AN INVESTIGATION OF THINKING STYLES AND LEARNING APPROACHES OF UNIVERSITY STUDENTS IN NIGERIA

by

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DEDICATION

This academic accomplishment is dedicated to my parents, my mother, Mrs. Patricia Mmadinobi Inweregbu, and my late father, Mr. Callistus Abara Inweregbu, for their support during my formative years.

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Que Dieu tout-puissant vous bénisse.

PREFACE

As I have gone through life I have observed how differently individuals perceive reality and operate in their environment. I have wondered why people are unique and process the same reality differentially.

In the academic world in particular why do both students and teachers approach schoolwork so differently? You become aware of how some emphasize brevity – just say it in one word, others operate better with greater details the more the better. Some may say this is a result of stylist preferences of individuals. A way of thinking that translates into choosing an approach to learning, to doing tasks and function in day-to-day life events. Reflecting on these variations and adaptations of perception, some people may suggest it is as a result of individual differences or personality differences.

As a starting point to my curiosity on this individual differences of perception and approaches to learning the basic question I have come to pose states "is there any relationship between thinking style and approaches to learning?" Could there be some cultural twist to these differences? Do people become aware of their stylistic preferences and operate on that? There are potentially many questions regarding these differences, however the present study is just a scratch in unveiling the relationship between thinking and learning differences. The present study was conducted with university students of Nigeria.

Results indicate that really there are relationships between individual preferences to certain thinking styles and approaches to learning. As there are differences in personalities, there are also variations on the preferences to individual choices. There are individuals with clear preferences to more task demanding situations, others just want to scan through and get over any undertaking they are faced with and still others have the skills to apply both preferences in their learning tasks.

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CHAPTER 1

INTRODUCTION

Purpose

This study investigates the relationship between thinking styles and learning approaches among Nigerian university students. In doing that attention was focused on identifying thinking styles that could enhance learning for students in Nigeria. Factor analysis and Pearson correlation were carried out to confirm the relationship of the scales of thinking styles and learning approaches of students as found through the inventory instruments.

As Zhang (2002) and Zhang and Sternberg (2000) argued, students with complex thinking styles (CTS) tend to have a deep approach (DP) to learning. Consequently, the present study attempted to determine whether such complex thinking styles were prevalent among students who may have a deep approach to learning. Likewise, the study examined if there were relationships between simple thinking styles (STS) and a surface apathetic approach (SAA) to learning. There are students who tend to adopt a strategic approach (ST) to learning. Hence, it was also important to investigate the relationship between strategic approach and thinking styles. Finally, the study examined whether the relationship between thinking styles and approaches to learning changes based on gender, field of study and educational level.

Background

Students learn differently based on individual idiosyncrasies. Some are global thinkers and tend to be analytic. They conceptualize and dwell in the world of ideas. Individuals who perceive reality in this way tend to apply complex thinking styles in learning. Others are local thinkers and apply simple thinking styles in their studies.

These students tend to be less sophisticated and cue in on details. They are students who prefer to deal with concrete events and tend to be pragmatically oriented.

Sternberg (1994) described the first group as those who go for the big picture; they see the forest and not the trees in it. The second group consists of those who go for the smaller picture; they see the trees and not the forest. To succeed in school, students need to be aware of their preferred thinking styles as reflected in the approach they adopt in their learning.

In the past few decades, studies on individual differences have investigated students' academic performances based on the effects of certain variables different from abilities. These variables include learning motivation (Dev, 1997; Niles, 1995) and cognitive and thinking styles (Gregorc, 1985; Kagan, 1976; Sternberg, 1988). These studies tend to suggest that 'approaches to learning' and 'thinking styles' may be two related concepts that might facilitate intellectual processing of information. Students who tend to use a complex thinking style may exhibit more flexible skill insights and commitments to higher intellectual processing of information in their academic performance.

Orientations Toward Learning and Thinking Styles

In higher education, students' manifest different orientation to learning that are dependent on the context, content and demands of their learning tasks (Marton et al., 1984; Richard et al., 1987). In an effort to explain orientation to learning, two theories have emerged in the past few years: 1) approaches to learning, and 2) thinking styles.

Approaches To Learning

The theory of approaches to learning developed by Entwistle (1983, 1998) stated three paradigms: deep approach, surface apathetic approach and strategic approach. Individuals who adopt the deep approach seek meaning and understanding, and build up knowledge from their previous experiences. According to Entwistle and Tait (1990), students with the deep approach to learning have preferences for teaching that challenges understanding. The deep approach, as found in Meyer (1999), is linked with the conception

of learning as transforming. There is a common understanding among researchers that the development of a deep approach is consistent with the goals of higher education. A deep approach may result from the relevance of students' interests (Biggs, 1999) in focusing on their educational goal and career.

A surface apathetic approach tends to scan information and present peripheral information processing and acquisition of knowledge. The emphasis of this approach suggests reproducing materials for the purpose of academic assessment. Students inclined to using this approach in their studies tend to direct learning toward assessment requirements. It also suggests evidence of unreflective association of concepts and facts.

Students using this approach may find it difficult to integrate previous knowledge with present learning and its application. The surface apathetic approach is marked by its emphasis on an external motive for learning, such as demands for assessment, memorization and knowledge that remain separate from everyday reality (Ramsden, 1988). The surface apathetic approach may result from assessment methods that reward reproducing information (Dart and Clarke, 1991) or from heavy workload (Ramsden, 1992).

The strategic approach tends to adopt heuristic techniques. Students using this approach are conscious of time management and seek the best ways of achieving the best possible academic result. Their focus is on obtaining grades and may concentrate on cues from the academic staff. The strategic approach is task-focused and tends to pursue knowledge from a restricted perspective. A strategic approach is characterized by a highly organized approach to study and high achievement motivation (Watkins, 1982).

According to Richard (1998), students adopt a deep approach, or meaning orientation, to the extent they acknowledge the more abstract forms of learning that are demanded in higher education and are motivated by the relevance of the syllabus to their personal needs and interests. They adopt a surface approach, or reproducing orientation,

whenever they encounter an overloaded curriculum and methods of academic assessments that emphasize the superficial properties of the material to be learned. They adopt a strategic approach, or an achieving orientation, to the extent that they receive cues about their assessment from members of the teaching staff. Studies indicate however, that students who combine deep and strategic approaches tend to perform better in discerning and using aspects of the learning environment that support their preferred learning approaches (Meyer, 1991; Meyer, Parsons, and Dunne, 1990). Deep approach represent an approach to studying characterized by an active search for meaning, interacting actively with what is learned and linking it with real life. Strategic approach focuses on practical application to learning and the best way to obtain the desired result. It also appears that conceptions of learning change and evolve as people mature and engage in intellectual activities (Marton, Dall'Alba, and Beaty, 1993).

Among the three approaches to learning the strategic approach, with its focus on context, does not seem to stand out distinctly but tends rather to be dependent on the other two (deep and surface approaches), which are in turn somewhat mutually exclusive.

Thinking Styles

The theory on thinking styles developed by Sternberg (1988, 1994 and 1997) was known as the theory of mental self-government. This theory described 13 thinking styles that vary with individual preferences. The thinking styles are grouped into five dimensions: functions, forms, levels, scopes and leaning (see details Chapter II). There are also polarity pairings in some of the thinking styles that suggest contrast, for instance: internal versus external; liberal versus conservative; and global versus local. This may reflect the different ways people think and learn as well. It appears that people with certain cognitive styles manifest a preference for a particular learning approach. This in turn could foster the relationship between thinking and learning styles.

Sternberg (1994) argued that two or more people may have the same range of intellectual ability but may differ in the way they think, perform and learn in a classroom. They also differ in their choice of fields of learning in higher education. Thinking styles may also affect the way tasks are performed by individuals in various fields of human endeavor. Furthermore, researchers have found that certain thinking styles are positively related to a deep approach to learning, and negatively related to a surface approach, among university students. Similarly, there are thinking styles that are positively related to a surface approach, and negatively related to a deep approach, to learning (Zhang, 2000b, Zhang and Sternberg, 2000). These studies suggest that Sternberg's thinking styles can be grouped into two categories, namely complex and simple.

In the present study, 10 thinking styles in two broad categories (complex and simple) were selected from Sternberg's (1988) 13 thinking styles and compared to the learning approaches of Nigerian university students.

The complex thinking styles consist of legislative, judicial, liberal, global, and external. These styles involve sophisticated information processing. Students who adopt these styles tend to be creative, independent and norm challenging in their approaches to learning. The simple thinking styles consist of executive, monarchic, conservative, local, and internal. These styles are perceived to be less rigorous. Students in this category tend to be structured, detail oriented, and norm favoring in processing information. The opposite features of these two groups were also indicated in two studies (Sternberg & Zhang 2000; Li-Fang Zhang 2002). Anarchic, oligarchic and hierarchic thinking styles are omitted in the two classifications because they do not seem to possess clear opposites in the 13 thinking styles. The reason for these groups is based on the opposing polar characteristics of complex and simple categories of the thinking styles and their degree of complexity in information processing. Furthermore, efforts will be made in this study to avoid duplicating

scales that appear to measure similar constructs in Stenberg's (1988) categories of preferred thinking styles.

The current study presented many opportunities to observe correlations of thinking styles when the strategic approach is combined with each of the two seeming contrasting paradigms of learning namely the deep and surface approaches.

Statement of the Problem

There is a general understanding in research literature that students in higher education manifest a number of different approaches to learning. Ideally, students tend to display particular approaches to learning in response to the perceived context, content and demands of their learning task. The approach a student applies in studies may reflect the educational policy and emphasis on individual learning and intellectual development in some countries.

As a developing country, Nigeria outlines several educational goals for students in Tertiary institutions of learning. These objectives present challenges to students in attaining their educational goals. According to the National Policy on Education (NPE, 1998) the objectives of tertiary education in Nigeria, as contained in section 6 of the document, include the following goals:

1. Develop the intellectual capacity of individuals to understand and appreciate their local and external environment.
2. Develop and articulate proper values for the survival of the individual and society.
3. Acquire both physical and intellectual skills, which will enable individuals to be self reliant and useful members of the society.
4. Promote and encourage scholarship and community service.

Inherent in these goals is the idea that individual students have the potential to develop and mature as productive citizens whose intellectual development and achievement can be facilitated by university education.

Fonlon (1978) asserted that the hallmark of studies at the tertiary level was in their quantity, quality and intrinsic organization. The intrinsic organization is purely dependent on the individual learner. Students are challenged by the responsibility of knowing their purpose for university education and consequently adopting learning strategies that will successfully lead to that purpose.

In a study with Nigerian secondary school students, Shuaibu and Ogunsola (1993) stated that "under the strain of the regional West African school certificate examination, which measures mainly how much students remember, students especially in their final years in the secondary schools are taught by methods which require them to memorize information and regurgitate it at the expense of higher cognitive activities" (P.101). Their findings further, suggested that the surface approach might not be the natural preference of Nigerian students outside the influence of external examination. Moreover, the study involved secondary school students who may not have developed the maturity and skills for higher education. Hence, there is the need to focus on tertiary students with participants from Nigerian Universities. This study investigated the extent to which the three learning approaches are to be associated with Nigerian university students.

Nneji (2002) found that the majority of university students in Nigeria depended on their course handouts or lecture notes as the main source of information and read mostly for passing exams. Others adopt memorization techniques in their approaches to studies. However, this study essentially determined how thinking styles are related to the learning approaches of Nigerian university students.

Instruments

Research by Entwistle in the United Kingdom and Sternberg in the United States has led to the development of a series of inventories to identify the approaches to learning and the thinking styles for individual students respectively. These instruments provide the means of establishing how students may differ in their choices of learning strategy. Students who adopt the most appropriate learning strategy in a particular context are likely to be more successful than less skilled learners (Entwistle, 1998). Two instruments were used in the present investigation: 1) Thinking Style Inventory -TSI (Sternberg, 1992), and 2) Approaches and Study Skills Inventory for Students – ASSIST (Entwistle, 1998), (Appendix F). The two inventories (TSI and ASSIST) are among the best in a number of standardized questionnaires, developed to operationalize students' dispositions to adopt specific approaches to learning within their normal academic studies.

The TSI were used to measure students' thinking styles and the ASSIST employed to measure the learning approaches students adopt.

In developing ASSIST, Entwistle expanded the meanings and concepts used in the three approaches to learning as reflected in the acronym. Apathetic was applied separately in the earlier versions of approaches to learning inventory (ASI and RASI). In ASSIST, surface apathetic approach (SA) is used in place of surface approach to learning. Hence, in this study, SA will be interpreted as meaning the same as surface approach. Surface apathetic approach is symptomatic of ineffective and unreflective studying

Validity and reliability tests were conducted to check for consistency and adaptability of the two instruments to the present study population.

Variables

Two concepts were measured in this study, namely, thinking styles and learning approaches. Thinking styles were assessed using 10 of the 13 subscales from the TSI

(Sternberg, 1988) and grouped into CTS (legislative, judicial, liberal, global, external) and STS (executive, monarchic, conservative, local, internal). The complex thinking style was derived from the sum of responses to the five facets indicated. Likewise, the simple thinking style was derived from the sum of its five facets. The CTS and STS were considered as two variables.

Learning approaches (LA) were measured as deep, surface apathetic (SA) and strategic using the ASSIST. The deep approach was derived from the sum of the scores on the three subscales: seeking meaning (SM), relating ideas (RI) and use of evidence (UE). The surface apathetic approach was obtained from the sum of the three subscales: lack of purpose (LP), unrelated memorization (UM) and syllabus-boundedness (SB).

The strategic approach was derived from the sum of the three subscales: organized studies (OS), time management (TM) and alertness to assessment demands (AD).

The 10 subscales of the TSI and the nine subscales of the ASSIST, as shown in Table 1.1, were used as subscales in the present study.

The three summated scales: DP, SA, and ST were treated as variables in subsequent analyses. Other variables were gender, and levels of study (level 100 and level 400, meaning first year and fourth year university students) and field of study (science and non-science students).

The population for this study was university students at two universities in Nigeria:

1) Federal University of JOS (FUJO), in Plateau State, Northern Nigeria,

2) Federal University of Port Harcourt (FUPH), in River State, Southern Nigeria.

Table 1.1

Major subscales of TSI and ASSIST and their abbreviations

TSI		ASSIST	
Subscale Name	Abbrev.	Subscale Name	Abbrev.
Legislative	LEG	Seeking Meaning	SM
Judicial	JUD	Relating Ideas	RI
Liberal	LIB	Use of Evidence	UE
Global	GLO	Lack of Purpose	LP
External	EXT	Unrelated Memorizing	UM
Executive	EXE	Syllabus Boundedness	SB
Monarchic	MON	Organized Studying	OS
Conservative	CON	Time Management	TM
Local	LOC	Alertness to Assessment Demands	AD
Internal	INT	Supporting understanding	SU
		Transmitting information	TI

Research Questions

The research questions for this study were as follows:

1. Is there a relationship between thinking styles and learning approaches?
2. Is there a difference in the relationship between thinking styles and learning approaches based on gender?
3. Is there a difference in the relationship between thinking styles and learning approaches based on field of study (Science and Non Science)?
4. Is there a difference in the relationship between thinking styles and learning approaches based on level of study?

5. Are there relationships between the combined deep and strategic learning approaches with complex thinking styles?

6. Are there relationships between complex thinking styles with the combined strategic and surface apathetic approaches to learning?

Research Hypotheses

The following null hypotheses were generated in an attempt to answer the research questions. All tests were based on Pearson correlations at nominal alpha = .05 with Bonferroni adjustment to 0.00139.

For all the participants in the study:

1a) H0: For DP versus CTS, $r = 0$

1b) H0: For DP versus STS, $r = 0$

1c) H0: For ST versus CTS, $r = 0$

1d) H0: For ST versus STS, $r = 0$

1e) H0: For SA versus CTS, $r = 0$

1f) H0: For SA versus STS, $r = 0$

For all males (m) and females (f) in the study:

2a) H0: For DP versus CTS, $r_m - r_f = 0$

2b) H0: For DP versus STS, $r_m - r_f = 0$

2c) H0: For ST versus CTS, $r_m - r_f = 0$

2d) H0: For ST versus STS, $r_m - r_f = 0$

2e) H0: For SA versus CTS, $r_m - r_f = 0$

2f) H0: For SA versus STS, $r_m - r_f = 0$

For levels 100 and 400 in the study:

3a) H0: For DP versus CTS, $r_{100} - r_{400} = 0$

3b) H0: For DP versus STS, $r_{100} - r_{400} = 0$

3c) H0: For ST versus CTS, $r_{100} - r_{400} = 0$

3d) H0: For ST versus STS, $r_{100} - r_{400} = 0$

3e) H0: For SA versus CTS, $r_{100} - r_{400} = 0$

3f) H0: For SA versus STS, $r_{100} - r_{400} = 0$

For Science (s) and Non-science (ns) in the study:

4a) H0: For DP versus CTS, $r_s - r_{ns} = 0$

4b) H0: For DP versus STS, $r_s - r_{ns} = 0$

4c) H0: For ST versus CTS, $r_s - r_{ns} = 0$

4d) H0: For ST versus STS, $r_s - r_{ns} = 0$

4e) H0: For SA versus CTS, $r_s - r_{ns} = 0$

4f) H0: For SA versus STS, $r_s - r_{ns} = 0$

Whether or not research questions 5 and 6 were pursued always depended on the initial results obtained. As indicated in chapter 4, the data from this study did not support pursuing these two research questions. Specifically, the data supported the existence of distinct deep, strategic and surface apathetic. Thus, combining them in different ways as indicated in research questions 5 and 6, and by some prior studies, was not supported by the data in this study. Further, the existence of complex (and simple) thinking styles referred to in research questions 5 and 6 (and identified in some prior study) were not supported by the results of this study. Given this context, research questions 5 and 6 were no longer meaningful.

Importance of the Study

This study tended to show some importance for Nigerian university students and educators in understanding approaches to learning and thinking styles. It exposed Nigerian university students to the concepts of thinking styles and approaches to learning that have been previously explored with both Asian and Western university students.

Previous studies with Nigerian university students have tended to focus on study habits and implied that "poor study habits" result in poor academic performance (Denga, 1982; Ikegbuna, 1998; Ikeotuonye and Bashmir, 1982). Conversely, "good study habits" trigger positive effects on performance (Bakare, 1977; Okonkwo, 1993; Fayley, 1989).

There is no known detailed study that has assessed the relationship between thinking styles and approaches to learning among Nigerian university students prior to this one. This study could, therefore provide a new horizon and awareness for university students in the ways they perceive their academic strategies and pursue career development as they discover better ways of applying themselves to learning. This study gives indication as to factors affecting the relationship between thinking and learning styles among tertiary students in Nigeria.

The study evokes awareness of harmonizing students' thinking styles with learning styles that may enhance their academic performance. One of the basic assumptions of the theory of mental self-government is matching learning styles with thinking styles. Students who are cognizant of their match of the styles in a conducive environment tend to do better in their academic pursuits.

This study also gives some insights into why Nigerian students may or may not use surface approach in learning, especially under the stress of examination conditions. The results and findings of the study empower and challenge the evaluation of the present curricula at different levels of University education in Nigeria. Moreover, the instruments for this study are the latest and most refined versions. The findings of the study could lead to better detection of anticipated relationships.

Assumptions of the Study

This study focused on University students of Nigeria, and the generalization of the findings were further based on this population. Among the basic assumptions of the theory

of the mental self-government and the need to match learning styles with thinking styles in order to excel in information processing. It was also assumed that the strategic approach might have higher correlation with the deep than surface approaches to learning. Thinking styles theoretically can be flexible, sociable and adaptable.

Limitations of the Study

This study is an exploratory investigation, as a result, there may not be an explicit way of knowing how well the individual Nigerian student will actually do in school based on the preferences of students' learning and thinking styles. Since this study did not use a longitudinal approach, it was limited to examining quantitatively the pattern of relationship between learning and thinking styles among Nigerian students.

Another limiting factor is the fact that because this was a quantitative study, the findings may not provide detailed insights into individual student's idiosyncrasies and personality traits that affect developmental growth in learning.

There was no data collection measuring individual students' achievements so as to estimate how thinking and learning styles could enhance learning of Nigerian students.

Short forms of the two primary survey instruments were used in order to better match prior research and limit the length of the data collection instrument. Longer forms were available for both instruments and their use might have resulted in higher reliability.

Definitions

Tertiary education is education given after secondary education in universities, colleges of education, polytechnics, etc. (NPE, 1998, section 6).

The National Policy on Education (NPE) is the officially recognized set of guidelines for the development of the entire education system in Nigeria (Federal Republic of Nigeria, 1981).

CHAPTER 2

LITERATURE REVIEW

Theory of Mental Self Government

Through many approaches to cognitive styles, and studies on it, Sternberg over the years evolved the theory of mental self-government. It is a concept of style, which could be applied in many settings as in schools, homes, communities, work places etc. The overall supposition, underlying of this theory is the fact that it avails many options for people. Consequently, styles may change with time, situations or life's demands; hence, the concept of mental self-government as posited by Sternberg can be socialized. Thinking style in this context refers to how individuals prefer doing something with some form of flexibility. A match of one's ability and in the present study a flexibility that allows a student to combine effectively one form of thinking style with learning will facilitate to a greater extent in actualizing the student's academic potentials.

Sternberg (1994, 1997) further posited that the various forms of government in the world are reflections of what goes on in people's minds. They can be seen as the external indications of how individuals organize their thinking, a compartmentalization of the world of their thinking. As a result, the forms of government represent the mirrors of their minds namely the thinking styles.

The theory of mental self-government therefore describes 13 styles that fall under five dimensions of the mental self government namely functions, forms, levels, scopes, and leanings. Just as there are different, forms of governments there are also various thinking styles that are applicable to each person, on a daily reality check. Sternberg describes these dimensions as follows:

Functions: Just as in government, there are three functions in a human being's mental self-government: *Legislative, Executive and Judicial.* A person with legislative style

enjoys being engaged in tasks that require creative strategies. An individual with the executive style is more concerned with implementation of tasks with set guidelines. They like to follow directions within the framework and structure of a given assignment or task. An individual with a judicial style focuses on evaluating the products of others' activities. Such people critique the works of others, give feedback, and are good generally in giving advice or counseling.

Forms: As in government, a person's mental government takes on four forms: *Monarchic, hierarchic, oligarchic, and anarchic.* An individual with a monarchic style enjoys being engaged in tasks that allow a complete focus on one thing at a time. The person with hierarchic style likes setting priorities and times to whatever task that needs to be accomplished. They like budgeting and devoting time and energy to things they consider more important than others. An individual with an oligarchic style likes to work toward multiple objectives during the same period but may not enjoy setting priorities. They seem to be holistic and tend to tackle problems or tasks at one shot. Finally, a person with an anarchic style enjoys working on tasks that would allow flexibility and eschews systems of any kind. They do not want to be tied to a particular task or job but tend to move randomly from operation one to the other.

Levels: Also as with governments, the individual's mental self-government is at two levels: *local* and *global*. An individual with local style enjoys being engaged in tasks that require working with concrete details. Their challenge is to focus on the whole and not just its individual elements. In the words of Sternberg, they tend to focus on particular trees, sometimes at the expense of the forest. In contrast, an individual with a global style pays attention to the over all picture of an issue and to abstract ideas. They are people who prefer to deal with relatively larger and often abstract concepts.

Scope: Mental self-government can deal with *internal* and *external* matters. An individual with an internal style enjoys engaging in tasks that allow one to work independently. They are people who tend to be task-oriented, less sensitive and may lack interpersonal awareness. More over, they tend to focus inward and be self-sufficient. In contrast, an individual with an external style likes engaging in tasks that provide opportunities for developing interpersonal relationships. They tend to be more extroverted, people-oriented, outgoing, and socially more sensitive. They enjoy working with peers, and in group assignments or projects.

Leanings: Finally, in mental self-government, there are two leanings: *Liberal* and *conservative*, a person with liberal style enjoys in engaging in tasks that involve novelty and ambiguity. They prefer to go beyond the existing rules and procedures in an effort to maximize change, preferring some degree of unfamiliarity in life and work. People with conservative style adhere strictly to existing rules and procedures in performing tasks. Such individuals tend to minimize orientation toward change and novelty.

The Impact of Learning and Thinking Styles on Education

There are varying opinions in the literature on the few attempts made to understand learning approaches and thinking styles among Nigerian students. The earlier studies (Omokhodion, 1989; Ehindero, 1990), focused on the general conception of what students consider as learning and how learning applies to them. Some insightful observations have been made on which of the three approaches to learning tends to be prevalent among tertiary students in their various stages of learning processes.

Watkins and Akande (1992) studied the question of whether the concepts of deep, surface and achieving approaches to learning are relevant in the Nigerian classroom. The study was done using the Study Process Questionnaire (SPQ) developed by Biggs (1987). In this instrument, Biggs used the categories deep, surface and achieving approaches to

measure concepts similar to Entwistle's classification of deep, surface apathetic and strategic approaches. They found that Nigerian students scored variously on these approaches. The Nigerian students scored higher on achieving scales, an indication that they apply the achieving strategy more than the deep and surface approaches. Overall, the study showed that Nigerian students scored higher on all scales of the SPQ than their counterparts in Australia.

Watkins and Akande (1992) also computed reliability indices from which, they concluded that the SPQ instrument was relevant in measuring approaches to learning for the Nigerian population, providing evidence for the construct validity of the instrument for the Nigerian study. Furthermore, comparison of their findings, with those of identical study of Australian students, showed similar results.

In another study, Ehindero (1990) presented a pilot study of 250 Nigerian university students. The study investigated the question, "what strategies do you use to study?" Based on content analysis of students' responses, the following were observed: memorizing content material without understanding, building up understanding and diligence to learning. The findings from the study reflected some good measures of the concepts of achieving, surface and deep approaches involved in learning. However, that study appeared to be more of a survey than a typical experimental study with valid instruments.

A comparative study by Watkins & Akande (1994), again using also the SPQ instrument, compared learning approaches of secondary school students from Nigeria, Nepal, Hong Kong, Australia and the Philippines. In that study, the findings showed that Nigerian and Nepalese students tended to utilize "achieving strategies" largely than students from the other nations. Furthermore, the study reflected that the Nepalese students were more inclined to use deep motivation and study strategy than were the Nigerian and

Philippino students. Hong Kong and Nepalese students seemed to utilize reproducing strategies less often than the other students.

The emphasis of Higher Education is to encourage 'critical thinking' which Perry (1970) refers to this as "relativistic reasoning." In other words, critical thinking should train individuals in broadening their understanding and increasing their flexible application of constructive reasoning and information processing. As a result a "deep approach derives from the intention to understand ideas for oneself, by relating ideas to previous knowledge and experience, looking for patterns and underlying principles, checking evidence and relating it to conclusions, and examining logic and argument cautiously and critically" (Entwistle, 1997, p. 214). These reflect effective strategies and tools for success in higher learning.

Perspectives on Learning

The emphasis here was to examine what constitutes a learner's better understanding in order to achieve 'productive learning outcomes'. Riding (1997) investigated the nature of cognitive styles and formulated two cognitive dimensions, namely: holist-analytic and verbal-imagery. The holist-analytic individual tries to understand whether the individual tends to process information as a whole or in parts. Verbal-imagery is concerned with whether individuals express information during thinking verbally or as mental pictures. Giving some details of learning behavior Riding (1997), elaborated that people who tend to be holist benefited from structured material, whereas the analytics tend to impose their own structure. Imagers learn best from pictorial representations, whereas verbalizers learn best through verbally communicating their ideas. Again, the goal is that the individuals become aware of what learning strategy and thinking style that best fits them and could be adapted to their unique styles.

Furthermore, on students' teaching preferences, Ridding (1997) suggested that while the analytics are inclined to control their own learning, the holists tend to have no particular preference. Overall, learners lean toward those course areas that suit their style, and sometimes they may over-estimate their abilities in those areas, while at the same time may underrate their performance on those subject areas that do not suit that style. Other research has focused on certain variables affecting learning such as course expectations (Marton and Saljo, 1976b; Gow and Kember, 1990), student's age, major area of study and gender (Hattie & Watkins, 1981), requirement of learning task (Marton and Saljo, 1976a), teaching context and orientation to learning (Biggs, 1991). These variables affect students differentially in their unique stylistic approach to learning.

Theoretical Basis

The work of Entwistle in United Kingdom and of Biggs in Canada and Australia has focused on developing assessment instruments to identify the differences in approaches to learning between individual students. These instruments take as their bases an 'atheoretical quantitative' framework (Biggs, 1993), meaning one founded in psychometric technique referred to as 'student approaches to learning' or the SAL model. Measurement of the SAL paradigm includes foremost the following instruments: Study Process Questionnaire (SPQ) (Biggs, 1987), Approaches to Studying Inventory (ASI) (Entwistle and Ramsden, 1983) and the associated Revised Approaches to Studying Inventory (RASI) (Entwistle and Tait, 1994). The most recent revision of ASI is the Approaches and Study Skills Inventory for Students (ASSIST) (Entwistle, 1998). In the SAL model, there appears to be a considerable degree of convergence between the instruments developed by Biggs and Entwistle (Sadler-Smith and Tsang, 1998). Meyer and Parson (1989) have gone further to argue that the theoretical constructs upon which the ASI is based are universally perceived.

In terms of understanding students' academic learning in educational institutions, Saljo (1979) identified five different ways of conceptualizing learning, namely: 1) The increase of knowledge; 2) Memorizing; 3) Acquisition of facts, procedures etc., which can be retained or utilized in practice, 4) Abstraction of meaning, and 5) An interpretative process aimed at the understanding of reality. Furthermore, a sixth conception of learning, referred to as learning as changing a person, has been added to the list (Van Rossum and Taylor 1987; Marton, F., Dall'Alba, G. and Beaty, E. 1993).

One of the participants in the Marton et al. study stated, "... you learn to understand about people and the world about you and why things happen and therefore when you understand more of why they happen, it changes you" (p. 292). In other words learning is not limited only to the person's personal world, nor is it limited in time, indicating that various factors come into play in learning that act differentially on changing each person's comprehensive knowledge of reality and self.

Perspectives on Thinking Styles

Research literature is replete with investigations on different ways of doing things under the name 'styles', and such studies have focused on cognitive style, learning style, personality style, etc. Recently, there has been a shift from all these perceptions to an emphasis on thinking style propounded Sternberg (1988). According to Sternberg, a style of thinking is a preferred way of thinking.

In an effort to emphasize the novel meaning of thinking style, Sternberg (1994) studied thinking style as an interface between the domain of ability and the domain of personality. The focus of research on learning has been on ability and its psychometric measurements. Constructive critiques have stressed the lapse on the categorical imperatives of ability assessment as focusing on classifying people or labeling. The critics have come up with "good thinking", "thinking styles" that are informally applied in every day

tasks to mean flexible, insightful and productive thinking (Sternberg, Conway, Ketron and Berstein, 1981). Thinking, other than ability, is thus, perceived as policies that help people fulfill their goals based on their styles.

The theory of mental self-government originated by Sternberg (1988) has expanded this view and placed its base on the interface between two components that are personality and ability. According to Sternberg, two students with the same cognitive ability may differ in their stylistic thinking preferences and performances. Among the goal of the theory of mental self-government is to integrate various learning approaches and cognitive styles to provide a new direction for theories in applied educational practices, intellectual development and personal interactions.

According to Riding (1997) cognitive style is seen as the individual's characteristic and consistent approach to organizing and processing information. In accordance with Riding, while style may have a physiological basis and is fairly fixed for individuals, strategies to cope with situations and tasks may be learned. Riding (1997) described cognitive styles as having two dimensions, one that concerns individual processing and the other the representation of information. He asserted that while styles may have a physiological base, they require strategies to use them to the best advantage. Smith and Kolb (1986), by contrast, held that "learning style is not a fixed trait but a current state of the mind or of operating" (p. 5). This is a perception similarly maintained by Sternberg in stating thinking styles can be socialized. However, the views of Riding, Smith and Kolb reflected the personality component of Sternberg's understanding of styles as exemplified in the theory of mental self-government.

Griggorenko and Sternberg (1995) grouped the literature on styles into three overlapping areas. The first group is cognitive centered and is associated with the cognitive aspect of styles. Proponents of this style focus their investigation on "the characteristic, self-

consistent mode of functioning, which individuals show in their perceptual and intellectual activities" (Witkin, Oltman, Raskin, and Karp, 1971, p. 3). Some of the areas of their studies include impulsivity-reflectivity (Kagan, 1958), and field dependence-independence (Witkin, 1973).

The second group is personality centered. The work of Myers and Myers (1980) which was based on Jung (1923), distinguished two attitudes (extraversion and introversion), two perceptual functions (intuition and sensing); two judgment functions (thinking and feeling), and two ways of dealing with the outer world (judgment and perception).

The third group is activity-centered, which tends to focus on styles of learning that have direct applications to classroom settings. The champions of this approach include Dunn and Dunn (1978), who grouped styles in terms of preferred elements in the learning situation such as various aspects of environments (sound and light) and the various aspects of interactions with self and others, namely, peers and adults. A similar theory that is more oriented toward career and work is that of Holland (1973), who proposed the realistic, investigative, artistic, social and enterprising styles on the job. These are styles and thinking processes that help individuals to function effectively in everyday interactions and activities. Students in higher learning require lots of thinking skills that will enable them cope with academic loads in school.

Thinking Style and Self-Esteem

Various studies point to the fact that thinking style relates well with different personality characteristics and academic performance. For instance, self-esteem has been found to be associated with interpersonal relationships (Chiu, 1987) and cognitive styles (Bosacki, Innerd, and Towson, 1997). Furthermore, it has been argued that thinking style is an interface between intelligence and personality. Sternberg (1994) demonstrated the relationship between personality, ability, the constructs of the mental self-government and

some measures of self-esteem. Results of the study supported the idea that the more effective thinking styles like legislative, judicial and liberal were significantly positively correlated with self-esteem. On the other hand, when the results were compared with the less effective thinking styles such as executive and conservative the findings did not completely support the hypothesis that self-esteem and the constructs of the mental self-government are strongly related but it did show some partial correlation. These findings suggest that the stronger the association of more effective thinking styles, the higher the self-esteem of students and the more students are motivated to learn and relate meaningfully with others or peers.

This of course may vary with different cultures; government set standards and various university goals. More over, the study was done with preadolescent youths in early stages of their educational formation. The expectation in the present study is to observe the correlations of the construct "mental self-government" via thinking styles in ways that affect mature students in the university setting to learning.

Thinking Style and Learning Approaches

Zhang and Sternberg (2000) explored the relationship between thinking style and approaches to learning. Research subjects consisted of students in various stages of their university studies ranging from undergraduate freshmen to graduate students from China (Hong Kong) and the United States. Regardless of their level of mental functioning (global or local), Hong Kong students employed both deep and surface approaches to learning. For the US sample the global thinkers indicated deep and achieving motivation, while the local thinkers used a surface learning strategy. The findings tend to suggest some cultural variations.

Sternberg's (1995, 1997) studies were concerned with describing and measuring characteristics and preferred modes of using abilities in processing information. Findings

suggested that styles are changeable and flexible according to tasks and that styles are mostly learned. The descriptions obtained from the two studies suggested that styles are concerned with underlying characteristics as well as measurable preferences and ways of processing information. Similarly, approaches to learning as described and measured by Biggs (1997a and b) and Entwistle, et al. (2000) are concerned with determining observable motives and strategies for learning. (Sternberg and Zhang, p.140).

The salient emphasis of the two authors (Entwistle and Biggs) lies in the distinction they made between the two approaches to learning. Deep approach is characterized as having an intrinsic motive, namely the genuine interest and commitment to thorough learning. In addition, surface approach, which is directed toward extrinsic intention that is studying for exams where the objective is solely to pass or to obtain a good grade.

Strategies in Effective Learning

Learning Preferences

The expression 'learning preferences' can be defined as the individual's propensity to choose, or express a liking for, a particular instructional technique or combination of techniques. Riechmann and Grasha (1974) identified three learning preference styles – dependent learners, collaborative learners, and independent learners. Dependent learners are individuals who tend to prefer teacher-directed, highly structured programs with explicit assignments set and assessed by the teacher. Collaborative learners prefer discussion-oriented classes and favor group projects, collaborative assignments and social interactions. Independent learners prefer to exercise influence on the content and structure of learning programs within which the teacher is only seem as a resource and a facilitator. Riechmann and Grasha (1974) findings suggest that students achieve their best of performance when they attend classes with teachers whose teaching style matches with their preferred style of learning. In other words, when students' learning preferences and thinking styles match that

of their teachers' teaching styles, students are encouraged in the pursuit of a particular learning approach and thinking style they are likely to adopt and perform in the best of their abilities.

Some studies indicate that certain students have preferences to learning environments or teachings that encourage understanding. A parallel finding further showed that other students adopt preferences to teaching environments that just encourage transmit of information and directs learning toward assessment requirements (Entwistle and Tait, 1990; Entwistle, McCume and Walker, 2001).

Learning and Performance

With regard to the SAL model the emphasis and its challenges have been for teachers to inculcate and encourage the approaches that foster advantages to individual learners in higher institutions. There are a number of studies suggesting various outcomes from the use of different subscales of the ASI instrument. Clarke (1986 used a modified version of ASI to predict the validity of the end-of-year assessments of students. Results showed that performance was better predicted by ASI subscales that addressed student motivation namely strategic approach and achievement motivation, than those favoring cognitive skills, as in the deep approach.

Bigg's and Entwistle's original theories are based on the three learning approaches namely deep, surface and achieving/strategic forming a three factor model. However, there are some researchers (Rowell, Dawson and Pollard, 1993; Wong et al. 1996; Watkins & Dahlin, 1997) who have suggested there are only two factors deep and surface. These researchers indicated that the achieving (strategic) subscales usually loaded on one of the other two factors or be divided between them.

Newstead (1992) presented correlations between ASI scores and academic performance for 2nd and 3rd year undergraduate students in psychology courses.

The findings suggested that the best predictor of academic performance was the achieving orientation for students in year 2 ($r = 0.33$; $p < .01$). Sadler-Smith (1996), in a study of undergraduates in a UK business school found low but statistically significant correlation between scores on the deep approach and on aggregate learning performance across twelve undergraduate modules ($r = 0.25$; $p < .01$). Watkins et al. (1991) in their study of Asian learners found a number of statistically significant correlations between approach and performance; the best predictor of learning performance was 'achievement motivation' ($0.24 < r < 0.33$; $p < .01$). The ASI apparently demonstrated some limited success in predicting learning performance. The use of the ASI in these studies indicated the strategic approach as the best predictor of learning. However, the ASI instrument has been criticized as limited in scope and hence several revisions of it have been made.

Age and Gender

Meyer, Dunne and Richardson (1994) argued that "gender differences constitute a potentially important and neglected source of variance in student learning which when detected in context, can and should be explicitly managed by academic practitioners" (p. 469). Yet there appears to be few studies in this regard. Richard (1995) compared approaches taken by mature and non-mature students and found statistically significant correlations between age and scores on the deep subscales ($r = 0.25$; $p< .05$) on a short form of the ASI. In the same study, age was negatively correlated with a reproducing orientation ($r = -0.35$; $p < .05$). Sadler-Smith (1996) found that mature students reported a 'deeper' approach than non-mature students, and vice versa for the surface approach (p. 376). Males reported a 'deeper' approach than females but that did not seem to confirm a clear advantage in terms of any measures of learning performance.

On the various subscales of the ASI there were some variations in learning approaches by gender. For instance, Clarke (1986) found that females scored higher than

males on the fear of failure subscale. However, on another study by Miller, et al (1990) females scored higher than males on relating ideas, a subscale that contributes to deep approach. These contrasting findings suggest that there has not been a consistent result on how males and females apply themselves on learning approaches.

In a cross-cultural study, Zhang (2000) examined the role age and gender play in the approach students from United States and China adopt in their learning. The research found that for the U.S sample, age was a good predictor of achieving approach. For the Chinese sample, age was identified as a good predictor of achieving approach, and gender was a good predictor of deep approach. In general, the results demonstrated that the older the participants the lower their achieving scores for both the U.S and Chinese samples. Among the Chinese sample, males scored significantly higher on deep approach than their female counterparts.

The differences in scores for the U.S population were not reported. The studies reviewed in this section suggest that age and gender may have some relationship with the approach students adopt in their learning in different cultures and nations.

Motivations and Approaches to Learning

The relationships between motivations and approaches to learning have also been explored in some studies. Entwistle, Kozeki, and Tait (1989) investigated this relationship among students in Britain and Hungary. Their findings suggested that the quality of long-term learning ultimately determines success in learning. This view was supported by the idea that task persistence is an important characteristic accounting for progress in learning (Carrier & Williams, 1988; Pressley, Goodchild, Fleet, Zajchowski, and Evans 1989). To be successful in learning, students have to be motivated as well as persevering in their pursuit of learning and that could be modified by specific context.

In a study by Pressley et al. (1989) the three domains of school motivation namely affective, cognitive and moral were studied in relation to study orientations of meaning, reproducing and achieving and also student's perception of their learning environment. Each domain showed significant relationship with learning approaches. Their finding supported Entwistle, Kozeki and Tait (1989) for both Britain and Hungarian students, there were indication of associations between school motivation and learning approaches.

In a comparable study Ramsden, Martin and Bowden (1989) reported learning approaches of final year secondary school students. The highest correlations at individual level were deep approach and independent learning; surface approach showed relationship with structure and cohesiveness, and strategic approach related with emphasis on formal academic achievement.

Learning style has been variously explained in different research and academic literatures, and some results suggest individual differences in the way information is perceived, processed and communicated (Campbell, Campbell and Dickinson, 1999). Styles in a way tend to reflect lessons learnt from experiences and instincts.

It is important for students to know how to assess themselves with regard to their learning styles. Assessment will help them to discover their strengths or weaknesses with regard to learning styles and adopt the best strategy in educational endeavors. Students process information in unique ways. Hence, self-understanding is one of the key ways of understanding, communicating and learning within groups in various settings. The learning approaches individuals adopt reflect their preferred style and awareness of one's most effective approach could facilitate learning and success in education.

Idiosyncratic Paradigm of Learning

McCune and Entwistle (2000) focused on individual peculiarity in approaches to learning using a paradigm of longitudinal research. The study generally suggested that a

student's development tends to be highly influenced by a complex and idiosyncratic combination of experiences, abilities, attitudes, motivations and beliefs. The findings, further pointed to the fact that there are other factors influencing certain student's learning styles. For instance, one of the participants in the study used the word 'fighter' as describing a crucial and persistent way of achieving success in learning.

The goal for such a student is never to give up until success is achieved. However, it may not be possible to have an over all model to describe the mirage of students' idiosyncratic influences in their learning and development.

In another study by Beauty, Dall'Alba and Marton (1997), a detailed case study was presented on development of students' perceptions of learning. Findings in that study suggested that although students' learning could be represented by a system of categories describing their conceptions, there were also considerable idiosyncratic strings running through each individual case. The studies by McCune, et al (2000) and Beauty, et al (1997) presented not only a consistency in approaches to learning but also drew attention to the influence of individual personality and past experiences. Moreover, it suggested that while some students come into higher learning with well established views of their strengths and weaknesses, favorable susceptibility to advice on studying, others are much more unstable, and may take more time to develop effective skills for academic rigors. On the whole, the study emphasized giving effective advice, which ideally should take into consideration student's idiosyncratic characteristics, the dynamic aspects of studying, the specific course content, and the context that envelop the students' learning environment.

From the early days of the development of the ASI the concepts of deep and surface approaches have been evolving. The surface approach was designated as 'narrow orientation' (Harper and Kember, 1989). In addition, it has been variously called 'operation

learning' (Watkins, 1982, p. 80), and 'disorganized study' (Ramsden and Entwistle, 1981, p. 372).

These concepts, and their implications for successful academic performance, apply differentially to individual students at various stages of learning. In line with this, the present study will assess university students at two levels of learning.

Student Approach to Learning (SAL) and Information Processing (IP) Models

In an effort to better understand the concepts involved in idiosyncratic learning, there is a need to closely examine the theoretical underpinnings of SAL and IP theory. The later is often referred to as a top-down theory that derived from cognitive psychology to interpret how students learn. It tends to portray the learner as a mere receiver and has been criticized as being "too narrow on the study processes of students as if studying took place in a vacuum" (Entwistle et al., 1988, p. 264). Theorists in this leaning tend to ignore the context of learning. They emphasize the eccentric details of students' learning and the complex effects of the differing learning environments.

To address the lack of personal contextual variables of SAL theorists proposed the bottom-top perspective. Proponents of this theory (Marton, Enwistle, Biggs, etc) emphasized the input that students bring to learning in applying different styles. In so doing the SAL approach takes a serious look at the context of learning, including institutional and community systems (Biggs, 1993). The approach, even takes into consideration the input of government at various levels of education. However, this approach sometimes may not clearly filter cultural biases in individual learning processes.

Marton and Saljo (1976) presented an impressive qualitative analysis of approach to studying that yielded two categories of evaluating students' study behaviors resulting in what is termed the Deep and Surface approaches to learning. These two approaches to learning were further emphasized in later studies with larger samples (Biggs, 1987; Entwistle and

Ramsden, 1983). These studies reveal the fact that students make various efforts depending on the context and intention of their studying hence they bring something with them to learning in their unique stylistic ways of processing information. Consequently, "the approach to learning a student adopts reflects the interaction between characteristics of the individual student and the context and content of the particular learning" (Watkins and Akande 1994, p. 167). Fundamental to the SAL premise is the integration of these characteristics and also the fact that students have different rationales for studying which affect their strategies for learning.

Following the two categories involved in learning as proposed by Marton et al. (1976), a third approach was proposed and adopted by Biggs (1987) as "achieving approach" while Entwistle (1983, 1987) called it strategic approach. The approaches adopted by Biggs and Entwistle measure similar constructs in learning. The strategic approach is based on "achievement motivation" and focuses on strategies students believe will lead to obtaining higher results (good grades) in school. Thus, "high grade-oriented students concentrate on the material that they believe will be on the examination, where as low-grade oriented students tend to study materials in a broader sense" (R. J. Rose et al. 1996, p.165). The impression that low grade-oriented students study broadly may rarely happen however, and if they do, it may not reflect profound understanding. This leads to the three ways of looking at the SAL model (deep, surface and strategic) that have been widely applied in research, especially in the western world. However, there are some subtle distinctions that have been made with regard to the three approaches; the achieving approach is seen as context dependent, whereas the deep and surface approaches are related to the general cognitive processes of coding and rehearsal respectively. Put simply, while the strategic approach is context dependent, the deep and surface approaches are related to the general cognitive processes of coding and rehearsal, respectively.

Furthermore, while it can be asserted that the deep and surface approaches tend to be mutually exclusive, the strategic approach can coexist with both the deep and surface approaches. Thus, it is important to note that approaches to learning may contain elements of both "individual stability" and "contextual variability".

The inventories used in this study are assessment tools aimed at sorting out students' individual differences and their gradual academic improvement over time. For the most part, emphasis has been laid on the importance of developing deep approach as a better skill for academic success (Biggs, 1993, Entwistle, 1995). "The core aspect of a fully developed deep approach is the intention to form a personal understanding of the topic under study, this is then combined with a range of conceptually related learning understanding processes" (McCune and Entwistle, 2000, p.3). The adoption of such learning processes is characterized by "active engagement" and "interest" in the different areas of study.

There has also been emphasis on the application of the construct of self-regulation to effective learning. From this perspective self-regulation considers learning as the ability to plan, direct and select relevant information processing activities. Boekaerts (1997) found that encouraging students to accept the primary responsibility for controlling their studying, rather than relying on teachers to direct their learning, led to a more effective learning. Students who are aware of their styles of learning will be able to better organize and apply themselves in educational process. Given the various findings on the relationships between learning approaches and thinking styles that affect individual processing of information at different stages of intellectual formation, there are still many questions unanswered from the above literature review. Such unanswered questions include: How does the Nigerian university student study? Do they apply complex or simple styles in their learning? What thinking styles

do they have and how are the thinking styles and learning approaches, related in their academic endeavor.

CHAPTER 3

METHOD

Population

The population for this study consisted of undergraduate students in Nigeria. Specifically, the study focused on two Nigerian universities, Federal University of JOS (FUJO) in Plateau state and Federal University of Port Harcourt (FUPH) in Rivers state. The universities are located in the two major geographic regions of Nigeria: 1) Northern region (FUJO) and Southern region (FUPH). The number of undergraduate students in FUJO was approximately 13,000 with 3,000 students in the 1st year and 2,500 in the 4th year. The approximate number of students in FUPH was 12,000 with 2,000 students in the 1st year and 1,300 in the 4th year (see Table 3.1).

Table 3.1

Students available for sampling by university, gender and level

	FUJO		FUPH		
Level	Male	Female	Male	Female	Total
100	1500	1500	1000	1000	5000
400	1250	1250	650	650	3800
Total	2750	2750	1650	1650	8800
Total	5500		3300		

These schools were chosen because of their federal character. In Nigeria, the federal government owns and operates federal universities, and they usually have the most experienced and qualified teachers. Federal institutions of higher learning also select students to fairly represent various parts of the country. FUJO has more students from the Northern region and FUPH has more from the Southern region.

Consequently, the goal of having equal number of participants from these universities was aimed at obtaining a representative sample of Nigerian students for the present study.

Students Available for Sampling

The students available for sampling were undergraduates in their 100 or 400 levels (first or fourth years). Focusing on this set of students was intended to allow examination of the relationships between stages of training and approaches to learning and thinking styles students may adopt. The available students included the broad range of fields of study among university students so that the relationships between approaches to learning and thinking styles could be examined based on choice of field of study (science and non-science). Finally, this set of students had approximately equal number of males and females, allowing for an examination of the relationships between approaches to learning and thinking styles based on gender.

Participants came from different fields of studies ranging from Arts, Architecture, Education, Counseling, Engineering, School of Business, Pharmacy, and Linguistics to Social Sciences. Indeed participants included students from natural sciences, social sciences, education, languages, political sciences and Engineering.

Students were required to fill background information with demographic data covering gender, field of study, level of study and the university where they are studying as part of the questionnaires.

Planned Sample and Selection

The original intended sample size of the study population was 640 participants; 320 participants from FUJO and 320 from FUPH. Table 3.2 shows the demographic breakdown of the sampling design.

Table 3.2

Planned sample by university, gender, level and field of study

		FUJO		FUPH			
Level	Field	Male	Female	Male	Female	Field Total	Level Total
100	Science	40	40	40	40	160	320
	Non-Science	40	40	40	40	160	
400	Science	40	40	40	40	160	320
	Non-Science	40	40	40	40	160	
Total		160	160	160	160	640	
Total		320		320			

Instruments

Two instruments were used for this study: The Thinking Style Inventory (TSI) and the Approaches to Study and Skills Inventory for Students (ASSIST). The ASSIST is the latest version of ASI, which overall presents better results and much more comprehensive evaluation. There is a common understanding that theories of thinking and learning styles point to a common goal of explaining individual differences in performance that are not explained by abilities (Sternberg, 1994). By design, the two theories postulate similar theoretical constructs on ways of thinking and ways of learning. Hence, Entwistle's theory of learning and Sternberg's theory of mental self-government suggest two types of mental functioning namely complex and simple. These two inventories operationalize students' dispositions to adopt specific approaches to learning within their normal academic studies. Both instruments were available in long and short forms. The short forms where used in this study because: 1) They are the versions most often cited in the research cited in this study, and 2) It was desired that the combined survey instrument not be excessively long.

Thinking Style Inventory (TSI)

The TSI measures the 13 subscales of thinking styles in Sternberg's theory of mental self-government. The instrument has two versions: the long form and the short form. In the long form, each subscale has eight items resulting in a total of 104-item questions. There are 65-items in the short form with five items in each subscale. In the present study, 10 of the 13 subscales were used under two broad categories of:

1) Complex Thinking Styles: Legislative, Judicial, Liberal, Global, External;

2) Simple Thinking Styles: Executive, Monarchic, Conservative, Local, Internal.

The 10 subscales for this study are referred to as The Modified TSI (TSI-M) and have 50 items. Sample items of the two instruments are found in (Appendix I). The five items in each summated subscale were scored on (5-35), while each scale (complex or simple) was scored on scales of (25-175).

The modified TSI (TSI-M) had sample 50 items as shown in (Appendix F). The TSI inventory is scored on a seven-point Likert scale with 1 as the least that describes the student and 7 as the most that describes the student on each of the item of the inventory from (1 = not at all well to 7 = extremely well). Thus, each subscale has possible scores of 5 to 35. Complex thinking style and simple thinking style have scales of 25 to 175.

Reliability of Thinking Style Inventory (TSI)

The TSI (Sternberg and Wagner, 1992) was normed with various age groups in the long version of the inventory. Initial research was carried out with the long form of the inventory with TSI to assess its reliability and validity. The study (cited in Sternberg, 1997, p.125) was done with college students with a sample of 75 participants. The 13 scales of the thinking style inventory were found to have internal consistency reliability that ranged from .57 to .88 with an average of .82. Only one subscale had reliability in the .50s, two in the .60s and one was in the .70s. The rest were in the .80s.

In another study, Sternberg (1994) presented research on a five- factor model that corresponded with the five dimensions of the mental self-government theory. The analysis of the study showed that the factors accounted for 77% of the variance in the data.

Studies with students from US, Chinese, and Hong Kong Universities have used the TSI short version and results showed that the instrument is reliable and valid in identifying thinking styles of University students. For example, Zhang and Sach (1997) found reliability indices that ranged from .53 to .87 among the thinking styles. Overall, these studies (Sternberg, 1994, Zhang & Sach, 1997) produced reliability indices indicating that the TSI instrument tended to be a consistent. Guilford (1956) argued that a test is internally consistent when the value of the reliability coefficient is around 0.7.

Validity of TSI

Sternberg (1994b) presented an initial study to assess validity of the TSI. In some of the studies done with the instrument correlational indices ranged above .50 in absolute values suggesting good validity suggesting that TSI was measuring the construct it was designated to measure. For example, global with local (-.61), liberal with legislative (.66), conservative with legislative (-.50), conservative with executive (.59), liberal with conservative (-.60). These results indicated that global and local are negatively associated as well as conservative and legislative. Additionally, legislative and liberal styles are associated, as do the executive and conservative. These findings support the investigation of the groupings of complex and simple thinking styles in the present study. The validity indices further indicated that the thinking style instrument is measuring in the direction of the constructs it is supposed to validate.

In another study, Zhang and Sternberg (1998) tested the validity of the TSI through an interscale correlational matrix with executive and conservative styles, internal and

external thinking styles and found that the scales in general correlated in the predicted directions.

Approaches and Study Skills Inventory for Students (ASSIST)

The original inventory of ASSIST consists of four sections. The first section is a six-item measurement of the student's conception of the meaning of learning and was not used in the present study. The second section consists of 52 items designed to measure approaches to learning. According to the author, the items consist of statements made by university students when asked what they would normally do in their learning processes. In response, participants usually indicate their relative agreement or disagreement with comments about studying on a 5-point scale (5 = agree; 4 = agree somewhat; 3 = unsure; 2 = disagree somewhat and 1 disagree). The instructions require participants not to mark number 3 (unsure), unless they really have to or if the statement does not really describe their learning circumstance. A modified form with 36 items, corresponding to the nine main subscales of ASSIST was used in the present study.

The third section of ASSIST consists of eight questions measuring preferences for various forms of teaching and learning. Students are required to indicate the extent to which they like different types of lectures, exams, courses and books on a five-point scale.

This section is meant to extract two factors, supporting understanding and transmitting information, that are meant to correspond with deep and surface approaches to learning. This section was also used in the present study.

The fourth section of ASSIST requires students to rate themselves on how well they think they are doing in their over all assessed academic work to date on a nine point scale (9 = very well to 1 = rather badly). This section was not used in the present study.

The present study utilized the second, and the third sections of the ASSIST instrument, referred to as the modified ASSIST (ASSIST-M), which focused on measuring

the three approaches and preferred student's style of learning. The 36 items from section 2 were used to assess the three different ways of learning: deep, surface apathetic and strategic approaches. Each of the three (scales) approaches has three subscales with four item questions. Thus, scores in each subscale ranged from 4 to 20, while the scales (deep, surface apathetic and strategic) ranged from 12 to 60. The complete items of the combined instruments are listed on (Appendix F).

Reliability of ASSIST

As a new instrument for measuring learning approaches, the ASSIST appears to be in use in on-going studies. Published research done with this instrument has shown appreciable reliability indices.

Entwistle (2000) in explaining the scoring key for the ASSIST instrument stated, "The first three subscales in each approach are most consistently related to each other, and can be combined with confidence" (p. 1). There are two subscales, however, that showed somewhat lower reliability indices. Entwistle's (2000) internal consistency reliability (Cronbach alpha) results for the nine subscales of interest were: Deep approach (seeking meaning-SM = .57, relating ideas-RI= .59 use of evidence-UE= .53), Surface apathetic approach (lack of understanding-LU = .57, lack of purpose LP = .76, Syllabus boundedness-SB = .55), Strategic approach (organized studying-OS= .54, time management-TM = .68, monitoring effectiveness-ME = .62). In each of these subscales there are four item questions. The reliability indices of the scales were 84, .87 and .80 for Deep, Surface apathetic and Strategic approaches respectively.

Diseth (2001) produced reliability indices of 0.81, 0.70 and 0.81 for the deep; surface apathetic and strategic approaches respectively. The subscale reliability indices were as follows: Deep approach (SM = .49, RI = .62, UE = .49); Surface apathetic (LP = .68, LU = .57, SB = .57); Strategic approach (OS = .59; TM = .72; AD = .41). In all these studies

ASSIST demonstrated reliability in measuring the constructs of deep, surface and strategic approaches to studies among university students in different countries.

ASSIST (Entwistle, 1998) has been validated by various studies to have adequate and consistent psychometric properties. A recent study by Entwistle et al. (2000), of university students from Britain and South Africa resulted in reliability indices of 0.84, 0.80 and 0.87 for the deep, surface apathetic and strategic approaches respectively. They followed the expected pattern of response to approaches to learning

Validity of ASSIST

McCume and Entwistle (2000), used cluster analysis to analyze a large sample and found consistent subscales loading on the three scales of deep, surface apathetic and strategic approaches. Findings from the two techniques of analysis (factor analysis and cluster analysis) suggest that the instrument is measuring the constructs it was designed to assess.

Cultural Influences

There is also an issue of cultural equivalence with instruments designed in one culture and used with students in a different cultural background. In the present study, it may raise some concerns to apply two instruments developed and normed with British and American students to assess the approaches to learning and thinking styles of Nigerian University students. However, Berry (1989) brings up the concept of 'emic' and 'etic' approaches to research. The emic approach explains that using what is found within one culture by associating it with the tradition of another culture. On the other hand, the etic approach tends to adopt or impose concepts of one culture onto another as if they are universals. The etic understanding may likely posit some problem in research. As a result, Triandis (1972) particularly warns against what he calls 'pseudoetic' research. It is important

to test the validity of an instrument designed in one culture for a study in another culture before generalizations can be inferred from the results obtained from such research.

Analysis

The data analysis was performed using SPSS version 12 software package. Factor analysis and correlational procedures were applied. After performing and obtaining descriptive statistics information on the two instruments the following tests were carried out: factor analysis and Pearson's correlation. First the responses of participants were coded, followed by the calculation of item-scale correlations to determine the suitability of items for inclusion in the analysis. Next was to estimate the internal consistency of each of the 9 subscales and 3 scales of ASSIST, followed by the 10 subscales and 3 scales of TSI using the Cronbach alpha.

Factor analysis and internal consistency reliability were used to determine if items loaded on subscales as claimed by the instruments. Also factor analysis and internal consistency reliability were used to determine if scales items loaded as claimed.

Factor analysis was used to determine if the subscales reflect loadings on their corresponding scales. The factor analysis performed was to establish whether the patterns of responding across subscales and scales were consistent with the assumptions of the theories of learning approaches (Entwistle, 1983, 1998) and mental self-government (Sternberg1997, 1998). In doing that, the focus was on examining how seeking meaning, relating ideas and use of evidence relate to deep approach; lack of purpose, unrelated memorizing and syllabus boundedness relate to Surface apathetic approach as well how consistent is organized studying, time management and alertness to assessment demand with strategic approach. The same procedure was also applied to complex and simple thinking styles with their corresponding five subscales as proposed in this study. However, there were some indications the scales did not come out in two factors but three factors in

the TSI-M. Two of the factors showed same characteristics of complex and simple thinking styles while the new factor was a combination of both thinking styles. The factors were labeled as Liberal thinking, Independent thinking and Structural thinking. These labels reflected the meanings associated with thinking styles in the mental self-government constructs. The resulting scales were intended for checking the meaningfulness of correlating learning approaches with thinking styles.

The reliability of the three learning approaches in the ASSIST and the three factor scales of the TSI were estimated by Cronbach's alpha coefficients. The internal consistency of each of the two inventories was examined through the relations shown in their respective intercorrelational matrix structures.

There were also estimations of the dimensionality on both subscale and scale levels to determine the integrity of each subscale and scale in the two instruments. Some items were dropped and the resulting reliabilities improved the strengths in the subscales as well as scales of the instruments.

Finally, the scores from the three scales of Approaches and Study Skills Inventory for Students were correlated with the three factor scales (Liberal thinking, Independent thinking and Structural thinking) of Thinking Style Inventory.

Pearson's product moment correlation coefficient was used to determine how thinking styles (Liberal thinking, Independent thinking and Structural thinking) correlated with learning approaches (deep, surface apathetic and strategic), with the scales of the ASSIST providing one set of variables and those of the TSI providing another.

Finally, a test described by Sheskin (1997) – test 22c on pages 561-563 was applied. It is a test for evaluating hypotheses on whether there are significant differences between independent correlations. The test involves finding the Fisher transformed value of each of the (Pearson r) correlations, and taking the difference of the transformed values. The result

gives a z, which is then evaluated to see if it is statistically different from zero. This procedure was used in comparing Liberal thinking, Independent thinking and Structural thinking with Deep approach, Surface apathetic approach and Strategic approach based on males and females, 100 and 400 level students as well as science and non-science students, and students' preferences namely Supporting understanding and Transmitting information.

Determining if the difference between two Pearson correlations is significant requires the use of a transformational procedure, described in Sheskin, (1997) p. 561-563. This procedure requires the use of two tables (from same book), Table A1, Table of normal distribution (p. 670-674) and Table A17 – Table of Fisher's z_r, Transformation (p.706).

The procedure is as follows: The Fisher transformed z value is found from Table 17 for each of the correlations to be compared. The difference of these z values is then divided by SQRT $[1/(n_1 - 3) + 1/(n_2 - 3)]$ where n_1 and n_2 are the sample sizes for the two correlations. The resulting z value is then referred to Table A17 to determine its significance level. In practice, Table A17 is somewhat coarse, requiring that the z_r 's be found by linear interpretation between table entries. An excel spreadsheet was set up for this purpose. Entries in the spreadsheet included the correlations to be compared and the corresponding sample size, the correlation in Table A17 that corresponded to the correlation entries just below and just above the target correlations. The spreadsheet then calculated the interpolation z value for each correlation, formed the numerator as the difference, formed the denominator from the sample sizes, and perform the required division. The significance of the resulting z value was determined from Table A1 and entered into spreadsheet.

Special notice needs to be taken of the fact that a large number of correlations are being computed, compared and tested for significance. As such, it was necessary to make an adjustment to the alpha level to guard against inflation of the type-1 error rate. A

commonly accepted approach is to apply Bonferroni's correction, in effect dividing the nominal alpha level by the number of tests of significance to be made to obtain the corrected alpha level to be used in making judgments of statistical significance. In the present research, the nominal alpha level was originally set at .05 and the corrected alpha level was .05/36 = .00139. This correction was used in determining significant results. The overall results are displayed in Appendix G, a table of significance or non-significance of the relationship between thinking styles and approaches to learning.

Figure 3.1

For all participants - check of correlations matrix for TSI-M

	Exe	Mon	Con	Loc	Int	Leg	Jud	Lib	Glo
Exe									
Mon									
Con									
Loc									
Int									
Leg									
Jud									
Lib									
Glo									
Ext									

The correlations are examined by looking at the lower vertical matrices of the entire grid as shown in Figure 3.1. Figure 3.2: LA and TS – Testing results of the correlations of the originally intended scales matrices as shown in the highlighted grid. Whereas the original research hypotheses required examination of six correlations as presented in Figure

3.2, the reversed research hypotheses required examination of nine correlations as shown in Figure 3.3. Testing the hypotheses of the research questions are now on a 3 x 3 matrices instead of the originally proposed 2 x 3 matrices. The matrices are highlighted in both Figures 3.2 and 3.3.

Figure 3.2

LA and TS: check for correlation scales matrices as in original design

		DP	ST	SA	CTS
12-60	DP				
12-60	ST				
12-60	SA				
25-175	CTS				
25-175	STS				

Figure 3.3

LA and TS: check for correlation of scales matrices of the actual study

Range		DP10	SA10	ST6	LT	IT
10-50	DP10					
6-30	ST6					
10-50	SA10					
14-98	LT					
9-63	IT					
9-63	STR					

Actual Sample and Collection Procedure

Approximately five school days were allotted to each of the universities for the administration of the instruments. The first three days in each school focused on the first year students with another two days for the fourth year students. However, it took 16 school days to complete data collection and the total numbers of participants were 810 students.

The period for the administration of the instruments was April 20 to May 10, 2004. This period fell in the first quarter of the second semester. The first semester examinations for the two universities were conducted in the month of February, for this was an appropriate time to examine the natural disposition of students toward learning and their thinking styles, as they were not under the pressure of exams and they were much more available to respond to the inventories. As a result, the data that was collected is more likely to reflect the natural inclination of the students had with regard to the learning and thinking styles they apply in their University education. That is likely to give some indications on whether they do possess intrinsic motivation to learn or just to pass the exams.

After permission was obtained from the authorities of the two universities, the principal investigator went to different classes of the first and fourth year students. Copies of permission letters from the two institutions are provided in Appendix C. With this letter, the principal investigator went to the different class periods of the first and fourth year students. At the end of a lecture, the instructor introduced the researcher (after reading the permission letter) to the students and permitted him to explain his research project to the students. The investigator then read the recruitment script (Appendix D) to the students followed by the administration of the questionnaires. The script explained the purpose of the study, the tasks involved and that participation in the study was voluntary. Participants could withdraw from the study at any time. At that point, the investigator asked for volunteers by show of hand

and asked them to remain seated while non-volunteers left the classroom. The actual sample obtained is described later.

The Questionnaires were numbered 1 – 202 for level one, students and 203–405 for level four students with corresponding university FUJO or FUPH. The participants for this study were provided with inventories and pencils. They were asked to rate themselves on Likert scales to each of the questions as it related to them. The principal investigator informed the participants to read the opening instructions in each inventory before attempting to respond to each item of the questionnaire. At that point, they were invited to ask questions if there was anything they did not understand on the instructions.

Participants were then given the information sheet, which explained the following issues: purpose of study, procedure, benefits, confidentiality and voluntary participation to the study (Appendix E). It was followed by the distribution of the questionnaires. The next step required each participant to circle his or her identifier (FUJO, FUPH), gender (Male, Female), field of study (Science, Non-science) and level (100, 400) of study in the demographic data section of the questionnaires.

The data were collected from the two instruments in a single session using a combined instrument (Appendix F), one, after the other. The TSI-M was administered first (because it had a few more items) followed by the ASSIST. The allotted time for each instrument was approximately 30 minutes. The participants were reminded and encouraged to answer all questions in each inventory for their responses to be relevant in the study. Participants were further told where to drop off the questionnaires in the classroom when completed and that the investigator would come back to pick them up in about an hour. The investigator and instructor then left the classroom.

The actual total sample size collected in the two universities was 810 with approximately equal sample proportions from each University in terms of gender, level and

field of study. The final sample size came down to 738 (as a result of incorrect data entries by some participants) at the end of data screening. This sample size (738) became the actual and overall sample size used in the rest of the analysis.

CHAPTER 4

RESULTS

The two instruments (ASSIST-M, TSI-M) used (in a combined form) in the current study have not been reported in any study with Nigerian university students. Consequently, it was one of the aims of the present study to investigate the validity and reliability of the instruments with the Nigerian population by examining the subscales and scales for both instruments. Results of the data screening process are presented first, followed by the reliability and validity results for each instrument. Finally, the correlations between the two instruments needed to answer the research questions are presented.

Data Screening and Preparation for Analysis

There were 810 surveys administered at the two universities in Nigeria – FUJO and FUPH and the items and dates entered into a spreadsheet. That means 810 subjects participated in the study. The surveys were anonymous. They were administered and collected in a given sequence of numbering in order that they could be tied back to a spreadsheet. The sequence numbers and all participant responses were subsequently keyed into the spreadsheet and double-checked. Details of the demographic responses were coded as numbers in the following format:

School:	1 = FUJO	2 = FUPH
Gender:	1 = Male	2 = Female
Faculty:	1 = Science	2 = Non-science
Level:	1 = 100	2 = 400
Age:	1 = 18-25	2 = 26 and above

After careful examination of the data, five surveys were found to have no demographic data at all and were discarded leaving 805 surveys with complete demographic details. All data from the 805 surveys were transferred to SPSS version 12 for further

analysis. TSI-M items were labeled T1 through T50. ASSIST-M items were labeled A1 through A36. Preference to learning (PTL) items from the ASSIST-M was labeled P1 through P8.

Responses for the TSI-M portion of the instrument were coded from 1 = Not At All Well, to 7 = Extremely Well with valid responses of 1, 2, 3, 4, 5, 6, 7. Responses to the ASSIST-M and PTL items were coded from 1 = Disagree to 5 = Agree with valid responses of 1, 2, 3, 4, 5. Missing responses for all items were coded as 9.

When descriptive statistics were run for each variable, only one variable (T50) had responses from all 805 participants, but most had a high number of responses. Overall there were high responses from the participants, with 513 cases responding to all items. Twelve data entry errors were detected by out of range values and corrected. Of the 94 items (TSI-M = 50; ASSIST-M = 36; and PTL = 8), 43 had 800 or more valid responses. Details are shown in tables 4.1 and 4.2.

Table 4.1

Summary table for TSI-M valid N for 805 Cases

Var	N	Var	N	Var	N	Var	N	Var	N
1	800	11	800	21	793	31	801	41	793
2	801	12	795	22	800	32	796	42	798
3	802	13	799	23	795	33	796	43	797
4	800	14	801	24	802	34	798	44	800
5	801	15	804	25	797	35	792	45	801
6	788	16	801	26	794	36	793	46	802
7	792	17	795	27	798	37	798	47	802
8	797	18	801	28	794	38	801	48	804
9	790	19	786	29	799	39	789	49	803
10	797	20	789	30	798	40	799	50	805

Table 4.2

Summary table for ASSIST-M valid N for 805 Cases

Var	N	Var	N	Var	N	Var	N	Var	N
1	802	10	790	19	804	28	795	PA	802
2	804	11	803	20	797	29	798	PB	802
3	803	12	793	21	798	30	799	PC	796
4	791	13	798	22	794	31	797	PD	801
5	802	14	802	23	802	32	799	PE	802
6	795	15	800	24	799	33	796	PF	802
7	799	16	803	25	788	34	798	PG	803
8	799	17	804	26	792	35	800	PH	803
9	800	18	802	27	797	36	802		

To help locate missing values, the 21 subscales of the combined instruments (10 for TSI-M, nine for ASSIST-M, and two for PTL) were computed as summated scales. The 10 subscales for the TSI-M were added to form a total score, as were the nine subscales for ASSIST-M and the two subscales of the PTL. These three total scores were then added to form a single score. Since these computations failed to take place for any particular case if a required data point was missing for that case, the final single score was used to identify cases that were incomplete, and the various subtotals helped identify where the missing data was located.

This analysis showed 513 complete cases and 292 cases with one or more data points missing. While the percentage of cases with missing data seemed to be large (36.27%), the amount of data missing was not. The total number of missing data points were 637 out of 75,670 (805 subjects x 94 items) or 0.84%. Of these, 13 cases were missing six or more data points (representing 138 data points in all) and 279 cases were missing five or less (representing 499 data points in all). Table 4.3 shows details of the distribution of missing data.

Table 4.3

Frequency distribution of missing data points in N = 292 incomplete cases

Items per case	Cases	Cum cases	Data points[1]	Cum points
1	154	154	154	154
2	65	219	130	284
3	35	254	105	389
4	15	269	60	449
5	10	279	50	499
6	3	282	18	517
7	1	283	7	524
8	2	285	16	540
9	2	287	18	558
10	1	288	10	568
11	1	289	11	579
15	2	291	30	609
28	1	292	28	637

(1) (Items per case) x (number of cases)

Imputation of missing data

Decisions about dropping cases or imputing data require investigator judgment based on a combination of examination of the empirical data and consistently applied criteria. As shown in Table 4.3, the frequency of cases with missing data dropped off sharply at six or more missing items per case. Five missing items represented only 5.3% of a participant's data (5 out of 94 items), so limiting imputation to cases with five or fewer missing responses ensured that the overwhelming percentage of the data used in subsequent analysis was as provided by the participants. The ASSIST-M subscales are based on four items. If a participant failed to answer two items for a particular subscale, this represented half of the information, and it was deemed unreasonable to impute the missing half from the provided half. It seemed therefore that a reasonable rule to adopt for imputing

missing data was to only consider cases that were missing five or fewer data points and were not missing more than one data point for any one of the 21 subscales. On this basis, 31 cases were dropped, including the 13 cases with six or more missing data points, and 18 cases that were missing five or fewer data points, but two or more on at least one subscale. This brought the number of potentially valid cases down to 774 (805 – 31), and the number requiring data imputation to 261 (292-31).

It was then decided that the least biased way to impute data for the instruments was on a combined case and subscale basis in order not to change the average response for each participant to the set of items making up a particular subscale. Thus, the missing value was imputed with the mean of the other values supplied by the participant for that subscale. In order to accomplish this, another spreadsheet was prepared listing all 261 cases to be imputed and all 94 variables, organized by subscale. Each subscale group included a column for computing the mean. The computed mean values were allowed to be real decimal numbers rather than being forced to be integers in order to ensure that no bias was introduced due rounding. These values were subsequently entered into the SPSS data file and the cases marked as having been imputed.

Outliers

Once imputing was completed, the search for outliers followed. Since this was a survey data with Likert Scale items, outliers were relatively meaningless on an individual variable (item) basis. Moreover, as the defined subscales have either five (TSI-M), or four (ASSIST and PTL) items each, univariate outliers were unlikely to be obvious, or even meaningful, as their summated subscales ranged from 5 to 35 for TSI-M and 4 to 20 for ASSIST and PTL. However, when the total summated score was considered as a single variable, the TSI-M score ranged from 50 to 350, the ASSIST-M score ranged from 36 to 180 and the grand total of all 94 items ranged from 94 to 562. Based on these summated scores, the only obvious

univariate outlier was a case with a grand total score of 94, indicating that the individual had given the same response (coded 1) to every item in the survey. This was obviously inconsistent with the other 773 potentially valid cases and inconsistent with the design of the instruments, which anticipated at least some differential response between subscales for a given participant or group of individuals. Indeed, such a response pattern suggests that the participant probably did not actually read or respond to the items.

By extension, anyone giving the exact same response to every item, regardless of the level of the response, may reasonably be assumed not to have responded seriously to the survey. What such cases have in common, regardless of the level of constant response, is zero or very small variance. Thus for each case, the mean and standard deviation were computed for the 50 items of TSI-M, 36 items of ASSIST-M and 8 items comprising the PTL. Cases with standard deviations of 0.50 or less were regarded as potential constant responses to be dropped. Cases with large standard deviations were also detected as representing a possible extreme response pattern. For the TSI-M, with items on a 7-point scale (1 to 7), cases with a standard deviation approaching 3.00 had means of approximately 4.00. On inspection, it was verified that these cases tended to have mostly extreme scores (1 or 7) and in fairly balanced numbers. These cases were difficult to identify as outliers on this basis, however, as the validity of the response set may depend on the pattern of response. Since a decision to drop cases with 'unfavorable' patterns and retain those with 'favorable' patterns was likely to be biased, this was not done.

A 'perfect' theoretical response pattern might consist of all 1's and 7's if certain thinking styles absolutely applied to an individual and others absolutely did not, and if the participant had responded to the appropriate items in a completely consistent way. In practice, both of these are highly unlikely. Given that the items for each subscale are not adjacent and not distributed in a regular pattern, it is unlikely that a subject would have a

response set with a regular, identifiable pattern, such as (1, 7, 1, 7, 1, 7...) or 25 1's followed by 25 7's, etc. The problem is that there are a very large number of such possible patterns, and no practical way to screen for them. This leads to multivariate outliers.

To identify potential multivariate outliers, a linear regression was performed on the TSI-M items using the 50 items as independent variables and the case numbers as the dependent variables. Mahalanobis Distances (MD) were computed and saved for each case. This was repeated for the ASSIST-M, using the 36 items as the independent variables and the case numbers as the dependent variable. The MD's constituted two new variables. Descriptive statistics were computed for these two variables and histograms produced. Using the mean and standard deviation of the distribution of MD's, cases with MDs that were more than 2.5 standard deviations above the mean were identified as potential multivariate outliers. Although arbitrary, 2.5 standard deviations above the mean is a generally accepted cutoff point for determining extreme scores in a distribution as values more extreme than this (in a standard normal distribution) represent less than 1% (0.6%) of the distribution. This also served as a reasonable cutoff point given the particular distribution of MDs for this data (as determined by examining a histogram). As a result of the foregoing analyses, 36 cases were dropped as outliers.

The 738 (774-36) cases retained for further analysis met the following criteria: case sd for TSI-M > .5094, case sd for ASSIST-M > .446, MD for TSI-M < 117.2 and MD for ASSIST-M < 76.72. The means and standard deviations for these variables are given in Table 4.4. The breakdown of how many cases was dropped for which reason(s) is given in Table 4.5.

Table 4.4

Means and Standard Deviations of Case Means, Case Standard Deviations and Case Mahalanobis Distances for TSI-M and ASSIST-M[1]

	TSI-M			ASSIST-M		
Statistic	Case Means	Case Std. devs.	MD^2	Case Means	Case Std. devs.	MD^2
Mean ($\bar{x}$)	5.196	1.685	49.935	3.849	1.283	35.955
Std. Dev.(sd)	0.651	0.465	26.904	0.451	0.331	16.305
$\bar{x}$ – 2.5sd	3.569	0.523	< 0	2.722	0.454	< 0
$\bar{x}$ + 2.5sd	6.823	2.847	117.2	4.977	2.111	76.717

(1) N = 774; (2) Mahalanobis distance (N = 773)

As indicated in Table 4.5, 31 cases were identified as outliers based on failure to meet a single criterion and five were identified based on two of the four criteria. There were no cases marked as outliers for failing to meet both low standard deviation criteria, and high Mahalanobis Distance criteria.

The demographic distribution of the original (805) sample was:

University:	FUJO	=	404	FUPH	=	401
Gender:	Male	=	410	Female	=	395
Faculty:	Science	=	414	Non-science	=	391
Level:	100	=	393	400	=	412

In the reduced sample (738) the demographic distribution was:

University:	FUJO	=	372	FUPH	=	366
Gender:	Male	=	379	Female	=	359
Faculty:	Science	=	385	Non-science	=	353
Level:	100	=	349	400	=	389

Table 4.5

Reasons for labeling 36 cases as outliers (1)

	Low Std. Dev.		High MD(2)	
Cases	TSI-M	ASSIST-M	TSI-M	ASSIST-M
4	Yes	—	—	—
3	—	Yes	—	—
14	—	—	Yes	—
10	—	—	—	Yes
1	Yes	Yes	—	—
4	—	—	Yes	Yes

(1) N = 774; (2) Mahalanobis Distance

As shown in Table 4.6, the 67 cases dropped due to incomplete data or extreme score patterns did not appreciably alter the demographic make up of the sample. For example, the percentages for each university in the original and reduced sample were very close. For FUJO the original and reduced sample (404, 372) showed 50.186% and 50.406% respectively, while FUPH (401, 366) were represented as 49.813% and 49.593%. Thus the reduced sample was considered to be at least as representative of the population as the original sample and probably more so due to the elimination of invalid and unrepresentative scores.

Finally, each case was randomly assigned a value from the uniform (0,1) distribution for use in splitting the sample into subsets. Random Subset 1 consisted of those cases with random value < .5, while Random Subset 2 consisted of those cases with random value > .5. The basic demographic breakdown for Random Subsets 1 and 2 is shown in Table 4.6.

Table 4.6

Study Sample Demographics (1)

Demographic Variable	Value	Random Subset 1 (N = 368) N	%	Random Subset 2 (N = 370) N	%	Population (N = 738) N	%
School	FUJO	198	53.8	174	47.0	372	50.4
	FUPH	170	46.2	196	53.0	366	49.6
Gender	Male	179	48.6	200	54.1	379	51.4
	Female	189	51.4	170	45.9	365	49.5
Age	18-25	280	76.1	251	67.8	531	76.75
	26 +	88	23.9	119	32.2	207	28.05
Field	Science	198	53.8	187	50.5	385	52.2
	Non-Science	170	46.2	183	49.5	353	47.8
Level	100	182	49.5	167	45.1	349	47.3
	400	186	50.5	203	54.9	389	52.7

(1) Random subset 1 cases selected by random value < 0.5. Random subset 2 cases selected by random value >0.5

Factor Analysis

Approaches and Study Skills Inventory for Students (ASSIST)

The internal consistency reliability (ICR) and dimensionality of ASSIST-M were examined using the statistical procedures of correlation and factor analysis. Hence each of the nine subscales (SM, RI, UE, LP, UM, SB, OS, TM, AD) of the modified instrument (ASSIST-M) was checked for the subscales and scales correlations, uni-dimensionality and internal consistency reliability.

ASSIST-M Subscales: Dimensionality and Internal Consistency Reliability

The items for each subscale were factor analyzed using principal component extraction of eigenvalues > 1 with varimax (orthogonal) rotation. The scree plot was also examined for each subscale. All the subscales were uni-dimensional (single factor) except

for RI which split into two factors: F1 (A08, A16) and F2 (A25, A34). Items 8 and 16 were used to form subscale RI-2 (F1) and items 25 and 34 used to form subscale RI-B (F2). Factor one showed stronger internal consistency reliability hence when factor two was eliminated relating ideas as in RI-2 formed a uni-dimensional factor with stronger internal consistency reliability Table 4.7.

Table 4.7

ASSIST-M Factor Analysis for Relating Idea Subscale (N=738)
(Principal Components Analysis, Varimax Rotation with Kaiser Normalization)

Item	Initial Solution				Final Solution (RI-2)		
	Rotated Loadings		Com[1]	MSA[2]	Loadings	Com[1]	MSA[2]
	F1	F2			F1		
8	.808	.070	.658	.530	.811	.657	.500
16	.807	.047	.654	.532	.811	.657	.500
25	.096	.783	.623	.542	.dropped		
34	.019	.802	.644	.535	.dropped		
EV[3]	1.315	1.265	2.579		1.314	1.314	
%VE[4]	32.877	31.613	64.475		65.699	65.700	
KMO MSA[5]				.534			.500
BtoS sig[6]	.000				.000		
ICR alpha[7]	.414				.473		

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha.

Furthermore, Internal consistency Reliability and uni-dimensionality were examined on both subscale and scale levels. Organized Studying and Time Management showed higher reliability indices only when a second factor solution for them was considered. These two subscales were reduced to a three-item subscale and they showed stronger internal consistency reliability indices. Although slightly improved, Organized Studying did not

present strong internal consistency reliability. The factor solutions of the two subscales are represented in Tables 4.8 and 4.9.

Table 4.8

ASSIST-M Factor Analysis for Organized Studying Subscale (N=738)
(Principal Components Analysis)

Item	Initial Solution			Final Solution (OS3)		
	Loadings F1	Com[1]	MSA[2]	Loadings F1	Com[1]	MSA[2]
1	.367	.135	.631	.dropped		
10	.679	.460	.599	.708	.501	.583
19	.685	.469	.602	.683	.466	.595
28	.634	.402	.613	.672	.452	.601
EV[3]	1.466	1.466		1.419	1.419	
%VE[4]	36.645	66.650		47.305	47.300	
KMO MSA[5]			.606			.592
BtoS sig[6]	.000			.000		
ICR alpha[7]	.393			.441		

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha.

Table 4.9

ASSIST-M Factor Analysis for Time Management Subscale (N=738)
(Principal Components Analysis)

Item	Initial Solution			Final Solution (TM3)		
	Loadings F1	Com[1]	MSA[2]	Loadings F1	Com[1]	MSA[2]
5	.716	.513	.678	.dropped		
14	.513	.263	.729	.744	.553	.638
23	.743	.552	.662	.754	.568	.630
32	.683	.467	.680	.733	.537	.647
EV[3]	1.794	1.795		1.659	1.658	
%VE[4]	44.860	44.875		55.286	55.267	
KMO MSA[5]			.679			.638
BtoS sig[6]	.000			.000		
ICR alpha[7]	.581			.591		

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha.

The syllabus boundedness subscale on the face value did present a single factor, however two items needed to be removed to form a summated scale (Surface apathetic approach) that was uni-dimensional. The factor solution is shown in Table 4.10.

Table 4.10

ASSIST-M Factor Analysis for Syllabus Boundedness Subscale (N=738)
(Principal Components Analysis)

Item	Initial Solution			Final Solution (SB2)		
	Loadings F1	Com[1]	MSA[2]	Loadings F1	Com[1]	MSA[2]
9	.602	.363	.679	.787	.619	.500
18	.721	.519	.596	.787	.619	.500
27	.719	.517	.604	.dropped		
36	.497	.247	.684	.dropped		
EV[3]	1.646	1.646		1.238	1.238	
%VE[4]	41.146	41.150		61.918	61.900	
KMO MSA[5]			.624			.500
BtoS sig[6]	.000			.000		
ICR alpha[7]	.518			.385		

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha.

In analyzing ASSIST-M five other subscales (Seeking Meaning, Use of Evidence, Lack of Purpose, Unrelated Memorizing and Alertness to Assessment Demand) showed relatively high internal consistency reliability. Each of these subscales resulted in a single factor and was consistent with the ASSIST theoretical constructs. Their factor solutions are shown in Tables 4.11, 4.12, 4.13, 4.14 and 4.15.

Table 4.11

ASSIST-M Factor Analysis for Seeking Meaning Subscale (N=738)
(Principal Components Analysis)

Items	Loadings F1	Com[1]	MSA[2]
4	.593	.352	.708
13	.756	.572	.633
22	.708	.501	.658
31	.564	.318	.704
EV[3]	1.743	1.743	
%VE[4]43.581	43.575		
KMO MSA[5]			.665
BtoS sig[6] .000	ICR alpha[7] .546		

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha.

Table 4.12

ASSIST-M Factor Analysis for Use of Evidence Subscale (N=738)
(Principal Components Analysis)

Item	Loadings F1	Com[1]	MSA[2]
7	.669	.448	.693
17	.666	.444	.699
26	.692	.479	.685
35	.653	.427	.699
EV[3]	1.797	1.798	
%VE[4]44.923	44.950		
KMO MSA[5]			.694
BtoS sig[6] .000	ICR alpha[7] .587		

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha.

Table 4.13

ASSIST-M Factor Analysis for Lack of Purpose Subscale (N=738) (Principal Components Analysis)

Item	Loadings F1	Com[1]	MSA[2]
3	.598	.358	.766
12	.691	.477	.726
21	.746	.556	.684
30	.730	.533	.697
EV[3]	1.925	1.924	
%VE[4]	48.113	48.100	
KMO MSA[5]			.711
BtoS sig[6] .000		ICR alpha[7] .640	

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha.

Table 4.14

ASSIST-M Factor Analysis for Unrelated Memorizing Subscale (N=738) (Principal Components Analysis)

Item	Loadings F1	Com[1]	MSA[2]
6	.606	.367	.728
15	.728	.530	.661
24	.595	.354	.733
33	.740	.548	.655
EV[3]	1.743	1.799	
%VE[4]	43.581	44.975	
KMO MSA[5]			.683
BtoS sig[6] .000		ICR alpha[7] .589	

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of sphericity significance, 7) Internal Consistency Reliability Cronbach alpha.

Table 4.15

ASSIST-M Factor Analysis for Alertness to Assessment Demand Subscale (N=738) (Principal Components)

Item	Loadings F1	Com[1]	MSA[2]
2	.598	.358	.621
11	.674	.455	.596
20	.543	.295	.624
29	.573	.328	.627
EV[3]	1.435	1.436	
%VE[4]	35.877	35.900	
KMO MSA[5]			.614
BtoS sig[6] .000		ICR alpha[7] .398	

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of sphericity significance, 7) Internal Consistency Reliability Cronbach alpha.

Finally, as indicated in all the factor analyses, the Internal consistency Reliability and uni-dimensionality were examined in all subscales. The resulting measures of internal consistency reliability (Cronbach's alpha) for all subscales ranged from .393 (OS) to .640 (LP). Six of the subscales had internal consistency reliability Cronbach's alpha > .5, one was less than .5 (RI) and two (OS, AD) were less than .4. The internal consistency reliabilities of two measures of preferences, supporting understanding (SU) and transmitting information (TI) were also estimated. The ASSIST-M internal consistency reliability results (Cronbach's alphas) for all the subscales are summarized in Table 4.16.

Table 4.16

ASSIST-M subscales internal consistency reliabilities

ASSIST-M Subscales		Internal Consistency Reliability (Cronbach's alpha)
SM	Seeking Meaning	.546
RI	Relating Ideas	.414
RI2	Relating Ideas (A8, 16)	.473
RI-B	Relating Ideas (A25, 34)	.418
UE	Use of Evidence	.587
LP	Lack of Purpose	.640
UM	Unrelated Memorizing	.589
SB	Syllabus Boundedness	.518
SB2	Syllabus Boundedness (A9, 18)	.385
SB-B	Syllabus Boundedness (A27, 36)	.308
OS	Organized Studying	.393
OS3	Organized Studying (A10, 19 28)	.441
TM	Time Management	.581
TM3	Time Management (A5, 23, 32)	.591
AD	Alertness to Assessment Demand	.398
SU	Supporting Understanding	.532
TI	Transforming Information	.542

ASSIST-M Subscales: Testing for factor loading

When factor analyzing all nine subscales based on all 36 variables and extracting factors based on eigenvalues > 1, two factors emerged under orthogonal varimax rotation of the solution. SM, RI, UE, OS, TM and AD loaded on one factor while LP, UM, and SB loaded on the other. Although the scree plot supported a two-factor solution, forcing three factors to be extracted, with orthogonal varimax rotation, separated the nine subscales into three factors as intended in the design of the instrument, namely DA (SM, UE, RI); SAA (LP, UM, SB) and ST (OS, TM, AD) with notable cross loading. Again when forcing extraction of three

factors with oblique rotation, the 3-factor structure was maintained. However, when the improved subscales were used three separate factors emerged. The correlation, however, between factors F1 and F3 (DA and ST) was r = .478, while the correlation between F1 and F2 was -.088 and the correlation between F2 and F3 was -.074. The emphasis in this analysis is to show the strength of the correlations between the three factors. Results are given in Table 4.17.

Table 4.17

Factor Analysis: ASSIST-M for All Subscales Improved and Reduced (N=738)
(Principal Components Analysis, Varimax Rotation with Kaiser Normalization)

Subscales	Rotated Loadings			Com[1]	MSA[2]
	F1	F2	F3		
SM	.791	-.097	.222	.684	.740
RI2	.778	-.124	.175	.651	.837
UE	.840	-.019	.139	.725	.858
LP	-.069	.831	-.054	.698	.825
UM	-.060	.839	.162	.733	.830
SB2	.011	.741	-.199	.589	.706
OS3	.357	-.029	.757	.701	.785
TM3	.248	-.063	.847	.783	.814
AD	.626	.076	.242	.456	.845
EV[3]	2.525	1.978	1.517	6.020	
%VE[4]	28.059	21.982	16.859	66.889	
KMO MSA[5]					.818
BtoS sig[6]	.000				

Note: 1) Structure loadings, 2) Communalities, 3) Measure of Sampling Adequacy, 4) Eigenvalue, 5) Percent of Variance Explained, 6) Bartlett's Test

ASSIST-M Scales: Dimensionality and Internal Consistency Reliability

The uni-dimensionality of the three main scales, Deep Approach (DA), Surface Apathetic Approach (SAA) and Strategic approach (ST), were then investigated.

When all the 12 variables from SM, RI and UE were factor analyzed using principal components extraction with eigenvalues > 1 and varimax orthogonal rotation, two factors were extracted from DA scale with internal consistency reliability – ICR α = .754. However, when items 25 and 34 were removed from Relating Ideas (RI) subscale (the remaining items from subscale RI forming RI2) the resulting scale was uni-dimensional – single factor with improved ICR α = .789. This scale was named DA10 and is represented in Table 4.18.

When all 12 variables of SAA (LP, UM, SB) scale were factor analyzed using principal component extraction with eigenvalues > 1 and varimax orthogonal rotation, two factors were produced for the Surface apathetic approach (SAA) scale with ICR α = .784. When items 27 and 36 were removed from the Syllabus Boundedness (SB) subscale (the remaining items from SB forming subscale SB2) the resulting scale was uni-dimensional (single factor) with ICR α = .776. This scale was named SAA10 as shown in Table 4.19.

When all 12 variables of ST (OS, TM, AD) scale were factor analyzed using principal component extraction with eigenvalues > 1 and varimax orthogonal rotation, three factors with some cross loadings emerged for the Strategic approach (ST) scale with ICR α = .703. The 3-factor (Table 4.20), structure could not, however be reduced to a single factor without substantially eliminating selected variables. To test this item 01 was removed from OS (the remaining items forming subscale OS3) and item 20 was removed from AD (the remaining items forming subscale AD3), the remaining 10 (OS3 + TM4+ AD3) items still formed two factors. This analysis was termed an intermediate solution with ICR α = .716. However, Alertness to assessment demand (AD) appeared to be a separate dimension from OS and TM as it cross-loaded inconsistently. This lead to eliminating all the items of Alertness to assessment demand and factor analyzing the 8 variables from OS and TM using principal component extraction with eigenvalues > 1 and varimax orthogonal rotation, two factors still emerged with ICR α = .661. However, when item 01 was removed from OS (the remaining

items forming subscale OS3) and item 14 was removed from TM (the remaining items forming subscale TM3), the six remaining items formed a uni-dimensional (single factor) scale with ICR α = .682. This resulting scale (OS3 + TM3) was named ST6 and the factor solution is shown in Table 4.21.

Table 4.18

ASSIST-M Factor Analysis for Deep Approach (SM +RI+UE) Scale (N=738)
(Principal Components Analysis, Varimax Rotation with Kaiser Normalization)

Item	Initial Solution				Final Solution (RI2)		
	Rotated Loadings		Com[1]	MSA[2]	Loadings	Com[1]	MSA[2]
	F1	F2			F1		
4	.511	-.075	.267	.858	.477	.228	.870
13	.706	-.005	.498	.881	.685	.470	.884
22	.585	.068	.347	.880	.583	.340	.877
31	.482	.241	.290	.890	.531	.282	.884
8	.630	.066	.401	.884	.626	.392	.881
16	.651	.110	.435	.886	.662	.438	.889
25	.078	.715	.518	.735	.dropped		
34	-.041	.794	.632	.620	.dropped		
7	.611	.031	.374	.864	.600	.360	.863
17	.561	.204	.357	.894	.594	.353	.901
26	.622	.136	.406	.875	.638	.407	.874
35	.449	.437	.392	.881	.542	.294	.896
EV[3]	3.439	1.479	4.917		3.563	3.564	
%VE[4]	28.657	12.322	40.975			35.640	
KMO MSA[5]				.868			.882
BtoS sig[6]	.000				.000		
ICR alpha[7]	.754				.789		

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha.

Table 4.19

ASSIST-M Factor Analysis for Surface Apathetic Approach (LP + SB + UM) Scale (N=738) (Principal Components Analysis, Varimax Rotation with Kaiser Normalization)

Item	Initial Solution				Final Solution (SB2)		
	Rotated Loadings		Com[1]	MSA[2]	Loadings	Com[1]	MSA[2]
	F1	F2			F1		
3	.407	.195	.204	.878	.450	.202	.883
12	.681	.127	.480	.873	.671	.450	.873
21	.700	.075	.496	.871	.657	.432	.867
30	.673	.114	.465	.885	.646	.418	.875
6	.275	.496	.321	.883	.481	.231	.895
15	.745	.140	.575	.854	.727	.529	.845
24	.438	.158	.216	.899	.465	.216	.887
33	.540	.251	.355	.890	.600	.360	.884
9	.206	.493	.286	.895	.425	.181	.891
18	.426	.482	.414	.873	.599	.359	.896
27	.115	.727	.541	.815	.dropped		
36	-.007	.603	.363	.807	.dropped		
EV[3]	2.923	1.794	4.716		3.377	3.378	
%VE[4]	24.359	14.947	39.300		33.770	33.780	
KMO MSA[5]			.870				.875
BtoS sig[6]	.000				.000		
ICR alpha[7]	.784				.776		

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha.

Table 4.20

ASSIST-M Factor Analysis for Strategic Approach (OS + TM + AD) Scale (N=738)
(Principal Components Analysis, Varimax Rotation with Kaiser Normalization)

Item	Initial Solution					Intermediate Solution (OS3 + TM4+ AD3)			
	Rotated Loadings			Com[1]	MSA[2]	Loadings		Com[1]	MSA[2]
	F1	F2	F3			F1	F2		
1	.000	-.013	.693	.480	.740	.dropped			
10	.439	.490	-.007	.434	.837	.465	.376	.358	.827
19	.331	.242	.425	.349	.858	.289	.494	.328	.848
28	.671	.000	.086	.458	.825	.627	.124	.408	.833
5	.598	.142	.293	.464	.830	.550	.354	.428	.820
14	.269	.548	.018	.373	.843	.321	.392	.257	.839
23	.683	.143	-.046	.489	.827	.695	.085	.491	.829
32	.689	.031	.000	.476	.810	.732	-.036	.537	.809
2	.052	.114	.750	.578	.706	-.088	.709	.511	.694
11	.047	.727	.088	.538	.785	.052	.652	.427	.775
20	-.055	.607	.140	.392	.814	.dropped			
29	.363	.202	.263	.242	.845	.318	.381	.246	.838
EV[3]	2.264	1.592	1.414	5.273		2.229	1.761	3.991	
%VE[4]	18.867	13.270	11.786	43.942		22.289	17.614	39.910	
KMO MSA[5]					.818				.817
BtoS sig[6]	.000					.000			
ICR alpha[7]	.703					.716			

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6)Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha.

Table 4.21

ASSIST-M Factor Analysis for Strategic Approach (OS + TM) Scale (N=738)
(Principal Components Analysis, Varimax Rotation with Kaiser Normalization)

Item	Initial Solution (ST8)				Final Solution ST6 (OS3+TM3)		
	Rotated Loadings		Com[1]	MSA[2]	Loadings	Com[1]	MSA[2]
	F1	F2			F1		
1	-.129	.889	.807	.717	.dropped		
10	.558	.222	.360	.827	.600	.360	.815
19	.390	.449	.353	.839	.527	.277	.829
28	.618	.038	.383	.831	.601	.361	.814
5	.639	.201	.449	.812	.686	.471	.789
14	.370	.384	.284	.812	.dropped		
23	.703	-.001	.495	.802	.667	.445	.792
32	.646	.070	.423	.809	.657	.432	.799
EV[3]	2.319	1.235	3.554		2.347	2.346	
%VE[4]	28.982	15.436	44.426		39.124	39.000	
KMO MSA[5]				.815			.803
BtoS sig[6]	.000				.000		
ICR alpha[7]	.661				.682		

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6)Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha.

Taking together all the modified subscales with subscales that were uni-dimensional (SM, RI2, UE, LP, UM, SB2, OS3, TM3, AD) and factor analyzing using principal component extraction with eigenvalues > 1 and varimax orthogonal rotation, two factors emerged as before: F1 = (SM, RI2, UE, OS3, TM3, AD) and F2 = (LP, UM, SB2) but with no cross factor loading > .20. Again the scree plot supported a 2-factor solution. When three factors were extracted with orthogonal varimax rotation, three uncorrelated factors that appeared with AD loading with Factor One as follows: F1 = (SM, RI2, UE, AD), F2 = (LP, UM, SB2), and F3 = (OS3, TM3), thus confirming that AD was representing something different from OS3 and

TM3. SM and AD cross-loaded on F3 at < .243. Extracting three factors with oblique (oblimin) rotation maintained the 3-factor structure with F1, F3 correlated r = .478, F1, F2 correlated -.088 and F2, F3 correlated -.074. This finding is reflected in Table 4.22.

Table 4.22

Factor Analysis: ASSIST-M for All Subscales Improved and Reduced (N=738)
Oblique (Oblimin) Rotation with Kaiser Normalization

Subscales	Rotated Loadings[1]			Com[2]	MSA[3]
	F1	F2	F3		
SM	.824	-.132	.433	.684	.740
RI2	.802	-.157	.385	.651	.837
UE	.850	-.054	.364	.725	.858
LP	-.118	.834	-.102	.698	.825
UM	-.062	.836	.108	.733	.830
SB2	-.068	.745	-.216	.589	.706
OS3	.515	-.063	.826	.701	.785
TM3	.431	-.096	.884	.783	.814
AD	.660	.047	.401	.456	.845
EV[4]	3.263	1.903	.855	6.020	
%VE[5]	36.260	21.143	9.497	66.899	
KMO MSA[6]					.788
BtoS sig[7]	.000				

Note: 1) Structure loadings, 2) Communalities, 3) Measure of Sampling Adequacy, 4) Eigenvalue, 5) Percent of Variance Explained

Table 4.23 summarizes the internal consistency reliabilities of the major Scales of ASSIST-M in the present study.

The factor analysis of the modified sets of subscales for ASSIST-M (SM, RI2, UE, LP, UM, SB2, OS3, TM3, AD) was repeated for the two randomly selected subsets of the sample (738), one with N = 368 and the other with N = 370. For each random subset,

principal components extraction of three factors with oblimin rotation reproduced the 3-factor solutions seen earlier.

Table 4.23

Internal consistency reliabilities of ASSIST-M scales

ASSIST-M Scales		Internal Consistency Reliability
DA10	Deep Approach	.789
SAA 10	Surface Apathetic Approach	.776
ST6	Strategic Approach	.682
AD	Alertness to Assessment Demand	.398

Thinking Style Inventory Modified (TSI-M)

The 10 subscales of TSI-M (LEG, EXE, JUD, GLO, LOC, LIB, CON, MON, INT, EXT) were examined for internal consistency reliability and for uni-dimensionality. Principal components factor analysis with eigenvalues > 1 and orthogonal varimax rotation, was used in a confirmatory analysis to determine if subscales and scales of the instrument (as designed) were in fact "scales", i.e., had uni-dimensional (single factor) structure with the data from this study.

TSI-M Subscales: Dimensionality and Internal Consistency Reliability

Each subscale was initially examined using all of its items. The scree plot was also examined for each subscale. Some of the subscales resulted in a single factor with a possibility of improvement in internal consistency reliability by dropping some items. Such subscales included (LEG, CON, EXT). However, three other subscales namely GLO, LOC, and MON, emerged as having two or more factors but could be reduced to a single factor with decreased reliability by dropping selected variables. These three subscales showed inconsistency in their structures, when factor analyzed using all the four items or with fewer items and resulted in low internal consistency reliability. These subscales had increased and

decreased internal consistency reliabilities. Some of the subscales, however, improved their internal consistency reliability by reduction of items included (EXT, CON) as demonstrated in Tables 4.24 and 4.25.

Table 4.24

TSI-M Factor Analysis for External Subscale (N=738) (Principal Components Analysis)

Item	Initial Solution			Final Solution (EXT4)		
	Loadings F1	Com[1]	MSA[2]	Loadings F1	Com[1]	MSA[2]
3	.366	.134	.723	.dropped		
15	.629	.396	.758	.623	.389	.747
25	.684	.468	.709	.716	.513	.714
30	.753	.567	.711	.757	.573	.697
35	.696	.485	.734	.708	.502	.723
EV[3]	2.049	2.060		1.976	1.977	
%VE[4]	40.982	41.000		49.409	49.425	
KMO MSA[5]			.725			.717
BtoS sig[6]	.000			.000		
ICR alpha[7]	.602			.655		

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha.

Table 4.25

TSI-M Factor Analysis for Conservative Subscale (N=738)
(Principal Components Analysis)

Item	Initial Solution			Final Solution (CON4)		
	Loadings F1	Com[1]	MSA[2]	Loadings F1	Com[1]	MSA[2]
12	.472	.223	.734	.494	.244	.725
18	.560	.314	.729	.552	.305	.719
21	.789	.623	.631	.800	.640	.615
22	.762	.580	.633	.790	.624	.621
26	.385	.149	.738	.dropped		
EV[3]	1.889	37.780		1.813	1.813	
%VE[4]	33.997	34.000		45.325	45.325	
KMO MSA[5]			.661			.642
BtoS sig[6]	.000			.000		
ICR alpha[7]	.560			.585		

Notes: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha

There were also subscales (Liberal, Judicial, Executive and Internal) that resulted in a single factor with reasonably high internal consistency reliability. Their factor solutions appeared to be consistent with the theory of the mental self-government as shown in Tables 4.26, 4.27, 4.28 and 4.29.

Table 4.26

TSI-M Factor Analysis for Liberal Subscale (N=738)
(Principal Components Analysis)

Item	Rotated Loadings F1	Com[1]	MSA[2]
34	.637	.406	.785
40	.671	.450	.724
44	.621	.385	.722
49	.707	.500	.709
50	.676	.457	.715
EV[3]	2.199	2.198	
%VE[4]		43.960	
KMO MSA[5]			.728
BtoS sig[6] .000	ICR alpha[7]	.676	

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha

Table 4.27

TSI-M Factor Analysis for Judicial Subscale (N=738)
(Principal Components Analysis)

Item	Rotated Loadings F1	Com[1]	MSA[2]
17	.668	.446	.717
19	.665	.443	.741
31	.662	.439	.728
39	.574	.329	.754
43	.706	.498	.712
EV[3]	2.155	2.155	
%VE[4]	43.103	43.100	
KMO MSA[5]			.728
BtoS sig[6] .000	ICR alpha[7]	.664	

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha

Table 4.28

TSI-M Factor Analysis for Executive Subscale (N=738)
(Principal Components Analysis)

Item	Loadings F1	Com[1]	MSA[2]
7	.581	.337	.707
10	.629	.396	.718
11	.667	.445	.736
23	.606	.367	.702
29	.662	.438	.707
EV[3]	1.984	1.983	
%VE[4]	39.671	39.660	
KMO MSA[5]			.715
BtoS sig[6] .000	ICR alpha[7]	.617	

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha

Table 4.29

TSI-M Factor Analysis for Internal Subscale (N=738)
(Principal Components Analysis)

Item	Rotated Loadings F1	Com[1]	MSA[2]
8	.715	.511	.697
14	.598	.357	.779
27	.704	.496	.700
42	.541	.293	.715
48	.684	.468	.720
EV[3]	2.125	2.125	
%VE4	42.499	42.500	
KMO MSA[5]			.717
BtoS sig[6] .000	ICR alpha[7]	.660	

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha

There were three subscales that showed irregular patterns of results in factor analyzing their constituent items. They showed sometimes an increase and decrease of their internal consistency reliabilities with more items and with less items in their factor analyses. From the different analyses with various internal consistency reliabilities, two forms for each subscale that appeared reasonable are demonstrated. These subscales are presented in Tables 4.30, 4.31 and 4.32. Although in a few instances, their internal consistency reliabilities were not too low, their irregular pattern of factor loading constituted some concerns and considerations for dropping them in subsequent analyses.

Taken together, the internal consistency reliabilities (Cronbach's alpha) for all the TSI-M subscales are summarized in Table 4.33. Three subscales (GLO, CON, EXT) appeared to have stronger internal consistency reliability with four items instead of five.

Table 4.30

TSI-M Factor Analysis for Global Subscale (N=738)
(Principal Components Analysis, Varimax Rotation with Kaiser Normalization)

Item	Initial Solution				Final Solution (GLO4)		
	Rotated Loadings		Com[1]	MSA[2]	Loadings	Com[1]	MSA[2]
	F1	F2			F1		
6	.739	-0.272	.621	.649	.dropped		
16	.667	0.237	.500	.631	.654	.428	.607
28	.378	0.628	.538	.621	.721	.520	.601
36	.537	0.300	.378	.686	.608	.370	.662
46	-.067	0.815	.669	.604	.520	.271	.617
EV[3]	1.427	1.279	2.706		1.589	1.589	
%VE[4]	28.537	25.583	54.120		39.718	39.725	
KMO MSA[5]				.636			.617
BtoS sig[6]	.000				.000		
ICR alpha[7]	.469				.486		

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach

Table 4.31

TSI-M Factor Analysis for Local Subscale (N=738)
(Principal Components Analysis, Varimax Rotation with Kaiser Normalization)

Item	Initial Solution				Final Solution (LOC4)		
	Rotated Loadings		Com[1]	MSA[2]	Loadings	Com[1]	MSA[2]
	F1	F2			F1		
1	.200	.574	.370	.595	.dropped		
5	.644	.068	.420	.598	.639	.409	.577
20	.767	-.109	.600	.545	.724	.525	.551
33	.583	.316	.381	.569	.637	.406	.578
47	-.127	.836	.715	.477	.dropped		
EV[3]	1.341	1.145	2.486		1.340	1.340	
%VE[4]	26.829	22.896	49.720		44.661	44.667	
KMO MSA[5]				.561			.566
BtoS sig[6]	.000				.000		
ICR alpha[7]	.330				.369		

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach

Table 4.32

TSI-M Factor Analysis for Monarchic Subscale (N=738)
(Principal Components Analysis, Varimax Rotation with Kaiser Normalization)

Item	Initial Solution				Final Solution (MON4)		
	Rotated Loadings		Com[1]	MSA[2]	Loadings	Com[1]	MSA[2]
	F1	F2			F1		
2	.139	.752	.585	.573	.dropped		
32	-.080	.788	.627	.497	.dropped		
38	.684	-.034	.469	.697	.684	.468	.694
41	.803	.080	.651	.602	.807	.652	.595
45	.767	.048	.591	.625	.772	.596	.613
EV[3]	1.727	1.196	2.923		1.716	1.716	
%VE[4]	34.532	23.915	58.460		57.188	57.200	
KMO MSA[5]				.620			.623
BtoS sig[6]	.000				.000		
ICR alpha[7]	.438				.624		

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach

Table 4.33

Internal Consistency Reliability of TSI-M Subscales (Cronbach's alpha)

Label	Name	ICR
LEG	Legislative	.497
LEG4		.477
EXE	Executive	.617
JUD	Judicial	.664
GLO	Global	.469
GLO4		.486
GLO-A(3)		.392
GLO-B(2)		.379
LOC	Local	.330
LOC-A(3)		.369
LOC-B(2)		.191
LIB	Liberal	.676
CON	Conservative	.560
CON4		.585
MON	Monarchic	.438
MON-A(3)		.624
MON-B(2)		.321
INT	Internal	.660
EXT	External	.602
EXT4		.655

TSI-M Subscales: Testing for factor loading

As shown in table 4.34, when all 10 subscales (based on all 50 variables) were submitted to principal component factor analysis extracting factors based on eigenvalues > 1, three factors emerged under orthogonal varimax rotation of the solution as F1: (JUD, LIB, EXT), F2: (LEG, GLO, MON, INT), F3: (EXE, LOC, CON). The scree plot confirmed the existence of three factors. Thus the 2-factor structure that was anticipated consisting of

Complex Thinking Style (LEG, JUD, GLO, LIB, EXT), and a Simple Thinking Style (EXE, LOC, CON, MON, INT) did not emerge. Under oblique (oblimin) rotation, the 3-factor structure was also maintained and all variables cross-loaded on at least two factors and six of the ten cross-loaded on all three factors. The correlation between the factors was F1, 2 = .228, F1, 3 = .371, F2, 3 = .252. Forcing extraction of two factors was not only unwarranted, but did not result in the desired (theoretically anticipated) 2-factor structure.

Table 4.34

TSI-M Factor Analysis for All Subscales, All 50 Variables
(N=738) Oblique (Oblimin) Rotation

Subscales	Rotated Loadings[1]			Com[2]	MSA[3]
	F1	F2	F3		
Leg	.374	.776	.125	.665	.829
Jud	.840	.296	.429	.729	.848
Lib	.818	.456	.257	.756	.831
Glo	.353	.564	.477	.453	.900
Ext	.801	-.044	.386	.715	.827
Exe	.483	.049	.772	.675	.819
Loc	.430	.421	.620	.490	.918
Con	.209	.289	.871	.782	.789
Mon	.431	.593	.544	.549	.907
Int	.010	.850	.259	.771	.708
EV[4]	2.929	2.554	2.745	6.585	
%VE[5]				65.850	
KMO MSA[6]					.839
BtoS sig[7]		.000			

Note: 1) Structure loadings, 2) Communalities, 3) Measure of Sampling Adequacy, 4) Eigenvalue, 5) Percent of Variance Explained, 6) Kaiser-Meyer-Olkin Measure of Sampling Adequacy 7) Bartlett's Test of Sphericity significance.

The above finding led to including the three inconsistent subscales and their reduced subscales in the analysis as shown in table 4.35. The reduced subscales were defined as

GLO-A (T= 6, 16, 36), GLO-B (T = 28, 46), LOC-A (T = 5, 20, 33), LOC-B (T = 1, 47), MON-A (T = 38, 41, 45), and MON-B (T = 2, 32). When factor analyzed with other full subscales, each of these A/B subscale pairs split between F1 (Jud, et al.) and F2 (LEG, et al.) as follows: F1: (GLO-B, LOC-A, MON-A); F2: (GLO-A, LOC-B, MON-B). Global, that originally loaded on F2, now moved to F1 when redefined as GLO4, and then split between F1 and F2 when defined as GLO-A and GLO-B and for that reason it might not be reasonable to retain these items in their A/B form. Likewise, Local, originally loaded on F3 (EXE, et al.), but now loaded on F1 and F2 when split into LOC-A and LOC-B.

Table 4.35

TSI-M Factor Analysis for All 50 Variables with split subscales (N=738) Varimax Rotation

Subscales	Rotated Loadings[1]			Com[2]	MSA[3]
	F1	F2	F3		
Leg	.464	.578	-0.323	.654	.842
Jud	.813	.094	.154	.694	.881
Lib	.822	.187	-.099	.720	.860
Glo-A	.079	.597	.168	.391	.852
Glo-B	.641	.228	.149	.485	.936
Ext	.678	-.154	.310	.580	.877
Exe	.461	.060	.667	.661	.827
Loc-A	.586	.040	.361	.476	.933
Loc-B	.052	.602	.169	.394	.857
Con	.192	.445	.721	.755	.794
Mon-A	.687	.077	.109	.490	.906
Mon-B	-.029	.748	.171	.589	.818
Int	.136	.804	-.162	.691	.758
EV[4]	3.561	2.587	1.476	7.580	
%VE[5]				58.308	
KMO MSA[6]					.859
BtoS sig[7]	.000				

Note: 1) Structure loadings, 2) Communalities, 3) Measure of Sampling Adequacy, 4) Eigenvalue, 5) Percent of Variance Explained, 6) Kaiser-Meyer-Olkin Measure of Sampling Adequacy 7) Bartlett's Test of Sphericity significance.

Reduced subscales were defined for Global, Local and Monarchic (all of which were originally 2-factors) as follows: GLO → GLO4 (dropping T06 only made GLO4 a single factor with α = .486); LOC → LOC3 (dropping T01 and T47 made LOC3 single factor with α = .369); and MON → MON3 (dropping T02 and T32 made MON3 single factor with α = .624).

(Note that with three reduced subscales, all subscales were now single factor and the three reduced subscales all had improved alpha).

As show in table 4.36, all 10 subscales (including the three reduced ones defined above), were then factor analyzed using principal components with eigenvalues > 1 and oblique rotation. Three factors emerged again but the scales loaded differently as F1: (JUD, LIB, EXT4, GLO4, LOC3, MON3); F2: (LEG, INT); F3: (EXE, CON). All subscales cross-loaded (> 0.20) on at least two factors while two (JUD, CON) cross-loaded on all three factors. The correlation between the factors was F1, 2 = .192; F1, 3 = .377; F2, 3 = .127.

Table 4.36

TSI-M Factor Analysis for All Subscales, 45 Variables
(N=738) Oblique (Oblimin) Rotation

Subscales	Rotated Loadings[1]			Com[2]	MSA[3]
	F1	F2	F3		
Leg	.378	.803	.098	.705	.780
Jud	.839	.231	.360	.711	.869
Lib	.803	.400	.176	.731	.854
Glo4	.530	.432	.423	.442	.898
Ext	.752	-.115	.337	.641	.864
Exe	.526	.019	.792	.702	.820
Loc3	.631	.074	.487	.475	.930
Con	.281	.272	.890	.824	.752
Mon3	.702	.187	.277	.496	.903
Int	.080	.865	.227	.782	.614
EV[4]	3.591	1.921	2.247	6.509	
%VE[5]				65.090	
KMO MSA[6]					.839
BtoS sig[7]	.000				

Note: 1) Structure loadings, 2) Communalities, 3) Measure of Sampling Adequacy, 4) Eigenvalue, 5) Percent of Variance Explained, 6) Kaiser-Meyer-Olkin Measure of Sampling Adequacy 7) Bartlett's Test of Sphericity significance.

These findings suggested that: 1) the clustering of (JUD, LIB and EXT) was stable, 2) The clustering of (LEG, INT) was stable, 3) the clustering of (EXE, CON) was stable, 4) the clustering of GLO/GLO4, LOC/LOC3, and MON/MON3 was not stable, and 5) the three stable clusters appeared to be separate factors given their relatively low inter-correlations. Thus the resulting two-factor structure of the generating theory did not appear.

On the basis of these results the GLO, LOC and MON subscales were dropped and the remaining seven subscales were factor analyzed using principal components with extraction of eigenvalues > 1 and oblique rotation. The remaining seven subscales were further investigated to see if their cluster might reasonably support the formation of summated scales to be used in subsequent analysis. Once again the previously identified clusters emerged as three separate factors. All subscales cross-loaded (> 0.20) on at least two factors while three (JUD, LIB, CON) cross-loaded on all three factors. Each subscale, however clearly loaded dominantly on only one factor. The factor correlations were F(1, 2) = .139, F(1, 3) = .313, F(2, 3) = .115. The percentage of the explained variance in these three factors was 65.71%. Table 4.37 shows the analysis.

Table 4.37

TSI-M Factor Analysis for All Subscales, Intermediate Solution (Drop Glo, Loc, Mon) (N=738) Oblique (Oblimin) Rotation

Subscales	Rotated Loadings[1]			Com[2]	MSA[3]
	F1	F2	F3		
Leg	.389	.811	.110	.740	.716
Jud	.844	.207	.372	.733	.783
Lib	.825	.391	.209	.763	.759
Ext	.798	-.140	.353	.718	.777
Exe	.487	.017	.822	.745	.748
Con	.221	.253	.898	.835	.667
Int	.028	.877	.233	.806	.555
EV[4]	2.469	1.706	1.855	4.600	
%VE[5]				65.714	
KMO MSA[6]					.727
BtoS sig[7]	.000				

Note: 1) Structure loadings, 2) Communalities, 3) Measure of Sampling Adequacy, 4) Eigenvalue, 5) Percent of Variance Explained, 6) Kaiser-Meyer-Olkin Measure of Sampling Adequacy 7) Bartlett's Test of Sphericity significance.

The factor solution in Table 4.37 led to the adoption of the seven subscales that have consistently had stable, interpretable factor solutions with improved internal consistency reliability. These subscales were consequently used in the rest of the analysis. Their factor structures are outlined in Table 4.38. Factor correlations were F1, F2 = .145, F1, F3 = .341, and F2, F3 = .089.

Table 4.38

TSI-M Factor Analysis for All Subscales, Final Solution (N=738)
Oblique (Oblimin) Rotation with Kaiser Normalization

Subscales	Rotated Loadings[1]			Com[2]	MSA[3]
	F1	F2	F3		
Leg4	.325	.825	.080	.728	.684
Jud	.852	.208	.394	.744	.778
Lib	.825	.387	.229	.758	.759
Ext4	.811	-.142	.366	.739	.767
Exe	.473	.051	.856	.773	.723
Con4	.250	.162	.912	.845	.659
Int	.036	.876	.170	.793	.555
EV[4]	2.456	1.689	1.943	5.380	
%VE[5]				76.857	
KMO MSA[6]					.718
BtoS sig[7]	.000				

Note: 1) Structure loadings, 2) Communalities, 3) Measure of Sampling Adequacy, 4) Eigenvalue, 5) Percent of Variance Explained, 6) Kaiser-Meyer-Olkin Measure of Sampling Adequacy 7) Bartlett's Test of Sphericity significance.

TSI-M Scales: Dimensionality and Internal Consistency Reliability

Each of the three clusters was factor analyzed at item level to see if they were uni-dimensional (single factor) and could be combined to form summated scales.

JUD + LIB + EXT: This cluster of three subscales consisted of 15 items. As shown in table 4.39, three factors emerged from principal components extraction of eigenvalues > 1 and oblique rotation. The variables in each factor scale were as follows: Factor 1: JUD (17, 31), LIB (34), EXT (15, 25, 30, 35); Factor 2: JUD (19, 39, 43), LIB (40, 44, 49, 50); Factor 3: EXT (03). Ten variables cross-loaded (> 0.20) on F1 and F2; one cross-loaded on F1 and

F3; two cross-loaded on all 3 factors. The correlation between the factors was F1, 2 = .428; F1, 3 = .127; F2, 3 = .057. The internal consistency of these three factors was .825.

Dropping variable T03 from External to make Ext4 with alpha of .655 resulted in this scale having two factors and it consisted of 14 variables. Although not uni-dimensional, this set of variables (JUD+LIB+EXT4) formed a scale with improved ICR α = .833. This scale was given the name liberal thinking (LT). All variables in this scale cross-loaded (> .20) on factors one and two except T44 (LIB) and T15 (EXT). The correlation between the two factors was .439. It was clear that this cluster of variables could not be reduced to a single factor without substantial loss of variables but the two were clearly related given their correlation. For the analyses results are given in Table 4.39.

Table 4.39

TSI-M Factor Analysis for Factor (JUD+LIB+EXT) Scale (N=738)
Oblique (Oblimin) Rotation with Kaiser Normalization

Item	Initial Solution					Final Solution (JUD+LIB+EXT4)			
	Rotated Loadings			Com[1]	MSA[2]	Loadings		Com[1]	MSA[2]
	F1	F2	F3			F1	F2		
17	.556	.365	.112	.331	.898	.554	.383	.331	.895
19	.447	.472	-.066	.312	.904	.423	.484	.289	.905
31	.722	.375	-.003	.536	.893	.706	.402	.509	.899
39	.216	.614	.223	.418	.899	.224	.612	.377	.898
43	.452	.659	.052	.469	.916	.437	.666	.470	.915
34	.636	.435	.027	.440	.918	.620	.454	.426	.916
40	.414	.663	.045	.460	.898	.398	.668	.460	.897
44	.194	.659	-.021	.446	.875	.655	.446	.873	.873
49	.300	.653	-.002	.429	.855	.280	.654	.428	.853
50	.343	.585	.116	.357	.881	.338	.588	.354	.878
3	.121	.207	.873	.792	.914	.dropped			
15	.522	.094	.506	.490	.889	.575	.115	.354	.883
25	.692	.247	-.036	.497	.909	.674	.274	.455	.917
30	.716	.293	.264	.544	.889	.731	.318	.535	.890
35	.648	.322	.110	.424	.909	.645	.344	.421	.908
EV[3]	3.804	3.442	1.188	6.945		3.728	3.524	5.855	
%VE[4]		41.000	46.300			41.821			
KMO MSA[5]					.895				.896
BtoS sig[6]		.000					.000		
ICR alpha[7]		.825					.833		

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6)Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha.

LEG + INT: This scale consisted of 10 variables. As shown in table 4.40, three factors also emerged from principal components extraction of eigenvalues > 1 and oblique

rotation. The three factors consisted of the following variables; F1: LEG (04), Int (08, 14, 27); F2: LEG (24, 37), INT (42, 48), F3: LEG (09, 13). Only two variables (T04, T13) loaded on a single factor. T13 was the only variable that loaded highly on F3 (.845). The correlation between the factors was F1, 2 = .288; F1, 3 = .143; F2, 3 = .174. This resulted in internal consistency reliability of .721.

Dropping T13 from LEG to form LEG4 with increased alpha of .477 resulted in two factors. T04 loaded on factor one only, while T09 and 24 loaded on factor two only. All other variables loaded on both factors (> .20). Although not uni-dimensional, this set of nine variables (LEG4+INT) had ICR α = .721. Again it was clear that it would not be possible to reduce this cluster to a single factor without substantial loss of variables. The two factors were at least somewhat related given their correlation of .343. This factor was termed Independent thinking (IT). The result of the analysis is given in Table 4.40.

Table 4.40

TSI-M Factor Analysis for Factor (LEG + INT) Scale (N=738)
Oblique (Oblimin) Rotation with Kaiser Normalization

Item	Initial Solution					Final Solution (LEG4 + INT)			
	Rotated Loadings[8]			Com[1]	MSA[2]	Loadings		Com[1]	MSA[2]
	F1	F2	F3			F1	F2		
4	.645	.168	-.020	.429	.817	.638	.170	.410	.818
9	.181	.430	.530	.398	.818	.200	.555	.308	.823
13	.135	.096	.845	.717	.729	.dropped			
24	.028	.691	.215	.523	.806	.033	.692	.527	.798
37	.397	.614	.336	.474	.807	.408	.662	.475	.793
8	.751	.214	.037	.569	.747	.744	.238	.555	.752
14	.618	.140	.380	.475	.826	.635	.240	.403	.835
27	.699	.271	.177	.499	.798	.700	.316	.497	.794
42	.313	.705	-.158	.598	.792	.300	.606	.377	.806
48	.493	.547	.157	.423	.824	.496	.550	.409	.818
EV[3]	2.401	2.011	1.380	5.105		2.398	2.139	3.551	
%VE[4]				51.050			39.456		
KMO MSA[5]					.798				.896
BtoS sig[6]		.000					.000		
ICR alpha[7]		.721					.721		

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6) Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha, 8) Structure Loadings

EXE + CON: This cluster consisted of ten variables. As shown in table 4.41, three factors also emerged from principal components extraction of eigenvalues > 1 and oblique rotation. The three factors were made up of the following variables, F1: EXE (23, 29), CON (21, 22); F2: CON (18, 26); F3: EXE (07, 10, 11), CON (12). Only one variable (T26) loaded on a single factor (F2). Four variables cross-loaded on F1 and F3, one (T07) loaded on F2 and F3 and three cross-loaded on all three factors. The correlation between the factors was

F1, 2 = .062; F1, 3 = .348; F2, 3 = -.012. Although the cluster was not a uni-dimensional, this set of items had ICR α = .720.

Dropping T26 from CON to make CON4 (with increased alpha of .585) resulted in two factors. T10 only loaded on factor two while T18 only loaded in Factor one. The other variables cross-loaded on both factors one and two (> .20). The correlation between the two factors was .369. It was clear that it would not be possible to reduce this cluster to a single factor without substantial loss of variables.

The two factors showed they were at least slightly related given their correlation. The internal consistency reliability of this cluster increased to .747. This factor was designated as structural thinking (STR) and is represented in Table 4.41. The different scales of TSI-M were examined for internal consistency reliability as shown in Table 4.42. The number of factors in each scale is also presented.

Table 4.41

TSI-M Factor Analysis for Factor (EXE + CON) Scale (N=738)

Item	Initial Solution					Final Solution (EXE + CON4)			
	Rotated Loadings			Com[1]	MSA[2]	Loadings		Com[1]	MSA[2]
	F1	F2	F3			F1	F2		
7	.154	.337	.693	.614	.815	.230	.601	.362	.823
10	.201	-.095	.711	.515	.799	.179	.694	.488	.812
11	.398	.275	.621	.503	.820	.310	.682	.470	.831
23	.587	.325	.298	.483	.865	.489	.402	.296	.876
29	.745	.141	.400	.588	.829	.752	.434	.593	.824
12	.352	-.049	.666	.462	.795	.293	.705	.498	.800
18	.450	.457	.191	.390	.807	.573	.115	.339	.808
21	.767	.201	.213	.615	.810	.782	.256	.613	.810
22	.773	.074	.233	.599	.822	.762	.293	.581	.816
26	.141	.795	.013	.640	.619	.dropped			
EV[3]	2.655	1.213	2.199	5.409		2.591	2.320	3.878	
%VE[4]				54.090			43.089		
KMO MSA[5]					.813				.821
BtoS sig[6]				.000			.000		
ICR alpha[7]				.720			.747		

Note: 1) Communalities, 2) Measure of Sampling Adequacy, 3) Eigenvalue, 4) Percent of Variance Explained, 5) Kaiser-Meyer-Olkin Measure of Sampling Adequacy, 6)Bartlett's Test of Sphericity significance, 7) Internal Consistency Reliability Cronbach alpha.

Table 4.42

TSI-M Scales' internal consistency reliabilities (Cronbach's α)

TSI-M Scales	Factors	ICR
JUD + LIB + EXT	3	.825
JUD + LIB + EXT4	2	.833
LEG + INT	3	.721
LEG4 + INT	2	.721
EXE + CON	3	.720
EXE + CON4	2	.747

TSI-M: Scales Comparison

In the (JUD + LIB + EXT4) cluster, two subscales (LIB + EXT4) were consisted with the original design of complex. The subscales (JUD + LIB + EXT4) cluster was rather called liberal thinking style. Furthermore, the two subscales (EXE + CON4) in structural thinking styles were all in the original simple thinking style, while the two subscales of independent thinking (LEG4 + INT) styles were a combination of both the hypothesized complex and simple thinking styles. Consequently, Liberal thinking and Structural thinking could reflect something similar to the originally proposed complex thinking and simple thinking styles, while the Independent thinking style seemed to represent a new way of thinking in this study different from the findings of prior studies.

Based on these findings, and the subsequent new categories, the rest of the analyses were performed on 3 x 3 (Figure 3.3) matrices of correlations of summated scales. The scales of ASSIST-M consisted of deep approach (DA10), surface apathetic approach (SAA10) and strategic approach (ST6) and that of TSI-M were liberal thinkers (LT), Independent thinkers (IT) and Structural thinkers (STR).

Factor Analysis of all scales (TSI-M, ASSIST-M and Preferences)

The factor analysis performed on the six main summated scales of the TSI-M and the ASSIST-M, along with the two scales of the preferences and a scale (Alertness to Assessment Demand) that emerged independent from ASSIST-M instrument, resulted in two factors (accounting for 60.55%) of the variance in the data. The analysis was done using principal component extraction with oblique rotation based on eigenvalues > 1 with scree test (Cattell, 1966) on factor structure matrix. As indicated in Table 4.43 each of the summated scales loaded differentially with both inventories suggesting significant relationships between thinking styles and learning approaches.

The first factor showed high positive loadings on Liberal thinking (LT) styles as well as in deep approach, alertness to assessment demand (AD), supporting understanding (SU) and strategic approach (ST6) to learning.

The second factor was positively loaded on Independent thinking (IT) and surface apathetic (SAA10) approach to learning, while the third factor had high positive loaded on transmitting information (TI) and fairly moderate negative loading on alertness to assessment demand (AD) and surface apathetic approach (SAA10).

Supporting understanding (SU) as expected loaded completely on liberal thinking (LT) and transmitting information as well loaded completely on structural thinking (STR).

The factor analysis of the seven modified subscales for TSI-M (JUD, EXE, LIB, EXT4, LEG4, INT, CON4) was repeated for the two randomly selected subsets of the sample, one with N = 368 (random subset 1) and the other with N = 370 (random subset 2). For each random subset, extraction based on principal components extraction of eigenvalues > 1 and oblique rotation reproduced the 3-factor solution which was also true of the complete sample.

Table 4.43

Factor Analysis: TSI-M Scales + ASSIST-M Scales + Preference Scales - Oblique (Oblimin) Rotation

	Structure Matrix Components		
	F1	F2	F3
LT	.735	.259	-.069
IT	.241	.833	.021
STR	.504	.269	-.466
DA10	.851	.005	-.096
SAA10	-.150	.766	-.351
ST6	.698	-.071	-.222
AD	.615	-.039	-.417
SU	.616	.081	.179
TI	.120	.162	.857

Correlations

Correlational analyses were conducted for the two instruments to check for relationships between the original and improved nine subscales and three scales of ASSIST, and the ten subscales and three scales of TSI. There were also correlations on the reduced subscales and scales of both instruments. Their correlations were stated and later tested for statistically significance differences based on gender, field of study and level of study. All correlations were Pearson product moment.

Approaches and Study Skills Inventory for Students (ASSIST)

ASSIST-M Subscales

The correlation matrices of the nine subscales showed correlations that are consistent with the theoretical framework of the ASSIST instrument. Their patterns of relationships are described with all variables in Table 4.44. However, the correlation indices were stronger in the improved subscales as shown in Table 4.45. Further, correlations

showed the same pattern of negative consistency in some subscales as in the original instrument. The Deep Approach subscales (SM, RI, UE) correlated negatively with the majority of the Surface Apathetic Approach subscales (LP, UM, SB) in both the original and improved subscales.

The improved subscales were designated as RI2, SB2, TM3 and OS3 in all analyses involving both the subscales and the scales.

The general trend in both the original and improved subscales is the fact that they tended to correlate according to the design of the instrument in the expected negative and positive directions.

As indicated in Table 4.46, the individual subscales, seeking meaning (SM), use of evidence (UE), and relating ideas (RI) had high significant correlation with deep approach (DA10) scale, and these subscales as well related negatively with surface apathetic approach (SAA10). The lack of purpose (LP) had significant correlation with surface apathetic approach (SAA10) and correlated negative with both the deep approach (DA10) and strategic approaches (ST6) hence these correlations indicate consistency with the original design of the ASSIST instrument.

Table 4.44

Correlations: ASSIST-M 9 Original Subscales + All Variables

Subscale	SM	RI	UE	LP	UM	SB	OS	TM
RI	.39**							
UE	.62**	.50**						
LP	-.15**	.16**	-.07					
UM	-.07*	.21**	-.03	.58**				
SB	-.01	.13**	.06	.44**	.46**			
OS	.42**	.34**	.37**	-.03	.06	.08*		
TM	.47**	.34**	.44**	-.09*	.03	-.04	.50**	
AD	.42**	.31**	.41**	-.04	.04	.11**	.41**	.35**

** p ≤ .01 level (2-tailed), * p ≤ .05 level (2-tailed)

Table 4.45

Correlations: ASSIST-M 9 Subscales reduced and improved (DA10, SAA10, ST6)

Subscale	SM	RI2	UE	LP	UM	SB2	OS3	TM3
RI2	.54**							
UE	.62**	.58**						
LP	-.15**	.12**	-.07					
UM	-.07*	-.07**	-.03	.58**				
SB2	-.10	.17**	-.06	.43**	.42**			
OS3	.42**	.42**	.37**	-.11**	.00	-.07*		
TM3	.41**	.34**	.39**	-.10**	.03	-.16**	.52**	
AD	.42**	.39**	.41**	-.04	.04	-.01	.39**	.29**

** p ≤ .01 level (2-tailed), * p ≤ .05 level (2-tailed)

Table 4.46

Correlations: ASSIST-M 7 Subscales improved with DA10 + SAA10 + ST6

Subscale	DA10	SAA10	ST6
SM	.88**	-.13**	.48**
RI2	.78**	-.14**	.43**
UE	.88**	-.07	.44**
LP	-.13**	.87**	-.12**
UM	.07	.85**	.02
SB2	-.12**	.69**	-.14**
OS3	.47**	.07*	.87**
TM3	.45**	-.08*	.88**
AD	.48**	-.00	.39**
SU	.45**	-.07	.27**
TI	.12**	.24**	.12**

** $p \leq .01$ level (2-tailed), * $p \leq .05$ level (2-tailed)

ASSIST-M Scales

As shown in Table 4.47, improved scales for the deep approach (DA10) to learning related negatively with the surface apathetic approach (SAA10) and there was more profound difference with the improved Scales of ASSIST-M. The deep approach had fairly high positive correlation with strategic (ST6), alertness to assessment demand (AD) as well as with preference for supporting understanding (SU).

Surface apathetic approach (SAA10) had no correlations with both deep approach (DA10) and alertness to assessment demand (AD). It also showed negative correlations with strategic approach (ST6) and supporting understanding (SU) but positively correlated with preference for transmitting understanding (TI). Again the negative correlations were manifested more with the improved ASSIST-M scales.

Furthermore, in both imputed and improved scales, the strategic approach (ST6), alertness to assessment demand (AD) and supporting understanding (SU) showed fairly high significant correlations with the deep approach (DA10). The surface apathetic approach (SAA10) had low negative and non-significant correlations with strategic approach (ST6), alertness to assessment demand (AD) and preference for supporting understanding (SU).

Table 4.47

Correlations: ASSIST-M 3 Scales reduced and improved with preference scales

Scale	DA10	SAA10	ST6	AD	SU
SAA10	-.13				
ST6	.53**	-.09			
AD	.48**	-.00	.39		
SU	.45**	-.07	.27**	.23**	
TI	.12**	.24**	.12**	.21**	.05

** p ≤ .01 level (2-tailed), * p ≤ .05 level (2-tailed)

Thinking Style Inventory Modified (TSI-M)

TSI-M: subscales

The correlation matrices of the 10 subscales of TSI-M were examined and they showed correlations that were somewhat consistent with the theoretical basis of the TSI-M instrument. Again the improved and reduced subscales showed stronger internal consistency reliability with the subscales as well with the scales. Their patterns of relationships are described in Tables 4.48 and 4.49.

There were also similar correlational consistency and in fact, stronger correlations existed among the seven improved and uni-dimensional subscales that were later adopted for this study as shown in Table 4.50

Furthermore, Table 4.51 showed consistency of correlation with both the imputed and improved subscales to the three scales of TSI-M. The subscales loaded as expected to the scales.

Table 4.48

TSI-M: Correlations between 10 original subscales

Subscale	Leg	Jud	Lib	Glo	Ext	Exe	Loc	Con	Mon
Jud	.33**								
Lib	.42**	.63**							
Glo	.33**	.38**	.36**						
Ext	.13**	.55**	.47**	.23**					
Exe	.16**	.43**	.34**	.23**	.42**				
Loc	.30**	.43**	.35**	.35**	.31**	.36**			
Con	.20**	.32**	.22**	.40**	.24**	.52**	.41**		
Mon	.36**	.41	.45**	.40**	.27**	.34**	.45**	.40**	
Int	.50**	.13**	.23**	.37**	-.08*	.08*	.30**	.29**	.42**

** $p \leq .01$ level (2-tailed), * $p \leq .05$ level (2-tailed)

Table 4.49

Correlations: TSI-M 13 Subscales reduced and improved

SS[1]	Leg 4	Jud	Lib	Glo3	Glo2	Ext4	Exe	Loc3	Loc2	Con4	Mon3	Mon2
Jud	.28**											
Lib	.38**	.63**										
Glo3	.25**	.18**	.19**									
Glo2	.28**	.51**	.46**	.24**								
Ext4	.09*	.55**	.47**	.03	.40**							
Exe	.13**	.43**	.34**	.10**	.34**	.43**						
Loc3	.17**	.47**	.39**	.11**	.39**	.39**	.41**					
Loc2	.25**	.16**	.12**	.23**	.17**	-.01	.11**	.12**				
Con4	.13**	.34**	.22**	.27**	.30**	.26**	.59**	.36**	.24**			
Mon3	.23**	.50**	.50**	.07	.37**	.41**	.39**	.37**	.17**	.27**		
Mon2	.33**	.08*	.14**	.37**	.15**	-.06	.11**	.09*	.35**	.26**	.08*	
Int	.50**	.13**	.25**	.35**	.21**	-.10**	.08*	.10**	.36**	.19**	.16**	.47**

1) Subscale, ** p ≤ .01 level (2-tailed), * p ≤ .05 level (2-tailed)

Table 4.50

TSI-M: Correlations of 7 Subscales (reduced and improved)

Subscale	Leg4	Jud	Lib	Ext4	Exe	Con4
Jud	.28**					
Lib	.38**	.63**				
Ext4	.09*	.55**	.47**			
Exe	.13**	.43**	.34**	.43**		
Con4	.13**	.34**	.22**	.26**	.59**	
Int	.50**	.13**	.25**	-.10*	.08**	.19**

** p ≤ .01 level (2-tailed), * p ≤ .05 level (2-tailed)

Table 4.51

Correlations: TSI-M 7 Subscales improved with Liberal + Independent + Structural

Subscale	LT	IT	STR
LEG4	.31**	.81**	.15**
JUD	.88**	.22**	.43**
LIB	.87**	.35**	.31**
EXT4	.77**	-.02	.39**
EXE	.47**	.12**	.89**
CON4	.32**	.19**	.89**
INT	.13**	.91*	.15**

** p ≤ .01 level (2-tailed), * p ≤ .05 level (2-tailed)

TSI-M subscales intercorrelation

The overall indication points to the fact that all ten subscales of the TSI-M positively correlated except external (EXT) and internal (INT) which were negatively correlated. All correlations were significant at the 0.01 level (2-tailed). However, internal (INT) versus external and (EXT), internal (INT) versus executive (EXE) showed significance at the 0.05 level (2-tailed).

With all 13 subscales (Table 4.49), the correlations followed the same positive pattern of loading, except that local-B (T01, 47) versus external (EXT) and monarchic-B (T02, 32) versus external (EXT) showed negative correlation.

When monarchic, local and global were dropped, then among the remaining seven subscales, the internal versus external again showed negative correlation at .05 significant level. The remaining subscales indicated positive correlations.

Results from the seven subscales further indicated that Judicial showed moderate correlation with liberal (.63) and external (.55). Legislative also manifested moderate correlation with internal (.50). Executive likewise showed moderate correlation with

conservative, at (.59). These correlations were consistent with the design of the TSI-M instrument except the moderate correlation between legislative and internal, which turned out to be one of the unique findings of this study. Again internal thinking style (INT) correlated negatively (-.01) with external thinking style at .05 significant level.

TSI-M Scales

As shown in Table 4.52, the three scales of the TSI-M are related weakly to each other. It appears the relationship is weak enough to regard them as separate scales. The structural thinking style scale however is related more to the liberal thinking style than to the independent thinking style. However, Table 4.51 showed that the subscales that contributed in a major way to the structural thinking style were the executive and conservative styles.

Table 4.52

Correlations: TSI-M three scales reduced and improved

Scale	LT	IT
IT	.24**	
STR	.44**	.17**

** p ≤ .01 level (2-tailed), * p ≤ .05 level (2-tailed)

Relationships of Approaches and Study Skills Inventory for Students (ASSIST-M) and Thinking Style Inventory (TSI-M)

Following the analysis of the subscales and scales of the two inventories TSI-M and ASSIST-M, summated scales were constructed for the TSI-M for JUD + LIB + EXT4 (F1); LEG + INT (F2) and EXE + CON4 (F3) and for ASSIST-M: DA10, SAA10, ST6 and AD as previously described. The inter-correlations of these scales, along with SU and TI scales from preference to learning (PTL) were computed and used to investigate the research hypotheses.

The first sets of hypotheses were simply to investigate if there were relationships between TSI-M scales and ASSIST-M scales. The answers to these questions are shown in the scale correlations of both instruments that are presented in Table 4.53.

The remaining three sets of research hypotheses asked if there were differences in correlations between various mutually exclusive subsets of the population, specifically male versus female, science versus non-science, and level 100 versus level 400. Note that in each set of comparisons, the two subgroups fully partition the total sample. Correlations based on the three demographics are demonstrated in Tables 4.54, 4.55 4.56, 4.57, 4.58 and 4.59.

Table 4.53

Correlations between TSI-M and ASSIST-M: (TSI-M + ASSIST-M Scales Improved + Preference Scales)

Subscale	Factor 1 = LT	Factor 2 = IT	Factor 3 = STR
DA10	.55**	.16**	.31**
SAA10	.00	.36**	.13**
ST6	.35**	.11**	.30**
AD	.32**	.11**	.27**
SU	.32**	.11**	.15**
TI	.09*	.10**	.24**

** $p \leq .01$ level (2-tailed), * $p \leq .05$ level (2-tailed)

Table 4.54

Correlations based on Gender: Correlations of Thinking Styles with Approaches to Learning for Males

	ASSIST-M Scales					
TSI-M Scales	DP10	SAA10	ST6	AD	SU	TI
LT	.617**	.012	.382**	.294**	.310**	.153**
IT	.171**	.457**	.179**	.147**	.070	.219**
STR	.390**	.127**	.337**	.328**	.157**	.288**

** p ≤ .01 level (2-tailed), * p ≤ .05 level (2-tailed)

Table 4.55

Correlations based on Gender: Correlations of Thinking Styles with Approaches to Learning for Females

	ASSIST-M Scales					
TSI-M Scales	DP10	SAA10	ST6	AD	SU	TI
LT	.482**	-.017	.317**	.340**	.325**	.026
IT	.134*	.239**	.032	.069	.149**	-.021
STR	.227**	.125*	.267**	.216**	.138**	.203**

** p ≤ .01 level (2-tailed), * p ≤ .05 level (2-tailed)

Table 4.56

Correlations based on field of study: Correlations of Thinking Styles with Approaches to Learning for Science Students

	ASSIST-M Scales					
TSI-M Scales	DP10	SAA10	ST6	AD	SU	TI
LT	.544**	.031	.369**	.304**	.304**	.063
IT	.170**	.397**	.152**	.086	.133**	.100
STR	.306**	.127*	.312**	.270**	.138**	.176**

** p ≤ .01 level (2-tailed), * p ≤ .05 level (2-tailed)

Table 4.57

Correlations based on field of study: Correlations of Thinking Styles with Approaches to Learning for Non-Science Students

	ASSIST-M Scales					
TSI-M Scales	DP10	SAA10	ST6	AD	SU	TI
LT	.554**	-.021	.319**	.330**	.333**	.125*
IT	.151**	.302**	.059	.148**	.089	.100
STR	.312**	.132*	.295**	.270**	.168**	.301**

** p ≤ .01 level (2-tailed), * p ≤ .05 level (2-tailed)

Table 4.58

Correlations based on students' level: Correlations of Thinking Styles with Approaches to Learning for level 100 Students

	ASSIST-M Scales					
TSI-M Scales	DP10	SAA10	ST6	AD	SU	TI
LT	.560**	.056	.353**	.387**	.329**	.149**
IT	.176**	.310**	.111*	.155**	.160**	.096
STR	.370**	.109*	.294**	.296**	.192**	.218**

** p ≤ .01 level (2-tailed), * p ≤ .05 level (2-tailed)

Table 4.59

Correlations based on students' level: Correlations of Thinking Styles with Approaches to Learning for level 400 Students

	ASSIST-M Scales					
TSI-M Scales	DP10	SAA10	ST6	AD	SU	TI
LT	.532**	-.047	.337**	.241**	.299**	.043
IT	.132**	.397**	.103*	.069	.062	.113**
STR	.253**	.147**	.311**	.243**	.110*	.260**

** p ≤ .01 level (2-tailed), * p ≤ .05 level (2-tailed)

Having demonstrated that there was some kind of relationship between the two instruments and the three demographics of interest, the next investigation was to show if the differences were statistically significant with particular reference to the three demographics, using a Bonferroni correction of the alpha level to account for type 1 error inflation due to the number of comparisons being made. Detailed computational procedures for these tests are presented in Appendix G. Results of the significance and no significance differences found on testing the correlations are stated in Tables 4.60, 4.61 and 4.62.

Table 4.60

Differences in correlations (Fisher transformed z values) between TSI-M and ASSIST-M based on gender

	F1 = LT	F2 = IT	F3 = STR
DA10	2.63	0.51	2.45
SAA10	0.39	3.38**	0.03
ST6	1.00	2.01	1.04
AD	-0.69	1.07	1.64
SU	-0.22	-1.08	0.26
TI	1.73	3.30*	1.23

** $p \leq .0008$, * $p \leq .001$

Table 4.61

Differences in correlations (Fisher transformed z values) between TSI-M and ASSIST-M based on level

	F1 = LT	F2 = IT	F3 = STR
DA10	0.54	0.61	1.75
SAA10	1.39	-1.34	-0.53
ST6	0.25	0.11	-0.26
AD	2.19	1.18	0.77
SU	0.45	1.34	1.14
TI	1.45	-0.24	-0.60

** $p \leq .0008$, * $p \leq .001$

Table 4.62

Differences in correlations (Fisher transformed z values) between TSI-M and ASSIST-M based on field of study

	F1 = LT	F2 = IT	F3 = STR
DA10	-0.20	0.27	-0.09
SAA10	0.70	1.47	-0.07
ST6	0.76	0.27	0.26
AD	-0.39	-0.85	0.00
SU	-0.43	0.61	-0.42
TI	-0.85	0.00	-1.80

** $p \leq .0008$, * $p \leq .001$

Research questions 5 and 6 did not make sense to pursue given the results obtained. Specifically, the data supported the existence of deep, strategic and surface apathetic as distinct approaches. Thus, combining them in different ways, as suggested by some prior studies, was not supported by the data in this study. Further, the existence of complex (and simple) thinking styles referred to in research questions 5 and 6 (as identified in prior studies) were not supported by the results of this study. Given this context, research questions 5 and 6 were no longer meaningful. However, results from the correlations and factor analyses of the scales in the two instruments suggested that participants who scored higher in Deep Approach (DA10) tended to score higher in strategic approach (ST6) as well as in liberal thinking (LT) which in turn is suggestive of the originally hypothesized complex thinking style.

Furthermore on question 6, Surface apathetic approach (SAA10) and strategic approach (ST6) tended to relate negatively to each other giving the indication that they are separate factors that could not necessarily be combined together for further analysis. As a result there were no hypotheses generated for the two questions.

Answers to the Research Questions

Correlations between TSI-M and ASSIST-M Summated Scales

Answering the research questions required testing the corresponding research hypotheses, which were based on the correlations between the scales of the TSI-M and ASSIST-M, as well as the differences in the correlations for different mutually exclusive (independent) groups. These correlations and differences were presented earlier in this chapter. Research questions were investigated based on the summated scales of the two instruments.

There was also some checking done using the preference scales. All results are reported using 2-tailed probabilities, with a Bonferroni adjusted alpha level of 0.00139 based on a nominal alpha level of .05 with 36 tests.

Research Question 1

Is there a relationship between thinking styles and learning approaches?

Corresponding hypothesis: H_0: $r = 0$

The results in table 4.44 indicate the following for research hypotheses 1a through 1i.

1a) DA10 vs. LT, $r = .55$, $p > .00139$, reject H_0

1b) DA10 vs. IT, $r = .16$, $p > .00139$, reject H_0

1c) DA10 vs. STR, $r = .31$, $p > .00139$, reject H_0

1d) SAA10 vs. LT, $r = .00$, $p < .00139$, fail to reject H_0

1e) SAA10 vs. IT, $r = .36$, $p > .00139$, reject H_0

1f) SAA10 vs. STR, $r = .13$, $p > .00139$, reject H_0

1g) ST6 vs. LT, $r = .35$, $p > .00139$, reject H_0

1h) ST6 vs. IT, $r = .11$, $p > .00139$, reject H_0

1i) ST6 vs. STR, $r = .30$, $p > .00139$, reject H_0

The above findings suggest that the answer to the research question one is yes. Only one out of the nine research hypotheses showed no relationship. The correlation between liberal thinking and surface apathetic approach as shown in (1d) is at $r = .00$, $p < .00139$. The result is similar to the correlation between deep approach and surface apathetic approach with $r = -.13$, $p > .00139$ as shown in Table 4.47. This suggests that students who apply liberal thinking and deep approach to learning do not use, at the same time a surface apathetic approach and in fact suggests mutual exclusivity. On the other hand, there was significant relationship between liberal thinking and deep approach with $r = .55$, $p > .00139$. The result further indicated that students who applied deep approach to learning were more than students that adopted surface apathetic approach to learning. Thus this finding supported previous studies that asserted that there is a strong relationship between deep approaches to learning with complex thinking style. This finding supported the theoretical bases for supporting understanding and transmitting information in ASSIST.

When the other scales (though not part of the hypotheses): supporting understanding, transmitting information and alertness to assessment demand, were included in the correlations, a similar pattern of relationship were found, with supporting understanding leaning toward more liberal thinking styles and transmitting information stronger with structural thinking styles. This correlation supported the theoretical bases of supporting understanding and transmitting information in ASSIST.

Research Question 2

Is there a difference in the relationship between thinking styles and learning approaches based on gender?

Corresponding null hypothesis: $r_m - r_f = 0$

The results in tables 4.54 and 4.55 indicate the following for research hypotheses 2a through 2i based on gender, test of significant difference at .00139 (Bonferroni Correction).

2a)	DA10 vs. LT,	$z_{diff} = 2.63$,	$p > .00139$,	fail to reject H_0
2b)	DA10 vs. IT,	$z_{diff} = .51$,	$p > .00139$,	fail to reject H_0
2c)	DA10 vs. STR,	$z_{diff} = 2.45$,	$p > .00139$,	fail to reject H_0
2d)	SAA10 vs. LT,	$z_{diff} = .39$,	$p > .00139$,	fail to reject H_0
2e)	SAA10 vs. IT,	$z_{diff} = 3.38$,	$p = .0008 < .00139$,	reject H_0
2f)	SAA10 vs. STR,	$z_{diff} = .03$,	$p > .00139$,	fail to reject H_0
2g)	ST6 vs. LT,	$z_{diff} = 1.00$,	$p > .00139$,	fail to reject H_0
2h)	ST6 vs. IT,	$z_{diff} = 2.01$,	$p > .00139$,	fail to reject H_0
2i)	ST6 vs. STR,	$z_{diff} = .1.04$,	$p > .00139$,	fail to reject H_0

This research question was answered by using a test statistic for the difference of two correlations between males and females. The findings above showed that there were basically no differences in the ways males and females applied their thinking styles and learning approaches. The only one that stood out was the significant difference found with the relationship between surface apathetic approach and independent thinking style at $z_{diff} = 3.38$, $p = .0008 < .00139$.

Considering a more detailed approach to this finding, the result showed there were some similarities in correlations between males and females in their applications of thinking styles and learning approaches. For instance, the patterns of positive correlations of liberal thinking on all the scales of learning approaches were very close in both genders. The males however showed slightly higher correlations on deep approach and strategic approaches to learning, while the females showed slightly higher correlations on supporting understanding and alertness to assessment demands (all correlations at 0.01 level, 2-tailed).

On independent thinking style, males showed slightly higher correlations in all the scales of learning approach than the females. However, on the use of structural thinking the correlations were similar in both genders across the different scales of learning.

When the Bonferroni adjusted alpha level = .00139 was used there were significant differences between males and females in their application of independent thinking style with surface apathetic approach to learning and also in their use of Transmitting information with independent thinking style. There were significant correlation between males and females in their application independent thinking styles and learning approaches at $p \leq .00139$. The remaining hypotheses were all rejected because there were levels of significant relationships between thinking styles and learning approaches based on gender at the level greater than 0.00139.

Furthermore, when the scales supporting understanding, transmitting information and alertness to assessment demand were investigated, there were significant correlations between the application of independent thinking and transmitting information among males and females in the study at $p \leq .00139$.

Research Question 3

Is there a difference in the relationship between thinking styles and learning approaches based on level of study?

Corresponding null hypothesis: $r_{100} - r_{400} = 0$

The adjusted alpha level of 0.00139 was applied in testing for statistical significant differences between the two levels of students in the study. The results in table 4.58 and 4.59 indicate the following for research hypotheses 3a through 3i based on field of study, test of significant difference at .00139 (Bonferroni Correction).

3a)	DA10 vs. LT,	$z_{diff} = .54$,	$p > .00139$,	fail to reject H_0
3b)	DA10 vs. IT,	$z_{diff} = .61$,	$p > .00139$,	fail to reject H_0
3c)	DA10 vs. STR,	$z_{diff} = 1.75$,	$p > .00139$,	fail to reject H_0
3d)	SAA10 vs. LT,	$z_{diff} = 1.39$,	$p > .00139$,	fail to reject H_0
3e)	SAA10 vs. IT,	$z_{diff} = -1.34$,	$p > .00139$,	fail to reject H_0

3f) SAA10 vs. STR, $z_{diff} = -0.53$, $p > .00139$, fail to reject H_0

3g) ST6 vs. LT, $z_{diff} = 0.25$, $p > .00139$, fail to reject H_0

3h) ST6 vs. IT, $z_{diff} = 0.11$, $p > .00139$, fail to reject H_0

3i) ST6 vs. STR, $z_{diff} = -0.26$, $p > .00139$, fail to reject H_0

In answering this research question using a test of statistical difference, the results showed there were no significant differences between the application of thinking styles and learning approaches based on level 100 and level 400 students who participated in the study hence all the null hypotheses were rejected.

Research Question 4

Is there a difference in the relationship between thinking styles and learning approaches based on field of study?

Corresponding null hypothesis: $r_s - r_{ns} = 0$

The Bonferroni adjusted value was applied to detect if there were statistical significance differences in the different hypotheses used in answering the research question. The results in table 4.56 and 4.57 indicate the following for research hypotheses 4a through 4i based on field of study, test of significant difference at .00139 (Bonferroni Correction).

4a) DA10 vs. LT, $z_{diff} = -0.20$, $p > .00139$, fail to reject H_0

4b) DA10 vs. IT, $z_{diff} = 0.27$, $p > .00139$, fail to reject H_0

4c) DA10 vs. STR, $z_{diff} = -0.09$, $p > .00139$, fail to reject H_0

4d) SAA10 vs. LT, $z_{diff} = 0.70$, $p > .00139$, fail to reject H_0

4e) SAA10 vs. IT, $z_{diff} = 1.47$, $p > .0008$, fail to reject H_0

4f) SAA10 vs. STR, $z_{diff} = -0.07$, $p > .00139$, fail to reject H_0

4g) ST6 vs. LT, $z_{diff} = 0.76$, $p > .00139$, fail to reject H_0

4h) ST6 vs. IT, $z_{diff} = 1.27$, $p > .00139$, fail to reject H_0

4i) ST6 vs. STR, $z_{diff} = 0.26$, $p > .00139$, fail to reject H_0

When the hypotheses were investigated and tested for significance, the results showed there was no significant difference on thinking styles and learning approaches based on science and non-science students who participated in the study. There were no significant differences found in all the tests, as a result all the hypotheses were rejected since the correlations were not zero.

Item Analysis

The results from the present study suggested some consistency with the findings of those earlier studies: Zhang and Sachs (1997); Allan, Zhang, and Carmelo (2002) found "when taking or writing about ideas, I stick to one main idea" (item 2, Monarchic); "I tend to pay little attention to details" (item 7, Global) and "I prefer to deal with specific problems, rather than with general questions" (item 1, Local) in the TSI fall in the range of unacceptable interscale correlations. These items were dropped in the two different studies with among students from China and Philippines. Interestingly, when the same items were dropped in the current study, the internal consistency reliability of the effected subscale increased. These findings further suggest two things: removal of the items or the total elimination of the three subscales involved as it was done in the present study enhanced the internal reliability consistency of the scales.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Practical Significance of Results for Survey Instruments

Approaches and Study Skills Inventory for Students (ASSIST-M)

With minor modifications the ASSIST seemed to have performed creditably well with the Nigerian sample. Findings from the different subscales and scales of the instrument mirrored closely to earlier studies (Diseth, 2001, McCune and Entwistle, 2000). However, the strategic approach scale did not result in a measure consistently as high as other scales. This was partly a result of removing the Alertness to Assessment Demand subscale as part of Strategic Approach as it appeared to measure something different. This weakness tended to support prior studies claiming that the strategic approach tends to be unstable as it can load to deep approach as well as in surface apathetic approach.

The modified ASSIST instrument (ASSIST-M) used in determining learning approaches in this study tended to show Nigerian students as applying deep, surface apathetic and strategic approaches to their studies in accordance with the design of the instrument (Entwistle, 1998).

In the Nigerian population the Deep Approach (DA) appeared to be a valid (uni-dimensional, single factor) construct in the ASSIST-M when using slightly reduced variable sets of the three subscales that constituted the DA scale. These 12 variables (DA12) all came from the three subscales with each having four variables: Seeking Meaning (SM), Relating Ideas (RI), and Use of Evidence (UE), as intended in the design of the instrument. When tested for uni-dimensionality, SM and UE appeared to be uni-dimensional in their own right, while RI came out as two factors. The subscale factor RI-2 with two items showed higher internal consistency reliability than using the four items and was used in subsequent

analysis. The other two items of RI were eliminated. With RI-2 the DA10 scale resulted to uni-dimensional scale. Thus, it was reasonable to represent the Deep Approach with a summated scale formed from the coded responses to these items. The resulting DA10 scale had Cronbach's alpha internal consistency reliability of .789.

The Surface Apathetic Approach (SAA) also appeared to be a valid (uni-dimensional, single factor) construct in the ASSIST-M when using a slightly reduced subscale. There were also 10 items from the three subscales: Lack of Purpose (LP), Unrelated Memorizing (UM) and Syllabus Boundedness (SB) to make it uni-dimensional with stronger internal consistency reliability and appeared to be consistent with the intended design of the instrument. LP, UM and SB subscales appeared to be uni-dimensional in their own right, but could not be uni-dimensional when combined to form a scale. As a result, elimination of two variables from SB was needed to make SAA10 a uni-dimensional scale. Thus, it was reasonable to represent the Surface Apathetic Approach with a summated scale formed from the coded responses to these items. SA10 had Cronbach's alpha internal consistency reliability of .776.

The Strategic Approach (ST) did not appear to be a uni-dimensional construct in the ASSIST-M, with the items for the Organized Studying (OS) and Time Management (TM) subscales tending to load together while the items for the Alertness to Assessment Demands subscale formed a different factor. All three subscales, however, were individually uni-dimensional. When all the items for OS and TM were factor analyzed they formed a uni-dimensional construct after the elimination of two variables, one from each subscale. Thus, a summated scale, ST6 (OS3, TM3), was formed from the coded responses to the remaining six items. ST6 had Cronbach's alpha internal consistency reliability of .682. The two items eliminated from organized study stated: 'I manage to find conditions for studying which allow me to get on with my work easily' and from time management: 'I manage pretty good at

getting down to work whenever I need to'. These items suggest an environment conducive to studying and effective time control. There are many challenges that university students face in Nigeria and those may have given rise to problems students encounter in using their time well and efficiently. Factors such as deficient enabling environments like constant power interruptions, high temperatures, and poor ventilation in the university facilities may exacerbate these problems. Research tools like the provision of Internet facilities, good libraries and up to date text books are very often not available in most of the universities in Nigeria as typical of developing nations.

The Alertness to Assessment Demands (AD) subscale was retained on its own. The four items formed a uni-dimensional scale with Cronbach's alpha internal consistency reliability of .398. This scale, although it was employed in the over all analysis was not considered as a separate factor in answering the research questions because of its low internal consistency reliability.

The Pearson correlations between these four summated scales are given in the upper right triangle in Table 5.1, while the probabilities (2-tailed) are given in the lower left triangle.

Table 5.1

ASSIST-M scale correlations with probabilities

	DA10	SAA10	ST6	AD
DA10		-.127	.528	.476
SAA10	.001		-.090	-.004
ST6	.000	.015		.391
AD	.000	.916	.000	

The patterns of correlations in Table 5.1 suggest that the summated scale for SAA10 is apparently independent of the summated scales for DA10, ST6 and AD. The relationship between DA10, ST6 and AD is consistent with some previous studies (Marton et al., 1976, and Marton and Booth, 1997) in which the strategic approach tended to load with the Deep Approach. Although there is some relationship between ST6 and AD, it is weak enough to support that they measure something different.

The internal consistency reliabilities of the ASSIST-M in the present study did not appear to be as strong as in some previous studies. They were, however, very similar to the results for Scottish and South African students in a study by Tait and McCume (2000) with Scottish, South African and British undergraduates.

Thinking Skills Inventory (TSI-M)

The TSI did not completely produce results as expected. However there were some results that were somewhat consistent with the design of the instrument. Going by the theoretical underpinnings of the theory of mental self-government which postulates thinking styles as dynamic rather than static constructs, the varying results of some of the subscales can be appreciably understood. In spite of the fact that the TSI did not perform completely as expected, it produced results that were similar enough to make it useful and interesting in the present study, specifically, the correlation of Liberal thinking style and Deep Approach to learning. A new category emerged (independent thinking style) which suggested that to some degrees, certain individuals' possess the skills of combining some rigorous thinking style with just rudimentary preferences to learning approaches.

In the Nigerian population not all of the 10 subscales of the TSI-M appeared to be valid (uni-dimensional; single-factor) constructs. Three of them, Global, Local, and Monarchic, yielded two factors under factor analysis of their constituent items. Global was made single factor by dropping T06 with an increase in IRC. Likewise, Local was made

single-factor by dropping T47, with an increase in IRC or by dropping T01 and T47 with a further increase in IRC to α = .369. This finding was consistent with some studies where local and Monarchic as subscales tended to produce the lowest internal consistent reliability (Zhang, 2001, Zhang and Sternberg, 2000, Zhang, 1999). Note, however, that this was still a very low reliability, the lowest of the 10 subscales. Finally, dropping two items (T02 & T32) from Monarchic yielded a single factor with improved IRC α = .624. Thus the 10 subscales were made uni-dimensional by the elimination of 5 variables.

The situation, however, was more complicated than that. When factor analyzing the original 10 subscales, a 3-factor structure emerged in which Judicial, Liberal and External formed one factor, Legislative, Global, Monarchic and Internal formed a second factor, and Executive, Conservative and Local formed a third factor. These factor loadings were not stable, however, when Global, Local and Monarchic (all 2-factor subscales) were replaced by their single-factor reduced subscales. Indeed, with the reduced subscales, all three now loaded on the first factor along with Judicial, Liberal and External, resulting in a two-factor solution. Regardless of what is reasonable under the theory of thinking styles and prior published research, the fact that the Global, Local and Monarchic subscales shifted their loading when made uni-dimensional (and more reliable) was psychometrically problematic. When the three problematic subscales were dropped and the remaining seven subscales (with 35 variables) were factor analyzed, the three previously identified factors once again emerged. The three factors came out as F1: JUD+LIB+EXT; F2: LEG+INT; and F3: EXE+CON.

However, when the 15 items for Judicial, Liberal and External (F1) were factored analyzed, it also yielded three factors. Elimination of one variable (T03) from External resulted in two factors for the 14 remaining items (JUD+LIB+EXT4) with substantial cross-loadings.

The correlation between the two factors was .439. The two factors apparently were somewhat related based on their correlation. When forced to one factor it resulted in the same internal consistency reliability as for two factors, giving the IRC α = .833. This factor, although it was somewhat consistent with the complex thinking style, was labeled liberal thinking. The term liberal is not applied here in the restricted (political) sense of the word but rather it is in line with the constructs (theoretical underpinnings) of the mental self-government. The subscales in this factor describe individuals who prefer to work freely in the midst of others. They tend to evaluate unstructured tasks requiring novel strategies without setting a priori goals.

When the 10 items for Legislative and Internal (F2) were factored, they initially yielded three factors as well. Elimination of one variable (T13) from Legislative resulted in two factors for the nine remaining items (LEG4+INT) with substantial cross-loadings. The correlation between the two factors was .343. The factors, however, were at least somewhat related given their correlation. When only one factor was extracted it had the same internal consistency reliability as for two factors giving rise to an IRC α = .721. This factor was termed Independent thinking style. The subscales in this factor describe people who are creative, imaginative and tend to isolate themselves in order to crystallize their originality, their independent thinking style and approach to reality.

When the 10 items for Executive and Conservative (F3) were factored, they initially yielded three factors. Elimination of one variable (T26) from Conservative resulted in two factors for the seven remaining items (EXE+CON4) with substantial cross-loadings. The correlation between the factors was .369. Again, based on this correlation, the two factors appear to be somewhat related to each other. However, when a single factor was extracted it resulted in an internal consistency reliability of α = .747. This factor, although it was consistent with the characteristics of the Simple thinking style was labeled Structural

thinking. The subscales items in this scale suggest a thinking style that adheres to structure. The factor describes a person who prefers to attend to some pre-structured tasks and focus on details of the traditional approach.

Although the present findings did not exactly match the intended grouping of complex and simple thinking styles, it was reasonable to continue the analysis based on the resulting three summated scales for Liberal, Independent, and Structural thinking styles. The first factor consisted of three subscales of the hypothesized complex thinking style, and the third factor consisted of subscales of the hypothesized simple thinking style. It was factor two that had a mixture of the complex and simple thinking styles. Hence factor two suggested a novel interpretation of thinking styles in the present study.

The summary correlations between the three summated scales of TSI-M are given in the upper right triangle in Table 5.2, while the correlations between the factors are given in the lower left triangle. All summated scale correlations had probability $p < .001$.

Table 5.2

TSI-M summated scale (upper right) and factor (lower left) correlations

	Liberal	Independent	Structural
Liberal		.235	.443
Independent	.145		.174
Structural	.341	.089	

The patterns of correlations in Table 5.2 suggest that the summated scale for independent thinking style is distinct from the summated scale for structural thinking style. However, the liberal thinking style showed a mild relationship with the structural thinking style and a slight relationship with the independent thinking style. Although there are some relationships between the three styles, it is weak enough to suggest that they do not

measure (represent) the same thing. The identification of the independent thinking style represented a new finding not found in previous studies.

Conclusions

Studies on individual differences have led many researchers to investigate if a relationship existed on how people use their thinking and learning styles based on personality types, cultures, gender, family social economic status, age, educational level etc. across the globe. These are variables that influence individuals' perception of reality, performance and approaches to tasks/things within their environment and daily operations. The individual requires a frame of mind, an awareness of it and indications of preferences consistent with the person's attributes in dealing with social environment and cognitive milieu. Sternberg (1988) calls this awareness mental self-government; a set of thinking preferences unique to each individual in making choices. These preferences can be socialized, meaning that mental self-governing as an attribute is adaptable at various stages of human development.

Findings from the present study have given some indications that university students in Nigeria apply diverse thinking styles and various approaches to learning in academic careers. In so doing it established the existence of some relationship between thinking and learning styles. Using the modified versions of two instruments that have been widely used in studies in Western and Asian countries, the results of the present study however, have shown some differences from results obtained in prior studies.

Two previous studies on Thinking Styles (Sternberg and Zhang 2000; Zhang 2001, 2002) suggested there were two clusters of thinking styles, namely, complex and simple thinking styles. However, among Nigerian students in the present study, the 10 thinking styles that were supposed to cluster between complex and simple thinking styles factored instead into three clusters named here as liberal thinking, independent thinking and

structural thinking. The liberal and structural thinking styles apparently reflected some consistency with the complex and simple thinking styles respectively as described in the previous studies. They consisted of some of the same subscales found in both the complex and simple thinking styles. The independent thinking style while showing some features of both the complex and simple thinking styles appeared to be distinct from the liberal and structural thinking styles.

Based on the results of this study, the use of complex and simple thinking styles as found in previous studies, could not be directly supported. The findings, on the other hand, did support three ways of applying thinking styles that showed some similarities with items of complex and simple thinking styles.

Sternberg perceived thinking styles as being dependent on situation, environment and conditions in which individuals found themselves. Those situations facilitated which thinking style or styles to apply in a given circumstance. In the study by Sternberg and Zhang (2001), there were distinctions made between the application of complex and simple thinking styles. However, results from the present study showed three paradigms of thinking style, namely Liberal, Independent and Structural. Independent thinking style included some aspects of complex thinking styles as well as some aspects of the simple thinking style. Complex thinking styles had some strong correlations with judicial and external thinking styles, and correlates as well with deep approach in the Sternberg and Zhang (2001) study. The same patterns of relationships were found in the present study with liberal thinking style and included preference of supporting understanding. The reason for identifying a liberal thinking style is that not all subscales required for the complex thinking style loaded on a common factor.

Three approaches to learning were also identified, consistent with prior studies. Although no prior studies have examined the relationship between thinking styles (as

exemplified by Sternberg's TSI) and approaches to learning (as represented by Entwistle's ASSIST) with Nigerian students, the present study presumed a relationship existed in which the hypothesized "complex" thinking style would tend to be associated with a deep approach to learning and possibly a strategic approach to learning as well. It was also presumed that the hypothesized "simple" thinking style would tend to be associated with a surface apathetic approach to learning. The findings in this study tend to support these presumptions.

This study also presumed that there would be differences in the patterns of relationship between thinking styles and approaches to learning based on gender, level of study and field of study. Support for this presumption was not found. This is somewhat surprising given that other studies (Sadler-Smith, 1996; Miller, et al., 1990, and Clarke, 1986), have suggested that there might be differences in how participants respond to each instrument based on the given demographic variables, in particular gender. The results of the present study indicate correlations that were almost homogenous and possibly as result of homogenous response of the item questions. However, this finding does not suggest that there might not actually be differences based on the given demographics. Possibly investigations on such correlations could be pursued in another study.

In retrospect, it is perhaps not surprising that there was no difference in the pattern of relationship between learning approach and thinking style based on level of study. Although the participants in this research ranged in age from 18 to more than 26 years, all of these ages are beyond the formal operational stage where Piaget theorized that cognitive development tends to stabilize.

The participants who tended to adopt a liberal thinking style also tended to adopt deep approach learning. The survey items suggest that such people are out-going, enjoy the company of others, and could effectively excel in group assignments and projects at school, as well as in other ventures of life. This interpretation is based on high contribution of

external thinking style to the scale liberal thinking style. The TSI-M subscales associated with liberal thinking style were judicial, external and liberal, while the ASSIST-M subscales were seeking meaning, use of evidence and relating ideas. All these TSI-M subscales, in previous studies (Zhang and Sternberg 2000; Zhang, 2002) suggested strong relationships with higher academic performance and complex thinking.

The Independent thinking style reflected assertive and individualistic personalities. These individuals could be creative and in doing that they needed to be withdrawn and be by themselves, an attribute consistent with creativity (Fieldhusen and Yun Dai, 1999), and a preference for solitary play and activity in gifted children (Torrance, 1986). This suggests people who prefer to work alone on unstructured settings that require using novel problem-solving strategies of creativity. These qualities have emerged distinctively from the study as individuals who exhibited these attributes tended to draw from liberal and structural thinking styles. The independent thinking style could as well be called the integrated approach because of its extrapolations of Liberal (complex) and Structural (simple) thinking styles. Some studies have also indicated that creativity in students was associated with an integrative mode of thinking (Kim and Michael, 1995; Okabayashi and Torrance, 1984). This finding is also consistent with the theory of mental self-government, where individuals may not necessarily be pinned down to only a particular thinking style.

However, in this study, Independent thinking style has shown unexpectedly consistent high correlation with the surface apathetic approach to learning. This could mean that Nigerian students who adopt a surface apathetic approach may do well in a study environment enhancing independent thinking and creativity.

The structural thinking style was characterized by high positive loadings of the executive and conservative subscales. This name was chosen for the factor as it characterized a preference for a thinking style that tended to adhere to structure.

Furthermore, the style described individuals leaning toward a prefigured task with a predefined approach. Finally, individuals that mirrored a simple thinking style in the study portrayed characteristics of those who could conservatively adhere to lay down rules and sequences. They may like to be given precise instructions in doing their assignments and routine tasks. They were represented in the study as applying structural thinking.

The three paradigms discovered in this study tended to reflect Riechmann and Grasha (1974) three learning preference styles – independent learners, dependent learners and collaborative learners. These forms of learning in a way reflected adaptation of some characteristics of liberal, independent and structural thinking styles.

The cross-loading and close correlations of many variables of the thinking style inventory in this study tended to reflect characteristics of the theory of mental self-government. Sternberg (1988, 1997; Sternberg & Grigorenko, 1997) proposed that thinking style constructs are not typological but nomothetic and continuous in nature, meaning that stylistic differences are not a matter of whether one possesses or does not possess a specific style but of the degree of that particular thinking preference.

On the opposite polarities characteristic of some thinking styles, it was only Internal and External thinking styles that showed some evidence of negative correlation. Their negative correlation (-.08) resulted in external thinking relating to liberal style and internal style in independent thinking style. Sternberg's (1994) study of college students indicated that legislative and executive, liberal and conservative, global and local, and internal and external styles are negatively correlated with each other. The present study did not find similar negative relationships between most of these subscales.

On learning approaches, the overall results from the measures of ASSIST in the present study were largely consistent with the original design of instrument. Some studies have suggested that the strategic approach interpolates between deep and surface

approaches to learning. The finding in this study however, suggested a consistent correlation between deep and strategic approaches, thereby presenting and suggesting the two model approaches to learning. The initial and original studies of Marton (1976); Marton and Booth, (1997) proposed specifically deep and surface approaches to learning. The ASSIST-M instrument was somewhat inclined to be relevant with Nigerian university students and appeared to giving some support for adopting the two forms of learning as deep and surface approaches proposed by Marton et al. However, the consistency in results of the three approaches to learning prevailed in adopting the designed paradigm of the three approaches by the author of ASSIST instrument.

The overall correlation indices tended to suggest mutual exclusivity between deep and surface apathetic approaches to learning. Again the strategic approach and alertness to assessment demands showed relatively high correlations with deep approach and sometimes showed negative correlation with surface apathetic approach to learning. The findings suggested that individuals adopting deep approaches are different from those individuals who may be adopting surface approaches to learning. The strategic approach to learning showed greater correlation with deep than with surface apathetic approaches to learning.

"Executive people" according to the theory of mental self-government are basically implementers, who like to enforce rules and laws (theirs and others); they are likely to adopt a traditional approach in their daily tasks. They like to do things in a way that adheres to set rules and guidelines. The executive and conservative scales were consistently related to each in this study, showing that some Nigerian students may apply these styles in their studies. Those who adopt these styles are likely to be those students that tend to be dependent on the teacher's handouts and notes. This finding tends to support Nneji (2002) who found that the majority of university students in Nigeria depended on their course

handouts or lecture notes as the main source of information and read mostly for passing exams. They are likely to do well in class with those teachers who require students to give them what had been taught, what they have precisely outlined in their handouts. Individuals oriented to this approach styles, would generally tend to adhere to existing rules and procedures. They will likely be inclined to minimizing change and avoid ambiguous situation that challenge novelty and will tend to prefer familiar situations in daily life, work place, as well as in school.

Implications of the Study Results for Nigerian Education

The findings from this study indicated that there were relationships between thinking styles and learning approaches. It therefore raised challenges for students, teachers and governments in developing curriculum in various cultures at different levels of studies. Further, it laid credence to the claims of the theory of mental self-government that a match between students' learning styles and thinking styles could enhance self-confidence and performance in school.

The fact that there are a variety of thinking styles and preferred ways of learning suggests that teachers should be encouraged to design a learning context that allows for different thinking styles. In so doing, students regardless of their favored ways of thinking will benefit from their learning context.

As stated in the National policy on Education in Nigeria, one of the goals of tertiary education is to acquire both physical and intellectual skills, which enable individuals to be self-reliant and productive members of the society. These goals are tenable when government can solidly finance and support programs designed in enabling students to excel in their preferred ways of thinking and learning. Government should set up monitoring and evaluating processes for the effective implementation of the set goals and ideals of education in all levels of learning.

The analyses performed on the ASSIST and TSI showed that the correlations between the two instruments were not strong. In fact the highest correlation was .551. The rest of the correlations were less than .551, suggesting that the instruments actually measure different constructs. In the present study, although thinking style and learning approach do have something in common, the findings indicate that they are different ways of perceiving reality and can be adapted to differentially suit individual idiosyncrasies, potentials and preferences.

Recommendations for Further Study

1) The investigation with Thinking Styles Inventory (TSI) and Approaches and Study Skills Inventory for Students (ASSIST) is considered to be a novel approach to exploring learning for Nigerian students. There is the need therefore to use each of these instruments separately to explore the complete details of each instrument in its full version.

2) The ASSIST instrument further suggested some deficiency in the application of organized study and time management in the sample; further investigation in this direction could be useful for both students in their career development and for the government's investment in education.

3) Students often become an extension of their teachers' ideas, ideals and approaches to learning. Consequently, future study could investigate the relationship between teaching styles with thinking styles, learning approaches or both.

4) Future studies might also consider taking the path of a longitudinal approach with these instruments in studying Nigerian students' styles of thinking and learning over time. In that way, detailed attention could be given to each student, as the individual develops and is assessed at various stages of learning using a qualitative approach in research.

5) Emphasis on developing skills in Internet research that reduces reliance on hand out. However, that presupposes availability of computers and Internet connections in Nigerian Universities.

6) There is a need to further investigate the internal consistency reliabilities and factor structures of the two instruments, perhaps using their long versions. This is especially true of the TSI given that three of the ten subscales were dropped from this study due to their poor performance. Alternatively, if the three subscales continued to perform inconsistently with the long version, the TSI could be revised/extended by adding new/additional items.

7) Factor analysis describes the relationship between variables in ways that show the broad overall pattern clearly, but cannot identify the different patterns of relationships, which may exist in sub-groups within a population (Meyer, 2000). For this reason cluster analysis could be recommended as an alternative way of studying the relationships in the present study.

8) Further investigations are required with some data on students' test scores, performance scores, and grade point average in order to estimate how possibly thinking styles could improve learning of university students.

9) The pattern of relationship between learning approaches and thinking styles may be determined, or at least strongly influenced, by cultural factors. As such, the present study could be extended to investigate cross-cultural comparisons.

APPENDIX A – TSI SAMPLE ITEMS

Sample Items	*Scale Type*	*Key Characteristics*
I like tasks that allow me do things my own way.	Legislative	Being creative
I like situations in which it is clear what role I must play or what way I should participate.	Executive	Being conforming
I like to evaluate and compare different points of view on issues that interest me.	Judicial	Being analytic
I like to complete what I am doing before starting something else.	Monarchic	Dealing with one task at a time.
When undertaking some tasks I like first to come up with a list of things that the task will require me to do and to assign an order of priority to the items on the list.	Hierarchical	Dealing with multiple prioritized tasks.
I usually know what things need to be done but I sometimes have trouble deciding in what order to do them.	Oligarchic	Dealing with multiple un-prioritized tasks.
When working on a written project mind wander and my pen follow up on whatever thoughts cross my mind.	Anarchic	Dealing with tasks usually let my at random.
Usually when I make a decision, I don't pay attention to details.	Global	Focusing on Abstract ideas.
I like problems that require engagement with details.	Local	Focusing on concrete ideas.
I like to be alone when working on a problem.	Internal	Enjoy working Independently.
I like to work with others rather than by myself.	External	Enjoy working with groups.
I like to do things in new ways, even if I am not sure they are the best ways.	Liberal	Using new ways to Deal with tasks.
In my work, I like to keep close to what has been done before. with tasks.	Conservative	Using traditional ways to deal

APPENDIX B – ASSIST SAMPLE ITEMS

Sample Items	*Scale Type*	*Key Characteristics*
I usually set out to understand for myself the meaning of what I have to learn.	Deep Approach	Seeking meaning
I like to play around with ideas of my own even when they don't get me very far.	Deep Approach	Relating ideas
Often I find myself questioning things I hear in lectures or read in books.	Deep Approach	Use of evidence
I usually plan out my week's work in advance, either on paper or in my head.	Strategic Approach	Organized studying
I generally make good use of my time during the day.	Strategic Approach	Time management
I keep an eye open to what lecturers seem to think is important and concentrate on that.	Strategic Approach	Alertness to Assessment demands
I am not really interested in this course but I have to take it for other reasons.	Surface Apathetic App	Lack of purpose
I like to be told precisely what to do in essays or other assignments.	Surface Apathetic App	Syllabus-boundedenes
I often seem to panic, if I get behind with my work.	Surface Apathetic App	Fear of failure

APPENDIX C

APPROVAL LETTERS

UNIVERSITY OF JOS, NIGERIA
FACULTY OF NATURAL SCIENCES

DEAN OF NATURAL SCIENCES
PROFESSOR CELESTINE O.E. ONWULIRI
B.Sc., Ph.D. (Nigeria) C. Biol,
M. Biol (London) FNSP, FBSN
E-mail: onwuliric@unijos.edu.ng

Private Mail Bag 2084
Jos, Nigeria
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OFFICE OF THE DEAN

Ref: UJ/FNS/D/04

Date: 13/4/ 2004

Rev. Jude O Inweregbu <af5753@wayne.edu>
Wayne State University
Detroit, Michigan
United States of America, Phone- 313-577-1677.
Fax 313-993-7122; 734-655-1620

Dear Rev. Inweregbu,

VISIT TO THE UNIVERSITY OF JOS TO CONDUCT STUDY

Your e-mail requesting permission to collect data on "Thinking Styles and Learning Approaches of University Students in Nigeria" is acknowledged.

Permission is hereby granted to you to undertake the study.

There is no IRB here that reviews this type of research . We have however determined that the research that Fr. Inweregbu will be doing here is ethically sound and have it in the standard way in which similar projects of this kind are reviewed.

This study will however be at no cost to the University of Jos.

With kindest regards

12/04/04

Prof. C O E Onwuliri
Dean,
Faculty of Natural Sciences

CC VICE CHANCELLOR
UNIVERSITY OF JOS.

UNIVERSITY OF PORT HARCOURT

FACULTY OF SCIENCE

Telephone: (084) 334400/398
Telegrams: University Pharcourt
Telex : 61185 Phuni

EAST-WEST ROAD
CHOBA
P. M. B. 5323
PORT HARCOURT.

Our Ref: .....

Your Ref:.....

OFFICE OF THE DEAN

29th March, 2004
.....19.....

The Vice Chancellor,
University of Port Harcourt,
Port Harcourt.

Dear Sir,

PERMISSION TO COLLECT DATA ON "THINKING STYLES AND LEARNING APPROACHES OF UNIVERSITY STUDENTS IN NIGERIA": REV. JUDE O. INWEREGBU

The above-named is pursuing a Ph.D programme at Wayne State University, Detroit, Michigan, United States of America. He desires to collect data from several Nigerian Universities for the purpose of writing his Ph.D thesis on "Learning Styles of Nigerian Students".

Your approval is please being sought for him to collect the relevant data from our students. The study will have no cost implication whatever to the University of Port Harcourt.

Thank you for your anticipated approval.

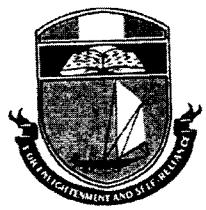
Yours sincerely,

Prof. B. E. Okoli

VC
To see fra.
29/03/04
A. com. Science

UNIVERSITY OF PORT HARCOURT

DEAN
PROF. S. I. UDOIDEM
B. A. Rome, M A (WASH.DC) Ph.D. (WASH.DC)
Telephone: 084-230890, Ext. 3360
Telegrams: University Pharcourt



East-West Road
Choba
P. M. B. 5323
Port Harcourt
Nigeria.

Our Ref ——————————

——————————20——

OFFICE OF THE DEAN
FACULTY OF HUMANITIES

Rev. Jude O. Ineregbu
Wayne State University
Detract, Michigan
United States

Dear Rev. Ineregbu

I have received your request through Dr. Mrs. Nwachukwu that a letter permitting you to distribute questionnaire in the faculty of Humanities for the purpose of undertaking a study on "Thinking styles and learning Approaches of University students in Nigeria" be written on your behalf.
You are by this letter permitted to carryout the study in the faculty. Please note that the study is at no cost to the University of Port Harcourt and the University has no accompanying obligation.

With best wishes

Prof. S.I. Udoidem

Appendix D

Recruitment Script

This study is about the different thinking and learning style students apply in their studies. Students need to be aware of the styles that work for them. Participation in this study may evoke awareness of your thinking and learning styles strengths and weaknesses.

If you are interested in participating, you will be required to read an information sheet and fill out two questionnaires one on thinking styles and the other on learning approaches. Choosing to participate is voluntary, and there is at this time no known risks involved. This study will not have an effect on your grades in school. You need to be 18 years or older to participate in this study.

Any question at this time?

If you would volunteer to participate in this study please remain seated and you will be given a copy of the information sheet and the questionnaires. Non-volunteers may leave. When you have completed the questionnaires, please leave them at the designated place.

Appendix E

Information Sheet

Title of Study: AN INVESTIGATION OF THINKING STYLES AND LEARNING APPROACHES OF UNIVERSITY STUDENTS IN NIGERIA

You are being asked to be in a research study of Thinking Styles and learning Approaches of University Students at Federal University of JOS (FUJO) and Federal University of Port Harcourt (FUPH). Please read this form and ask any questions you may have before agreeing to be in the study. Jude Inweregbu a doctoral candidate in Evaluation and Research at Wayne State University, Detroit, Michigan, United States, is conducting the study.

Study Purpose:
The purpose of the study is to investigate the relationship between thinking styles and learning approaches of university students focusing on those in their first year and fourth year levels. The estimated number of study participants to be enrolled at FUJO is about 320 as well as about 320 at FUPH.

Study Procedures:
If you take part in the study, you will be asked to fill out 2 questionnaires: one on thinking styles and the other on learning approaches. There are 7 scales for the thinking styles and 5 scales for the learning approaches. You are to read statements carefully and circle a number in the scales that indicate how well the statements fit your way of thinking and learning. You need to answer all questions to make your responses relevant to the study. Each of the questionnaires will take about 30 minutes.

Benefits: Participation in this study may evoke awareness of your thinking styles and learning strengths that would enhance your academic performance. It may provide information leading to a re-evaluation of university curriculum in Nigeria.

Risks: There are no known risks at this time to participation in this study.

Compensation: You will not be paid for taking part in this study.

Confidentiality:
All information collected about you during the course of this study will be kept confidential to the extent permitted by law. You will not be identified in the research records. No identifying information will be collected.

Voluntary Participation /Withdrawal:
Taking part in this study is voluntary. You may choose not to take part in this study. If you complete the questionnaires, you are consenting to participate. Your decision will not change any present or future relationships with Wayne State University or its affiliates or other services you are entitled to receive.

Questions:
If you have any questions now or in the future, you may contact Jude Inweregbu at af5753@wayne.edu or one of his research team members at the following phone number (313) 577-1677. If you have questions or concerns about your rights as a research participant, the Chair of the Human Investigation Committee can be contacted at (313) 577-1628.

Appendix F

Background information

Identifier: JOS / PH **Gender**: M / F **Age**: 18 – 25 / 26 - Above

Faculty: Science / Non Science **Level of study**: 100 / 400

THINKING STYLES QUESTIONNAIRE MODIFIED (TSI-M)

This is a Questionnaire about the different strategies and ways people use to solve problems, to carry out tasks or projects, and to make decisions. Read each statement carefully and decide how well it describes you. Use the scale provided to indicate how well the statement fit the way you typically do things at school, at home, or on a job. Circle 1 if the statement does **not** fit you at all, that is, you almost never do things this way. Circle 7 if the statement fits you extremely well, that is, you almost always do things this way. Use the values in between to indicate that the statement fits you in varying degrees.

7	6	5	4	3	2	1
Extremely Well	**Very Well**	**Well**	**Somewhat Well**	**Slightly Well**	**Not Very Well**	**Not At All Well**

There are, of course, no right or wrong answers.

Please read each statement and circle the statement on the scale next to the statement that best indicates how well the statement describes you.

Please proceed at your own pace, but do not spend too time on any one statement.

If you have any questions, feel free to ask them now.

1. I prefer to deal with specific problems, rather than with general questions	7	6	5	4	3	2	1
2. When working or writing abstract ideas, I stick to one main idea.	7	6	5	4	3	2	1
3. When starting a task, I like to brainstorm ideas with friends or peers.	7	6	5	4	3	2	1
4. When faced with a problem, I use my own ideas and strategies to solve it.	7	6	5	4	3	2	1
5. In discussing or writing a topic, I think the details and facts are more important than the overall pictures.	7	6	5	4	3	2	1
6. I tend to pay little attention to details.	7	6	5	4	3	2	1
7. I like to figure out how to solve a problem following certain rules.	7	6	5	4	3	2	1
8. I like to control all phases of a project, without having to consult with others.	7	6	5	4	3	2	1
9. I like to play with my ideas and see how far they go.	7	6	5	4	3	2	1
10. I am careful to use the proper method to solve any problem.	7	6	5	4	3	2	1
11. I enjoy working on things that I can do by following directions.	7	6	5	4	3	2	1
12. I stick to standard rules or ways of doing of doing things.	7	6	5	4	3	2	1
13. I like problems where I can try my own way of solving them.	7	6	5	4	3	2	1
14. When trying to make a decision, I rely on my own judgment of the situation.	7	6	5	4	3	2	1
15. In a discussion or report, I like to combine my own ideas with those of others.	7	6	5	4	3	2	1

7	6	5	4	3	2	1
Extremely Well	Very Well	Well	Somewhat Well	Slightly Well	Not Very Well	Not At All Well

16. I care more about the general effect than about the details of a task I have to do.	7	6	5	4	3	2	1
17. I like situations where I can compare and rate different ways of doing things.	7	6	5	4	3	2	1
18. When I am in charge of something, I like to follow methods and ideas used in the past.	7	6	5	4	3	2	1
19. I like to check and rate opposing points of view or conflicting ideas.	7	6	5	4	3	2	1
20. I like to collect detailed or specific information for projects on which I work.	7	6	5	4	3	2	1
21. I like situation where I can follow a set routine.	7	6	5	4	3	2	1
22. I like tasks and problems that have fixed rules to follow in order to complete them.	7	6	5	4	3	2	1
23. I like projects that have clear structure and a set of plan and goal.	7	6	5	4	3	2	1
24. When working on a task, I like to start with my own ideas.	7	6	5	4	3	2	1
25. I like to participate in activities where I can interact with others as a part of a team.	7	6	5	4	3	2	1
26. When faced with a problem, I like to solve it in a traditional way.	7	6	5	4	3	2	1
27. I like to work alone on a task or a problem.	7	6	5	4	3	2	1
28. I tend to emphasize the general aspect of issues or the overall effect of a project.	7	6	5	4	3	2	1
29. I like to follow definite rules or directions when solving a problem or doing a task.	7	6	5	4	3	2	1
30. When working on a project, I like to share ideas get input from other people.	7	6	5	4	3	2	1
31. I like projects where I can study and rate different views of ideas.	7	6	5	4	3	2	1
32. When trying to make a decision, I tend to see only one major factor.	7	6	5	4	3	2	1
33. I like problems where I need to pay attention to details.	7	6	5	4	3	2	1
34. I like to challenge old ideas or ways of doing things and to seek better ones.	7	6	5	4	3	2	1
35. I like situations where I interact with others and everyone works together.	7	6	5	4	3	2	1
36. I like working on projects that deal with general issues and not with nitty-gritty details.	7	6	5	4	3	2	1
37. I like situations where I can use my own ideas and ways of doing things.	7	6	5	4	3	2	1
38. If there are several important things to do, I do the one most important to me.	7	6	5	4	3	2	1
39. I prefer tasks or problems where I can grade the designs or methods of others.	7	6	5	4	3	2	1
40. When faced with a problem, I prefer to try new strategies or methods to solve it.	7	6	5	4	3	2	1
41. I like to concentrate on one task at a time.	7	6	5	4	3	2	1
42. I like projects that I can complete independently.	7	6	5	4	3	2	1
43. I enjoy work that involves analyzing, grading, or comparing things.	7	6	5	4	3	2	1
44. I like to do things in new ways not used by others in the past.	7	6	5	4	3	2	1
45. I have to finish one project before starting another one.	7	6	5	4	3	2	1
46. In talking or writing down ideas, I like to show the scope and context of my ideas, that is the general picture.	7	6	5	4	3	2	1
47. I pay more attention to parts of a task than to its overall effect or significance.	7	6	5	4	3	2	1
48. I prefer situations where I can carry out my own ideas without relying on others.	7	6	5	4	3	2	1
49. I like to change routines in order to improve the way tasks are done.	7	6	5	4	3	2	1
50. I like to take old problems and find new methods to solve them.	7	6	5	4	3	2	1

Approaches and Study Skills Inventory for Students Modified (ASSIST-M)

This questionnaire has been designed to allow you to describe, in a systematic way, how you go about learning and studying. The technique involves asking you a substantial number of questions, which overlap to some extent to provide good overall coverage of different ways of studying. Most of the items are based on comments made by other students. Please respond truthfully, so that your answers will **accurately** describe your **actual** ways of studying, and work your way through the questionnaire quite **quickly**.

This questionnaire asks you to indicate your relative agreement or disagreement with comments about studying again made by other students. Please work through the comments, giving your immediate response. It is also very important that you answer all questions.

5 = agree 4 = agree somewhat 2 = disagree somewhat 1 = disagree

Try not to use 3 = unsure, unless you really have to, or if it cannot apply to you.

There are, of course, no right or wrong answers.

Please read each statement and circle the number on the scale next to the statement that best indicates how well the statement describes you.

Please proceed at your own pace, but do not spend too time on any one statement.

If you have any questions, feel free to ask them now.

1. I manage to find conditions for studying which allow me to get on with my work easily.	5	4	3	2	1
2. When working on an assignment, I am keeping in mind how best to impress the maker.	5	4	3	2	1
3. Often I find myself wondering whether the work I am doing here is really worthwhile.	5	4	3	2	1
4. I usually set out understand for myself the meaning of what we have to learn.	5	4	3	2	1
5. I recognize my study time carefully to make the best use of it.	5	4	3	2	1
6. I find I have to concentrate on just memorizing a good deal of what I have to learn.	5	4	3	2	1
7. I look at the evidence carefully and try to reach my own conclusion about what I am studying.	5	4	3	2	1
8. I try to relate ideas I come across to those in other topics or other courses whenever possible.	5	4	3	2	1
9. I tend to read very little beyond what is actually required to pass.	5	4	3	2	1
10. I think I am quite systematic and organized when it comes to reversing for exams.	5	4	3	2	1
11. I look carefully at tutors' comments on course work to see how to get highest marks next time.	5	4	3	2	1
12. There is not much of the work here that I find interesting or relevant.	5	4	3	2	1
13. When I read article or book, I try to fine out for myself exactly what the author means.	5	4	3	2	1
14. I am pretty good at getting down to work whenever I need to.	5	4	3	2	1
15. Much of what I am studying makes little sense: it is like unrelated bits and pieces.	5	4	3	2	1
16. When I'm working on a new topic, I try to see in my own mind how all the ideas fit together.	5	4	3	2	1
17. Often I find myself questioning things I hear in lectures or read in books.	5	4	3	2	1

5	4	3	2	1
Agree	**Agree Somewhat**	**Unsure**	**Disagree Somewhat**	**Disagree**

18. I concentrate on learning just those bits of information I have to know to pass.	5	4	3	2	1
19. I am good at following up some of the reading suggested by lecturers or tutors.	5	4	3	2	1
20. I keep in mind who is going to mark an assignment and what they're likely to be looking for.	5	4	3	2	1
21. When I look back, I sometime wonder why I ever decided to come here.	5	4	3	2	1
22. When I am reading, I stop from time to time to reflect on what I am trying to learn from it.	5	4	3	2	1
23. I work steadily through the semester or term, rather than leave it all until the last minute.	5	4	3	2	1
24. I am not really sure what is important in lectures so I try to get down all I can.	5	4	3	2	1
25. Ideas in course books or articles often set me off on long chains of thought of my own.	5	4	3	2	1
26. When I read, I examine the details carefully to see how they fit in with what is being said.	5	4	3	2	1
27. I gear my studying closely to just what seems to be required for assignments and exams.	5	4	3	2	1
28. I usually plan out my week's work in advance either on paper or in my head.	5	4	3	2	1
29. I keep an eye open for what lecturers seem to think is important and concentrate on that.	5	4	3	2	1
30. I am not really interested in this course, but I have to make it for other reasons.	5	4	3	2	1
31. Before tackling a problem or assignment, I first try to work out what lies behind it.	5	4	3	2	1
32. I generally make good use of my time during the day.	5	4	3	2	1
33. I often have trouble in making sense of the things I have to remember.	5	4	3	2	1
34. I like to play around with ideas of my own even if they don't get me very far.	5	4	3	2	1
35. It is important for me to be able to follow the argument, or to see the reason behind things.	5	4	3	2	1
36. I like to be told precisely what to do in essays or other assignments.	5	4	3	2	1

Preferences to different Types of Courses and Teaching

a. Lecturers who tells us exactly what to put down in our notebooks.	5	4	3	2	1
b. Lecturers who encourage us to think for ourselves and show us how they themselves think.	5	4	3	2	1
c. Exams, which allows me to show that I've thought about the course material for myself.	5	4	3	2	1
d. Exams or tests, which need only the material, provided in our lecture notes.	5	4	3	2	1
e. Courses in which it is made very clear just which books we have to read.	5	4	3	2	1
f. Courses where we are encouraged to read around the subject a lot for ourselves.	5	4	3	2	1
g. Books, which challenge you and provide explanations, which go beyond the lecture.	5	4	3	2	1
h. Books, which give you definite facts and information, which can easily be learned.	5	4	3	2	1

APPENDIX G

DIFFERENCES OF CORRELATIONS

Appendix G-1 Significance of Differences of Correlations for TSI-M, ASSIST-M and PTL Scales. Total N = 738

Males vs. Females

Zdiff = (Zr1 - Zr2) / denom**
* Zr1 and Zr2 obtained by linear interpolation from Table A17, p. 706, Sheskin
** denom = denominator = SQRT{ [1/(n1-3)] + [1/(n2-3)] }
*** Significance level of Zdiff From Table A1, pgs. 670 - 674, Sheskin, 2-sided critical values: z(.05) = 1.96, z(.01) = 2.58, z(.001) = 3.33; Values > .05 not shown.
Bonferroni alpha adjustment: alpha* = .05/36 = 0.00139 Values greater than this should not be regarded as significant. Significant values in **bold**

Var 1	Var 2	r1			r2			r1					r2					num	denom**	Zdiff	sig***
TSI-M	ASSIST-M	group	value	n1	group	value	n2	r below	Zr below	r above	Zr above	Zr1*	r below	Zr below	r above	Zr above	Zr2*	Zr1 - Zr2			2-tailed
F1	DA10	M	0.617	379	F	0.482	359	0.615	0.717	0.620	0.725	0.720	0.480	0.523	0.485	0.530	0.526	0.1944	0.0739	2.63	0.0086
F2	DA10	M	0.171	379	F	0.134	359	0.170	0.172	0.175	0.177	0.173	0.130	0.131	0.135	0.136	0.135	0.0380	0.0739	0.51	
F3	DA10	M	0.390	379	F	0.227	359					0.412	0.225	0.229	0.230	0.234	0.231	0.1810	0.0739	2.45	0.0142
F1	SAA10	M	0.012	379	F	-0.017	359	0.010	0.010	0.015	0.015	0.012	-0.020	-0.020	-0.015	-0.015	-0.017	0.0290	0.0739	0.39	
F2	SAA10	M	0.457	379	F	0.239	359	0.455	0.491	0.460	0.497	0.493	0.235	0.239	0.240	0.245	0.244	0.2496	0.0739	**3.38**	**0.0008**
F3	SAA10	M	0.127	379	F	0.125	359	0.125	0.126	0.130	0.131	0.128					0.126	0.0020	0.0739	0.03	
F1	ST6	M	0.382	379	F	0.317	359	0.380	0.400	0.385	0.406	0.402	0.315	0.326	0.320	0.332	0.328	0.0740	0.0739	1.00	
F2	ST6	M	0.179	379	F	0.032	359	0.175	0.177	0.180	0.182	0.181	0.030	0.030	0.035	0.035	0.032	0.1490	0.0739	2.01	0.0444
F3	ST6	M	0.337	379	F	0.267	359	0.335	0.348	0.340	0.354	0.350	0.265	0.271	0.270	0.277	0.273	0.0770	0.0739	1.04	
F1	AD	M	0.294	379	F	0.340	359	0.290	0.299	0.295	0.304	0.303					0.354	-0.0510	0.0739	-0.69	
F2	AD	M	0.147	379	F	0.069	359	0.145	0.146	0.150	0.151	0.148	0.065	0.065	0.070	0.070	0.069	0.0790	0.0739	1.07	
F3	AD	M	0.328	379	F	0.216	359	0.325	0.337	0.330	0.343	0.341	0.215	0.218	0.220	0.224	0.219	0.1214	0.0739	1.64	
F1	SU	M	0.310	379	F	0.325	359					0.321					0.337	-0.0160	0.0739	-0.22	
F2	SU	M	0.070	379	F	0.149	359					0.070	0.145	0.146	0.150	0.151	0.150	-0.0800	0.0739	-1.08	
F3	SU	M	0.157	379	F	0.138	359	0.155	0.156	0.160	0.161	0.158	0.135	0.136	0.140	0.141	0.139	0.0190	0.0739	0.26	
F1	TI	M	0.153	379	F	0.026	359	0.150	0.151	0.155	0.156	0.154	0.025	0.025	0.030	0.030	0.026	0.1280	0.0739	1.73	
F2	TI	M	0.219	379	F	-0.021	359	0.215	0.218	0.220	0.224	0.223	-0.025	-0.025	-0.020	-0.020	-0.021	0.2438	0.0739	**3.30**	**0.0010**
F3	TI	M	0.288	379	F	0.203	359	0.285	0.293	0.290	0.299	0.297	0.200	0.203	0.205	0.208	0.206	0.0906	0.0739	1.23	
DA10	SU	M	0.445	379	F	0.452	359					0.478	0.450	0.485	0.455	0.491	0.487	-0.0094	0.0739	-0.13	
DA10	TI	M	0.189	379	F	0.066	359	0.185	0.187	0.190	0.192	0.191	0.065	0.065	0.070	0.070	0.066	0.1250	0.0739	1.69	
SAA10	SU	M	-0.121	379	F	-0.009	359	-0.125	-0.126	-0.120	-0.121	-0.122	-0.010	-0.010	-0.005	-0.005	-0.009	-0.1130	0.0739	-1.53	
SAA10	TI	M	0.290	379	F	0.196	359					0.299	0.195	0.198	0.200	0.203	0.199	0.1000	0.0739	1.35	
ST6	SU	M	0.284	379	F	0.264	359	0.280	0.288	0.285	0.293	0.292	0.260	0.266	0.265	0.271	0.270	0.0220	0.0739	0.30	
ST6	TI	M	0.170	379	F	0.085	359					0.172					0.085	0.0870	0.0739	1.18	
AD	SU	M	0.240	379	F	0.220	359					0.245					0.224	0.0210	0.0739	0.28	
AD	TI	M	0.301	379	F	0.125	359	0.300	0.310	0.305	0.315	0.311					0.126	0.1850	0.0739	2.50	0.0124
N Total							738														

Appendix G-2 Significance of Differences of Correlations for TSI-M, ASSIST-M and PTL Scales. Total N = 738

Males vs. Females

	F1	F2	F2
DA10	2.63 0.0086	0.51	2.45 0.0142
SAA10	0.39	**3.38** **0.0008**	0.03
ST 6	1.00	2.01 0.0444	1.04
AD	-0.69	1.07	1.64
SU	-0.22	-1.08	0.26
TI	1.73	**3.30** **0.0010**	1.23

Z score and significance or difference of Fisher Transformed Z scores
blank sig means > 0.50

Bonferroni adjust alpha level = 0.00139

Values greater than this should not be regarded as significant.

Values less than this marked in **bold**.

Appendix G-3 Significance of Differences of Correlations for TSI-M, ASSIST-M and PTL Scales. Total N = 738

Science vs. Non-science

Zdiff = (Zr1 - Zr2) / denom**
* Zr1 and Zr2 obtained by linear interpolation from Table A17, p. 706, Sheskin
** denom = denominator = SQRT{ [1/(n1-3)] + [1/(n2-3)] }
*** Significance level of Zdiff From Table A1, pgs. 670 - 674, Sheskin, 2-sided critical values: z(.05) = 1.96, z(.01) = 2.58, z(.001) = 3.33; Values > .05 not shown.
Bonferroni alpha adjustment: alpha* = .05/36 = 0.00139 Values greater than this should not be regarded as significant. Significant values in **bold**

Var 1	Var 2	r1			r2			r1					r2					num	denom**	Zdiff	sig***
TSI-M	ASSIST-M	group	value	n1	group	value	n2	r below	Zr below	r above	Zr above	Zr1*	r below	Zr below	r above	Zr above	Zr2*	Zr1 - Zr2			2-tailed
F1	DA10	S	0.544	385	N	0.554	353	0.540	0.604	0.545	0.611	0.610	0.550	0.618	0.555	0.626	0.624	-0.0148	0.0740	-0.20	
F2	DA10	S	0.170	385	N	0.151	353					0.172	0.150	0.151	0.155	0.156	0.152	0.0200	0.0740	0.27	
F3	DA10	S	0.306	385	N	0.312	353	0.305	0.315	0.310	0.321	0.316	0.310	0.321	0.315	0.326	0.323	-0.0068	0.0740	-0.09	
F1	SAA10	S	0.031	385	N	-0.021	353	0.030	0.030	0.035	0.035	0.031	-0.025	-0.025	-0.020	-0.020	-0.021	0.0520	0.0740	0.70	
F2	SAA10	S	0.397	385	N	0.302	353	0.395	0.418	0.400	0.424	0.420	0.300	0.310	0.305	0.315	0.312	0.1084	0.0740	1.47	
F3	SAA10	S	0.127	385	N	0.132	353	0.125	0.126	0.130	0.131	0.128	0.130	0.131	0.135	0.136	0.133	-0.0050	0.0740	-0.07	
F1	ST6	S	0.369	385	N	0.319	353	0.365	0.383	0.370	0.388	0.387	0.315	0.326	0.320	0.332	0.331	0.0562	0.0740	0.76	
F2	ST6	S	0.152	385	N	0.059	353	0.150	0.151	0.155	0.156	0.153	0.055	0.055	0.060	0.060	0.059	0.0940	0.0740	1.27	
F3	ST6	S	0.312	385	N	0.295	353	0.310	0.321	0.315	0.326	0.323					0.304	0.0190	0.0740	0.26	
F1	AD	S	0.304	385	N	0.330	353	0.300	0.310	0.305	0.315	0.314					0.343	-0.0290	0.0740	-0.39	
F2	AD	S	0.086	385	N	0.148	353	0.085	0.085	0.090	0.090	0.086	0.145	0.146	0.150	0.151	0.149	-0.0630	0.0740	-0.85	
F3	AD	S	0.270	385	N	0.270	353					0.277					0.277	0.0000	0.0740	0.00	
F1	SU	S	0.304	385	N	0.333	353	0.300	0.310	0.305	0.315	0.314	0.330	0.343	0.335	0.348	0.346	-0.0320	0.0740	-0.43	
F2	SU	S	0.133	385	N	0.089	353	0.130	0.131	0.135	0.136	0.134	0.085	0.085	0.090	0.090	0.089	0.0450	0.0740	0.61	
F3	SU	S	0.138	385	N	0.168	353	0.135	0.136	0.140	0.141	0.139	0.165	0.167	0.170	0.172	0.170	-0.0310	0.0740	-0.42	
F1	TI	S	0.063	385	N	0.125	353	0.060	0.060	0.065	0.065	0.063					0.126	-0.0630	0.0740	-0.85	
F2	TI	S	0.100	385	N	0.100	353					0.100					0.100	0.0000	0.0740	0.00	
F3	TI	S	0.176	385	N	0.301	353	0.175	0.177	0.180	0.182	0.178	0.300	0.310	0.305	0.315	0.311	-0.1330	0.0740	-1.80	
DA10	SU	S	0.426	385	N	0.473	353	0.425	0.454	0.430	0.460	0.455	0.470	0.510	0.475	0.517	0.514	-0.0590	0.0740	-0.80	
DA10	TI	S	0.146	385	N	0.111	353	0.145	0.146	0.150	0.151	0.147	0.110	0.110	0.115	0.116	0.111	0.0358	0.0740	0.48	
SAA10	SU	S	-0.070	385	N	-0.027	353					-0.070	-0.030	-0.030	-0.025	-0.025	-0.027	-0.0430	0.0740	-0.58	
SAA10	TI	S	0.234	385	N	0.238	353	0.230	0.234	0.235	0.239	0.238	0.235	0.239	0.240	0.245	0.243	-0.0046	0.0740	-0.06	
ST6	SU	S	0.248	385	N	0.305	353	0.245	0.250	0.250	0.255	0.253					0.315	-0.0620	0.0740	-0.84	
ST6	TI	S	0.111	385	N	0.138	353	0.110	0.110	0.115	0.116	0.111	0.135	0.136	0.140	0.141	0.139	-0.0278	0.0740	-0.38	
AD	SU	S	0.204	385	N	0.258	353	0.200	0.203	0.205	0.208	0.207	0.255	0.261	0.260	0.266	0.264	-0.0570	0.0740	-0.77	
AD	TI	S	0.160	385	N	0.267	353					0.161	0.265	0.271	0.270	0.277	0.273	-0.1124	0.0740	-1.52	
N Total							738														

Appendix G-4 Significance of Differences of Correlations for TSI-M, ASSIST-M and PTL Scales. Total N = 738

Science vs. Non-science

Z score and significance or difference of Fisher Transformed Z scores
blank sig means > 0.50

Bonferroni adjust alpha level = 0.00139

Values greater than this should not be regarded as significant.

Values less than this marked in **bold**.

	F1	F2	F2
DA10	-0.20	0.27	-0.09
SAA10	0.70	1.47	-0.07
ST 6	0.76	1.27	0.26
AD	-0.39	-0.85	0.00
SU	-0.43	0.61	-0.42
TI	-0.85	0.00	-1.80

Appendix G-5 Significance of Differences of Correlations for TSI-M, ASSIST-M and PTL Scales. Total N = 738

100 Level (1st year) vs. 400 Level (4th year)

Zdiff = (Zr1 - Zr2) / denom**
* Zr1 and Zr2 obtained by linear interpolation from Table A17, p. 706, Sheskin
** denom = denominator = SQRT{ [1/(n1-3)] + [1/(n2-3)] }
*** Significance level of Zdiff From Table A1, pgs. 670 - 674, Sheskin, 2-sided critical values: z(.05) = 1.96, z(.01) = 2.58, z(.001) = 3.33; Values > .05 not shown.
Bonferroni alpha adjustment: alpha* = .05/36 = 0.00139 Values greater than this should not be regarded as significant. Significant values in **bold**

Var 1	Var 2	r1			r2			r1					r2					num	denom**	Zdiff	sig***
TSI-M	ASSIST-M	group	value	n1	group	value	n2	r below	Zr below	r above	Zr above	Zr1*	r below	Zr below	r above	Zr above	Zr2*	Zr1 - Zr2			2-tailed
F1	DA10	100	0.560	349	400	0.532	389					0.633	0.530	0.590	0.535	0.597	0.593	0.0402	0.0740	0.54	
F2	DA10	100	0.176	349	400	0.132	389	0.175	0.177	0.180	0.182	0.178	0.130	0.131	0.135	0.136	0.133	0.0450	0.0740	0.61	
F3	DA10	100	0.370	349	400	0.253	389					0.388	0.250	0.255	0.255	0.261	0.259	0.1294	0.0740	1.75	
F1	SAA10	100	0.056	349	400	-0.047	389	0.055	0.055	0.060	0.060	0.056	-0.050	-0.050	-0.045	-0.045	-0.047	0.1030	0.0740	1.39	
F2	SAA10	100	0.310	349	400	0.397	389					0.321	0.395	0.418	0.400	0.424	0.420	-0.0994	0.0740	-1.34	
F3	SAA10	100	0.109	349	400	0.147	389	0.105	0.105	0.110	0.110	0.109	0.145	0.146	0.150	0.151	0.148	-0.0390	0.0740	-0.53	
F1	ST6	100	0.353	349	400	0.337	389	0.350	0.365	0.355	0.371	0.369	0.335	0.348	0.340	0.354	0.350	0.0182	0.0740	0.25	
F2	ST6	100	0.111	349	400	0.103	389	0.110	0.110	0.115	0.116	0.111	0.100	0.100	0.105	0.105	0.103	0.0082	0.0740	0.11	
F3	ST6	100	0.294	349	400	0.311	389	0.290	0.299	0.295	0.304	0.303	0.310	0.321	0.315	0.326	0.322	-0.0190	0.0740	-0.26	
F1	AD	100	0.387	349	400	0.241	389	0.385	0.406	0.390	0.412	0.408	0.240	0.245	0.245	0.250	0.246	0.1624	0.0740	2.19	0.0286
F2	AD	100	0.155	349	400	0.069	389					0.156	0.065	0.065	0.070	0.070	0.069	0.0874	0.0740	1.18	
F3	AD	100	0.296	349	400	0.243	389	0.295	0.304	0.300	0.310	0.305	0.240	0.245	0.245	0.250	0.248	0.0572	0.0740	0.77	
F1	SU	100	0.329	349	400	0.299	389	0.325	0.337	0.330	0.343	0.342	0.295	0.304	0.300	0.310	0.309	0.0330	0.0740	0.45	
F2	SU	100	0.160	349	400	0.062	389					0.161	0.060	0.060	0.065	0.065	0.062	0.0990	0.0740	1.34	
F3	SU	100	0.192	349	400	0.110	389	0.190	0.192	0.195	0.198	0.194					0.110	0.0844	0.0740	1.14	
F1	TI	100	0.149	349	400	0.043	389	0.145	0.146	0.150	0.151	0.150	0.040	0.040	0.045	0.045	0.043	0.1070	0.0740	1.45	
F2	TI	100	0.096	349	400	0.113	389	0.095	0.095	0.100	0.100	0.096	0.110	0.110	0.115	0.116	0.114	-0.0176	0.0740	-0.24	
F3	TI	100	0.218	349	400	0.260	389	0.215	0.218	0.220	0.224	0.222					0.266	-0.0444	0.0740	-0.60	
DA10	SU	100	0.510	349	400	0.381	389					0.563	0.380	0.400	0.385	0.406	0.401	0.1618	0.0740	2.19	0.0286
DA10	TI	100	0.234	349	400	0.036	389	0.230	0.234	0.235	0.239	0.238	0.035	0.035	0.040	0.040	0.036	0.2020	0.0740	2.73	0.0064
SAA10	SU	100	-0.025	349	400	-0.099	389					-0.025	-0.100	-0.100	-0.095	-0.095	-0.099	0.0740	0.0740	1.00	
SAA10	TI	100	0.153	349	400	0.316	389	0.150	0.151	0.155	0.156	0.154	0.315	0.326	0.320	0.332	0.327	-0.1732	0.0740	-2.34	0.0192
ST6	SU	100	0.367	349	400	0.182	389	0.365	0.383	0.370	0.388	0.385	0.180	0.182	0.185	0.187	0.184	0.2010	0.0740	2.72	0.0066
ST6	TI	100	0.172	349	400	0.081	389	0.170	0.172	0.175	0.177	0.174	0.080	0.080	0.085	0.085	0.081	0.0930	0.0740	1.26	
AD	SU	100	0.288	349	400	0.166	389	0.285	0.293	0.290	0.299	0.297	0.165	0.167	0.170	0.172	0.168	0.1286	0.0740	1.74	
AD	TI	100	0.223	349	400	0.199	389	0.220	0.224	0.225	0.229	0.227	0.195	0.198	0.200	0.203	0.202	0.0250	0.0740	0.34	
N Total							738														

Appendix G-6 Significance of Differences of Correlations for TSI-M, ASSIST-M and PTL Scales. Total N = 738

100 Level (1st year) vs. 400 Level (4th year)

	F1	F2	F2
DA10	0.54	0.61	1.75
SAA10	1.39	-1.34	-0.53
ST 6	0.25	0.11	-0.26
AD	2.19 0.0286	1.18	0.77
SU	0.45	1.34	1.14
TI	1.45	-0.24	-0.60

Z score and significance or difference of Fisher Transformed Z scores
blank sig means > 0.50

Bonferroni adjust alpha level = 0.00139

Values greater than this should not be regarded as significant.

Values less than this marked in **bold**.

APPENDIX H

Wayne State University Human Investigation Committee Approval

WAYNE STATE UNIVERSITY

HUMAN INVESTIGATION COMMITTEE
4201 St Antoine Boulevard - UHC-6G,
Detroit Michigan 48201
Phone: (313) 577-1628
FAX: (313) 993-7122
HIC website: www.hic.wayne.edu

NOTICE OF EXPEDITED CONTINUATION APPROVAL

TO: Jude Inweregbu
(Educational Evaluation Research)
36475 Five Mile Rd.
Livonia, MI 48154

FROM: Ellen Barton, Ph.D. Ellen Barton
Chair, Behavioral Institutional Review Board (B3)

DATE: March 25, 2005

RE: **HIC#:** 039604B3E **Expiration Date:** March 24, 2006
Study Title: An Investigation of the Thinking Styles and Learning Approaches of University Students in Nigeria
Sponsor: No funding requested

The above-referenced Protocol (Closed to Accrual) and Continuation Form, submission dated 02/24/05, were **APPROVED** following Expedited Review by the Chair of the Wayne State University Institutional Review Board (B3) for the period of **March 25, 2005 through March 24, 2006.**

MARK YOUR CALENDAR!
Deadline for Re-review: **Monday, January 30, 2006**
To be reviewed by the Chair or his/her designee and reported to the next convened B3 meeting

This approval does not replace any departmental or other approvals that may be required.

Federal regulations require that all research be reviewed at least annually. **It is the Principal Investigator's responsibility to obtain review and continued approval before the expiration date.** You may not continue any research activity beyond the expiration date without HIC approval.

- If you wish to have your protocol approved for another year, please submit a completed Continuation Form at least six weeks before the expiration date. It may take up to six weeks from the time of submission to the time of approval to process your continuation request.
- **Failure to receive approval for continuation before the expiration date will result in the automatic suspension of the approval of this protocol on the expiration date. Information collected following suspension is unapproved research and can never be reported or published as research data.**
- If you do not wish continued approval, please submit a completed Closure Form when the study is terminated.
- All changes or amendments to your protocol or consent form require review and approval by the Human Investigation Committee (HIC) **BEFORE** implementation.
- You are also required to submit a written description of any adverse reactions or unexpected events on the appropriate form (Adverse Reaction and Unexpected Event Form) within the specified time frame.

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ABSTRACT

AN INVESTIGATION OF THINKING STYLES AND LEARNING APPROACHES OF UNIVERSITY STUDENTS IN NIGERIA

by

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This study focused on investigating the relationship between thinking styles and learning approaches. Two samples of Nigerian university students, one from Federal University of Port- Harcourt (FUPH) and the other from Federal University of Jos (FUJO), participated in the study. The participants responded to ten subscales of Thinking Styles Inventory (Sternberg, R. J., 1992) based on Sternberg's theory of mental self-government. The Approaches and Study Skills Inventory for Students (Entwistle, N. J., 1998) with nine subscales and eight learning preferences was also used to assess three learning approaches. There were 810 participants, however, 738 participants who responded to all the all items were used for the final analyses.

Results from both samples supported the idea that thinking styles have statistical significant relationships with learning approaches. Participants who scored high on thinking styles that tended to be more rigorous and complex (liberal thinkers) also had high score on learning approaches that were rooted in seeking thorough understanding by applying use of evidence and relating ideas with previous knowledge.

On the opposite polarities people who tended to use simple thinking style (structured thinking) tended to apply rudimentary learning. They showed inclinations to thinking styles

that involved working with set guidelines. They are implementers that adhere strictly to conservative rules. These styles of thinkers correlated highly with learning approaches that involved transmitting information.

Results further showed that there were relationships between decision makers (legislative thinkers), a style that involved creativity characterized as being alone and withdrawn adopted with those that are less rigorous but methodic learners by adopting surface apathetic approach to learning. Interestingly, and more important, was the finding that those who tended to use thinking styles learning styles that were peripheral in nature. Surprisingly these people tended to relate significantly to learning approaches that were less rigorous and complex. This finding suggests that there are students who apply both sophisticated and simple thinking styles as well to some degree.

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