores and that of Chinese commercial students in respect of the 61 items combined.

The items are:

Q1	Q2	Q3	Q6	Q7	Q8	Q9	Q10	Q12	Q13	Q14	Q15	Q16
Q19	Q20	Q21	Q22	Q23	Q25	Q27	Q28	Q29	Q31	Q32	Q33	Q34
Q35	Q37	Q39	Q40	Q41	Q43	Q45	Q46	Q47	Q48	Q50	Q51	Q52
Q53	Q54	Q56	Q57	Q58	Q59	Q60	Q61	Q62	Q63	Q64	Q65	Q66
Q67	Q68	Q69	Q71	Q72	Q74	Q75	Q76	Q77				

Table 5.3.4.6

Hotelling's T square test for the differences between the vector of mean test scores of the two commercial student groups in respect of the 61 items combined.

Hotelling's T square value	F-value	D.F.	P
3377 1340	52,8368	61; 1255	0,0000 **

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two commercial student groups. The null hypothesis HoT4.3 is rejected and the alternative hypothesis HaT4.3 is supported.

Hot4.4 There is no statistically significant difference between the mean test scores of South African commercial students and that of Chinese commercial students in respect of each of the 61 items taken separately.

Hat4.4 There is a statistically significant difference between the mean test scores of South African commercial students and that of Chinese commercial students in respect of each of the 61 items taken separately.

Table 5.3.4.7

Student's t-test for the difference between the mean test scores of the two commercial student groups in respect of each of the following 61 items.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P
Q1	RAU	709	4,3752	1,1112	-22,78	1234,7	0,0000 **
	CCU	608	2,8931	1,2312			
Q2	RAU	709	3,8604	0,8694	-7,67	1290,6	0,0000 **
	CCU	608	3,4951	0,8552			
Q3	RAU	709	3,0212	1,1936	-5,86	1315	0,0000 **
	CCU	608	2,6431	1,1347			
Q6	RAU	709	3,9450	0,9379	-7,50	1283,8	0,0000 **
	CCU	608	3,5559	0,9398			
Q7	RAU	709	3,7786	1,1048	-6,86	1315	0,0000 **
	CCU	608	3,3668	1,0640			
Q8	RAU	709	3,7955	0,9338	0,04	1315	0,9666
	CCU	608	3,7977	0,9776			
Q9	RAU	709	2,8025	1,0921	2,49	1315	0,0129 *
	CCU	608	2,9572	1,1601			

Q10	RAU	709	4,1100	0,8664	-7,00	1169,3	0,0000	**
	CCU	608	3,3719	1,0641				
Q12	RAU	709	3,3752	0,9959	-2,59	1315	0,0096	**
	CCU	608	3,2319	1,0044				
Q13	RAU	709	3,3780	1,0103	-0,42	1315	0,6741	
	CCU	608	3,4013	0,9943				
Q14	RAU	709	4,0028	1,0000	-11,93	1218,1	0,0000	**
	CCU	608	3,2928	1,1393				
Q15	RAU	709	3,5952	1,0675	-5,32	1315	0,0000	**
	CCU	608	3,2796	1,0788				
Q16	RAU	709	3,8025	1,0308	-15,55	1256,1	0,0000	**
	CCU	608	2,8849	1,0981				
Q19	RAU	709	3,9873	0,9499	-8,76	1194,7	0,0000	**
	CCU	608	3,4803	1,1232				
Q20	RAU	709	3,9309	0,9841	-4,79	1315	0,0000	**
	CCU	608	3,6743	0,9532				
Q21	RAU	709	3,4753	1,1404	-1,87	1312,0	0,0613	
	CCU	608	3,3635	1,0258				
Q22	RAU	709	2,6728	1,1162	-10,77	1315	0,0000	**
	CCU	608	3,3306	1,0910				
Q23	RAU	709	3,7997	0,9475	-7,60	1253,7	0,0000	**
	CCU	608	3,3865	1,0140				
Q25	RAU	709	3,7193	1,0504	1,44	1315	0,1488	
	CCU	608	3,8026	1,0351				
Q27	RAU	709	3,9760	0,9377	-7,09	1284,9	0,0000	**
	CCU	608	3,6086	0,9369				
Q28	RAU	709	3,8364	0,9993	-4,70	1261,5	0,0000	**
	CCU	608	3,5691	1,0530				
Q29	RAU	709	3,8660	0,9802	-9,74	1273,7	0,0000	**
	CCU	608	3,3306	1,0062				
Q31	RAU	709	2,8674	1,2210	8,70	1310,8	0,0000	**
	CCU	608	3,4260	1,1076				
Q32	RAU	709	4,0381	0,8470	-7,34	1261,6	0,0000	**
	CCU	608	3,6842	0,8924				
Q33	RAU	709	3,6671	1,0479	7,47	1300,9	0,0000	**
	CCU	608	4,0888	0,9969				

Q34	RAU	709	3,7362	0,9490	-0,45	1310,4	0,6535	
	CCU	608	3,7138	0,8631				
Q35	RAU	709	3,5148	0,9531	-14,39	1315	0,0000	**
	CCU	608	2,7418	0,9929				
Q37	RAU	709	3,2934	1,0007	7,48	1313,5	0,0000	**
	CCU	608	3,6826	0,8872				
Q39	RAU	709	3,7983	1,0362	-13,04	1250,4	0,0000	**
	CCU	608	3,0197	1,1158				
Q40	RAU	709	3,8181	0,9294	-3,08	1315	0,0021	**
	CCU	608	3,6628	0,8928				
Q41	RAU	709	3,9013	0,9880	-4,69	1315	0,0000	**
	CCU	608	3,6480	0,9645				
Q43	RAU	709	3,7109	0,9491	-1,75	1315	0,0804	
	CCU	608	3,6184	0,9635				
Q45	RAU	709	4,1551	0,9320	-6,41	1315	0,0000	**
	CCU	608	3,8224	0,9491				
Q46	RAU	709	3,5346	1,0579	-6,46	1315	0,0000	**
	CCU	608	3,1497	1,1007				
Q47	RAU	709	3,5035	1,0744	1,94	1315,0	0,0530	
	CCU	608	3,6102	0,9243				
Q48	RAU	708	3,1483	1,0726	-5,56	1313,7	0,0000	**
	CCU	608	2,8405	0,9358				
Q50	RAU	709	3,4669	1,1804	-10,77	1315	0,0000	**
	CCU	608	2,7697	1,1607				
Q51	RAU	709	4,0028	0,7919	-5,36	1244,1	0,0000	**
	CCU	608	3,7566	0,8629				
Q52	RAU	709	3,8547	0,9067	0,65	1314,9	0,5179	
	CCU	608	3,8849	0,7849				
Q53	RAU	709	3,0846	1,1985	-1,75	1309,3	0,0799	
	CCU	608	2,9737	1,0978				
Q54	RAU	709	3,5374	1,0842	4,46	1314,2	0,00000	**
	CCU	608	3,7878	0,9533				
Q56	RAU	709	3,6121	1,0281	1,98	1314,8	0,0484	*
	CCU	608	3,7155	0,8703				
Q57	RAU	709	3,0550	1,2008	-1,15	1315	0,2522	
	CCU	608	2,9803	1,1564				
Q58	RAU	709	3,2835	1,1753	9,86	1297,5	0,0000	**

	CCU	608	3,8470	0,8955				
Q59	RAU	709	4,2327	0,8375	-3,31	1282,5	0,0010	**
	CCU	608	4,0789	0,8419				
Q60	RAU	709	3,7080	0,9962	-0,11	1315	0,9155	
	CCU	608	3,7023	0,9563				
Q61	RAU	709	3,7362	0,9416	-8,46	1315	0,0000	**
	CCU	608	3,2928	0,9552				
Q62	RAU	709	3,9944	0,8603	-8,16	1236,6	0,0000	**
	CCU	608	3,5839	0,9499				
Q63	RAU	709	3,7814	1,1054	-7,32	1315	0,0000	**
	CCU	608	3,3454	1,0439				
Q64	RAU	709	3,6756	1,0274	5,68	1315,0	0,0000	**
	CCU	608	3,9737	0,8758				
Q65	RAU	709	3,9690	0,9398	-19,41	1242,6	0,0000	**
	CCU	608	2,9095	1,0268				
Q66	RAU	709	3,2595	1,1239	10,98	1308,7	0,0000	**
	CCU	608	3,8717	0,8985				
Q67	RAU	709	3,4330	1,0762	-2,60	1313,2	0,0089	**
	CCU	608	3,2862	0,9572				
Q68	RAU	709	3,5063	1,0023	2,60	1307,2	0,0094	**
	CCU	608	3,6447	0,9285				
Q69	RAU	709	4,0592	0,8126	2,68	1315	0,0074	**
	CCU	608	4,1809	0,8299				
Q71	RAU	709	3,5853	0,9743	-1,05	1310,0	0,2926	
	CCU	608	3,5313	0,8887				
Q72	RAU	709	3,5092	0,9693	-2,52	1315	0,0118	*
	CCU	608	3,3734	0,9794				
Q74	RAU	709	3,9408	0,9429	0,84	1313,7	0,4011	
	CCU	608	3,9819	0,8346				
Q75	RAU	709	3,7461	0,9405	-2,06	1312,7	0,0391	*
	CCU	608	3,6447	0,8409				
Q76	RAU	709	3,5783	0,9836	-0,34	1312,2	0,7350	
	CCU	608	3,5609	0,8834				
Q77	RAU	709	3,7842	0,9771	-0,86	1312,7	0,3877	
	CCU	608	3,7401	0,8733				

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level
* : Significant at the 5% significance level

There are statistically significant differences in respect of 47 items (43 at 1% level, 4 at 5% level) between the two commercial student groups. There are no significant differences for the items Q8, Q13, Q21, Q25, Q34, Q43, Q47, Q52, Q53, Q57, Q60, Q71, Q74, and Q76.

5.3.5 Hypotheses and analyses for Law Students

HoT5.1 There is no statistically significant difference between the vector of means of South African law students' test scores and that of Chinese law students in respect of the variables Z1, Z2, Z3 combined.

HaT5.1 There is a statistically significant difference between the vector of means of South African law students' test scores and that of Chinese law students in respect of the variables Z1, Z2, Z3 combined.

Table 5.3.5.1

Hotelling's T square test for the differences between the vector of mean test scores of the two law student groups in respect of the Z1, Z2, Z3 variables combined.

Hotelling's T square value	F-value	D.F.	P
19,9981	6,6529	3; 1013	0,0002**

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two law student groups. The null hypothesis HoT5.1 is rejected and the alternative hypothesis HaT5.1 is supported.

Hot5.1 There is no statistically significant difference between the mean test scores of South African law students and that of Chinese law students in respect of each of the following variables taken separately.

Hot5.1.1: Z1

Hot5.1.2: Z2

Hot5.1.3: Z3

Hat5.1 There is a statistically significant difference between the mean test scores of South African law students and that of Chinese law students in respect of each of the following variables taken separately.

Hat5.1.1: Z1

Hat5.1.2: Z2

Hat5.1.3: Z3

Table 5.3.5.2

Student's t-test for the difference between the mean test scores of the two law student groups in respect of each of Z1, Z2, Z3 variables.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P	
Z1	RAU	145	79,8345	12,0554	-2,85	1015	0,0044	**
	CCU	872	76,6583	12,4718				
Z2	RAU	144	79,3820	12,6042	-1,66	180,3	0,0989	
	CCU	872	77,5344	10,9348				
Z3	RAU	145	61,8207	9,4741	-4,22	1015	0,0000	**
	CCU	872	58,2614	9,3922				

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There are statistically significant differences (p=0,0000; 0,0044) on Z1 and Z3 variables between the two law student groups. The two null hypotheses of Hot5.1.1 and Hot5.1.3 are rejected and the two alternative hypotheses Hat5.1.1 and Hat5.1.3 are supported. There is no statistically significant difference on Z2 variable between the two law student groups. The null hypothesis Hat5.1.2 cannot be rejected.

HoT5.2 There is no statistically significant difference between the vector of means of South African law students' test scores and that of Chinese law students in respect of the 10 LASSI subscales combined.

HaT5.2 There is a statistically significant difference between the vector of means of South African law students' test scores and that of Chinese law students in respect of the 10 LASSI subscales combined.

Table 5.3.5.3

Hotelling's T square test for the differences between the vector of mean test scores of the two law student groups in respect of the 10 LASSI subscales combined.

Hotelling's T square value	F-value	D.F.	P
204,0765	20,2267	10; 1006	0,0000**

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two law student groups. The null hypothesis HoT5.2 is rejected and the alternative hypothesis HaT5.2 is supported.

Hot5.2 There is no statistically significant difference between the mean test scores of South African law students and that of Chinese law students in respect of each of the following 10 LASSI subscales taken separately, viz.:

Hot5.2.1 : ATT (Attitude)

Hot5.2.2 : MOT (Motivation)

Hot5.2.3 : TMT (Time Management)

Hot5.2.4 : ANX (Anxiety)

Hot5.2.5 : CON (Concentration)

Hot5.2.6 : INP (Information Processing)

Hot5.2.7 : SMI (Selection Main Idea)

Hot5.2.8 : STA (Study Aids)

Hot5.2.9 : SFT (Self Testing)

Hot5.2.10: TST (Test Strategies)

Hat5.2 There is a statistically significant difference between the mean test scores of South African law students and that of Chinese law students in respect of each of the following 10 LASSI subscales taken separately, viz.:

Hat5.2.1 : ATT (Attitude)

Hat5.2.2 : MOT (Motivation)

Hat5.2.3 : TMT (Time Management)

Hat5.2.4 : ANX (Anxiety)

Hat5.2.5 : CON (Concentration)

Hat5.2.6 : INP (Information Processing)

Hat5.2.7 : SMI (Selection Main Idea)

Hat5.2.8 : STA (Study Aids)

Hat5.2.9 : SFT (Self Testing)

Hat5.2.10: TST (Test Strategies)

Table 5.3.5.4

Student's t-test for the difference between the mean test scores of the two law student groups in respect of each of the 10 LASSI subscales.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P	
ATT	RAU	145	19,7724	2,7354	-6,19	1015	0,0000	**
	CCU	872	18,1284	2,9963				
MOT	RAU	145	26,4897	4,1149	-3,48	1015	0,0005	**
	CCU	872	25,1743	4,2344				
TMT	RAU	144	19,2569	4,7123	3,42	167,8	0,0008	**
	CCU	872	20,6559	3,3551				
ANX	RAU	145	26,2759	5,5283	-0,74	1015	0,4579	
	CCU	872	25,9083	5,5186				
CON	RAU	145	21,6069	4,4804	-3,79	1015	0,0002	**
	CCU	872	20,1353	4,3015				
INP	RAU	145	29,0759	5,1046	-1,92	1015	0,0547	
	CCU	872	28,1881	5,1520				
SMI	RAU	145	18,8345	3,6344	-2,34	1015	0,0195	*
	CCU	872	18,1296	3,3127				
STA	RAU	145	18,1862	3,7062	-6,07	1015	0,0000	**
	CCU	872	16,2557	3,5164				
SFT	RAU	145	10,7517	2,2716	-4,44	1015	0,0000	**
	CCU	872	9,9323	2,0214				
TST	RAU	145	30,7724	4,8401	-1,95	1015	0,0517	
	CCU	872	29,9461	4,7125				

ATT=Attitude
MOT=Motivation
TMT=Time Management
ANX=Anxiety
CON=Concentration

INP=Information Processing
SMI=Selecting Main Ideas
STA=Study Aids
SFT=Self Testing
TST=Test Strategies

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level
* : Significant at the 5% significance level

There are statistically significant differences (p=0,0000; 0,0005;0,0008;0,0002;0,0195) on the 7 LASSI subscales between the two law student groups except ANX, INP and TST. The 7 null hypotheses Hot5.2.1, Hot5.2.2, Hot5.2.3, Hot5.2.5, Hot5.2.6, Hot5.2.7 and Hot5.2.8 are rejected, and the alternative hypotheses Hat5.2.1, Hat5.2.2, Hat5.2.3, Hat5.2.5, Hat5.2.6, Hat5.2.7 and Hat5.2.8 are supported. No significant differences for ANX, INP and TST variables and the 3 null hypotheses of Hat5.2.4, Hat5.2.6 and Hat5.2.10 cannot be rejected.

Hot5.3 There is no statistically significant difference between the mean test scores of South African law students and that of Chinese law students in respect of the Z variable (Z=Z1+Z2+Z3).

Hat5.3 There is a statistically significant difference between the mean test scores of South African law students and that of Chinese law students in respect of the Z variable (Z=Z1+Z2+Z3).

Table 5.3.5.5

Student's t-test for the difference between the mean test scores of the two law student groups in respect of the Z variable.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P
Z	RAU	144	221,1389	26,9045	-3,63	1014	0,0003 **
	CCU	872	212,4542	26,5290			

There is a statistically significant difference (p=0,0003) between the mean test scores of the two law student groups in respect of Z variable. The null hypothesis Hot5.3 is rejected and the alternative hypothesis Hat5.3 is supported.

HoT5.3 There is no statistically significant difference between the vector of means of South African law students' test scores and that of Chinese law students in respect of the 61 items combined.

HaT5.3 There is a statistically significant difference between the vector of means of South African law students' test scores and that of Chinese law students in respect of the 61 items combined.

The items are:

Q1	Q2	Q3	Q6	Q7	Q8	Q9	Q10	Q12	Q13	Q14	Q15	Q16
Q19	Q20	Q21	Q22	Q23	Q25	Q27	Q28	Q29	Q31	Q32	Q33	Q34
Q35	Q37	Q39	Q40	Q41	Q43	Q45	Q46	Q47	Q48	Q50	Q51	Q52
Q53	Q54	Q56	Q57	Q58	Q59	Q60	Q61	Q62	Q63	Q64	Q65	Q66
Q67	Q68	Q69	Q71	Q72	Q74	Q75	Q76	Q77				

Table 5.3.5.6

Hotelling's T square test for the differences between the vector of mean test scores of the two law student groups in respect of the 61 items combined.

Hotelling's T square value	F-value	D.F.	P
1086,4797	16,7583	61; 955	0,0000 **

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two law student groups. The null hypothesis HoT5.3 is rejected and the alternative hypothesis HaT5.3 is supported.

Hot5.4 There is no statistically significant difference between the mean test scores of South African law students and that of Chinese law students in respect of each of the 61 items taken separately.

Hat5.4 There is a statistically significant difference between the mean test scores of South African law students and that of Chinese law students in respect of each of the 61 items taken separately.

Table 5.3.5.7

Student's t-test for the difference between the mean test scores of the two law student groups in respect of each of the following 61 items.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P
Q1	RAU	145	4,1586	1,2839	-10,60	1015	0,0000 **
	CCU	872	2,9759	1,2378			
Q2	RAU	145	3,8414	1,0047	-5,06	1015	0,0000 **
	CCU	872	3,4427	0,8566			
Q3	RAU	145	2,9172	1,2276	-1,57	1015	0,1165
	CCU	872	2,7546	1,1418			

Q6	RAU	145	3,8069	0,8842	-4,06	1015	0,0001	**
	CCU	872	3,4748	0,9164				
Q7	RAU	145	3,5586	1,1953	-1,45	1015	0,1460	
	CCU	872	3,4140	1,0935				
Q8	RAU	145	3,8069	0,8921	0,98	1015	0,3252	
	CCU	872	3,8853	0,8878				
Q9	RAU	145	2,6138	1,1558	3,42	1015	0,0006	**
	CCU	872	2,9578	1,1189				
Q10	RAU	145	3,9448	0,9263	-1,72	1015	0,0862	
	CCU	872	3,7982	0,9563				
Q12	RAU	145	3,4483	0,9713	-1,22	1015	0,2223	
	CCU	872	3,3372	1,0215				
Q13	RAU	145	3,4276	1,0052	-0,20	1015	0,8393	
	CCU	872	3,4094	0,9988				
Q14	RAU	145	4,0354	1,1572	-6,95	1015	0,0000	**
	CCU	872	3,3039	1,1740				
Q15	RAU	145	3,5586	1,0857	-1,94	1015	0,0527	
	CCU	872	3,3647	1,1197				
Q16	RAU	145	3,8966	0,9108	-10,01	214,3	0,0000	**
	CCU	872	3.0585	1,0597				
Q19	RAU	145	3,9931	0,9538	-6,25	206,2	0,0000	**
	CCU	872	3,4507	1,0476				
Q20	RAU	145	3,8828	1,0705	-2,98	1015	0,0030	**
	CCU	872	3,6032	1,0437				
Q21	RAU	145	3,5379	1,0542	-1,60	1015	0,1102	
	CCU	872	3,3865	1,0568				
Q22	RAU	145	2,7379	1,0803	6,50	1015	0,0000	**
	CCU	872	3,3635	1,0714				
Q23	RAU	145	3,6966	0,9812	-3,30	1015	0,0010	**
	CCU	872	3,4048	0,9868				
Q25	RAU	145	3,4690	1,1429	3,43	1015	0,0006	**
	CCU	872	3,8005	1,0668				
Q27	RAU	145	3,9034	1,0022	-2,34	1015	0,0194	*
	CCU	872	3,7007	0,9589				
Q28	RAU	145	3,7172	1,0846	-1,75	1015	0,0798	
	CCU	872	3,5436	1,1075				

Q29	RAU	145	3,7241	1,0102	-5,01	1015	0,0000	**
	CCU	872	3,2557	1,0476				
Q31	RAU	145	2,8552	1,2415	5,68	1015	0,0000	**
	CCU	872	3,4312	1,1124				
Q32	RAU	145	4,0621	0,8915	-4,48	201,3	0,0000	**
	CCU	872	3,7007	0,9420				
Q33	RAU	145	3,7724	1,0189	2,35	1015	0,0191	*
	CCU	872	3,9581	1,0090				
Q34	RAU	145	3,8621	0,9833	-2,53	1015	0,0116	*
	CCU	872	3,6433	0,9608				
Q35	RAU	145	3,4345	0,9987	-7,85	1015	0,0000	**
	CCU	872	2,7087	1,0355				
Q37	RAU	145	3,3517	0,9685	2,66	1015	0,0079	**
	CCU	872	3,5768	0,9383				
Q39	RAU	145	3,5517	1,0667	-5,80	1015	0,0000	**
	CCU	872	2,9610	1,1474				
Q40	RAU	145	3,7862	0,9143	-1,37	1015	0,1708	
	CCU	872	3,6732	0,9204				
Q41	RAU	145	3,9724	0,9856	-3,66	1015	0,0003	**
	CCU	872	3,6468	0,9932				
Q43	RAU	145	3,6621	0,9876	-1,53	1015	0,1253	
	CCU	872	3,5252	0,9957				
Q45	RAU	145	4,0897	0,9046	-3,81	1015	0,0001	**
	CCU	872	3,7775	0,9160				
Q46	RAU	145	3,5172	1,0743	-2,99	1015	0,0028	**
	CCU	872	3,2248	1,0927				
Q47	RAU	145	3,4276	0,9982	2,72	1015	0,0066	**
	CCU	872	3,6571	0,9307				
Q48	RAU	144	3,1736	1,1178	-3,17	176,8	0,0018	**
	CCU	872	2,8624	0,9251				
Q50	RAU	145	3,5655	1,1774	-7,17	1015	0,0000	**
	CCU	872	2,7787	1,2312				
Q51	RAU	145	3,9310	0,6631	-4,32	249,1	0,0000	**
	CCU	872	3,6571	0,9295				
Q52	RAU	145	3,8483	0,9154	0,71	1015	0,4809	
	CCU	872	3,9002	0,8049				
Q53	RAU	145	3,0828	1,2775	-1,05	181,9	0,2946	

	CCU	872	2,9644	1,1093				
Q54	RAU	145	3,3517	1,1816	3,52	180,1	0,0006	**
	CCU	872	3,7167	1,0023				
Q56	RAU	145	3,7586	1,0360	-0,28	180,7	0,7772	
	CCU	872	3,7328	0,8854				
Q57	RAU	145	2,8138	1,2190	1,62	1015	0,1049	
	CCU	872	2,9817	1,1419				
Q58	RAU	145	3,2138	1,1377	6,18	178,3	0,0000	**
	CCU	872	3,8303	0,9420				
Q59	RAU	145	4,2483	0,8460	-2,38	1015	0,0177	*
	CCU	872	4,0654	0,8607				
Q60	RAU	145	3,7379	1,0139	-0,54	1015	0,5897	
	CCU	872	3,6915	0,9500				
Q61	RAU	145	3,7310	0,9665	-4,71	1015	0,0000	**
	CCU	872	3,3131	0,9922				
Q62	RAU	145	3,9862	0,8974	-4,17	201,4	0,0000	**
	CCU	872	3,6479	0,9493				
Q63	RAU	145	3,5793	1,0844	-2,52	1015	0,0118	*
	CCU	872	3,3349	1,0791				
Q64	RAU	145	3,6414	1,1345	2,53	179,7	0,0123	*
	CCU	872	3,8933	0,9578				
Q65	RAU	145	3,8621	1,0516	-9,59	1015	0,0000	**
	CCU	872	2,9690	1,0367				
Q66	RAU	145	3,2483	1,1089	6,44	176,6	0,0000	**
	CCU	872	3,8727	0,8958				
Q67	RAU	145	3,3931	1,1137	0,45	179,5	0,6545	
	CCU	872	3,4369	0,9369				
Q68	RAU	145	3,3379	1,0356	3,27	182,9	0,0013	**
	CCU	872	3,6365	0,9103				
Q69	RAU	145	3,9931	0,8779	1,79	1015	0,0735	
	CCU	872	4,1342	0,8779				
Q71	RAU	145	3,5586	1,0467	-0,36	181,8	0,7176	
	CCU	872	3,5252	0,9076				
Q72	RAU	145	3,5862	1,0579	-1,80	1015	0,0722	
	CCU	872	3,4266	0,9769				
Q74	RAU	145	3,9517	0,8606	0,27	1015	0,7876	
	CCU	872	3,9725	0,8581				

Q75	RAU	145	3,8276	0,9305	-2,61	1015	0,0092 **
	CCU	872	3,6147	0,9057			
Q76	RAU	145	3,7034	0,8670	-1,10	1015	0,2710
	CCU	872	3,6135	0,9172			
Q77	RAU	145	3,8621	0,9974	-2,03	1015	0,0423 *
	CCU	872	3,6835	0,9766			

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level
* : Significant at the 5% significance level

There are statistically significant differences in respect of 39 items between the two law student groups. There are no significant differences for Q3, Q7, Q8, Q10, Q12, Q13, Q15, Q21, Q28, Q40, Q43, Q52, Q53, Q56, Q57, Q60, Q67, Q69, Q71, Q72, Q74, and Q76.

5.3.6 Hypotheses and analyses for Literature and Arts Students

HoT6.1 There is no statistically significant difference between the vector of means of South African literature and arts students' test scores and that of Chinese literature and arts students in respect of the variables Z1, Z2, Z3 combined.

HaT6.1 There is a statistically significant difference between the vector of means of South African literature and arts students' test scores and that of Chinese literature and arts students in respect of the variables Z1, Z2, Z3 combined.

Table 5.3.6.1

Hotelling's T square test for the differences between the vector of mean test scores of the two literature and arts student groups in respect of Z1, Z2, Z3 variables combined.

Hotelling's T square value	F-value	D.F.	P
70,9797	23,6051	3; 861	0,0000**

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two literature and arts student groups. The null hypothesis HoT6.1 is rejected and the alternative hypothesis HaT6.1 is supported.

Hot6.1 There is no statistically significant difference between the mean test scores of South African literature and arts students and that of Chinese literature and arts students in respect of each of the following variables taken separately, viz.:

Hot6.1.1: Z1

Hot6.1.2: Z2

Hot6.1.3: Z3

Hat6.1 There is a statistically significant difference between the mean test scores of South African literature and arts students and that of Chinese literature and arts students in respect of each of the following variables taken separately, viz.:

Hat6.1.1: Z1

Hat6.1.2: Z2

Hat6.1.3: Z3

Table 5.3.6.2

Student's t-test for the difference between the mean test scores of the two literature and arts student groups in respect of each of Z1, Z2, Z3 variables.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P
Z1	RAU	292	80,0753	12,7242	-2,52	863	0,0118 *
	CCU	573	77,7452	12,8978			
Z2	RAU	292	79,4794	13,6088	-1,56	496,1	0,1193
	CCU	573	78,0384	11,1911			
Z3	RAU	292	63,6507	9,9179	-7,97	863	0,0000 **
	CCU	573	58,0785	9,6258			

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level
* : Significant at the 5% significance level

There are statistically significant differences (p=0,0000; 0,0118) on Z1 and Z3 variables between the two literature and arts student groups. The 2 null hypotheses Hot6.1.1 and Hot6.1.3 are rejected and the 2 alternative hypotheses

Hat6.1.1 and Hat6.1.3 are supported. There are no significant differences for Z2 variable and the null hypothesis Hot6.1.2 cannot be rejected.

HoT6.2 There is no statistically significant difference between the vector of means of South African literature and arts students' test scores and that of Chinese literature and arts students in respect of the 10 LASSI subscales combined.

HaT6.2 There is a statistically significant difference between the vector of means of South African literature and arts students' test scores and that of Chinese literature and arts students in respect of the 10 LASSI subscales combined.

Table 5.3.6.3

Hotelling's T square test for the differences between the vector of mean test scores of the two literature and arts student groups in respect of the 10 LASSI subscales combined.

Hotelling's T square value	F-value	D.F.	P
336,9272	33,3413	10; 854	0,0000**

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two literature and arts student groups. The null hypothesis HoT6.2 is rejected and the alternative hypothesis HaT6.2 is supported.

Hot6.2 There is no statistically significant difference between the mean test scores of South African literature and arts students in respect of each of the following 10 LASSI subscales taken separately, viz.:

Hot6.2.1 : ATT (Attitude)
Hot6.2.2 : MOT (Motivation)
Hot6.2.3 : TMT (Time Management)
Hot6.2.4 : ANX (Anxiety)
Hot6.2.5 : CON (Concentration)
Hot6.2.6 : INP (Information Processing)
Hot6.2.7 : SMI (Selection Main Idea)
Hot6.2.8 : STA (Study Aids)
Hot6.2.9 : SFT (Self Testing)
Hot6.2.10: TST (Test Strategies)

Hat6.2 There is a statistically significant difference between the mean test scores of South African literature and arts students and that of Chinese literature and arts students in respect of each of the following 10 LASSI subscales taken separately, viz.:

Hat6.2.1 : ATT (Attitude)
Hat6.2.2 : MOT (Motivation)

Hat6.2.3 : TMT (Time Management)

Hat6.2.4 : ANX (Anxiety)

Hat6.2.5 : CON (Concentration)

Hat6.2.6 : INP (Information Processing)

Hat6.2.7 : SMI (Selection Main Idea)

Hat6.2.8 : STA (Study Aids)

Hat6.2.9 : SFT (Self Testing)

Hat6.2.10: TST (Test Strategies)

Table 5.3.6.4

Student's t-test for the difference between the mean test scores of the two literature and arts student groups in respect of each of the 10 LASSI subscales.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P	
ATT	RAU	292	19,9794	3,1283	-7,35	863	0,0000	**
	CCU	573	18,3263	3,1284				
MOT	RAU	292	26,4520	4,4792	-3,38	523,2	0,0008	**
	CCU	573	25,4066	3,9304				
TMT	RAU	292	19,2192	4,8588	4,05	446,6	0,0001	**
	CCU	573	20,5131	3,4699				
ANX	RAU	292	26,7603	5,8024	-1,16	863	0,2472	
	CCU	573	26,2845	5,6690				
CON	RAU	292	21,5479	4,7647	-3,31	863	0,0010	**
	CCU	573	20,4572	4,4773				
INP	RAU	292	30,0582	5,0686	-5,64	863	0,0000	**
	CCU	573	27,9145	5,3963				
SMI	RAU	292	18,7055	3,4515	-1,56	863	0,1203	
	CCU	573	18,3229	3,4064				
STA	RAU	292	18,9726	3,6645	-10,03	863	0,0000	**
	CCU	573	16,3822	3,5556				
SFT	RAU	292	10,7295	2,3328	-4,93	520,2	0,0000	**
	CCU	573	9,9372	2,0328				

TST	RAU	292	30,7808	4,8133	-1,34	863	0,1819
	CCU	573	30,3176	4,8264			

ATT=Attitude
MOT=Motivation
TMT=Time Management
ANX=Anxiety
CON=Concentration
INP=Information Processing
SMI=Selecting Main Ideas
STA=Study Aids
SFT=Self Testing
TST=Test Strategies

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level
* : Significant at the 5% significance level

There are statistically significant differences (p=0,0000;0,0008;0,0010) on the 7 LASSI subscales between the two groups except ANX, SMI, and TST. The 7 null hypotheses Hot6.2.1, Hot6.2.2, Hot6.2.3, Hot6.2.5, Hot6.2.6, Hot6.2.8 and Hot6.2.9 are rejected and the 7 alternative hypotheses Hat6.2.1, Hat6.2.2, Hat6.2.3, Hat6.2.5, Hat6.2.6, Hat6.2.8 and Hat6.2.9 are supported. There are no significant differences for ANX, SMI and TST variables and the 3 null hypotheses Hot6.2.4, Hot6.2.7 and Hot6.2.10 cannot be rejected.

Hot6.3 There is no statistically significant difference between the mean test scores of South African literature and arts students and that of Chinese literature and arts students in respect of the Z variable (Z=Z1+Z2+Z3).

Hat6.3 There is a statistically significant difference between the mean test scores of South African literature and arts students and that of Chinese literature and arts students in respect of the Z variable (Z=Z1+Z2+Z3).

Table 5.3.6.5

Student's t-test for the difference between the mean test scores of the two literature and arts student groups in respect of the Z variable.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P
Z	RAU	292	223,2054	28,8626	-4,64	863	0,0000 **
	CCU	573	213,8621	27,6019			

There is a statistically significant difference (p=0,0000) on Z variable between the two groups. The null hypothesis Hot6.3 is rejected and the alternative hypothesis Hat6.3 is supported.

HoT6.3 There is no statistically significant difference between the vector of means of South African literature and arts students' test scores and that of Chinese literature and arts students in respect of the 61 items combined.

HaT6.3 There is a statistically significant difference between the vector of means of South African literature and arts students' test scores and that of Chinese literature and arts students in respect of the 61 items combined.

The items are:

Q1	Q2	Q3	Q6	Q7	Q8	Q9	Q10	Q12	Q13	Q14	Q15	Q16
Q19	Q20	Q21	Q22	Q23	Q25	Q27	Q28	Q29	Q31	Q32	Q33	Q34
Q35	Q37	Q39	Q40	Q41	Q43	Q45	Q46	Q47	Q48	Q50	Q51	Q52
Q53	Q54	Q56	Q57	Q58	Q59	Q60	Q61	Q62	Q63	Q64	Q65	Q66
Q67	Q68	Q69	Q71	Q72	Q74	Q75	Q76	Q77				

Table 5.3.6.6

Hotelling's T square test for the differences between the vector of mean test scores of the two literature and arts student groups in respect of the 61 items combined.

Hotelling's T square value	F-value	D.F.	P
1851,1740	28,2372	61; 803	0,0000**

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level

There is a statistically significant difference (p=0,0000) between the two literature and arts student groups. The null hypotheses HoT6.3 is rejected and the alternative hypothesis HaT6.3 is supported.

Hot6.4 There is no statistically significant difference between the mean test scores of South African literature and arts students and that of Chinese literature and arts students in respect of each of the 61 items taken separately.

Hat6.4 There is a statistically significant difference between the mean test scores of South African literature and arts students and that of Chinese literature and arts students in respect of each of the 61 items taken separately.

Table 5.3.6.7

Student's t-test for the difference between the mean test scores of the two literature and arts students groups in respect of each of the following 61 items.

Variable	Group	N	Mean	S.D.	t-value	D.F.	P	
Q1	RAU	292	4,2979	1,0890	-14,69	654,0	0,0000	**
	CCU	573	3,0942	1,2339				
Q2	RAU	292	3,8836	0,8166	-6,02	634,5	0,0000	**
	CCU	573	3,5183	0,8939				
Q3	RAU	292	2,9007	1,2242	-2,92	863	0,0036	**
	CCU	573	2,6597	1,1067				
Q6	RAU	292	3,7363	0,9821	-2,18	863	0,0298	*
	CCU	573	3,5881	0,9282				
Q7	RAU	292	3,8733	1,0459	-6,25	609,0	0,0000	**
	CCU	573	3,3962	1,0928				
Q8	RAU	292	3,8940	0,9641	-0,68	863	0,4997	
	CCU	573	3,8447	0,9304				
Q9	RAU	292	2,7260	1,1548	2,17	863	0,0305	*
	CCU	573	2,9040	1,1357				
Q10	RAU	292	4,1146	0,8930	-3,39	863	0,0007	**
	CCU	573	3,8866	0,9677				
Q12	RAU	292	3,4349	1,0417	-1,90	863	0,0582	
	CCU	573	3,2932	1,0384				
Q13	RAU	292	3,4110	1,0232	-0,30	863	0,7644	
	CCU	573	3,3892	1,0037				
Q14	RAU	292	3,9144	1,1012	-7,33	639,8	0,0000	**

	CCU	573	3,3124	1,2169				
Q15	RAU	292	3,9212	1,0140	-9,17	650,3	0,0000	**
	CCU	573	3,2234	1,1416				
Q16	RAU	292	3,8733	0,9312	-12,17	649,4	0,0000	**
	CCU	573	3,0227	1,0467				
Q19	RAU	292	3,9726	0,9521	-6,47	641,6	0,0000	**
	CCU	573	3,5131	1,0554				
Q20	RAU	292	3,8390	1,0245	-2,30	863	0,0218	*
	CCU	573	3,6754	0,9731				
Q21	RAU	292	3,4212	1,0860	-1,07	863	0,2828	
	CCU	573	3,3386	1,0613				
Q22	RAU	292	2,6986	1,1359	9,09	863	0,0000	**
	CCU	573	3,3997	1,0390				
Q23	RAU	292	3,9144	1,0066	-7,22	863	0,0000	**
	CCU	573	3,3927	1,0041				
Q25	RAU	292	3,5651	1,1221	3,14	863	0,0017	**
	CCU	573	3,8098	1,0629				
Q27	RAU	292	4,0260	0,9229	-3,99	863	0,0001	**
	CCU	573	3,7592	0,9053				
Q28	RAU	292	3,7226	1,0528	-1,39	863	0,1649	
	CCU	573	3,6195	1,0200				
Q29	RAU	292	3,8048	1,0319	-5,89	863	0,0000	**
	CCU	573	3,3525	1,0861				
Q31	RAU	292	2,8630	1,2050	7,20	532,4	0,0000	**
	CCU	573	3,4660	1,0795				
Q32	RAU	292	4,1096	0,8133	-8,11	693,3	0,0000	**
	CCU	573	3,5986	0,9874				
Q33	RAU	292	3,6507	1,1004	5,62	512,6	0,0000	**
	CCU	573	4,0750	0,9422				
Q34	RAU	292	3,8014	0,9425	-1,32	863	0,1865	
	CCU	573	3,7086	0,9933				
Q35	RAU	292	3,3493	0,9920	-7,95	863	0,0000	**
	CCU	573	2,7818	0,9927				
Q37	RAU	292	3,4144	1,0066	2,93	537,2	0,0036	**
	CCU	573	3,6195	0,9113				
Q39	RAU	292	3,7192	1,1168	-8,39	863	0,0000	**
	CCU	573	3,0332	1,1469				

Q40	RAU	292	3,8630	0,9241	-2,70	598,2	0,0072	**
	CCU	573	3,6824	0,9463				
Q41	RAU	292	3,8288	0,9551	-1,90	863	0,0572	
	CCU	573	3,6946	0,9926				
Q43	RAU	292	3,7123	0,9736	-1,35	863	0,1769	
	CCU	573	3,6195	0,9452				
Q45	RAU	292	4,1130	0,9475	-5,43	863	0,0000	**
	CCU	573	3,7435	0,9454				
Q46	RAU	292	3,4418	1,1427	-2,80	543,0	0,0053	**
	CCU	573	3,2181	1,0476				
Q47	RAU	292	3,6199	1,0065	0,17	863	0,8682	
	CCU	573	3,6318	0,9924				
Q48	RAU	292	3,1473	1,0692	-4,77	513,1	0,0000	**
	CCU	573	2,7976	0,9166				
Q50	RAU	292	3,7842	1,1206	-11,32	863	0,0000	**
	CCU	573	2,8394	1,1806				
Q51	RAU	292	4,0377	0,8050	-4,74	626,7	0,0000	**
	CCU	573	3,7557	0,8688				
Q52	RAU	292	3,8082	0,8953	1,85	535,2	0,0655	
	CCU	573	3,9232	0,8071				
Q53	RAU	292	3,3185	1,1890	-3,97	561,7	0,0001	**
	CCU	573	2,9843	1,1335				
Q54	RAU	292	3,3425	1,1603	5,56	508,4	0,00000	**
	CCU	573	3,7836	0,9834				
Q56	RAU	292	3,8493	0,9585	-1,99	863	0,0468	*
	CCU	573	3,7190	0,8848				
Q57	RAU	292	2,9623	1,1907	1,52	863	0,1289	
	CCU	573	3,0908	1,1672				
Q58	RAU	292	3,2979	1,1201	6,03	512,7	0,0000	**
	CCU	573	3,7609	0,9592				
Q59	RAU	292	4,2192	0,8575	-2,91	863	0,0037	**
	CCU	573	4,0384	0,8682				
Q60	RAU	292	3,6473	1,0946	1,20	522,0	0,2290	
	CCU	573	3,7382	0,9578				
Q61	RAU	292	3,6336	1,0318	-4,95	863	0,0000	**
	CCU	573	3,2618	1,0517				

Q62	RAU	292	4,0240	0,8592	-5,80	653,1	0,0000	**
	CCU	573	3,6492	0,9271				
Q63	RAU	292	3,6541	1,0778	-3,93	863	0,0001	**
	CCU	573	3,3543	1,0520				
Q64	RAU	292	3,7123	1,0743	2,85	532,4	0,0046	**
	CCU	573	3,9250	0,9624				
Q65	RAU	292	3,8938	1,0182	-12,13	863	0,0000	**
	CCU	573	2,9791	1,0642				
Q66	RAU	292	3,1712	1,1598	9,44	474,4	0,0000	**
	CCU	573	3,9040	0,9004				
Q67	RAU	292	3,5240	1,0401	-0,59	863	0,5567	
	CCU	573	3,4817	0.9797				
Q68	RAU	292	3,3048	1,0452	5,98	524,1	0,0000	**
	CCU	573	3,7365	0,9191				
Q69	RAU	292	4,1096	0,8585	0,84	863	0,4036	
	CCU	573	4,1623	0,8869				
Q71	RAU	292	3,5993	0,9846	-0,29	538,7	0,7720	
	CCU	573	3,5794	0,8945				
Q72	RAU	292	3,4144	1,1043	0,84	510,8	0,3994	
	CCU	573	3,4782	0,9414				
Q74	RAU	292	4,0034	0,8986	-0,19	863	0,8459	
	CCU	573	3,9913	0,8538				
Q75	RAU	292	3,7808	0,9560	-1,06	863	0,2883	
	CCU	573	3,7086	0,9408				
Q76	RAU	292	3,6712	0,9424	-0,90	863	0,3673	
	CCU	573	3,6108	0,9258				
Q77	RAU	292	3,8699	1,0205	-1,77	863	0,0769	
	CCU	573	3,7435	0,9782				

D.F. : Degrees of freedom
P : Probability
** : Significant at the 1% significance level
* : Significant at the 5% significance level

There are statistically significant differences in respect of 41 items (37 at 1% level, 4 at 5% level) between the two literature and arts student groups. There are no significant differences for the items Q8, Q12, Q13, Q21, Q28, Q34, Q41, Q43, Q47, Q52, Q57, Q60, Q67, Q69, Q71, Q72, Q74, Q75, Q76, and Q77.

CHAPTER 6

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.1. INTRODUCTION

The education system of the Republic of China is different from South Africa. In Taiwan, there is a severe competition for entering the high school and university, with resulting adverse emphasis on rote learning and memorization. In South Africa, on the other hand, the competition is less severe, but the students seem to have problems with the application of proper learning strategies as is reflected in an alarming drop out rate.

In view of these problems the research was done through an extensive inquiry into learning styles and learning strategies among university students, and the analysis of collected questionnaires from the students.

6.2. RESEARCH DESIGN

The purpose of this study was to apply the Learning and Study Strategies Inventory (LASSI) to first year university students in South Africa and Taiwan, Republic of China, to identify the differences in their respective learning strategies. The sample consisted of 1489 first year university students at the Rand Afrikaans University in South Africa and 2053 first year university students at the Chengchi University in Taiwan, Republic of China.

The null hypothesis stated that South African and Chinese students did not differ significantly concerning the learning strategies. A further hypothesis stated that male and female students did not differ regarding learning strategies, and thirdly that students from three faculties (law, commerce, literature and arts) did not differ in regarding learning strategies.

This study utilized the SPSS-package, Kuder-Richardson 20 formula, BMDP3D, BMDP4M (for factor analysis), NP50 program (for item analysis), Hotelling's T-square and Student's t-test to analyze the hypotheses from the collected questionnaires.

Validity was investigated with a first and second order factor analysis. In the first order analysis a PCA (principal component analysis) was followed by a PFA (principal factor analysis). The second order analysis consisted of a further PCA (orthogonal axes and varimax rotation) followed by a PFA (Doblimin rotation).

The reliability was investigated with NP50 program (for item analysis) by utilizing the factors resulting from the second order analysis.

6.3. RESEARCH FINDINGS

The principal component analysis (PCA) and principal factor analysis (PFA) were done, followed by a separate iterative item analysis (NP50) program. The results suggested that the two groups to a large extent contain the same items in each factor. The validity and reliability were high enough to do the further analyses (see Table 5.2.1 and Table 5.2.2). From the factor analyses, three factors Z1, Z2, Z3 were identified. In each group the same three factors were identified, only 16 items had to be deleted because most of them did not appear in the same factors. The factors are:

Factor 1 (Z1): Study Anxiety-teststrategies.

Factor 2 (Z2): Study Mindedness.

Factor 3 (Z3): Study Involvement.

The first null hypothesis stated that South African and Chinese students did not differ significantly concerning the three factors, but it was rejected (by employing Hotelling's T-square).

The second null hypothesis stated that South African and Chinese male and female students did not differ significantly concerning the three factors, and this was rejected.

The third null hypothesis stated that South African and

Chinese students did not differ significantly concerning the three faculties, this was rejected, too.

From the Student's t-test for the differences between the mean test scores of the two student groups, the tendencies in the mean test scores of the 10 LASSI subscales seem to be rather consistent (See Table 6.3.1). Only in the Time Management subscale Chinese students scored higher than South African students. On all other subscales South African students scored higher than Chinese Students. There were also statistically significant differences between the mean test scores of the two student groups on all LASSI subscales. Therefore the null hypotheses were rejected, and alternative hypotheses were supported.

With reference to students in the law faculty this research did not find statistically significant differences between the two groups on the subscales of ANX, INP and TST. Likewise, literature and arts student groups did not have statistically significant differences on the subscales of ANX, SMI and TST.

Table 6.3.1

Mean test scores of each student groups in respect of each of the 10 LASSI subscales.

Vari.	Gro.	Mean.1	Mean.2	Mean.3	Mean.4	Mean.5	Mean.6
ATT	RAU**	20,1565**	19,7267**	20,5800**	20,0860**	19,7224**	19,9794
	CCU	18,2591	17,7679	18,6269	18,3832	18,1284	18,3263

MOT	RAU	**26,6259	**25,6536	**27,5840	**26,3075	**26,4897	**26,4520
	CCU	25,1992	24,5085	25,7164	25,0395	25,1743	25,4066
TMT	RAU	**19,4311	**18,7551	**20,0988	**19,3319	**19,2569	**19,2192
	CCU	20,5743	20,1047	20,9259	20,5148	20,6559	20,5131
ANX	RAU	**27,6105	**28,1880	**27,0493	**27,6530	26,2759	26,7603
	CCU	26,0209	25,6541	26,2956	25,9342	25,9083	26,2845
CON	RAU	**22,1760	**21,9580	**22,3907	**22,2313	**21,6069	**21,5479
	CCU	20,2684	19,5393	20,8143	20,2813	20,1353	20,4572
INP	RAU	**29,5809	**29,1867	**29,9693	**29,1410	29,0759	**30,0582
	CCU	27,9679	27,9147	28,0077	27,7023	28,1881	27,9145
SMI	RAU	**18,8502	**18,7483	*18,9507	**18,6573	*18,8345	18,7055
	CCU	18,1773	17,6462	18,5750	18,1086	18,1296	18,3229
STA	RAU	**18,5373	**17,6658	**19,3960	**18,3177	**18,1862	**18,9726
	CCU	16,2669	15,7053	16,6874	16,1744	16,2557	16,3822
SFT	RAU	**10,7911	**10,5589	**11,0200	**10,7377	**10,7517	**10,7295
	CCU	9,9406	9,8510	10,0077	9,9556	9,9323	9,9372
TST	RAU	**31,0403	**30,6739	**31,4013	*30,7377	**30,7724	30,7808
	CCU	30,0984	29,2139	30,7606	30,1102	29,9461	30,3176

ATT=Attitude
MOT=Motivation
TMT=Time Management
ANX=Anxiety
CON=Concentration

INP=Information Processing
SMI=Selecting Main Ideas
STA=Study Aids
SFT=Self Testing
TST=Test Strategies

Mean.1=whole student group
Mean.2=male student group
Mean.3=female student group

Mean.4=commercial student group
Mean.5=law student group
Mean.6=literature and arts student group

** : Significant at the 1% significance level
* : Significant at the 5% significance level

6.4. COMPARATIVE STUDY

This is a comparative study of the differences of the learning and study strategies between South African and

Chinese students. Comparisons between all students with regard to gender and faculties will follow.

6.4.1 A Comparison between Students from ROC and RSA

The subscale with the most obvious mean difference between the two student groups is the way they make use of study aids (STA, mean=18,5373:16,2669**). South African students tend to be better than Chinese students at using and creating study aids to improve the effectiveness of their learning. This is specifically found in the way they make use of drawings and sketches to clarify their study material, as well as the way they use the chapter heading as a guide towards the content (Q62, mean= 4,0128: 3,6293**). South African students also tend to make better use of notes as they work through their textbooks. This is an important aid when they review their study material (Q19, mean= 3,9940:3,4769**).

Secondly, differences are found regarding concentration (CON, mean=22,1760:20,2684**) and attitude (ATT, mean= 20,1565:18,2591**) of students towards studying. South African students tend to be distracted more easily than Chinese students. They are more confused and undecided as to what their educational goals should be (Q14, mean=4,0242:3,3030**). South African students are more likely to study only the subjects they like (Q45, mean=

4,1870:3,7818**), and they tend to dislike most of the work in their classes (Q51, mean= 4,0154:3,7141**).

Both the student groups share the opinion that the study material which is taught in their classes is often not worth learning (Q69, mean, Rau=4,0873, CCU=4,1559**). With regard to this aspect, it seems that Chinese students have stronger feelings on this issue.

Thirdly, this research refers to the level of anxiety and motivation. It seems that South African students experience more anxiety compared to with Chinese students (ANX, mean=27,6105:26,0209**). They are also more anxious of failing in their classes (Q1, mean= 4,3606:2,9844**). Although their motivation to study is stronger than that of Chinese students (MOT, mean=26,6259:25,1992**), more South African students attend classes unprepared (Q16, mean=3,8381:2,9971**).

When it comes to time management, Chinese students tend to manage their time better than South African students (TMT, mean=20,5743:19,4331**). However, Chinese students tend to put off schoolwork more than their South African counterparts (Q66, mean=3,8811:3,2572**). Both groups of students of the two countries spend time with their friends to such an extent that their schoolwork may suffer as a result (Q74, mean, RAU=3,9960, CCU= 3,9805**).

The South African students seem to be better at using information processing skills (INP, mean= 29,5809:

27,9679**), especially in translating academic materials into their own terms (Q23, mean= 3,8146:3,3960**). When they study a specific topic they manage to link different ideas together in order to clarify the study material (Q32, mean= 4,1068:3,6673**).

Concerning the ability to select main ideas, the statistics show no significant difference between the students of the two countries. Both groups try to identify the main ideas while being taught (Q8, mean, RAU=3,8402, CCU=3,8480), and both have difficulty in identifying the most important ideas when they read (Q60, mean, RAU=3,7401, CCU=3,7077).

Strategies to use when writing tests or examinations are important to all students. With regard to this issue, Chinese students plan their studies more strategically (Ref. Table 5.3.1.7 Q20, Q27, Q34, Q59, Q64 & Q75). The common problem for both student groups seems to be studying the wrong material for a test (Q59, mean, RAU=4,2821; CCU=4,0609**).

6.4.2 A Comparison between the Male and Female Students

According to gender, there are statistically significant differences between male and female students respectively:

6.4.2.1 Male students

The most obvious difference between the two groups of male students lies in their ability to concentrate. South African male students seem to have more difficulty in concentrating on their studies than Chinese male students. (CON, mean=21,9580:19,5393**).

The second group of subscales refers to attitude towards studying (ATT, mean, RAU=19,7267 and CCU=17,7679**). It is interesting to note that both male student groups consider the study material taught in their classes often not worth learning (Q69, mean, RAU=3,9932, CCU=4,0091). No statistically significant difference was found. Furthermore, South African male students tend to study only the subjects they like (Q45, mean=4,0623:3,6803**), and feel confused and undecided as to what their educational goals should be (Q14, mean=3,9946:3,3289**).

The third group of subscales refers to the level of anxiety of the students. It shows that South African male students are far more anxious than Chinese male students (ANX, mean=28,1800:25,6541**). They are particularly anxious about failing (Q1, mean=4,3532: 2,8680**). Chinese male students, however, are more easily discouraged by low grades than the South African male students. (Q9, mean=3,8088:2,9033**).

Both groups of male students score below average on the use of study aids. However, South African male students are better than Chinese male students at taking notes (Q19,mean=3,8336:3,2810**).

6.4.2.2 Female students

The most significant difference between the two female student groups lies in the use of study aids (STA, mean, RAU=19,3960, CCU=16,6874**). The South African female students tend to use study aids more effectively (Ref. Table5.3.3.7 Q7, Q19, Q50 & Q62). This applies especially to note-taking (Q19, mean= 4,1520: 3,6235**).

With regard to motivation, South African female students seem to set higher standards or goals for themselves in studying than Chinese female students (Q41, mean= 4,0973: 3,7206**). Both groups of female students tend to rationalize excuses for not executing assignments and in this regard, the tendency is stronger among Chinese female students (Q33, mean= 4,1661:3,8347**).

Thirdly the subscales of attitude and information processing are referred to. The South African female students feel more confused and undecided as to what their educational goals should be (Q14, mean= 4,0533:3,3509**). They seem to study only the subjects they like (Q45, mean=4,2973:3,8569**). Both groups of female students consider the study material taught in their classes often not worth learning (Q69, mean, RAU=4,1800, CCU=4,2658*).

Another subscale worth mentioning is the vast amount of time spent by female student groups with their friends. this may have a negative effect on their studies (Q74, mean, RAU=4,1787, CCU=4,0937*). South African female students tend to be more anxious about failing than their Chinese counterparts (Q1, mean=4,3680:3,0715**).

6.4.3 A Comparison between the Students in the Different Faculties

Both universities have the the same faculties of Commerce, Law, and Literature and Arts. These three faculties were compared.

6.4.3.1 Commerce faculty

The most significant difference between the two groups of commerce students lies in the use of study aids. The South African commercial students tend to use study aids more effectively (STA, mean, RAU=18,3117 and CCU=16,1744**).

With regard to concentration, South African commerce students seem to be more easily distracted (CON, mean=

22,2313:20,2813**). It seems that South African commerce students tend to let their concentration wander and often do not concentrate on what is taught in class (Q6, mean=3,9450:3,5559**). When studying, on the other hand, they pay more attention than Chinese commerce students (Q61, mean=3,7362:3,2928**).

Thirdly, attention will be given to attitude and anxiety. The South African commercial students feel confused and undecided as to what their educational goals should be (Q14, mean=4,0028:3,2928**). They are particularly anxious about failing (Q1, mean=4,3752:2,8931).

Both commerce student groups consider the study material taught in their classes often not worth learning (Q69, mean, RAU=4,0592, CCU=4,1809**). South African commercial students are much more anxious than Chinese commercial students. They are specifically anxious about failing (Q1, mean=4,3735:2,8931**).

6.4.3.2 Law faculty

The most prominent difference between the two groups of law students is found in the use of study aids. The South African law students tend to use study aids more effectively (STA, mean=18,1862:16,2557**). The Chinese law students seem to make less use of drawings or sketches to help them clarify the study material (Q50, mean=2,7787:3,5655*).

Referring to students' attitude and anxiety towards studying, the South African law students tend to be more anxious about failing than their Chinese counterparts (Q1, mean=4,1586: 2,9759**). It seems that they feel more confused and undecided as to what their educational goals should be (Q14, mean=4,0354:3,3039**). There is also a tendency to study only those subjects that they like (Q45, mean=4,0897:3,7775**). Both groups of law students share the opinion that the study material which is taught in their classes is often not worth learning (Q69, mean, RAU=3,9931, CCU=4,1342).

Thirdly when it comes to time management, both groups of law students tend to manage their time effectively. However, there is a tendency among students of both countries to spend time with their friends to such an extent that their academic work may suffer (Q74, mean, RAU=3,9517, CCU=3,9725).

The law students of both countries tend to have no problems concerning anxiety. However, South African law students seem to be more anxious that they may fail in their classes than Chinese law students do (Q1, mean= 4,1586:2,9759**).

6.4.3.3 Literature and Arts faculty

The most obvious difference between the two groups of literature and arts students is in the use of study aids. The South African students tend to use study aids more effectively (STA, mean=18,9726:16,3822**). The South African students tend to make better use of notes as they work through their textbooks. (Q19, mean=3,9726:3,5131**). It seems that they also make better use of the chapter headings as a guide towards the content of the chapter (Q62, mean=4,0240:3,6492**).

Secondly, a difference is found regarding information processing. South African literature and arts students seem to be better than Chinese literature and arts students at using information processing skills (INP, mean=30,0582:27,9145**). For example, when they study a topic they are able to integrate the study material (Q32, mean=4,1096:3,5968**).

The third group of subscales refers to attitude. South African literature and arts students feel more confused and undecided as to what their educational goals should be (Q14, mean=3,9144: 3,3124**). They are more likely to study only the subjects they like (Q45, mean= 4,1130:3,7435**), and dislike most of the work in their classes (Q51, mean=4,0377:3,7557**).

Both groups of literature and arts students often consider the study material taught in their classes not worth learning (Q69, mean, RAU=4,1096, CCU=4,1623). Although it shows that both group of literature and arts students are low in anxiety, South African literature and arts students also worry about failing their courses (Q1, mean=4,2979:3,0942**).

When it comes to motivation, South African literature and arts students seem to be more motivated than Chinese literature and arts students. They tend to be up-to-date with their class assignments (Q10, mean= 4,1146:3,8866**). They do, however, seem to come to class unprepared more often than Chinese students do (Q16, mean=3,8733:3,0227**).

Both groups of literature and arts students tend to spend time with their friends to such an extent that their studies may suffer (Q74, mean, RAU=4,0034, CCU=3,9913).

6.5 CONCLUSION

According to the statistical analyses and interpretation above, the following conclusion are made.

6.5.1 Merits and Problems of South African Students

The following tendencies were identified regarding the

South African students.

1. They tend to be good at using study aids to improve their learning effectiveness.
2. They tend to be better at using information processing skills.
3. They tend to be easily distracted.
4. They tend to feel confused and undecided as to what their educational goals should be.
5. They seem to study only the subjects that they like, and dislike to a great extent some of the work in their classes.
6. They tend to worry about failing their courses.

6.5.2 Merits and Problems of Chinese students

From the statistical analyses, the following tendencies were identified concerning the Chinese students.

1. On the whole they are good at using test strategies, and their time management is more effective than that of South African students.
2. They tend to put off their studies more easily.
3. They are not as good at using study aids.
4. They tend not to make good use of study hours after school.

6.5.3 Common Problems of the Students of South Africa and Taiwan, Republic of China

The following common problems with learning and study strategies were identified in the two student groups.

1. They tend to share the opinion that the study material which is taught in their classes is often not worth learning.
2. Academic work tends to suffer as a result of too much time spent with friends.
3. Students often experience difficulty in extracting the important ideas from their reading.
4. Both female student groups are prone to rationalizing excuses for not doing a homework assignment.

6.6 RECOMMENDATIONS

The results of this study indicate that there are differences between the learning strategies of the first year university students in South Africa and the Republic of China. Common problems are also experienced. For the improvement of education, it is recommended that:

1. Learning and study strategies should be taught to the first year university students at the beginning of their university career.

2. Education authorities should consider the content of the curricula concerned in order to enhance the relevance of the subject matter, since most students find the work taught in their classes irrelevant.
3. Educational goals should be clarified to South African students, because many feel confused and undecided as to what their goals should be.
4. Too much time seems to be spent on social activities with an adverse affect on studies.
5. Students need to know how to use study aids created by others and how to create their own. This is particularly necessary for Chinese students.
6. Helping students to learn how to reduce their level of anxiety is necessary to help them improve their performance. This is specific need among South African students.
7. Education exchange activities (for both students and teachers) may be beneficial to both countries.

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Appendix 1

English LASSI questionnaire

1. I worry that I will fail my classes.
2. I can tell the difference between more important and less important information my teacher tells me.
3. I find it hard to stick to a study schedule.
4. After a class, I look over my notes to help me understand the information.
5. I don't care if I finish high school as long as I can get a job.
6. I find that when my teacher is teaching I think of other things and don't really listen to what is being said.
7. I use special study helps, such as italics and headings, that are in my textbook.
8. I try to identify the main ideas when I listen to my teacher teaching.
9. I get discouraged because of low grades.
10. I am up-to-date in my class assignments.
11. Problems outside of school--dating, conflict with parents, etc.-- cause me to not do my school work.
12. I try to think through a topic and decide what I am supposed to learn from it rather than just read it over when doing schoolwork.
13. Even when study materials are dull and not interesting, I manage to keep working until I finish.
14. I feel confused and undecided as to what my educational goals should be.
15. I learn new words or ideas by imaging a situation in which they occur.
16. I come to class unprepared.
17. When studying for an exam, I think of questions that might be on the test.
18. I would rather not be in school.

19. The notes I take as I read my textbooks are helpful when I review the textbook material.

20. I do poorly on tests because I find it hard to plan my work within a short period of time.

21. I try to think of possible test questions when studying my class material.

22. I only study when there is the pressure of a test.

23. I change the material I am studying into my own words.

24. I compare class notes with other students to make sure my notes are correct.

25. I am very tense when I study.

26. I look over my notes before the next class.

27. I have trouble summarizing what I have just heard in class or read in a textbook.

28. I work hard to get a good grade, even when I don't like a class.

29. I often feel like I have little control over what happens to me in school.

30. I step often while reading and think over or review what has been said.

31. Even when I am well prepared for a test, I feel very upset when taking it.

32. When I study a topic I try to make the ideas fit together and make sense.

33. I talk myself into believing some excuse for not doing a homework assignment.

34. When I study, I have trouble figuring out just what to do to learn the material.

35. When I begin a test, I feel pretty sure that I will do well.

36. When it comes to schoolwork, I put things off until another time.

37. I check to see if I understand what my teacher is saying during a class period.

38. I do not want to learn a lot of different things in school. I just want to learn what I need to get a good job.

39. I am sometimes unable to keep my mind on my schoolwork because I am restless or moody.

40. I try to find connections between what I am learning and what I already know.

41. I set high standards or goals for myself in school.

42. I end up "cramming" for almost every test.

43. I find it hard to pay attention during class.

44. I key in on the first or last sentences of most paragraphs when reading my textbooks.

45. I only study the subjects I like.

46. I am distracted from my studies very easily.

47. I try to find connections between what I am studying and my own experience.

48. I make good use of study hours after school.

49. When work is difficult I either give up or study only the easy parts.

50. I make drawings or sketches to help me understand what I am studying.

51. I dislike most of the work in my classes.

52. I have trouble understanding just what a test question is asking.

53. I make simple charts, diagrams, or tables to pull together material in my classes.

54. While I am taking a test, worrying about doing poorly gets in the way of keeping my mind on the test.

55. I don't understand some class material because I do not listen carefully.

56. I read textbooks assigned for my classes.

57. I feel very panicky when I take an important test.

58. When I decide to do schoolwork, I set aside a certain amount of time and stick with it.

59. When I take a test I realize I have studied the wrong material.

60. It is hard for me to know what is important to remember in a

textbook.

61. I pay attention fully when studying.

62. I use the chapter headings as a guide to find important ideas in my reading.

63. I get so nervous and confused when taking a test that I don't answer questions to the best of my ability.

64. I memorize grammatical rules, technical terms, formulas, etc. without understanding them.

65. I test myself to be sure I know the material I have been studying.

66. I put off schoolwork more than I should.

67. I try to see how what I am studying would apply to my everyday living.

68. My mind wanders a lot when I do schoolwork.

69. In my opinion, what is taught in my classes is not worth learning.

70. I go over homework assignments when reviewing class materials.

71. I have a hard time knowing how to study for different types of subjects.

72. Often when doing schoolwork I seem to get lost in details and can't remember the main ideas.

73. When they are available, I go to study or review sessions.

74. I spend so much time with my friends that my schoolwork suffers.

75. In taking tests, writing themes, and other schoolwork, I find I have not understood what the teacher wants and lose points because of it.

76. I try to make connections between various ideas in what I am studying.

77. I have a hard time finding the important ideas in my reading.

Appendix 2

Chinese LASSI questionnaire

問　卷　試　題

1、我耽心功課不及格。
2、我能分辨老師上課內容，那些較重要，那些較不重要。
3、我發現很難堅持自己的讀書計劃。
4、下課後我看筆記，幫助了解上課內容。
5、只要能找到工作，我不在乎高中學歷。
6、上課時，我想其他事情，無法眞正專心聽老師所說內容。
7、我用特別的學習輔助方法，例如教科書上之標題或斜體字。
8、我聽課時，設法抓重點。
9、我因爲分數低而氣餒。
10、我按時完成作業。
11、校外的困擾，如約會和父母的衝突等，使我不做學校功課。
12、我做學校功課時，不僅讀讀而已，而常設法去思考主題，決定從其中學到某些東西。
13、即使課程內容單調乏味，我仍設法繼續直到做完。
14、我覺得迷惑，而不知道什麼是我的教育目標。
15、我用想像發生之情形，學習生字或新觀念。
16、我事前不加準備，即前往上課。
17、考試時我事前會做猜題工作。
18、我寧願不上學。
19、我做的筆記，在複習功課時很管用。
20、我考試成績不佳，因爲我覺得在短短時間內，很難安排功課。
21、我讀課堂教材時，會想想考試可能出的題目。
22、我只有考試壓力時才讀書。
23、我將研讀的教材，轉換成自己的用辭。
24、我對照同學的筆記，訂正自己筆記的錯誤。
25、我讀書的時侯很緊張。
26、下次上課前，我複習我的筆記。
27、我無法摘錄看過之書，或在課堂聽過之課。
28、即使不喜歡的課，我仍努力去獲得高分。
29、我常覺得我不太能控制在學校之事。
30、我在閱讀、思考或回想說過的話時，常中途停下來。
31、即使充分準備了，考試時仍覺手忙脚亂。
32、當我研究一個主題時，我設法整合觀念去理解。
33、我常自找藉口，不做家庭作業。
34、讀書時我很難想出如何去學習這些教材。
35、開始考試時我就十分有信心考好。
36、做學校功課時，我放開其他事情。
37、上課時我檢查是否聽懂老師所說內容。
38、我不想在學校學太多東西，只想學能找到好工作所需事物。

３９、由於好動與心情不定，我有時候不能專心做學校功課。
４０、我設法找出正在學的和已知道的事物之間的相互關係。
４１、我對學校功課標準自我要求很高。
４２、幾乎所有的考試我都填鴨式地去準備。
４３、我發現上課時很難專心。
４４、我讀教材時，對每段之第一句或最後一句特別專注。
４５、我只讀我喜歡的科目。
４６、我讀書容易分心。
４７、我設法找出我正在研究的東西和自己已有經驗之間的關係。
４８、下課後我善於利用時間。
４９、遇到困難工作，我放棄或只做容易的部分。
５０、我用圖畫或素描幫助理解我所研讀的東西。
５１、大部分課堂上的工作我都不喜歡。
５２、我不了解考試的問題在問些什麼。
５３、我做簡單圖表或一覧表，將課堂上教材放在一起。
５４、考試時我耽心考不好而無法專心做答。
５５、因爲不用心聽課，有些上課內容我不太了解。
５６、我閱讀課堂指定之教材。
５７、當我參加重要考試時，我覺得非常驚慌。
５８、當決定做學校功課時，我保留某段時間專注於功課。
５９、到了考試時我才發現讀錯了資料。
６０、我很難知道教材上什麼是該記的重點。
６１、我讀書時全神貫注。
６２、我以章節標題，做爲閱讀重點之指標。
６３、考試時我緊張、迷惑而無法發揮我的最佳能力作答。
６４、我死記文法規則、工程術語、公式等，而不去理解。
６５、我自我測驗以確定了解所學教材。
６６、我耽誤學校功課甚多。
６７、我試圖找出所學是否能用於日常生活中。
６８、做學校功課時我常心不在焉。
６９、我個人認爲課堂所教，不值得去學。
７０、溫習課堂教材時，我複習指定之家庭作業。
７１、我很難知道如何去學習不同類型科目。
７２、做學校功課時，我似乎常迷失方向於細節上，而無法記住重點。
７３、只要有時間，我就讀書或複習功課。
７４、我花太多時間交朋友，而荒廢了學校功課。
７５、考試、寫作文和做其他學校功課時，我發現我不知道老師要我做些什麼，而抓不到重點。
７６、我設法將我正在學習之各種觀念連結起來。
７７、我閱讀時很難找到重點。

Appendix 3

FACTOR 1 (Z1)--Study anxiety-teststrategies

1. I worry that I will fail my classes.

2. I can tell the difference between more important and less important information my teacher tells me.

9. I get discouraged because of low grades.

14. I feel confused and undecided as to what my educational goals should be.

20. I do poorly on tests because I find it hard to plan my work within a short period of time.

25. I am very tense when I study.

27. I have trouble summarizing what I have just heard in class or read in a textbook.

29. I often feel like I have little control over what happens to me in school.

31. Even when I am well prepared for a test, I feel very upset when taking it.

34. When I study, I have trouble figuring out just what to do to learn the material.

35. When I begin a test, I feel pretty sure that I will do well.

52. I have trouble understanding just what a test question is asking.

54. While I am taking a test, worrying about doing poorly gets in the way of keeping my mind on the test.

57. I feel very panicky when I take an important test.

59. When I take a test I realize I have studied the wrong material.

60. It is hard for me to know what is important to remember in a textbook.

63. I get so nervous and confused when taking a test that I don't answer questions to the best of my ability.

64. I memorize grammatical rules, technical terms, formulas, etc. without understanding them.

71. I have a hard time knowing how to study for different types of subjects.

72. Often when doing schoolwork I seem to get lost in details and can't remember the main ideas.

75. In taking tests, writing themes, and other schoolwork, I find I have not understood what the teacher wants and lose points because of it.

77. I have a hard time finding the important ideas in my reading.

Appendix 4

FACTOR 2 (Z2)--Study mindedness

3. I find it hard to stick to a study schedule.

6. I find that when my teacher is teaching I think of other things and don't really listen to what is being said.

10. I am up-to-date in my class assignments.

13. Even when study materials are dull and not interesting, I manage to keep working until I finish.

16. I come to class unprepared.

22. I only study when there is the pressure of a test.

28. I work hard to get a good grade, even when I don't like a class.

33. I talk myself into believing some excuse for not doing a homework assignment.

39. I am sometimes unable to keep my mind on my schoolwork because I am restless or moody.

41. I set high standards or goals for myself in school.

43. I find it hard to pay attention during class.

45. I only study the subjects I like.

46. I am distracted from my studies very easily.

48. I make good use of study hours after school.

51. I dislike most of the work in my classes.

56. I read textbooks assigned for my classes.

58. When I decide to do schoolwork, I set aside a certain amount of time and stick with it.

61. I pay attention fully when studying.

66. I put off schoolwork more than I should.

68. My mind wanders a lot when I do schoolwork.

69. In my opinion, what is taught in my classes is not worth learning.

74. I spend so much time with my friends that my schoolwork suffers.

Appendix 5

FACTOR 3 (Z3)--Study involvement

7. I use special study helps, such as italics and headings, that are in my textbook.

8. I try to identify the main ideas when I listen to my teacher teaching.

12. I try to think through a topic and decide what I am supposed to learn from it rather than just read it over when doing schoolwork.

15. I learn new words or ideas by imaging a situation in which they occur.

19. The notes I take as I read my textbooks are helpful when I review the textbook material.

21. I try to think of possible test questions when studying my class material.

23. I change the material I am studying into my own words.

32. When I study a topic I try to make the ideas fit together and make sense.

37. I check to see if I understand what my teacher is saying during a class period.

40. I try to find connections between what I am learning and what I already know.

47. I try to find connections between what I am studying and my own experience.

50. I make drawings or sketches to help me understand what I am studying.

53. I make simple charts, diagrams, or tables to pull together material in my classes.

62. I use the chapter headings as a guide to find important ideas in my reading.

65. I test myself to be sure I know the material I have been studying.

67. I try to see how what I am studying would apply to my everyday living.

76. I try to make connections between various ideas in what I am studying.