A STUDY ON STUDENTS' LEARNING PREFERENCES IN THE LIGHT OF DUNN AND DUNN MODEL

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2015

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By

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(04-arid-24)

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

Doctor of Philosophy

In

Education

Division of Continuing Education, Home Economics and Women Development
Pir Mehr Ali Shah
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Pakistan
2015

CERTIFICATION

I hereby undertake that this research is original one and no part of this thesis falls under plagiarism. If found otherwise, at any stage, I will be responsible for the consequences.

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In the name of Allah,
The most Beneficent, the most Merciful.

DEDICATION

I earnestly dedicate this feeble effort to my loving father Principal (Retd) Sher Khan Niazi who has been the greatest source of inspiration for me during the entire process of exploring the ideas and evolving thought in this thesis

&

I very humbly attribute the credit of effort to my very dear and caring mothers without whose affection and love I would not have been able to substantiate my abstraction in this thesis

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ACKNOWLEDGEMENTS

Above all, my humblest praise to Allah, the Almighty; and omnipotent, the greatest source of inspiration. The Holy Prophet Muhammad (peace be upon him), the greatest ever Human Ocean and house of knowledge and learning.

Researcher feels heavily indebted to his supervisor, Professor (Lt. Col., Dr. M. H. Arif, Retd.) for his kind supervision, and guidance in the process of research till its completion. Researcher is extremely grateful to Dr. M. Saeed Khan and Dr. M. Munir Kayani, who are the honorable members of the supervisory committee. They provided academic guidance, co-operation, expert opinion and encouragement for the smooth completion of this research.

Researcher is also thankful to Professor Dr. Muhammad Iqbal, Ex-Director UIER, PMAS-Arid Agriculture University, Rawalpindi, Prof. Dr. R. A. Farooq and Prof. Dr. Rabia Tabassum for their critical appraisal and highly valuable suggestions that conspicuously aided the process of research.

The researcher is also highly obliged to Dr. Imran Yousaf, Director, Division of Continuing Education, Home Economics and Women Development, PMAS-AAUR, Dr. Hamid Khan Niazi, AIOU, Islamabad, for their guidance, encouragement and valuable suggestions during this research work.

No words to convey the gratefulness to my uncles Mr. M. Iqbal Khan, Mr. Ameer Abdullah Khan. The highest gratitude and humble thanks to my loving parents, brothers and sisters who always prayed and helped me selflessly.

Sher Afgan Khan

LIST OF ABBREVIATIONS

LP	Learning Preference
ELT	Experiential Learning Theory
DfES	Department for Education and Skills
MBTI	Myers-Briggs Type Indicator
EI	Extroversion or Introversion
SN	Sensing or Intuition
TF	Thinking or Feeling
JP	Judgment or Perception
SDI	Style Differentiated Instruction
LPI	Learning Preferences Inventory
NASSP	National Association of Secondary School Principles
ATI	Aptitude Treatment Interaction
GCSE	General Certificate of Secondary Education
SAT	Scholastic Aptitude Test
NAEP	National Assessment of Educational Progress
IQ	Intelligence Quotient
QCA	Qualification and Curriculum Authority
FE	Further Education
F.A	First Examination of Arts
F.Sc	First Examination of Science
B.A	Bachelor of Arts
B.Sc	Bachelor of Science
BS	Bachelor of Studies

GPA	Grade Point Average
VARK	Visual Aural/Auditory Read/Write Kinesthetic
BLPI	Barsch Learning Preferences Inventory
SD	Standard Deviation

ABSTRACT

Study of learning involves investigation of the ways an individual perceives and processes information. People perceive and gain knowledge differently; they think and act on ideas differently. A large number of learning preferences have been identified in psychological literature but the focus of this study was on visual, auditory and kinesthetic learning preferences of college students as given in Dunn and Dunn model and their difference in gender, area of study and their relationship with academic achievement of students. Objectives of the study were: a) to measure college students' learning preferences, b) to examine the difference between gender and learning preferences of students, c) to find out the difference between area of study and learning preferences of students, d) to explore the difference between high achievers and low achievers in their preferences for learning, e) to explore relationship between students' learning preferences and their academic achievement. As the study dealt with college students' learning preferences and their difference in the context of gender, area of study and relationship with academic achievement, therefore the nature of the study was quantitative, descriptive and correlational. All (male and female, science and arts) students who had passed Intermediate examination (F.A./F.Sc.) and currently enrolled/studying in B.A./B.Sc. and BS programmes of all public sector colleges of Punjab province constituted the population of the study. Punjab province was divided in three different regions, viz., are North Punjab, Central Punjab and South Punjab. The study sample was delimited to six districts of Punjab province with two districts from each region. Three-stage cluster sampling technique was used to select the sample of 1200 students. In the first stage, two districts from each of

three regions were randomly selected. At second stage, one male and one female college from each district were selected. At third stage, from each selected college, fifty arts and fifty science students were randomly selected. In order to identify students' learning preferences, 24-item Barsch Learning Preferences Inventory (BLPI) (visual, auditory and kinesthetic) developed by Barsch (1996), was used as a research instrument. Each item was responded on three-point rating scale. The responses collected from the sample on questionnaire items were assigned scores and these scores were summed up for identification of learning preference of each student on the basis of their highest scores on a learning modality. The variable of academic achievement was measured by percentage marks obtained by students in previous annual examination. Product Moment correlation coefficient (Pearson r) was used to find out the relationship between each learning preference and academic achievement. Furthermore, differences among male and female, science and arts, low achieving and high achieving students with respect to their learning preferences were analysed by applying z-test and Chi-Square contingency test. Level of significance used to test the hypotheses of the study was 0.05. Main conclusions are that the college students are predominantly visual in their learning preference. Female, science, and high achieving students are also more visual and kinesthetic. Female science, male science and female high achieving students are more kinesthetic in their learning mode. Further, there is significant relationship between auditory learning preference and academic achievement.

Chapter 1

INTRODUCTION

Effective teaching largely depends on understanding the way the learners learn and develop. Teachers, therefore, are required to be aware of research based principles of human learning and human development. Classroom teaching requires being adapted to such individual differences in intelligence, creativity, personality, cognitive styles, learning preferences and group differences among students such as gender, social class and cultural differences which also influence learning (Ormrod, 1998).

Differences in learning preferences are the ways of learning and studying such as deep processing and surface processing, individual preferences for particular way of learning and preferences for learning environment such as where, when, with whom or with what lighting, food, music they liked to study and learn. Much has been written on learning preferences since late 1970's about differences in learning preferences chiefly by Dunn and Dunn (Woolfolk, 2004). There are many types of learning preferences that influence classroom learning as well as life long learning such as the physiological, psychological and cognitive. Physiological preferences are consistent ways to learn through use of senses or environmental stimuli that include visual, auditory and kinesthetic preferences. Dunn and Dunn are of the view that teachers should try to match learning preferences with teaching (Parsons *et al.*, 2001).

Quality of education is a burning issue in the colleges and universities of Pakistan. We know that, though all human learning is the result of experiences yet,

there are group differences and individual differences in learning. Group differences refer to the age, gender and social class differences. Due to these group differences, some students learn more easily than others and solve problems more quickly than others. Creativity is domain-specific: some students may be creative in science, whereas others are more creative in fine arts (Ormrod, 1998).

But as we consider group differences, we need to keep in mind that there is a great deal of individual variability within any group. Despite how students of different groups behave and learn on the average, some students may be quite different from the "average" student. Moreover, there is almost always a great deal of overlap between the groups. For example, research on gender differences in verbal ability often finds that girls demonstrate slightly higher verbal performance than boys. Yet the difference is quite small, with a great deal of overlap or similarity between two groups (Ormrod, 1998).

Learning preferences (LP), which is complex concept, has conditions in which the most effectively, learners perceive, process, store and recall what they try to learn (James and Gardner, 1995). Learning preferences defined as relatively stable indicators of how students perceive the factors of learning environment for interaction and response for the composite cognitive, emotional, social and physical development and learning (Keefe, 1979).

Learning preferences is generally accepted as the beliefs, preferences and behaviors of individuals, in certain circumstances to help them learn (Brown, 2000). People can differ a little in their ways to learn or much differ in their ways to learn (Dunn and Griggs, 1998) e.g. you may ponder upon which way of learning

a name is effective for you, whether it is in written form or visual form, whether learning to see or read will be the best. If we learn a name better by hearing, we are auditory learners (Slavin, 2000).

College students in a learning situation are different in many aspects, because, besides other variations, they have developed their own learning preferences. Miller (2001) is of the view that it is the responsibility of educators and teachers to understand and deal with the diversity of students' learning preference.

Three facets of learning preferences recognized by James and Blank (1993) are: 1) how an individual student prefers to process information. It is defined as identifying, pondering, handling problems to solve, and structures relating to normal memory. Such types of preferences as perceptions, organization of the knowledge are considered as unique and consistent. 2) In style based on emotions, attention, mood and how to motivate yourself to maintain the behavior related to personality traits is defined. 3) Physiological style can be defined as the response of bio-based mode, depending on the physical environment, gender differences and personal nourishment and health. These three facets of learning preferences combine to provide a comprehensive approach, taking into account for considering students' mind, emotions and body.

Educational psychologist, Curry (1990a), advocates four learning preference model, the teaching and environmental preferences model, social interaction model, information processing model and the personality model which is presented in Figure 1.

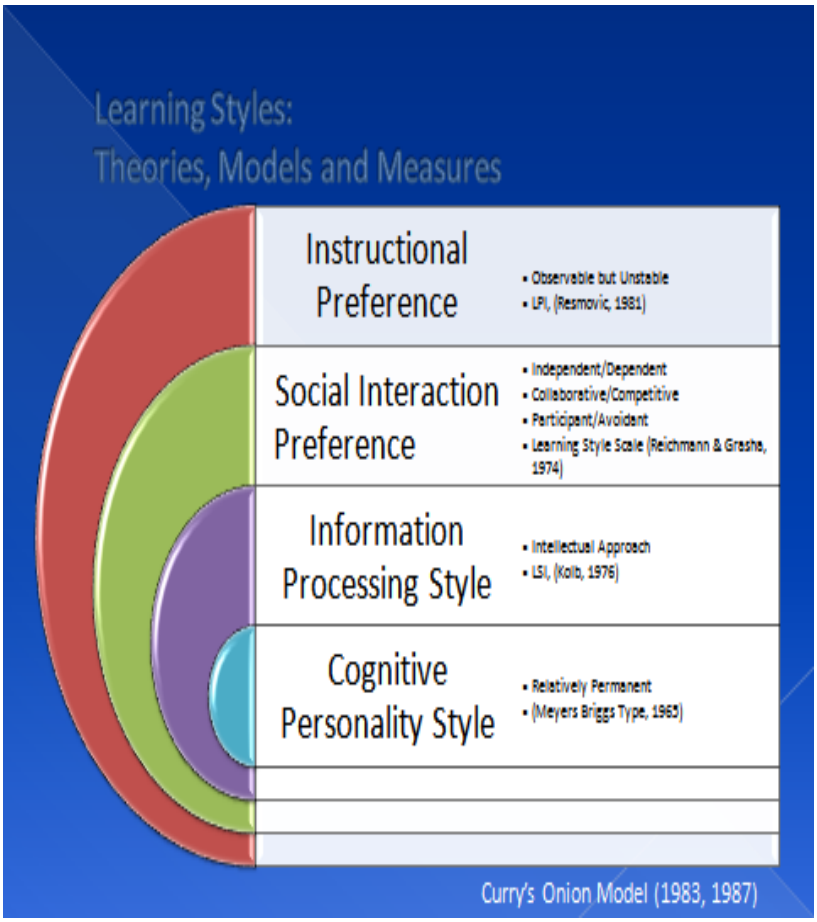

Figure 1. Curry's Onion Model of Learning Preferences

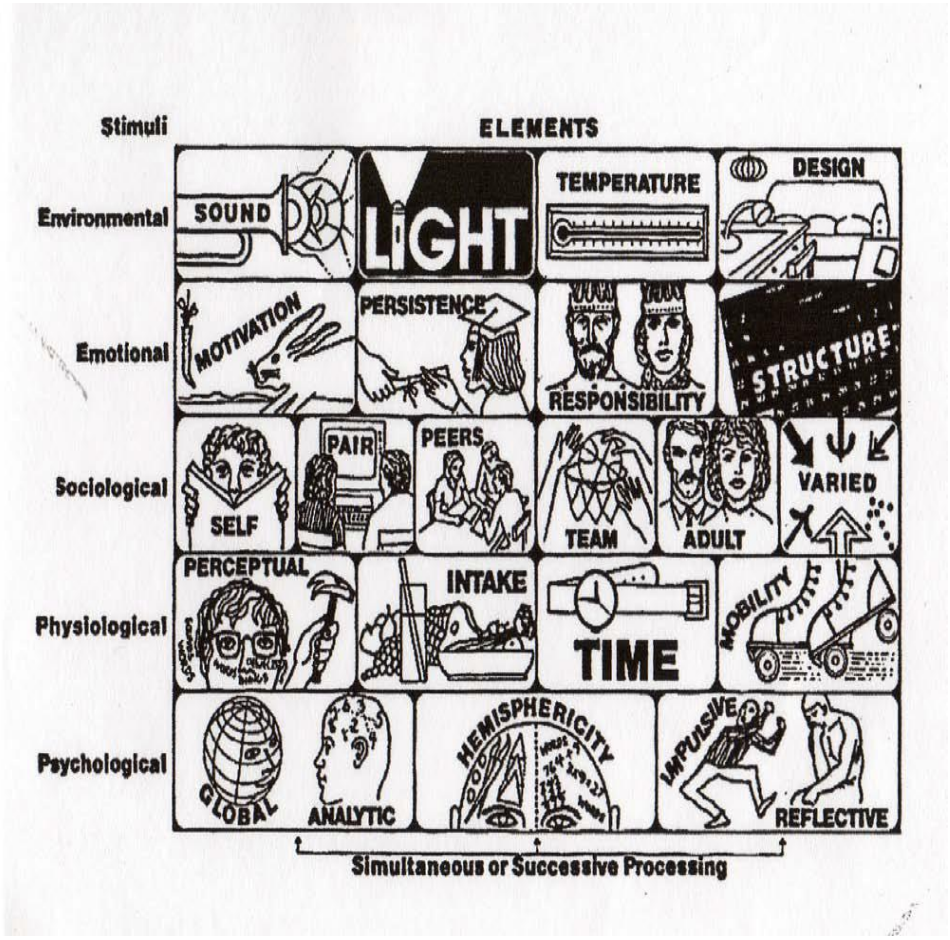

Figure 2. Learning Preferences Model of Dunn and Dunn

Environmental and instructional preferences model given by Dunn and Dunn depicts that last outer stratum of the onion includes the characteristics and traits. Instructional and environmental preferences involve sound, temperature, light and class design; emotional preferences involve enthusiasm, striving and consistency, responsibility and structure; and sociological preferences involve private, peers, adult, team, or different relations in learning. Physiological and psychological preferences involve learning mode analysis, hemesphericity, and action on the basis of perception, consumption, time and mobility preferences (O'Connor, 1997).

Second kind of model is the social interaction model which takes into account how the actors in a particular social environment adopt particular strategy. A well known model presented by William Perry, shows how college students go under process of development of the intellectual level of maturity at college. Mary Belenky describes how women prioritize to reward those strategies in a typical university. Marcia Baxter Magolda illustrates that students with gender and maturity differences have their various strategies related to ways of gaining knowledge in their response to subject matter of teaching (O'Connor, 1997).

Third type of model of learning preference is model of information processing which depicts the middle stratum of onion; is a struggle to comprehend the procedure through which information is attained, made separate, hoarded and used. Possibly, the notion of information processing is identified by right brain/left brain discussion. Versatile use of this method was given the name of experiential learning by Kolb (1984) who is of the view that there are four quadrants which can be used as holistic segments of learning to see individual differences in this

process. Theory of multiple intelligences by Gardner is another example of this model (O'Connor, 1997).

Fourth type is the model of personality which describes the onion's deepest stratum, which takes into account and figures out the orientation towards the world. People are categorized as sensing/intuition, extroverts/introverts, thinking/feeling, and perceiving/judging in the popular Myers- Briggs Type Indicators Model. This model indicates how people of these categorizations have attitudes towards engagement in the world. This model fastens our selections to start an act to overcome our shortcoming. This model is helpful for teachers not only to teach complicated skills like training of attitudes but also recognition of different peoples' varied instincts. Their success rate is low when they are put under activities which do not match with their attitudes (O'Connor, 1997).

Dunn and Dunn hold their opinion that learning preference is divided into five major stimuli strands. The branches and channels of stimulus are: a) environmental, b) emotional c) sociological d) physical, and e) psychological factors which influence learning, i.e., how many people learn (Dunn, 2003b). Dunn and Dunn Model presented in Figure 2.

Branch and channel related to environment combines peoples' preferences for sound and lighting, furniture and temperature, and seating plan. Emotional factor focuses on students' encouragement, responsibility, and identity. Social preferences factor provides regulatory requirements for students to deal learning alone or joint learning with their colleagues, as part of a team with teachers, either formally or collectively. Physiological channel encompasses visual, auditory and

kinesthetic or tangible, and energy levels during the day, and needs to be addressed (food and drink) and having different movements during learning. Finally, the psychological chain gives integration of information processing unit of global with analysis and impulse and reflection behavior, but it is not to the earlier versions of the models.

Sensory learning preferences, i.e., visual, auditory and kinesthetic, as recognized by Dunn and Dunn, depicts that learners have visual preference who like to see while learning because they comprehend information, concepts and ideas better by pictures and images than by details. Drawing is of much importance for them than discussing. In a learning situation, visual learner creates in mind picture of what is being discussed or described. Reading, for many persons, is like an action which is visualized. Most of the people learn the words which are spoken by us. Resultantly, they are named as auditory learners who prefer listening. They are also labeled as 'Print-oriented' which makes them close to learners having visual preference. Shape and form orientation is for learners preferring visual form, and more dependence on words and numbers in their images is followed by Print-oriented people (Conner *et al*., 1996).

There are two types of auditory learners. Spoken messages are given importance by them. This category, which has less understanding, has to hear their own voice to acquaint themselves well with the information. This is the more prevailing type, 'Listeners,' prone to do good performance in school. Same is the case with them also outside the school. They can also demonstrate intellectual replacement of ideas and learn how to remember the words of others. In contrast, people who are categorized as "talk it out" are often needed to talk to those people

who are around them. In classroom setting, when the instructor is not asking questions, hearing oral processors (speakers or talk oriented people) slowly comment like muttering to talk. They seem to be troublemaking, one cannot doubt it but they think that it is necessary to speak. These students are named as "interactive" by some researchers who give importance to listen to both themselves and others (Conner *et al.*, 1996).

Kinesthetic or physical and palpable learners want to use their good judgment, intelligence and logic about the situation on which they are working. Learners having physical preference are inclined towards touching instead of much seeing and talking. Even where discussion or the written materials are not much helpful to kinesthetic or physical learner, they plan to prolong lesson planning and get help from pictorial forms and labs. So these types of learners cannot prosper and flourish in unconventional classroom settings (Conner *et al*., 1996).

Many research studies have focused on association between gender with respect to learning preference. Belenky *et al.* (1986) employed gender to recognize two philosophical concepts related to knowledge and mode of knowing: namely, related or associated knowing and detached knowing. They observed an assumed correspondence between associated knowing and concrete experience because they both bring to light feelings. In the same way, detached knowing had association with abstract conceptualization because they heighten thinking. There was no association between detach knowing and abstract conceptualization in males and females as reported by Knight *et al*. (1997) who used learning style inventory in his study. In males, positive association was found with respect to associated knowing. Gender differences were also found in the study by Brew (2002) with respect to

learning style inventory. Brew (2002) found that in male, preferences for concrete experience is not jointly and communally restricted and female preference was to abstract conceptualization.

In many studies association between preference to learning and academic achievement in different field of study were observed (Mainemelis *et al*., 2002; Rutz, 2003). Learning preferences' association with four different accounting formats of exam (multiple-choice theory, the number of multiple-choice and open-ended theory and open-quantitative) was found by Holley and Jenkins (1993). They observed a clear difference in learning preferences for all but there was no difference found in multiple-choice quantitative format. The students of different learning preferences execute in a different way depending format of the examination. Resultantly, various methods to assess whole performance of students are needed. As a whole, when taking all courses across the curriculum plan, it appears that education should be considered in the development of all learning styles. On the other hand, when the main features of the different courses (basic, technology, art, design studio based) are taken into account, it may have different learning styles most useful. Since it is required to design studio is the combination of all other courses design education (Teymur, 1996; Demirbas and Demirkan, 2000; Demirbas, 2001). As design process is mixture of all, so all learning preferences are useful in different phases of the design process. In general, the principle that most students either linked to design, cooperative and/or converging preferences, as education is accepted as the practical form in acceptance. However, the design process is, when considered part of theory, other learning styles can also be effective. English Language Teaching on the basis of Dewey, Lewin, Piaget

theories (Kolb, 1984), provides a platform designed to promote the development and evaluation of the education curriculum design studio.

Numerous studies (Erton, 2010; Matilde, 2008; Baykan and Nacar, 2007; Slater *et al.*, 2007) conducted in various countries of the world manifest gaps and contradictions in their results with regard to gender, area of study and academic achievement. Though much research has been conducted on learning preferences in developed countries but this area in Pakistan still lacks much research. Only two studies (Akhtar, 2010; Din, 2010) related to this area have been conducted. So, this substantiates the importance of this topic to be researched upon.

Hand (1990) stated that learning through the study of their own learning priorities and the priorities of their colleagues, students can learn new and efficient strategies to work. Above all, it increases confidence in students' strength to deal with difficult situations and develop a variety of methods. Hand (1990) also upholds that students may initiate, more importantly, to learn that their way is better or worse than those of their peers are not, and it is just different.

The present study on college students intended to measure their sensory learning preferences and to determine the relationship between learning preferences and academic achievement. It was also seen whether there were gender differences in learning preferences, and differences in learning preferences with respect to the arts and science groups.

The main objectives of this study were:

1. To measure college students' learning preferences.

2. To examine the difference between gender and learning preferences of students.
3. To find out the difference between area of study and learning preferences of students.
4. To explore the difference between high achievers and low achievers in their preferences for learning.
5. To explore relationship between students' learning preferences and their academic achievement.

Hypothesis of this study was that "college students differ in average learning preferences (visual, auditory, kinesthetic) with respect to gender, field of study, and level of achievement; and these learning preferences are more or less correlated with academic achievement".

Chapter 2

REVIEW OF LITERATURE

Literature and findings of various researchers on the concept of learning preferenceand its categories with special reference to personal variables as gender, area of study and academic performance are reviewed in the following paragraphs:

Individual differences are the variables that characterize learners and give each one her/his individual uniqueness. The goal of investigating individual differences is to explore the diversity of intellect, forms of cognitive processes, and different mental functions. Categories used by various researchers, e.g. Ellis (1994), Skehan (1989) and Eysenck (1994), for investigating these differences are: personality, learning preferences, motivation, intelligence, autonomy, learning strategies, gender, age, language aptitude, anxiety, affective states, and need for power. Individual differences have received their importance in teaching from studies which state that people learn in different ways, no two brains learn the same way (Cast Universal Design for Learning, 2001). "Any two human beings, even identical twins, may respond quite differently to the same stimulus"(Hampson and Colman, 1994).Modern psychology has formalized the study of individual differences over the last one hundred years or so. Individual differences psychology is still a young shoot of science and a relatively recent development in modern psychology. There are still many points to be debated and many issues to be resolved. Current knowledge will change and evolve. Since there are multiple and controversial viewpoints, it is necessary to move beyond reliance on personally preferred viewpoints to look into alternative perspectives also, particularly those

which are utilized in psychological practice and which have solid research support (Neill, 2003).

2.1 PERSONALITY

Personality is considered a very important criterion of individual differences since the individual is often judged depending on her/his personality. An individual's personality is assessed by the effectiveness with which he or she is able to elicit positive reaction from a variety of persons under different circumstances. The second use considers the personality of the individual consisting of the most outstanding or extraordinary impression that he or she creates in others (Calvin *et al*., 1998). Kakkar (2001) states the following definition which explains the meaning, nature and concept of personality. "Personality is the integrated organization of all the pervasive characteristics of an individual as it manifests itself in focal distinctness to others". "Personality refers to those relatively stable and enduring aspects of the individual which distinguish him from other people, and at the same time, form the basis of our predictions concerning his future behaviour" (Wright *et al.*, 1970, quoted in Shackleton and Fletcher, 1984). It is also regarded as referring to stable internal factors or traits which underlie consistent individual differences in behaviour. These internal factors, according to Eysenck, are called traits. He says that it is assumed that individuals differ in terms of the extent to which they possess any given trait (Eysenck, 1994). Another definition that captures much of what psychologists mean by personality is Child's description ofpersonality characteristics as more or less stable, internal factors that make one person's behaviour consistent from one time to another, and also from one situation to another and different from the behaviour and reaction other people

would manifest in comparable situations (Eysenck, 1994). Therefore, it is expected that any given individual will behave in a reasonably consistent manner on different occasions. Those who study human personality are often interested in individual differences. They assume that there are considerable individual differences in personality and that these differences will be revealed by difference of behaving and reaction in a given situation (Eysenck, 1994). That is why one feature common to the majority of personality theories is the emphasis on the individual. Researchers, during the last few decades, have done a lot of work in order to find a comprehensive definition of personality.

2.2 LEARNING, TEACHING AND ASSESSMENT

Biggs (1999) has written that "Learning is the result of the constructive activity of the student. Teaching is effective when it supports those activities appropriate to understand the curriculum objectives". According to this view, the learner's achievement of the stated course learning outcomes depends upon two factors. The first is that the unit assessment, or the learning activities, must be designed to enable the learners to demonstrate their understanding. The second demands that the learning process around which the course is built, must support the student's approach to fulfilling the course outcomes, and hence understanding the course objectives.

In devising course outcomes, Bloom's taxonomy (Bloom, 1956) which focuses upon a hierarchy of understanding, highlights the student's demonstration of: knowledge: comprehension: application: analysis: synthesis: and evaluation. Biggs' own criteria (1999) focus upon the deployment of key verbs, which exhibit

the relationships between information and understanding. Assessment hinges upon the highest level verb that can be demonstrated by the learner in the assessment tasks. In this way, student's learning attainment can be said to be at a deep or at surface-level. Biggs' deep-level verbs are: hypothesize, generalize, reflect, apply, integrate, analyse and explain. His surface-level verbs include: classify, describe, identify and recongnise. Other authors concur that deep-level learning transforms an individual's world-view and allows learners to apply their knowledge in new contexts, whilst surface-level learning focuses upon reproducing information (Entwistle, 1992: Prosser and Trigwell, 1998).

For these authors, the achievement of deep level learning depends upon curriculum design. It is vital that consistency is achieved through the statement of clear objectives and levels of understanding that the learner needs to meet, the development of a set of learning activities and teaching processes which are designed to enable those objectives to be met, and the development of assessment tasks which measure the stated objectives (Biggs, 1999). By ensuring that these elements are seen to be directly relevant to each other, or in harmony, the module learning outcomes can be achieved.

Promoting harmony depends upon learners understanding why the design of the curriculum will help them achieve the learning outcomes (Entwistle, 1992). Giving students the big picture will enable them to see "what's in it for me", a cultural concept in motivating learning. By engaging with learners about the educational methods that underpin a course and by negotiating the course culture with them, the learning experience can become a holistic process with manageable outcomes.

A clear benefit of this type of approach is promoting the learner's emotional involvement. Deep-level understanding depends upon creating an environment where the learners want to be proactive. In order to support this end, several key curriculum issues must be made explicit. These include: assessing what the students already know about a topic: relating the key themes of the lesson to their understanding: developing a relevant learning agenda, with appropriate opportunities for peer and tutor support: and, providing learning opportunities which will enable students to generate conceptual and affective understanding. This last point is crucial because there is a danger that students will see the fulfillment of the course outcomes merely in terms of covering topics, or declarative knowledge.(Whitston, 1998).

2.3 LEARNING PREFERENCES

According to Claxton and Murrell (1987), the psychologist Allport used the term ‘style’, in a publication in 1961, ‘to refer to consistent patterns on the part of individuals’.There has undoubtedly been some interesting and stimulating work which has originated from this work on learning preferences, both in whole school contexts (Wise and Lovatt, 2001) and in terms of research into teacher effectiveness (Hay McBer, 2000). Intriguingly, however, there is little independent empirical research which supports the wide-ranging claims made by protagonists of accelerated learning and multiple intelligences. Indeed, Hall (2004) reporting on an extensive study commissioned by the Learning Skills and Research Council, argues that ‘the theoretical and practical applications of many of the leading theories are either under-researched in educational contexts or mired in controversy. Learning

preference theory is complex and demanding and the desire to provide categories and groups inevitably leads to dangerous simplification in practice'.

It is significant, too, that Coffield*et al.* (2004) are highly critical of the use in educational contexts of both Dunn and Dunn's model, and Gregorc's style delineator, since both of these approaches to learning preferences are based around the four modalities (visual, auditory, kinesthetic and tactile) which underpin much of Smith's work on accelerated learning. In their review of thirteen major models of learning preference, Coffield*et al's* overall assessment of Dunn and Dunn's model is that 'Despite a large and evolving research programme, forceful claims made for impact are questionable because of limitations in many of the supporting studies and the lack of independent research on the model(Coffield*et al.*,2004).

Similarly, they conclude that Gregorc's style delineator is 'theoretically and psychometrically flawed, and not suitable for the assessment of individuals' (Coffield*et al.,* 2004). Smith does not explicitly link his work on accelerated learning to that of Dunn and Dunn or Gregorc, although there are clear parallels. One notable aspect of Smith's work is that, whilst it clearly offers a wide range of practical strategies which have undoubtedly been welcomed by some teachers, it does not cite the research evidence upon which it is based, and the derivation and credence of some claims and assertions are not always clear. Indeed, Smith himself is quite explicit in this, stating that, although the leading practitioners have spent many years characterising the typical attributes of visual, auditory and kinesthetic learners, 'This work is not research-based. It is pragmatic and based on detailed elicitation and modeling (Smith, 2001).

Despite the limited independent evidence base, however, there has been a proliferation of in-service training and professional development on learning preferences, for both secondary and primary schools. To some degree, this has been fuelled by commercial pressures and consultancy support, but there has also been active promotion of such approaches in the United Kingdom by some local education authorities and implicit endorsement by the Department for Education and Skills (DfES) itself. Thus, for example, the DfES website on learning preferences and brain-based learning uncritically references thirty-eight programmes for teachers to resource, and talks of how brain-based learning is 'a powerful means of engaging teachers and pupils in improving the quality of learning in classrooms' (DfES, 2004a). Similarly, the confidently titled support materials produced by London Challenge and the Key Stage 3 Strategy, Ensuring the Attainment of Black Caribbean Boys, includes materials on students' preferred learning preferences and on visual, auditory and kinesthetic learning which 'can be particularly powerful when shared with learners' (London Challenge / DfES, 2004b). These materials appear without context or critique, and the implicit assumption is that these are valuable tools, which can be implemented quickly and uncritically, to extend the range of teachingwhich these students encounter. The learning preferences movement has thus gained both a self-generating momentum and a rather uncritical golden halo effect. As Coffield*et al.* (2004) note: 'In many ways, the use of different inventories of learning preferences has acquired an unexamined life of its own, where the notion of learning preferences itself and the various means to measure it, are accepted without question' (Coffield*et al.*,2004).

Santrock (2001) stated that styles are not abilities but rather preferred way of using abilities. Sternberg (1997) characterized 'learning preferences' as individual preferences for how to learn. Cano-Garcia and Hughes (2000) referred to three different approaches to the conceptualizations of style, in relation to the use of the term 'learning preferences', viz., cognition-centered, personality-centered, and activity-centered approaches. According to Cano- Garcia and Hughes (2000), the concept of 'learning preference' developed from an activity-centered approach to conceptualizing and defining 'style', whereas the concept of 'cognitive style' developed from a cognition-centered approach. Anderson (1995), citing Curry (1983), referred to 'learning preferences' as a generic term subsuming several 'general levels of learning behaviour'. Learning preference is a biologically and developmentally determined set of personal characteristics that make the identical instruction effective for some students and ineffective for others (Dunn and Griggs, 2000). Learning preferences are innate preferences of individuals such as how they prefer to go about the process of learning (Wintergersta*et al.,* 2001). Learning preferences can be an expression, in the academic context, of more fundamental, and relatively stable, components of cognitive style and personality. Approaches to learning draw attention to the critical importance of intentionality in academic learning (Entwhistle, 1987). Learning preference is the preference or predisposition of an individual to perceive and process information in a particular way or combination of ways (Sarasin, 1999). Grasha (1996) has defined learning preferences as personal qualities that influence a student's ability to acquire information, to interact with peers and the teacher, and to otherwise participate in learning experiences.Vermuntand Minnaert(2003) suggested that the use of the term 'learning preferences' has generally been associated with traditional, non-

student-oriented conceptualisations of learning. He characterized traditional conceptualisations of learning preferences as habitual, trait-type and style-like learning patterns dealing with components of processing strategies, regulation strategies, learning orientations and mental learning models.

Historically, the concept of learning preferences appears to have developed, to some extent concomitantly, with the concept of cognitive style, from research by psychologists into individual differences (Curry, cited by Hickcox, 1995). Dunn (1996) ostensibly implied that development of a concept of cognitive styles preceded the development of a concept of learning preferences.

From a psychological theory perspective, Messick (1984) described cognitive styles as 'typical modes of perceiving, remembering, thinking and problem solving'. According to Merriam and Caffarella (1991) and to Messick (1984), the concept of cognitive style focuses on how people process information, that is on what people do with the information that is available to them, whereas the concept of learning preferences places emphasis on the characteristics of the learning environment as well as characteristics of the learner, including how the learner processes information (Merriam and Caffarella, 1991). The historical relationship between the concepts of cognitive style and learning preferences, and the difference between the two concepts regarding their focus on information processing and on characteristics of the learning environment, lend support to a conclusion that the concept of learning preferences developed from attempts by educators to develop practical applications of the concept of cognitive style (Claxton and Murrell, 1987). Consistent with the diversity of conceptualisations and measures of learning preferences, there is considerable diversity of opinion in

the literature about the efficacy of applying theory of learning preferences to educational practice (Hickcox, 1985).

The terms cognitive style and learning preference are often used synonymously; however, Knowles, *et al.*(2005) pointed out the importance of distinguishing between the two terms. Cognitive style represents a stable characteristic representing an individual's typical manner of receiving and processing information (Knowles *et al.,* 2005). A common distinction in the way learners process information is the global versus analytical approach. A student who is more global will tend to take in the whole picture before taking in the details. The more analytical student will process new information in a step-by-step manner, focusing on a single concept at a time. These approaches correspond to the intuitive versus sensing scale of the Myers–Briggs Personality Type Indicator (Knowles *et al.,* 2005). Closely aligned with global versus analytical processing is an aspect of cognitive control called field dependence/ independence. Knowles *et al.* (2005) described the work of Jonassen and Grabowski who define field dependence/ independence as the degree to which an individual's perceptual field impacts understanding of new information. This cognitive control has been widely investigated and has implications for adult learners. Research findings by Jonassen and Grabowski suggest that field-dependent learners like group-oriented activities, organized information, and external reinforcement, whereas field-independent students learn best in independent, contract-oriented learning environments and prefer inquiry or discovery learning (Knowles *et al.,* 2005). Cognitive psychologists distinguish three other categories of typical ways learners acquire and process information: visual, verbal, and tactile or psychomotor (Knowles *et al.*,

2005). These approaches to processing information are addressed in Fleming and Mills' model of learning preferences. Learning preference refers to a broader concept that includes cognitive functioning and indicates general preferences for methods and environments for learning. Learning preferences encompass cognitive, affective, psychomotor, and physiologic dimensions (Knowles *et al.*, 2005). Dunn and Griggs (2000) describe learning preference as the "way students begin to concentrate on, process, internalize, and remember new and difficult academic information. Learning preference models that are applicable to college students include Kolb's model, Fleming and Mills' sense-based model, and the Dunn and Dunn Learning preference Model.

Cognitive style is the narrow term indicating the mental processes used by an individual to learn, while learning preference is the inclusive term identifying the stimuli most conducive to the effective use of one's cognitive style. Learning preference indicates an individual's preferred environment for learning through his or her personal cognitive style or habits for processing information to be learned. Dunn and Griggs (1989) states that identifying one's learning preference is much easier than explaining its existence. Students are affected by their own emotionality, sociological, environmental and physical preferences. These elements of the student's learning preference are distinguished from cognitive style, which describes the ways in which the brain processes information.

Included in this comprehensive definition are "cognitive styles" which are intrinsic information-processing patterns that represent a person's typical mode of perceiving, thinking, remembering and problem solving. According to Dunn*et al.* (1979) each individual learns through complex set of reactions to varied stimuli,

feelings and previously established thought patterns that tend to be present when an individual learns.

2.4 IMPORTANCE OF LEARNING PREFERENCES IN EDUCATION

There are a few very good reasons to know students' learning preferences:

If teachers know their students' learning preferences, they will be far better equipped to teach them**.** Most teachers assume their students learn exactly as they had done. Students often have different learning preferences from those of their siblings. Without knowing their students' learning preferences, teachers may choose a curriculum that doesn't reach their students where they're. It might do a decent enough job of educating them, but it won't give them optimal education. Once teachers know their students' learning preferences, they can choose a curriculum that meets their needs and they can be confident about their decision. Teachers will know how to help their students understand others. Students get frustrated just like adults, many times, because of their failure to communicate effectively with others. By understanding different learning preferences themselves, teachers can also help their students understand them, which will help them relate to and communicate better with various people in their life (Tobias, 1996).

Learning preference is a concept that can be important in this movement, not only in informing teaching practices but also in bringing to the surface issues that help faculty and administrators think more deeply about their roles and the organizational culture in which they carry out their responsibilities. Information about style can help faculty become more sensitive to the differences students bring

to the classroom. Learning preference is useful in the work setting as well. It enables administrative leaders to be more insightful about using staff members in ways that call on their greatest strengths--a particularly important feature in the future as colleges and universities focus more on individuals' ability to perform tasks than on where they are in the organizational hierarchy. At the same time, the use of information about learning preferencesreminds us that an institution that is seriously interested in the development of students as a purpose needs to embrace such a concept for faculty and administrators as well(Tobias, 1996).

2.5 THEORIES OF LEARNING PREFERENCES

Theories concerning learning preferences are as plentiful and diverse as the underlying theories of learning and instruction. Cornett (1983) and the National Association of Secondary School Principals (1982) identified and reviewed over thirty instruments used to assess learning preferences. And there are far more theories about learning preferences than there are instruments to measure them. Curry (1990a, 1990b) claimed that there are three general problems with learning preference theory: confusion in definitions, weakness in reliability and validity of measurements, and identification of relevant characteristics in learners and instructional settings.

Although Curry (1990a, 1990b) has pinpointed some of the problems involved with the organization of learning preference theory, noted theorist Pat Guild (Brandt, 1990) has developed an uncomplicated classification scheme. Guild believed that learning preference theories fall into three categories: those that focus

on the individual, those that focus on curriculum development, and those that are diagnostic/prescriptive (Brandt, 1990).

Guild claimed that personal awareness is an aspect that is common to all learning preference theories but some theories emphasize it more than others (Brandt, 1990). Historically, the individual has been the cornerstone of learning preference research. Carl Jung, the notable Swiss physician and psychologist of the early twentieth century, traced the history of individual differences back to the second century with the work of the Greek physician Claudius Galen (Jung, 1971). Many modern learning preference researchers, however, cite Jung's work as the beginning of modern learning preference theory (Lawrence, 1982; Guild and Garger, 1985).

Researchers such as Isabel Briggs Myers and Gordon Lawrence have furthered Jung's work by expanding the number of psychological types to sixteen. Myers and Lawrence have also created practical instruments and guidelines for using learning preference theory in education and for organizational management.

Briggs and Myers began working on an instrument in 1942 that was capable of measuring Jung's psychological types (Myers and Myers, 1980). Myers' and Briggs' research led them to believe that a fourth dimension which related to one's judgment and perception needed to be added to Jung's three dimensions (perception, judgement, and introversion/extraversion). The Myers-Briggs Type Indicator (MBTI) uses a judgement/perception dimension and defines the four learning preference preferences as follows:

Preference for	Affects a person's choice
EI (Extraversion or Introversion)	To focus the dominant (favorite) processon the outer world of ideas.
SN (Sensing or Intuition)	To use one kind ofperceptioninstead of theother when either could beused.
TF (Thinking or Feeling)	To use one kind ofjudgment instead of another when either could be used.
JP (Judgment or Perception)	To use the judging or theperceptive attitude fordealing with the outer world.

Source: Myers (1981)

The four dimensions of the MBTI are compiled to form an individual composite consisting of four letters (preferences). There are sixteen possible "people types", a comprehensive discussion of all sixteen people types as identified by the MBTI. There are many type tables and databases available that describe and interpret the findings of the MBTI (Myers, 1980; Lawrence, 1982; andMcCaulley, 1985).

The initial work started by Katherine Briggs and Isabel Briggs Myers has created a significant following known as "type research." Type research includes interest areas from the fields of Careers and Occupations, Counseling, Education, Management and Organizational Development, Psychological Theory, Religious Issues, and Research.

David A. Kolb is known for his influence on learning preference theory and organizational psychology through the use of model formulation (McCarthy, 1987).

The cornerstone of Kolb's model relied on experience-based learning. Kolb reviewed the work of Kurt Lewin, John Dewey, and Jean Piaget to create his theory of experiential learning. Although Kolb noted differences in their theories, he felt the similarities were too strong to be ignored. All three models involved a circular approach to learning and started with the experience of the learner (Kolb, 1984). Kolb's research demonstrates a clear link between learning preference research and the underlying theories of learning and instruction.

Kolb (1984) defined experiential learning as "the process whereby knowledge is created through the transformation of experience". Kolb used this working definition to create his model of the experiential learning process.

Similar to Jung (1971), the model of experiential learning involves two sets of polar opposites. Kolb believed humans "grasp experience" immediately in a concrete manner or abstractly in an indirect manner. Once an individual understands an experience, it can be added to other experience through reflective observation or active experimentation. The two methods used to grasp experience and the two ways in which this experience is transformed create four unique types of knowledge: divergent, assimilative, convergent, and accommodative.

Kolb's two methods of grasping information, two methods for transforming information and four types of knowledge helped him create an instrument that could be used to identify learning preference preferences. Educators and organizational managers use the Learning preference Inventory to assess individual learning preference. Kolb's depth of research, use of models and creation of the

Learning preference Inventory make him one of the pioneers in learning preference research.

Like Kolb, Fischer and Fischer (1979) noted distinct learning preferences based on observation, experience, and discussions with classroom teachers. Fischer and Fischer defined the following learning preferences:

1. Incremental Learners. These students proceed in a step-by-step fashion, systematically adding bits and pieces together to gain larger understandings.

2. Intuitive Learners. The learning preference of these students does not follow traditional logic, chronology, or a step-by-step sequence. There are leaps in various directions, sudden insights, and meaningful and accurate generalizations derived from an unsystematic gathering of information and experience.

3. The Sensory Specialist. This student relies primarily on one sense for the meaningful formation of ideas.

4. The Sensory Generalist. These students use all or many of the senses in gathering information and gaining insights.

5. The Emotionally Involved. There are students who function best in a classroom in which the atmosphere carries a high emotional charge.

6. The Emotionally Neutral. Some students function best in a classroom where the emotional tone is "low-keyed" and relatively neutral.

7. Explicitly Structured. These students learn best when the teacher makes explicit a clear, un-ambiguous structure for learning.

8. Open-Ended Structure. There are students who feel at home and learn best in a fairly open-ended classroom. The overall structure of the classroom is sufficiently visible, yet there is room within it for divergence, for exploration of relevant yet not explicitly preplanned phenomena (Fischer and Fischer, 1979).

In addition to these eight learning preferences, Fischer and Fischer (1979) describe two broad categories of learners that they feel are too inclusive to be identified as learning preferences. Damaged learners are physically normal but develop negative learning preferences from social and environmental influences. Eclectic learners, on the other hand, develop one or more dominant learning preferences but can often switch styles when needed. Despite Fischer and Fischer's (1979) reservations about utilizing their learning preference research to guide classroom practitioners, McCarthy (1980) incorporated it into the 4MAT System of instruction.

The elementary level work of Simon and Byrum has also been assimilated into McCarthy's model. Simon and Byrum's (1977) teaching and learning preference model is based on the way individuals communicate. School psychologist, Paul Mok, created a theory of "Communicating Styles" that he derived from the work of Carl Jung and his professional experience. The four Communicating Styles outlined by Simon and Byrum include feelers, intuitors, thinkers, and sensors. The similarities to Jung's dimensions of perception and judgement are very apparent. Simon and Byrum define feelers as sensitive, caring and artistic while sensors are active, competitive, and react quickly to what they "sense" in the world. Intuitors are imaginative and innovative, and have far

reaching ideas while thinkers are logical, orderly and accurate (Simon and Byrum, 1977).

Simon and Byrum's work is unique for two reasons. First, it was one of the earliest learning preference theories that highlighted the importance of understanding both the teachers' and the students' learning preference. Second, the issue of style flexibility for both students and teachers is addressed. "Style-flex means temporarily shifting your style to better match with other people's styles" (Simon and Byrum, 1977). On the other hand, Simon and Byrum's work is similar to other models because it is based on Jung's model and identifies four unique learning preferences.

Keirsey and Bates' (1984) work on character and temperament types is also similar to other learning preference theories. Keirsey and Bates train therapists and diagnosticians of dysfunctional behavior and have reviewed the work of Hippocrates, Jung, Kretschmer, Freud, Adler, Sullivan, and Maslow to develop four temperament types (Keirsey and Bates, 1984). The names of four Greek gods were used by Keirsey and Bates to explain their temperament types. Apollo, according to Keirsey and Bates, was commissioned to give man a sense of spirit and is “dedicated to helping others" (Keirsey and Bates, 1984). Prometheus, on the other hand, focuses on science and technology. The style of Epimetheus is characterized by a sense of duty and the Dionysus style focuses on a sense of joy. These broad characteristics and the Keirsey Temperament Sorter are used to outline sixteen specific personality types that are very similar to the ones given in work of Briggs and Myers.

All of the research reviewed has focused on personal awareness as the primary focus of learning preference research. Similarities across disciplines and theories were highlighted. In models that utilize quadrants and four learning preferences there are two notable similarities in the reviewed theories. The use of models, however, is not just limited to the theories concerned with personal awareness.

Knowing that people learn in different ways, Guild's second classification groups theories that create models for providing instruction to all major learning preferences (Brandt, 1990). Despite the fact that many learning preference researchers often promote the need for teacher flexibility (Ellis, 1979; Guild and Garger, 1985; Marshall, 1991), there are only a few researchers who have developed instructional models based on their learning preference theories.

Bernice McCarthy's 4MAT System is a very well known and widely used instructional model. McCarthy developed the 4MAT System in 1980 as a result of her classroom teaching experience, her dissertation (McCarthy, 1979) and a conference she held in Chicago in 1979 (McCarthy, 1987). The uniqueness of the 4MAT System lies in the synthesis of twelve learning preference theories from various disciplines and the incorporation of brain hemisphere research.

McCarthy noted a similarity in the learning preference theories that she researched. Almost all of the theories she researched defined two ways of perceiving information and two ways of processing information. McCarthy took the strands from each of the theories and placed them into Kolb's model. McCarthy

was thereby able to develop composites of four different types of learners (McCarthy, 1987).

Type learners, according to McCarthy, are imaginative learners. These learners perceive information concretely and process it reflectively. They need to be personally involved and their favorite question is Why? (McCarthy, 1987). McCarthy suggests that teachers give Type One learners reasons for learning (McCarthy, 1985).

McCarthy defines Type Two learners as analytic learners. These learners perceive information abstractly and process it reflectively. Type Two learners are interested in facts and their favorite question is What? (McCarthy, 1987). McCarthy recommends that teachers give them facts that will deepen their understanding (McCarthy, 1985).

Type Three learners are common sense learners. These learners perceive information abstractly and process it actively. Type Three learners are problem solvers that commonly ask How? (McCarthy, 1987). Teachers should let type three learners see how things work by letting them try things (McCarthy, 1985).

McCarthy defines Type Four learners as dynamic learners. These learners perceive information concretely and process it actively. Type Four learners are primarily interested in self-discovery and often ask the question If? (McCarthy, 1987). Teachers need to let these learners teach themselves and others (McCarthy, 1985).

McCarthy claimed that Type Two learners are the most comfortable in traditional school settings. Unfortunately, her research showed that seventy percent of students are not Type Two learners (McCarthy, 1987). This is one of the main reasons the 4MAT System was developed by McCarthy to create an instructional model that reaches all learners. The circular model contains four quadrants, one for each learner. This approach gives each student not only a comfortable period during the lesson but also introduces him/her to new learning methods.

The 4Mat System is not limited to learning preference quadrants. McCarthy also incorporated the brain hemisphere research of Roger Sperry (1973). Sperry conducted experiments on monkeys and cats during the 1950's. When Sperry completely severed the two halves of the animal's brains, he did not notice any differences in behavior but did notice a difference in trained tasks. McCarthy (1987) reports that similar operations on humans with epilepsy during the 1960's had similar results. Sperry and other researchers soon developed experiments that involved the two halves of the human brain.

Brain hemisphere researchers found two important discoveries through experimentation. First, they determined that the right side of the brain processes information globally while the left side of the brain processes information linearly. Second, each individual has a preferred method of processing information. McCarthy noted, however, that everyone uses both hemispheres to differing degrees, just as everyone uses all four learning preferences to differing degrees (McCarthy, 1980).

The complete 4MAT System model incorporates all four learning preferences and left and right mode processing. Therefore, activities that are created under the 4MAT System model have eight steps because each learning preference incorporates left and right mode processing techniques.

The 4MAT System has been widely used by learning preference researchers from several disciplines. Blair and Judah (1990) used the 4MAT model to implement a Tech Prep program. Kelley (1990) developed a model for implementing 4MAT lessons in law school. Kearney and Thacker (1994) used 4MAT lessons to teach photography in a youth correction facility. In addition, a wide range of students and teachers have used McCarthy's work with positive results. The 4MAT System has been taught to elementary students as a method to improve student presentations (Weber and Weber, 1990). Other groups having positive results with the 4MAT System include community college personnel (Allyn, 1989), and staff developers (McCarthy, 1982 and 1985; Kelley, 1990).

There is very little negative research or literature concerning the 4MAT System of McCarthy. Scott (1994) highlighted the lack of classroom research on the 4MAT System but praised designs such as Wilkerson and White's (1988) experimental pre-test, post-test dissertation. Scott (1994), however, faulted a second classroom study for poor sampling techniques and lack of validity (Mills, 1983). The synthesis used by McCarthy to develop the 4MAT System Model and the overwhelming support it has received make it one of the dominant learning preference theories in education.

In the field of management training, the work of Merrill and Reid (1981) demonstrate striking similarities to other learning preference theories. Through years of observation and analysis, Merrill and Reid constructed a "social style profile" consisting of four quadrants/behaviors. The social style profile is based on research of how people describe a person. The horizontal axis describes an individual's assertiveness while the vertical axis represents responsiveness.

Merrill and Reid's model can be used to classify four observable behaviors: driving, analytical, amiable, and expressive. Driving individuals are serious, assertive people who do not display feelings or emotions readily. Expressive people are also assertive but are more willing to show their feelings than drivers. Analytical people are low in assertiveness but have good control of their emotions. Analytical individuals also tend to ask questions, gather facts, and study data. Individuals who openly display feelings are less assertive, but are interested in being agreeable and cooperative characterizing amiable behavior (Merrill and Reid, 1981).

Merrill and Reid added a third dimension, versatility, to responsiveness and assertiveness. According to Merrill and Reid, "versatility is the dimension of behavior that indicates the extent to which others see us as adaptable, resourceful, and competent" (Merrill and Reid, 1981). The versatility dimension allowed Merrill and Reid to create adjectives that could be used to observe the four behaviors.

Merrill and Reid show how to use social style observation techniques in the workplace, community, and at home. In education, McCarthy has applied this

research for students and teachers. Butler (1984) used Anthony Gregorc's (1982) four classifications to assess learning preference. Butler's (1984) work used Gregorc'sEnergic Model of style but went further than Gregorc and recommended using "style differentiated instruction." Also, Butler, like Gregorc and many other learning preferenceresearchers, believed that individuals use one dominant style but the other nondominant styles are all utilized to some degree.

In addition to working with nondominant channels, Butler outlined a five-stage model that can be used for people to accept their style. Butler also outlined positive and negative ways in which learning preference research could be used. All of her work paralleled Gregorc's theory and establishes the foundation of Style Differentiated Instruction (SDI). Butler (1984) stated that SDI "is the process that promotes the intentional match or mismatch of learner style to instructional methods-- strategies, technologies, techniques, and activities."

Butler's work is recognized because of its relationship to Gregorc and consistencies with other learning preference theories. Butler's model is similar to McCarthy's because it highlights learners' preferred learning preferences and stretches their weaker styles. And, although a direct link to Simon and Byrum was not found, the concept of "style flexing" links Butler's work to a third learning preference theory.

The third classification of learning preferences, according to Guild, involves identifying key elements of the individual's learning preference and matching instruction and materials to the individual differences (Brandt, 1990). This classification differs from the second in two ways. First, learning preference

theories with a diagnostic/prescriptive focus usually assess the learner before instruction begins. Second, general guidelines instead of structured models are usually used to aid instruction.

Rita and Kenneth Dunn's work on assessing and providing instructional guidelines is predominant in the learning preference literature. Dunn and Dunn (1987) claimed that learners are affected by their environmental, emotional, sociological, and physical preferences. Dunn, Dunn, and Price (1984) created the Learning preference Inventory (LSI) to assess these preferences for children in grades 3-12 and the Productivity Environmental Preference Survey as an adult version of the LSI. Both instruments are accompanied with suggestions to help facilitate academic achievement (Dunn *et al.*, 1981).

In addition to creating assessment tools, Dunn and Dunn have concentrated on synthesizing learning preference research in order to debunk myths and influence classroom practice. Several fallacies of learning preference research that the Dunn's have focused on include, among others, the time of day for instruction, homework, group activities, and motivation. Many of the issues in Dunn and Dunn's research deal with teaching style and the physical learning environment.

Honey and Mumford created a learning preference theory for organizational management based on the work of David Kolb. Instead of using learning preference theory solely for style identification, however, Honey and Mumford strive to identify and modify style (Honey and Mumford, 1982). The Learning preferences Questionnaire is an eighty-item, self-scoring instrument designed to identify an individual's preference among four learning preferences. The four

learning preferences identified by Honey and Mumford are the activist, theorist, reflector, and the pragmatist. Just like the learning preference theories of Jung and Kolb, these learning preferences consist of two pairs of polar opposites. The activist is defined as the counterpart of the theorist and the reflector is the inverse of the pragmatist. Honey and Mumford use a similar illustration to graphically record preferences from the Learning preferences Questionnaire (Honey and Mumford, 1982).

Once an individual's learning preference is identified, Honey and Mumford discuss the styles' unique strengths and weaknesses. The final phase in the model involves recommendations to instill flexibility and awareness of other styles. Activities are geared toward self-development and are used primarily for managers and advisors.

In her 1964 publication, Movement Behavior: A Model For Action, Hunt also identified four learning preferences or "body tension" patterns. The assister, posturer, resister, and perceverator are the four learning preferences Hunt identified in her research on body movement. Each style varies on how the dancer handles the reality of movement. Although Hunt's work is not directly important to this study, it is significant because of its influence on educators and learning preference researchers.

Wetzig's work in the field of dance and choreography is based on Hunt's (1964) four "body tension" patterns and is also assimilated into McCarthy's 4MAT System model. McCarthy (1980) noted the similarity of Wetzig's model to learning preference research. Wetzig's research showed that when dancers accepted their

body patterns, they were able to develop their potential to higher degrees. Wetzig, like Butler and McCarthy, advocated exposing her students to all four patterns to increase awareness and style flexibility.

Alexis Lotas also used four learning preferences to promote awareness in teachers and students (McCarthy, 1980). As a high school principal in Michigan, Lotas based his curriculum on Jung's (1971) work and identified student and teacher's learning preferences through the same learning preference instrument.

In The Gregorc Style Delineator, along with observation and interview techniques, others measures are used to match instructional materials and methods to meet individual preferences (Dunn *et al*., 1981; Guild and Garger,1985). Gregorc's theory relies on distinct, observable behaviors that show how an individual perceives and orders information. The model developed by Gregorc (1979) is very similar to Jung's two dimensions and four basic functions. According to Gregorc, we tend to perceive information abstractly or concretely and order information randomly or sequentially.

A second similarity to Jung's theory is Gregorc's belief that everyone uses either of the perception and either of the ordering abilities, but individuals tend to favor their most comfortable style. Gregorc defines his four learning preferences accordingly:

> *Concrete sequential learners (CS)* prefer to gain information through direct, hands-on experience. These learners prefer concrete, touchable materials that are presented in a step-by-step manner. CS learners prefer ordered presentation of material in a quiet atmosphere.

Concrete random learners (CR) gain information through experimentation and are able to make intuitive leaps. CR learners use trial-and-error in problem solving situations and are often ridiculed for jumping to conclusions since their method is not structured. These learners work well in small groups or independently and usually do not respond well to teacher intervention.

Abstract sequential learners (AS) have the ability to decode information in written, verbal, and graphic form. These learners like sequential presentations and gain a lot of information from visual images. AS learners enjoy reading and listening but do learn well from authorities.

Abstract random learners (AR) are keenly aware of human behavior. AR learners prefer to learn in an unstructured manner and prefer to work in multi-sensory environments. These learners do not appreciate rules and guidelines (Gregorc, 1979).

The Gregorc Style Delineator and the characteristics of Gregorc's four learning preferences have had a tremendous impact on diagnosing individual learning preferences. Gregorc's work has also influenced the construction of several learning preference models, most notably the work of Kathleen Butler, Bernice McCarthy and the National Association of Secondary School Principals.

The National Association of Secondary School Principals (NASSP) model was created in 1982 through the work of a national task force. The task force sought to construct a learning preference paradigm and an assessment instrument based on a comprehensive review of literature. The three main areas studied

included personality theory, the information processing aspect of cognitive style research, and research on aptitude interaction (Keefe and Ferrell, 1990).

The personality theories reviewed by the NASSP task force included, among others, the work of Jung (1971) and Myers (1980, 1981). Keefe and Ferrell (1990) noted, however, that personality instruments usually do not measure deep learning preference constructs. The information processing theories, such as the work of Anthony Gregorc, do measure deeper learning preference constructs through experimentation and observation techniques. The NASSP model also looked at the variability of individual learners (Aptitude-Treatment-Interaction, ATI) as a measure of learning preference. ATI research focuses on learning preference variables such as the instructional environment and the cognitive style of the learner (Keefe and Ferrell, 1990).

Upon reviewing the literature on personality theory, information processing theory, and research on ATI, the NASSP task force defined learning preference as:

> "The composite of characteristic cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment. It is demonstrated in that pattern of behavior and performance by which an individual approaches educational experiences. Its basis lies in the structure of neural organization and personality which both molds and is molded by human development and the learning experiences of home, school, and society" (Keefe and Ferrell, 1990).

It was from this definition and the review of learning preference literature, that the NASSP model of student learning preferences was created. The model divides learning preferences into cognitive, affective, or physiological categories. The NASSP model simply lists the three learning preference categories and their respective sub-styles.

In addition to creating the Student Learning preference Model, the NASSP started the Learning preferences Network. In 1982, the Learning preferences Network held a conference that was attended by more than thirty practitioners and researchers in the fields of learning preference research and brain behavior. Among the conclusions of the Learning preferences Network conference was the recommendation to create "comprehensive, cohesive, and uncomplicated instruments to assist in identifying the ways students process information" (National Association of Secondary School Principals, 1982). Keefe and Ferrell (1990) reported that between 1983 and 1986, the task force members used the NASSP findings on learning preferences to create the Learning preference Profile. The Learning preference Profile has undergone extensive field-testing and review for readability, reliability, and validity. The four factors measured by the Learning preference Profile include cognitive elements, student study preferences, perceptual elements, and instructional elements.

2.6 GENDERAND LEARNING PREFERENCES

Loo (2002) believes that "not enough attention has been paid to the possibility of sex differences in learning preferences among business students" which, he believes, would be meaningful given that woman more often make up

the majority of student enrollment in business schools. Studies examining the issue of gender and learning preferences have also seen mixed results. Holley and Jenkins (1993) point out that "research by Mutchler and Williams (1987) and Lipe(1989) found significant evidence that female accounting students outperform their male counterparts".

Holley and Jenkins (1993) note that "several research studies have attributed this superior performance to a higher work need (e.g Tyson, 1998)". Further, Doran, Bouillon and Smith (as cited in Holley and Jenkins, 1993) found better performance in Accounting Principles I among male students than among female students. One explanation the researchers gave, in lieu of a gender effect, was the large enrollment of male engineering students in the course.

Kruzich*et al*. (as cited in Willcoxsonand Prosser, 1995) found no significance difference in preferences between males and females. Riding et al (cited in Riding and Rayner, 1998) point out that "there do not appear to be overall gender differences with respect to cognitive style. Differences are usually small and non-significant on both dimensions". Kolb's (1976) research found no consistent differences observed between men and women on the active/reflective dimensions. Further, Kolb's study (as cited in Willcoxsonand Prosser, 1995) reported a tendency for females to emphasize concrete experience and males to emphasize abstraction.

Nourayi and Cherry's (1993) research examined whether there is a statistically significant difference in performance in accounting classes by individuals based on gender, perception, and judgment. The results of the study

indicated a statistically significant difference in the quantitative and total SAT scores of male and female students. Also, although statistically insignificant, male students' verbal SAT scores, on average, exceeded those for female students by 19 points. However, this difference was attributed to the interaction between instructor gender and students' gender because the instructors teaching the courses were male. The results of Katz's (1998) study (as cited in Willcoxson and Prosser, 1995) of engineering students, using the original (1976) LSI, has shown that the students who scored high on the abstract learning preference dimension (i.e. converging learning preferences) were mainly men while the occupational therapy students who scored higher on the concrete dimension (i.e. Diverging learning preferences) were women. This finding suggests that "either academic discipline influences preferred learning preferences or that individuals tend to cluster in disciplines when the tasks and learning demands match their innate learning preference preferences".(Willcoxson and Prosser, 1995).

2.7 GENDER AND SUBJECT CHOICE

Each of the factors that might generate an association between social background and subject choice is mirrored in the case of gender. In addition, van de Werfhorst*et al.* (2003) suggest a further source of gender difference arising from the greater likelihood that females will adjust their view of their own capabilities in the light of external evidence (Wilder and Powell, 1989). School subjects in which it is relatively more difficult to gain high marks may be less attractive to those females who adjust their self-efficacy in response to test and examination grades secured. In England, evidence from survey data suggests that the effect of gender differences on subject choice appears to have been declining over time (Wikeley

and Stables, 1999; Francis, 2000). This is reflected in examination entries for French where the gender gap decreased from 20% to 8% between 1984 and 1997 (Bell, 2001). However, this pattern is not replicated in Geography (gap of roughly 10% in favour of males maintained), German (4% gap in favour of females maintained) or History (5% gap in favour of females replaced by 3% gap in favour of males) (Bell, 2001). Such narrowing of gender gaps as did occur may, as Francis argues, reflect changes in aspirations and norms in society. In addition, Brown (2001) uses a Gender Inequality Index to show that the trend of reduction in gender difference in examination entries in GCSE is strongly related to the introduction of a National Curriculum in England. There is mixed evidence from survey data collected by asking students about their subject preferences. A standard technique has been used to ask students to rank their preferences given a common list of subjects. Using this technique, Stables and Wikeley (1997) found little gender difference in preferences in relation to French, Geography or History. Hendley*et al.* (1996) found that male and female 14 year-olds preferred History to Geography, with the margin of difference greater for females. However, Colley and Comber (2003) find females expressing a clear preference for Geography over History and males expressing a clear preference for History over Geography. In each case, French was rated very low in the ranking of preferences. Francis (2000) and Francis *et al.* (2003) use a variant on this method in which they asked students to identify their favourite and least favoured subject. A very small proportion of their sample chose French, Geography or History in either category. Francis *et al.* (2003) find no effects of attending a single sex or mised school on gendered preferences towards these subjects. This degree of variation in results may indicate that the samples in these studies were not sufficiently large to overcome teacher and

department effects generating substantial differences in students' attitudes towards subjects.

Gender differences in science have received serious attention in the science education research for the last two decades. Boys and girls have been compared on variables such as achievement, attitude, motivation, interest, and performance behaviors (e.g., Ecclesand Blumenfield, 1985; Erickson and Erickson, 1984; Greenfield, 1997; Jovanovich and andKing, 1998; Kahle, *et al.*, 1993; Morrell and Lederman, 1998; Simpson and Oliver, 1985). In a comprehensive review of studies about correlations among affect, ability, achievement, and gender, Steinkamp and Maehr (1983) reported that (a) in science and cognitive ability, boys did slightly better than girls, (b) the achievement-with-affect correlations were similar for boys and girls, and (c) for both boys and girls, the achievement-with-cognitive ability relationship was strongest in biology and physics.

In a meta-analysis study, Weinburgh (1995) reported gender differences in science attitude in favor of boys, particularly among low and medium achieving students. Morrell and Lederman (1998) found that gender differences were not related to classroom science attitude but, regardless of gender, fifth graders had significantly more positive attitudes toward science than 7th and 10th graders. The 1976-1977 national surveys of science achievement conducted by the National Assessment of Educational Progress (NAEP, 1978) showed that boys outperformed girls, but gender differences varied across objectives assessed within subject-matter areas.

Gender differences in science, in favor of boys, have been attributed by

many authors to factors such as girls' lack of exposure to science-related activities outside the classroom (Kahleand Lakes, 1983), decrease in girls' science ability perception over the school year (Jovanovich and King, 1998), gender biases of teachers with respect to strategies for asking questions and fielding answers (Greenfield, 1997), cultural influences from society and school (Kelly, 1988), gender differences in spacial abilities (Gray, 1981), cognitive abilities (Meyer and Koehler, 1990), and mathematics background (Sells, 1976).

Kahle*et al.* (1993) argued that neither macro level frameworks suggested by international studies nor causal models developed in mathematics provide an adequate paradigm to guide gender and science research. They developed a model of the relationship between gender and science in schools based on interactions between six factors: (a) student behavior in the science classroom, (b) teacher behavior in the science classroom, (c) observable student outcomes, (d) student beliefs/attitudes, (e) teacher beliefs/attitudes, and (f) previous experience in sociocultural educational context for teachers and students. However, Kahle*et al*. clearly indicated the need for still more research to analyze specific relationships among and within factors of the model.

Regarding gender differences in science achievement, the need for more detailed analysis is indicated in many studies (e.g., Comber and Keeves, 1973; DeMars, 1998; Erickson and Erickson, 1984; Murphy, 1982; Saner*et al.*, 1994; Walford, 1980). For example, Erickson and Erickson (1984) indicated that "a good understanding of the nature and pattern of performance differences is important in order that we may attempt to explain them and thus to suggest ways of improving science education for girls".

It should be noted, however, that most previous results about gender differences in science achievement are based on multiple-choice items that need to be revisited in the light of the increased use of both multiple-choice and open-ended items in many national and statewide assessment programs. Also, very little is known about differential effects of student related factors (e.g., ethnicity and science ability) and test-related factors (e.g., item format and learning outcomes) on gender differences in science. When such effects are not taken into account, the results related to gender differences may be of little value or even misleading. Knowledge about patterns of gender differences across levels of other factors is important for revealing the dynamic nature of these differences and their interpretation.

2.8 GENDER AND ACADEMIC ACHIEVEMENT

Previous research has been carried out at a number of levels in an attempt to explain the failure of boys to achieve at the same levels as girls, and debate about the reasons for boys' lower levels of achievement and, crucially, possibly suggesting ways of narrowing the gap, has been vigorous. A variety of different explanations have been offered, and the gender gap is variously construed as resulting from brain differences between girls and boys (Sommers 2000, Gurian, 2001), with links to boys' testosterone and the 'natural' development of boys (Biddulph, 1998). Similarly, Archer and Lloyd (2002) have argued for a biological construction of masculinity, citing studies which show behavioural sex differences at a very early age, before children are able to form any notions of socially constructed gender (Connellan*et al.,* 2000; Baron-Cohen, 2003); boys' disregard for authority, academic work and formal achievement (Harris *et al*., 1993;

Rudduck*et al.,* 1996), and the formation of concepts of masculinity which are in direct conflict with the ethos of the school (Connell, 1989; MacanGhaill, 1994); differences in students' attitudes to work, and their goals and aspirations (Younger and Warrington, 1996, Warrington and Younger, 1999), linked to the wider social context of changing labour markets, de-industrialisation and male unemployment (Arnot*et al.,* 1998); girls' increased maturity and more effective learning strategies (Boaler, 1997; Gipps, 1996), with the emphasis on collaboration, talk and sharing (Askew and Ross, 1988; Fennema, 1996), whilst boys were seen neither as competitive nor as team players, unwilling to collaborate to learn (Barker, 1997), and less inclined to use cooperative talk and discussion to aid and support their own learning (Gipps, 1996); differential gender interactions between pupils and teachers in the classroom (Younger *et al.,* 1999).

Crucial to this discussion, however, is the need to understand how important it is for many boys to be accepted by other boys, to enable them to identify with and act in line with peer group norms, so that they are seen as belonging (Skelton, 2001; Martino andPallotta- Chiarolli, 2003) rather than as different. Such acceptance is often dependent on an act, negotiating an acceptable identity, and incorporating aspects of laddishness of behaviour and risk-taking (Jackson 2002, 2003). Expressed in behaviour, speech, dress code and body language, such laddishness often runs counter to the expectations of the school, but such behaviour is seen as a reasonable cost by boys if it allows them to protect their macho image, and enable them to ensure their acceptance as part of the chosen group (Francis, 2000).

Boys in schools in very different socio-cultural contexts, in inner cities and in rural counties, in Southern England's commuter belt and in Northern England's former mining villages, have all stressed this common theme of the vital need to conform to peer pressure, to be part of the crowd and to live up to crowd norms and expectations. Unlike girls, whose interests are quite widely spread, boys' groups mainly revolve around a football culture, and boys with little or no interest in football are often excluded or marginalized (Swain, 2000; West, 1996). Some boys, particularly those in higher sets, are certainly part of a group where hard work is accepted, and others have learnt to take no notice of taunts from their peers, but for many boys, being 'one of the lads', being 'real hard', 'having a laugh sometimes', 'not showing your emotions and having to win', embody the essence of the all-important macho image (MacanGhaill, 1994).

The adoption by lads of specific strategies associated with laddishness also minimises the possibility of failure and the consequent loss of status and esteem in the group context; it is linked to an avoidance of the feminine and the perceived 'stigma' of homosexuality (Jackson, 2002).

As the debate has intensified in the United Kingdom, so it has become obvious that the issue of boys' 'under-achievement' is far more complex and multi-faceted than assumed by some commentators. While it is clear that many boys negotiate a position with respect to the locally dominant masculinity, which preserves their image and status and leads them to take pride in disengagement with school, some boys also devise coping strategies which enable them to achieve academically within a legitimised local culture. Not all boys are under-achievers, therefore, and the issue of 'under-achievement' does not affect all boys.

An all-pervasive view of boys as under-achieving because of a laddish masculinity ignores the fact that, in many schools, boys are achieving high levels of success in academic, community, sporting and artistic contexts. Indeed, many boys have always done extremely well, and continue to do so (Arnot*et al.*, 1998). Equally, there are those boys who define their sexuality differently from the 'mainstream' macho, football-loving boys: gentle caring boys who find their comfort zone in the company of girls and women (MacanGhaill 1994, Martino and Pallotta-Chiarolli 2003). Whilst there are boys who can be aggressive perpetuators of homophobic aggression against other boys, not all boys act in the same way.

Just as it is important to look beneath the stereotype of the 'normal' boy, and acknowledge multiple perspectives on masculinity, so there are different kinds of girls and multiple perspectives on femininity (Frosh *et al.*, 2002, Reay 2001). Not all girls are high-achievers and conform to the conscientious, hard-working and well-motivated stereotype, distracted from their endeavours by recalcitrant boys. Indeed, some girls are taking on the 'laddish' attributes of their male peers (Jackson, 2004), and it is needed to pay greater attention to the monitoring of withdrawn, quiet, 'less visible' girls, whose quietness may hide severe problems (Bell, 2004). Boys do not have a monopoly on such matters: in many schools, there are also disengaged girls who do not reach their potential academically.

2.9 LEARNING PREFERENCES AND ACADEMIC ACHIEVEMENT

More recent research on learning preferences in higher education than that of Carroll in 1963 (cited by Claxton and Murrell, 1987), includes some studies of the efficacy of learning preference inventories as predictors of academic

performance, a line of inquiry that has produced equivocal findings (for example, Boyle *et al.,* 2003; Busato*et al.,* 1998; Brudnelland Carpenter, 1990; Van Zwanenberg*et al.,* 2000). The sensibleness of testing broad hypotheses about the relationship between general measures of learning preferences and achievement scores in higher education undergraduate programs has been problematised by Van Zwanenberg*et al.* (2000) and by Zywno (2003). These authors pointed out that there is a potentially large number of intervening variables which, at face value, seem likely to influence students' achievement scores over the period of undergraduate studies through interactions with learning preference variables. Some of these intervening variables relate to the variety of teaching styles and of academic performance expectations to which a student is exposed during the course of an undergraduate program.

The potentially large number of interactions between a student's learning preferences and intervening variables seem likely to confound attempts to identify any singular effects of the student's learning preferences, as measured by general learning preference inventories, on the somewhat heterogeneous collection of measures of academic achievement that are used in undergraduate programs (Van Zwaneberg*et al.,* 2000; Zywno, 2003). From some theoretical perspectives on the nature of learning in formal learning environments, however, there appears to be a strong case for further research into hypothesised relationships between specific aspects of learning preferences and academic achievement. Sternberg (1997), for example, concluded that measures of aptitude accounted for only approximately 20% of variance in academic achievement amongst school children. He suggested that some of the remaining variance could be accounted for in terms of what he

defined as ‘thinking styles’. Sternberg’s concept of ‘thinking styles’ appears to include an aspect of learning preferences identified by Vermunt (1998) as ‘metacognitive regulation’. Sternberg (1997) and Vermunt (1998) appear to share a common conceptualisation of the role of some aspects of styles in the self-regulation of cognitive processes. A study by Boyle *et al.* (2003), using Vermunt’s (1994) Inventory of Learning preferences that includes a scale for measuring metacognitive regulation, found a low, positive association between students’ academic performance and a learning preference identified by Vermunt (1998) as a ‘meaning-directed’ style. Students who are identified with the ‘meaning-directed’ style are characterised by selfregulation of learning processes. Vermuntand Minnaert (2003). Boyle *et al.* (2003) and Busato*et al.* (1998) found a low, negative association between academic performance and the ‘undirected’ style, which is characterised by a lack of regulation of learning processes. The existence of definite relationships between specific aspects of learning preferences and measured learning outcomes in terms of academic achievement, as predictable from the work of Sternberg (1997) and Vermunt (1998), for example, would have significant implications for curriculum, teaching, and academic counselling practice. If low metacognitive regulation was found to be reliably and strongly associated with poor academic performance in learning programs that required considerable student autonomy in the learning processes, for example, there would be a case for making interventions that identified students characterised by low metacognitive regulation and that facilitated their development in this aspect of learning preferences.

What evidence is there that individual differences in learning preferences can affect performance in learning settings? Much empirical research signals that learning preferences can hinder or enhance academic performance in several respects (Riding and Grimley, 1999; Ross and Schultz, 1999), although little research has been done on the relationship between instructional design of learning materials and learning preferences.

The two dimensions of cognitive style proposed by Riding and Cheema (1991) are the *wholist-analytic* and the *verbaliser-imager*. In support of these dimensions, studies conducted with students who were given a text comprehension task found that imagers learn better when information is presented in text-plus picture mode rather than in a wholly verbal mode (Cyrs, 1997 and Jeung,*et al.*, 1997). The additional visualisation afforded provides explanation that assists in comprehension (Riding and Douglas, 1993). These findings indicate that for imagers, learning performance suffers when information is presented only in textual mode. Imagers also prefer to use diagrams to present information during recall. In recent study on learning differences with multimedia materials, Riding and Grimley (1999) found that "style interacts with the structure of the materials in affecting learning (it) affects both performance and preference in terms of mode of presentation and also interacts with the structure of material in influencing learning".

Other research on learning preferences and achievement has shown that teaching students how to learn and how to monitor and manage their own learning preferences is crucial to academic success (Matthews, 1991; Atkinson, 1998; and Biggs and Moore, 1993).

2.10 FACTORS AFFECTING LEARNING PREFERENCES

There are several factors that can influence a student's learning preference. They are:

2.10.1 EnvironmentFactors

The environment can affect all learning preferences to some degree. If the room is too hot or too cold, or if there is outside noise making it difficult to concentrate or hear, all learning will be affected. However, some learners may be more affected than others. These learners may strain to hear you, may begin fidgeting in their seats, or may just tune out because it is too much work to try and stay focused with all of the environmental barriers (Sarasin, 1999).

2.10.2 PersonalityFactors

A student's personality can also have some bearing on his or her preferred learning preference. A normally outgoing person may need to engage in group activities so that they feel they had a chance to discuss the learning. More reserved people may resist group activities and prefer to work alone (Sarasin, 1999).

2.10.3 Genetics Factors

Sarasin, (1999), citing Rita Dunn (1990) that 3/5 of your learning preference is determined by genetics. So the combination of learning preferences of your parents will partially determine your learning preference. The other 2/5 is determined by outside factors.

2.10.4 Developmental Factors

One of the most important things to understand about learning preferences is that they are developmental in nature. The learning preference changes over time, based on experiences and level of education. This is a natural process, so people who have been out of school for some time may be surprised to find that they don't learn the same way they remember learning before (Sarasin, 1999).

2.10.5 Social Factors

People also learn simply by watching others and imitating them where reinforcement given to models motivate the observers to watch and imitate their behaviour. The observers get indirect or vicarious reinforcement instead of direct reinforcement. Learning, according to the social cognitive learning perspective, is influenced by the environmental consequences to modeled behaviour and personal characteristics of the observer or learner such as self-efficacy, personal goals and personal expectations. Using this perspective, teachers create an environment in which students see others getting reinforced or punished and promote among the students the personal characteristics of self-competence, high expectations for getting the expected rewards and setting challenging but realistic goals for their learning. Learning is thus viewed as a complex, reciprocal interaction between environment, personal cognitive characteristics and behaviour which mean that the instructional environment not only influences on students' personalities and their behaviour but students' characteristics and their behaviour also influence their future instructional environment and future learning (Arif, 2008).

2.11 THE DUNN AND DUNN LEARNING PREFERENCE MODEL

The Learning preferences Model as developed by Dunn and Dunn is built on the theory that each individual has a unique set of biological and developmental characteristics. These unique characteristics impact substantially on how a person learns new information and skills. The belief that individual students learn differently is well established in the educational literature (Good and Brophy, 1987). If the instructional situation is organized in a manner that takes advantaged of the individual's learning strengths, the rate and quality of learning will improve. The Dunn and Dunn Learning preferences Model draws upon two basic theories - cognitive style (Kagenand Kogen, 1970) and brain lateralization (Ornstein and Thompson, 1984). Two main dimensions or categories of cognitive style have been identified; conceptual tempo and field dependence-independence (Good and Brophy, 1987).

Conceptual tempo refers to a continuum of thinking style from impulsive thinking to reflective thinking that is observed as an individual responds to a variety of situations or learning tasks (Kagenand Kogan, 1970). It is possible for an individual to have a thinking style at one of these two extremes and it is also possible for an individual to have a thinking style that is somewhere in between these two extreme styles of thinking.The concept of field dependence-independence is closely related to the concept of global-analytic thinking styles. Again a continuum of thinking ability is used. On one end of the continuum are individuals who perceive information in a holistic and/or simultaneous manner (global thinkers), while learners at the other end of the cognitive style continuum perceive information sequentially in independent parts (analyticthinkers).Growing

out of her work in public and private school settings, Rita Dunn became interested in the development of a process to identify the unique learning preferences of students. Her efforts in this area led to the development of the Learning preferences Inventory which she used to identify individual learning preferences. The Learning preferences Inventory identifies five major categories of stimuli sources and twenty-one learning preference elements (Dunn, Dunn and Price, 1984). Later, the Reading Styles Inventory was developed by Carbo, *et al.* (1986) to identify specific learning preferences related to reading instruction and learning to read. Through the years the learning preferences approach to instruction has gained in popularity and is being used widely in schools, not without its critiques, however. Some professionals question the use of the learning preferences model - citing the vagueness of the underlying concept of learning preferences. Curry (1987), in extensive reviews of the cognitive and learning preferences literature, suggests that learning preferences as used by Dunn and Dunn is actually made up of three distinct "sub-constructs": (1) instructional preference, (2) information process style, and (3) cognitive personality style. Although supporting the reliability and validity of the Learning preference Inventory, Curry suggests that some of the learning preference elements -the psychological elements of Global/Analytic, Hemisphericity, and Impulsive/Reflective - are not compatible with the construct of instructional preference (Curry, 1987). Although many educators support the concept of learning preferences and have supported the implementation of the Dunn and Dunn Learning preferences Model, there is substantial concern with the conceptual framework and theoretical underpinnings of the model. In the early 1980s, the National Association of Secondary School Principals (NASSP) appointed a task force to study the concept of learning preferences with the goal of

improving on the theoretical framework for the use of learning preferences approaches in schools and to develop a psychometrically sound instrument to assess style (Keefe and Ferrell, 1990). As a result of these efforts, the NASSP has produced a framework of learning preferences that is similar, but varies some from the Dunn and Dunn learning preferences framework.

The Dunns' Learning preference Model is complex and encompasses five strands of 21 elements that affect each individual's learning. Some of these elements are biological and others, developmental. Style changes over time. A summary of these elements is provided below (Dunn, 2000):

2.11.1 Environmental Strand

The environmental strand refers to such elements as lighting, sound, temperature, and seating arrangement. For example, some people need to study in a cool and quiet room, and others cannot focus unless they have music playing and it is warm (sound and temperature elements).

2.11.2 EmotionalStrand

This strand includes the elements of motivation, persistence, responsibility, and structure. For example, some people must complete a project before they start a new one, and others work best on multiple tasks at the same time (persistence element).

2.11.3 SociologicalStrand

The sociological strand represents elements related to how individuals learn in association with other people: (a) alone or with peers, (b) an authoritative adult or with a collegial colleague, and (c) learning in a variety of ways or routine patterns. For example, a number of people need to work alone when tackling a new and difficult subject, while others learn best when working with colleagues (learning alone or with peers element).

2.11.4 Physiological Strand

The elements in this strand are perceptual (auditory, visual, tactile, and kinesthetic), time-of-day energy levels, intake (eating or not while studying) and mobility (sitting still or moving around). For example, many people refer to themselves as night owls or early birds because they function best at night or in the morning (time-of-day element).

2.11.5 PsychologicalStrand

The elements in this strand correspond to the following types of psychological processing: hemispheric, impulsive or reflective, and global versus analytic. The hemispheric element refers to left and right brain processing modes; the impulsive versus reflective style describes how some people leap before thinking and others scrutinize the situation before moving an inch. Global and analytic elements are unique in comparison to other elements because these two elements are made up of distinct clusters of elements found in the other four

strands. The elements that determine global and analytic processing styles are: sound, light, seating arrangement, persistence, sociological preference, and intake.

2.12 VISUAL, AUDITORY AND KINESHETIC LEARNING PREFERENCES

This study focuses upon three learning preferences, Visual, Auditory, and Kinesthetic, to determine the dominant learning preference. Learners use all three to receive information. However, one or more of these receiving styles is normally dominant. This dominant style defines the best way for a person to learn new information by filtering what is to be learned. This style may not always to be the same for some tasks. The learner may prefer one style of learning for one task, and a combination of others for another task. Classically, our learning preference is forced upon us through life like this: In grades, kindergarten to three, new information is presented to us kinesthetically; grades four to eight are visually presented; while grades nine to college and onwards, information is presented to us auditory by lectures. As trainers, we need to present information using all three styles. This allows all learners, no matter what their preferred style is, the opportunity to become involved. It also allows a learner to be presented with the other two methods of reinforcement. Just because we prefer one style, does not mean that the other two do us no good.

Lynne Celli Sarasin put forth a model that considers that previous theories and "attempts to synthesize the characteristics defined in those theories into an approach that can be easily translated in strategies in a college or university classroom setting" (Sarasin, 1999).

On the contrary, they help us to learn even faster by reinforcing the material. Some hints for recognizing and implementing the three styles are:

1. **Visual -** like charts, graphs and other visual aids to make the students really understand the material from general to specific. These students will sometimes create their own pictures to help themselves learn. "Visual learners have characteristics that are random, holistic, global, perceptual, concrete, and imaginative" (Sarasin, 1999).
2. **Auditory** - prefer to hear the information, work from pieces to the whole. These learners are orderly and sequential and have the ability to think in an abstract manner. "They tend to be reflective, sequential, and analytic, and are cognitive by nature" (Sarasin, 1999).
3. **Kinesthetic -** learn best by being physically and actively involved in the learning process. "They are behavioral by nature and need to "do" something in order to understand the nuances or truly master a concept" (Sarasin, 1999).

2.12.1 Visual Learners

Visual learners are almost polar opposites of auditory learners. Lectures and class discussions don't work well for them as they have a difficult time following along, since there are no visual clues for them to grasp. So the way to teach visual learners is completely different from how to teach auditory learners. Sarasin says"to accommodate students with visual learning strengths and needs, instructors need to almost completely abandon conventional approaches and develop innovative ways to address the needs of visual learners" (Sarasin, 1999).

2.12.1.1 Descriptors

Visual learners are able to work from the general to the specific. They are:

1. Abstract random - they like to receive information from many sources when learning new concepts;
2. Global - they see the “big picture” before seeing its parts;
3. Concrete - like to “see” things in order to understand them;
4. Active - like to be physically involved;
5. Affective - relate learning to emotions;
6. Field-sensitive - learn by looking at the world around them;
7. Concept-oriented - see concepts before individual facts.

Visual learners need time to take what they hear and make it some sort of visual so that they can remember it. They need to be able to relate it to their environment and attach feelings to it.

2.12.1.2 Characteristics of visual learners

1. Have a strong sense of color;
2. Follow written directions well;
3. Process what they hear slowly;
4. "Translate" word messages into pictures or images;
5. Closely watch a speaker's body language and facial expression;
6. Get very distracted by noise or people talking in the background;
7. Use mental pictures to remember things;
8. Use visual representations to understand ideas, e.g. graphs, organizers,

pictures, slides, videos, diagrams, demonstrations, overheads, flip charts, handouts etc.

9. Know something by seeing it;
10. Conjure up the image of a form by seeing it in their "mind's eye";
11. Have a vivid imagination;
12. Often stare, need something to watch;
13. Do not talk at length;
14. Become impatient or lose focus when extensive listening is required;
15. Prefer the visual arts and media;
16. Often prefer to take notes or draw pictures to absorb information;
17. Like to write on the blackboard;
18. Remember quickly and easily what is read;
19. Learn better after seeing or writing something;
20. Get called "bookworms";
21. Grasp important concepts on first reading of material;
22. Love to read books, journals, magazines;
23. Perform hands-on tasks well;
24. Read well from picture clues (Nystrom, 2000).

2.12.2 Auditory Learners

Auditory learners are “traditional” students. They learn best by hearing and listening, so traditional instructional techniques, such as lectures, work very well for this style of learner. This is the way that many of us learned to teach, to lecture and then test. For this type of learner, methods that revolve around talking and listening work very well. “Schools have traditionally tended to reward the students

with auditory learning strengths. Therefore, many of the teaching strategies used in today's classrooms are appropriate for the learner who prefers to learn through the auditory mode and who has experienced success" (Sarasin, 1999).

2.12.2.1 Descriptors

Auditory learners are:

1. Abstract sequential - they can take pieces and pull them together, in an orderly fashion, to understand the whole concept;
2. Reflective - they spend time considering learning;
3. Independent - like to be left alone to learn and reflect after hearing;
4. Achievement-oriented - like to do well on tests, win contests;
5. Memory-oriented - can memorize facts and figures fairly easily;
6. Competitive - like to be placed in situations where there is a winner/loser;
7. Skill-oriented - like to learn and display new skills, less interested in theory.

In looking at the auditory learner descriptors, you see a student who will do well when presented with individual facts and allowed to take time, alone, to process those facts into a larger concept. To take one step further, an auditory learner acts in the following ways when engaged in a learning experience:

2.12.2.2 Characteristics of auditory learners

1. Tend to remember and repeat ideas that are spoken;
2. Learn well through lectures;

3. Get described as excellent listeners;
4. Find it easy to reproduce symbols, letters or words by hearing them;
5. Like to talk;
6. Enjoy games, dialogues, and dramas;
7. Learn concepts by listening to tapes;
8. Enjoy music;
9. Find it easy to repeat or fulfill verbal instructions;
10. Think out loud;
11. Often hum or talk to themselves or to others;
12. Rarely stay quiet for great lengths of time;
13. Often talk at length;
14. Like to use other people as a sounding board;
15. Enjoy question/answer sessions;
16. Like small group discussions;
17. Prefer to discuss things with others;
18. Like to participate in class discussions or debates;
19. Like to make speeches and presentations;
20. Do well at telling the difference between sounds, musical notes and tones;
21. Memorize by listening to something over and over;
22. Have difficulty copying from the blackboard (Nystrom, 2000a).

2.12.3 Kinesthetic Learners

Kinesthetic learners are the movers of the education world. They learn best by doing whatever it is they are learning, whether it is a computer application or a

biology lab. They are tactile, use their senses to help them learn, and are often discouraged from learning in their preferred method at an early age. “The tactile learning preference is the most neglected at the post secondary level. The needs of tactile learners are rarely addressed, other than in classrooms intended for the actual doing, such as science laboratories” (Sarasin, 1999).

2.12.3.1 Descriptors

Kinesthetic learners are:

1. Dependent and independent - need to receive information and stimuli from environment and others and then be free to incorporate it into their learning as for as necessary;
2. Creative - in problem-solving approaches and in their work;
3. Behavioral - associate physical behaviors with learning;
4. Interact in a hands-on fashion - must be physically involved;
5. Physical by nature - in everything that they do, when they read, their lips or fingers will move to help them retain information better;
6. Sensory - use all their senses in the learning experience;
7. Active - in all aspects of learning.

Kinesthetic learners are often labeled as hyper or unable to pay attention when they are learning since their need for movement often appears as if they are tuned out, when in reality, they are using movement to help them retain focus.

2.12.3.2 Characteristics of kinesthetic learners

1. Involve the sense of touch in learning;

2. Like to do artwork;
3. Like to piece things together;
4. Like to doodle;
5. Like to trace words and pictures;
6. Succeed with tasks requiring manipulation;
7. Like to chew gum while studying;
8. Often fidget or find reasons to move;
9. Have a hard time paying attention to visual or auditory presentations;
10. Want to be "doing" something;
11. Try things out;
12. Talk with their hands;
13. Get accused of being poor listeners;
14. Have a hard time being still when music is playing;
15. Learn better when able to move during learning;
16. Like to move hands (doodling, tapping) while learning;
17. Use movement to help concentrate;
18. Like to take frequent study breaks;
19. Like to work, standing up;
20. Use bright colors to highlight reading material;
21. Like to listen to music while studying;
22. Like to skim through reading material to get a rough idea as to what it is about before settling down to read it in detail;
23. Have good, fine and gross motor skills (Nystrom, 2000b).

A person's preference as to whether tasks or activities are presented to appeal to auditory, visual, tactile or kinesthetic senses (modality preference) is an important dimension in Dunn and Dunn model. Carbo(1983), on the Dunns' behalf, questioned earlier research into modality preference, suggesting that 'although only two of the 19 studies achieved significant interactions between reading method and modality strengths', methodological weaknesses in the majority of studies have obscured the connection between reading instruction and modality preference. This led Carbo to assert that there is, after all, a connection. Many other researchers on modality preference (not using the Dunns' model) have reported a lack of evidence for modality preference as a guide to teaching strategy. For example, in a review of 22 studies, Kampwirth and Bates (1980) reported that 20 'failed to indicate a significant interaction', while Tarver and Dawson (1978) found that only two out of 14 studies showed an interaction between modality preference and teaching method. Similarly, Deverensky (1978) argued that research had not shown a causal relationship between modality and reading performance, but he suggested that this might be because of the difficulty of finding sensitive measures of preference.

Research into modalities suggests that different modality effects are associated with reading performance, in particular with the problems that poor readers have with echoic (sound-based) memory (Penney and Godsell, 1999). This implies that auditory instruction may benefit good readers more than poor readers. Westman and Stuve (2001) suggest that modality preferences exist and that self-report questions based around enjoyment are one way to elicit them. Yet, there is disagreement as to whether modality preferences are important. There is also evidence to suggest that learning preferences are more likely to be influenced by

students' understanding of the demands of a particular task than by modality preference (Westman*et al.*, 1997).

Kavale and Forness excluded many studies in support of the Learning preference Inventory (LSI) because these did not fit their meta-analysis criteria – namely, that studies should assess modality preference formally, design instructional materials and techniques to capitalise specifically on the assessed preference, and assess results of that instruction with a standardised outcome measure. This external research into one of the most important underlying claims of the Dunn and Dunn model provoked a response from Dunn (1990) and a riposte from Kavale and Forness (1990). These have been referred to as a 'blistering exchange' over 'allegations and counter-charges of shoddy scholarship and vested interests [that] have clouded the issue and made it all the more difficult for practitioners to decide what's worth pursuing' (O'Neil, 1990). Rita Dunn rejected the findings of Kavale and Forness because they excluded studies produced in support of the LSI and asserted that high achievers 'may strongly prefer one modality more than another, but often they have two or more preferences and can learn easily through one or the other. In contrast, underachievers may have either no preference or only one – usually tactual or kinesthetic' (Dunn, 1990).

In response, Kavale and Forness re-asserted the criteria for including studies in their meta-analysis and added (Kavale and Forness,1990) 'When even a cursory examination revealed a study to be so inadequate that its data were essentially meaningless, it was eliminated from consideration. This is the reason that only two of Dunn's studies were included in our analysis.' Instead of modality-based teaching, Kavale and Forness recommended that specific instructional

strategies could benefit all students. This idea is supported by the Dunn's own research (Miller *et al.*,2000/01), which found that a teaching strategy based on a 'programmed learning sequence' and designed to favour visually- and tactilely-oriented students increased attainment for all students in the experimental group. Jaspers (1994) rejected the utility of identifying dominant modality preferences as a basis for designing targeted instructional materials, arguing that there is both a lack of theoretical support and doubts about the practical efficiency of such an approach. Targeted instructional materials were not supported by Moreno and Mayer (1999) who found that mixed modality presentations (visual/auditory) produce better results, 'consistent with Paivio's theory that when learners can concurrently hold words in auditory working memory and pictures in visual working memory, they are better able to devote attentional resources to building connections between them'.

2.13 THEORIES AND RESEARCH ON GENDER DIFFERENCES IN HIGHER EDUCATION

A common explanation for gender segregation in higher education as well as more generally is that it is due to differences in the early socialization of boys and girls (cf. Eagly, 2000). Boys and girls internalize different values and preferences, and this leads them to choose different educations. In particular, the nurturing role of women may encourage girls and women to make educational choices that lead to caretaking occupations (Bradley, 2000). A second type of explanation, particularly common among economists, is that gender differences arise becausewomen tend to choose careers that make it easier to combine employment and family life (e.g. Polachek, 1981). According to this theory, men

and women have the same basic value or preference (maximization of life time income), but the opportunity situations in which they find themselves lead them to make different choices. A third type of explanation assumes that men and women are exposed to different external factors, including possible gender discrimination. An example of this strand of theory is the "social control perspective" suggested by Jacobs (1989). Jacobs argues that women are exposed to a lifelong system of social control. External social pressures rather than internalized values or calculation of costs and benefits push women in the direction of making traditional choices at all life stages.

There is a huge literature addressing the gendered nature of science and engineering. Consistent with the socialization perspective, a prevalent claim found in the research in this area is that the roots of gender segregation in higher education lie in the earlier stages of the student's career (Oakes, 1990; Ma, 1999). Several studies have also shown that there are cultural beliefs that males are more competent than females at mathematics (Hyde *et al.*, 1990; Wagner and Berger 1997; Seymour and Hewitt, 1997; andCorrell, 2001), even though the empirical support for actual gender differences in mathematical competence is weak (Baker and Jones 1993; Finn 1980). Furthermore, males tend to overestimate their mathematical competence relative to females and are therefore more likely to pursue activities leading toward a career in science and engineering (Correll, 2001).

The family and the peer group have been found to be an important influence on educational choices (Mooga*net al.*, 1999). Parents play an early role in helping students develop postsecondary aspirations (Somers *et al.*, 2002). Girls are found to have a collaborative approach to the choice process towards their parents,

especially mothers, while boys tended to be more resistant to parental involvement (David *et al.*, 2003). Girls are also more likely than boys to be influenced by peers and perhaps to consult more with others more generally (Reay, 1998). The implication of these differences for students' choice of field of study has not been examined. It may, however, be hypothesised that these patterns play an important role in the reproduction of gender segregation in higher education. Moreover, irrespective of whether or not men and women differ in the overall level of support or influence from parents and friends, the specific direction or content of this influence may be different. One possibility is that parents in particular influence sons and daughters in the direction of making traditional gender-typical choices, like nursing for females and engineering for males.

A focus on family and peer influences is consistent with both socialization and social control theories, depending on whether these influences are assumed to be internalized or not. Research on student dropout has focussed more clearly on the impact of factors external to the individual. In particular, the emphasis has been on student integration (Austin 1993; Tinto 1987, 1997; Braxton *et al.*, 1997; Read *et al.*, 2003). Tinto draws heavily on Durkheim's work (1897/1951) and focuses on the role of social structure in the persistence process. Students enter higher education with a set of background characteristics, intentions and expectations and the way these variables interact and are modified in a social and academic integration process are decisive for students' decision to persist or depart. In terms of this theory, higher dropout of students in educational fields dominated by the opposite gender could be understood as a result of these students being less

integrated. Differences between male and female dominated fields have not been a central topic in this research tradition, however.

Moving beyond studies of student persistence to more general theories, several authors have suggested that the numerical strength of a minority group has important consequences for the degree to which it is exposed to discrimination or more generally experience difficulties in various social settings. Particularly influential has been Kanter's (1977a, b) theory of "tokenism". Kanter suggests that small minorities, like women in predominantly male settings, are faced with special problems. The basic issue is that members of small minorities are not perceived and treated as individuals but rather as representatives or "tokens" of their category. As an example, she refers to an interview study conducted by Segal (1962) where a male nursing student reported that he thought he would enjoy being the only man in a group of women until he found out that he engendered a great deal of hostility and that he was teased every time he failed to live up to the manly image (Kanter, 1977b). A related, although different, idea is that traditionally privileged majorities may feel that their advantaged position is threatened by the minority, and that the minority is therefore subject to various kinds of hostile behaviour (Blalock, 1967). Kanter's and Blalock's theories give rise to different hypotheses. According to Kanter, the situation of the minority is more difficult the smaller it is. Blalock, on the other hand, argues that the majority is more likely to tolerate a very small minority group; when the relative size of the minority group increases, it is perceived to be a greater threat, and the majorities' hostility increases.

As noted above, results on the relationship between gender segregation and the dropout of female and male students are highly inconsistent. The reasons for these contradictory resultsmay be that even though demographic attributes as gender may well be objective categories, their interpretation and meaning are essentially social. Gender differences are social constructions in a particular organisational setting (Chatman and O'Reilly, 2004). Moreover, it has been argued that Kanter's theory of relative numbers lacks a gender power perspective (Zimmer, 1988; Teigen, 1999). Therefore, being a minority may differ between educational programmes as well as between women and men. A study of deviation from occupational gender stereotypes reported, for example, that deviance appeared more costly in the minds of undergraduate women than men (Yoder and Schleicher, 1996).

Reviewing the literature, it seems that the gendered patterns in choice of study field is highly resistant to increased female participation as well as egalitarian culture norms. It has been argued that expansion of higher education implies a diversification that affects the gender distribution across programmes and fields of study in the sense that female students in these "mass" systems are more willing to settle for lower status institutions and "gender appropriate" fields of study (Charles and Bradley, 2002). It is, therefore, reasonable to hypothesise to find significant gendered patterns in examination of students' educational choice process. Considering the literature on "tokenism" and the impact of relative numbers of minorities, it is less evident that we will find gender differences in student dropout. It is reasonable to assume that gender stereotypes have been modified during recent

decades and that they are less significant among young people in a country with strong egalitarian norms like Norway (Esping-Andersen, 1990).

2.14 STUDIES RELATED TOLEARNING PREFERENCES

In study of Lujanand DiCarlo (2006),students have preferences for the ways in which they receive information. The visual, auditory, reading/writing, kinesthetic (VARK) questionnaire identifies student's preferences for particular modes of information presentation. Knowing the students preferred modes can help provide instruction tailored to the student's individual preference, overcome the predisposition to treat all students in a similar way, and motivate teachers to move from their preferred mode(s) to using others.

BaykanandNacar (2007) stated that educational researchers postulate that every individual has a different learning preference. The learning preferences did not differ between male and female students, and no statistically significant difference was determined between the first-semester grade average points and learning preferences. Knowing that students have different preferred learning modes will help the medical instructors in faculty develop appropriate learning approaches and explore opportunities so that they will be able to make the educational experience more productive.

In study of Slater *et al*. (2007), students have specific learning preference preferences, and these preferences may be different between male and female students. Understanding a student's learning preferencepreference is an important consideration when designing classroom instruction. The numbers and types of modality combinations were not significantly different between genders. Although

not significantly different, the female student population tended to be more diverse than the male population, encompassing a broader range of sensory modality combinations within their preference profiles. Instructors need to be cognizant of these differences and broaden their range of presentation styles accordingly.

Beck (2007) showed that pre-service teachers found the use of case studies as potentially useful in helping them learn and process course content no matter what learning preferencepreference the pre-service teacher has.

Kratzig and Arbuthnott (2006) study, given the potential importance of using modality preference with instruction, tested whether learning preferencepreference correlated with memory performance in each of three sensory modalities: visual, auditory, and kinesthetic. In Study 1, results indicate that objective test performance did not correlate with learning preferencepreference. In Study 2, findings indicate that participants answered the inventory using general memories and beliefs rather than specific examples of learning in different modalities. These results challenge the hypothesis that individuals learn best with material presented in a particular sensory modality.

Murphy*et al.* (2004) study results clearly demonstrate that the dominant preference distributions for the two populations (dental student and sample population) are different. In particular, the proportions of learners who selected visual or kinesthetic are significantly different for the two populations, while the proportions of learners who selected aural or read/write are not significantly different. Dental students prefer visual learning at a higher percentage and kinesthetic learning at a lower percentage than the sample population measured in

the VARK website. Inter-class differences varied, and gender differences were not significant. The distribution of dental student scores shows a preference for instructors who use strong visual presentations and facilitate note-taking during lectures. Dental educators should be aware of these differences in order to explore opportunities for making the educational experience more productive and enjoyable.

Results of Arslan(2003) study indicated that engineering students, both male and female, were dominantly active learners and heavily sensing learners rather than intuitive. Considering input dimension, all engineering students indicated their preferences toward visual learning. The main conclusion drawn from the last dimension was that there was not any significant difference between sex, department, CGPA and four learning preference dimension. In conclusion, study revealed that learning preference preferences of the engineering students were not different from each other depending on department variable. Male and female students' learning preference preferences and CGPA scores were not significantly different from each other.

Akgün (2002) investigated the learning preferences of English learners at private English courses. The results indicated that the most preferred learning preference among learners was concrete learning preference, and in order the others were communicative, authority-oriented and analytical learning preferences. Among teachers the same order of learning preferences was inferred. The results related to age and gender did not indicate any difference in relation to learning preferences. In other words, participants' learning preferences did not differ according to their age and gender. However, in terms of level of education, there

was a significant difference between university graduates and M.A. students and other learners because university graduates and M.A. students preferred analytical learning preference more than the other learners.

Hoerr (2002) focused on the benefits and details of using multiple intelligences in learning a skill or concept. He presents implications for learning preferences in classroom environment and ways in understanding the learning preference of a child. Children that were used in this research were successfully absorbing information about trees and plants in different ways. While one of them grasped information best when he became physically involved in the process, another needed to touch and feel things to truly understand them.

In his study, Henke (2001) aimed to describe how an aspect of learning theory, specifically learning preferences, can be applied to the development of computer based training. According to the results, most computer-based training is designed to be completed in a short time span. In another article, it is stated that Computer Assisted Learning (CAL) is being widely used because CAL can be adjusted to each learner's style and learner's overcome their learning weaknesses. It is maintained that students learn in a variety of methods but that each student has a preferred learning preference. And as such, good course design must be developed to be flexible enough to meet each student's preferred learning preference.

The result of Cano (1999) study indicated that the 1994 entering freshmen tended to lean towards the field-independent learning preference. The students in the study who were field-independent, in 1995, majored in Agribusiness and

Applied Economics, Animal Sciences, Horticulture, or Agronomy. In 1996, the field-independent students majored in Agricultural Education, Animal Sciences, Food Science, or Horticulture. The field-dependent students, in 1995, majored in Agricultural Communication, Agricultural Education, and Food Science. In 1996, the field-dependent students majored in Agribusiness and Applied Economics, Agricultural Communication, Agricultural Systems Management, Agronomy, and Construction Systems Management. The results of the current study also indicated that field-dependent students were more likely to receive disciplinary action from the College due to a lower grade point average, than were field-independent students. Also, the findings indicated that as learning preference score moved from dependent to independent, there were corresponding increases in ACT scores and cumulative grade point average. The evidence in the current study is clear to indicate that leaning style does positively influence academic achievement in the College of Food, Agricultural, and Environmental Science.

The article of Slaats*et al.*(1999) reported two studies among students in secondary vocational education. The first is an interview study that examines these students' processing strategies, regulation strategies, conceptions of learning, and motivational orientations (reflecting four components that make up a learning preference, as found among students in higher education(Vermunt, (1992). Learning preferences and regulation of learning in higher education—towards process-oriented instruction in autonomous thinking, Amsterdam/Lisse: SwetsandZeitlinger). In the second study, results indicate strong differences in learning preferences between students in different disciplines of vocational study, thereby supporting a domain-dependent viewpoint. A comparison is made between

secondary vocational and higher education, practical implications are discussed, and guidelines for future research are given.

Hong *et al.* (1995) examined whether changes in children's learning preferences can occur from cultural, social, and environmental changes within an ethnic group. Similarities as well as differences in learning preferences were found between the two nationalities and between boys and girls in both groups. Those learning preferences on which differences were significant might have been influenced by the social and environmental differences found between Korea and the United States. The pattern of preferred learning preferences for Korean-American subjects tended to be similar to that reported for students in the U.S., indicating that the Korean-American subjects had become acculturated and their learning preferences became close to the learning preference pattern of students in the U.S.

Dunn*et al*. (1993) examined learning preference characteristics of Mexican-American students (n=687) in grades 4 through 6 and compared results to those from 70,000 Anglo-American children. Compared to Anglo Americans, Mexican-American students preferred formal seating designs and were significantly more peer oriented. Sex differences also were found.

Ewing and Yong (1993) compared learning preference preferences among gifted African-American (n=54), Mexican-American (n=61), and American-born Chinese (n=40) middle grade students attending Chicago, Illinois, public schools. Significant ethnic, gender, and grade differences were found. All three groups preferred studying in the afternoon and bright light and did not prefer noise,

structure, and authority figures.

Tseng (1993) investigated the differences in learning preferences among Chinese American, Anglo American and Hispanic American students in elementary third and fourth grades. There were some differences among the three ethnic groups. Discussion emphasized how the cultures influence the learning preferences and how teachers and parents can apply the results of this research.

Ewing and Yong (1992) examined whether significant group, gender, and grade differences existed in the preferred learning preferences of gifted minority 6th-8th graders. Significant gender differences were found in preferences for tactile, and intake modality. All three ethnic groups were responsible and motivated. African-American subjects preferred a visual modality and studying in the afternoon. Mexican-Americans preferred a kinesthetic modality. Chinese-Americans reported the strongest preference for the visual modality of the 3 groups.

Do learning preferences vary in predictable ways? There are four factors that significantly differ between groups and among individuals: global versus analytic processing styles, age, gender, and high- versus low-academic achievement (Dunn & Griggs, 1998). The educational implications of these four variables are important to fully comprehend and employ because they provide direction and structure for effective teaching strategies, especially for low-achieving children.

Dunn and Dunn (1979) found that only 20 to 30 percent of the school age children they studied were auditory learners, that 40 percent of the students they

studied were visual, and that the remaining 30 to 40 percent were tactile and kinesthetic, visual and tactile, or some other combination.

Previous research also indicated that students' learning preferences were significantly related to their achievement level. Park (1997) found that among high, middle and low achievers, high achievers were the most visual and low achievers were the least visual and that middle and low achievers had minor preferences and high achievers had negative preference for group learning. Other research about learning preference identified gender differences. In his study of young children, Restak (1979) documented various gender differences. He observed that girls were both more sensitive to sounds and more proficient at fine motor performance than boys. Boys, in contrast, showed an earlier visual superiority to girls. They were, however, clumsier, performing poorly at a detailed activity such as arranging a row of beads, but excelled at other activities requiring total body coordination. Dunn*et al.* (1993) also found gender differences in their study of the learning preferences of Mexican and Anglo-American children in elementary schools and concluded that both Mexican and Anglo female students were more persistent than males; male Mexican-American students had the strongest tactile learning preferences whereas both groups of females in general preferred the least amount of tactile learning; the least auditory were the male Anglo-American children. Dunn, Griggs, and Price found that Mexican-American children were more peer-oriented than the males. However, Park (1997) found that there were no gender differences in the learning preference preferences in Anglo, Chinese, Filipino, Koreon, and Vietnamese students in secondary schools. Recent studies have focused on assessing the learning preferences of students. Learning preferences have found to

have positive relationships with academic performance, as measured by grade point average (GPA) (Torres, 1993; Torres and Cano, 1994), performance in agriculture courses (Gartone*t al.*, 1999) and overall success in higher education (Cano and Porter, 1997; Cano, 1999).

Chapter 3

MATERIALS AND METHODS

This study was undertaken on college students in the Punjab province of Pakistan during 2010-12. Students' learning preferences were explored and difference in learning preference of college students were examined with reference to gender, area of study and academic achievement. The study was quantitative,descriptive and correlational. Details of the methodologies and data collection are described in the following paragraphs:

3.1 POPULATION

All (male and female, science and arts) students who had passed Intermediate examination (F.A/F.Sc) and were currently enrolled/studying in B.A/B.Sc and BS programmes of all public sector colleges of Punjab province were the population of the study. The approximate size of the student population was 1,52,385 students, 36,960 students who passed F.Sc. examination and 1,15,425 students who passed F.A. examination.

3.2 DELIMITATION OF THE STUDY

The Punjab province of Pakistan was divided into three regions, North Punjab, Central Punjab and South Punjab. The research was confined to six districts of Punjab province with two districts from each region.

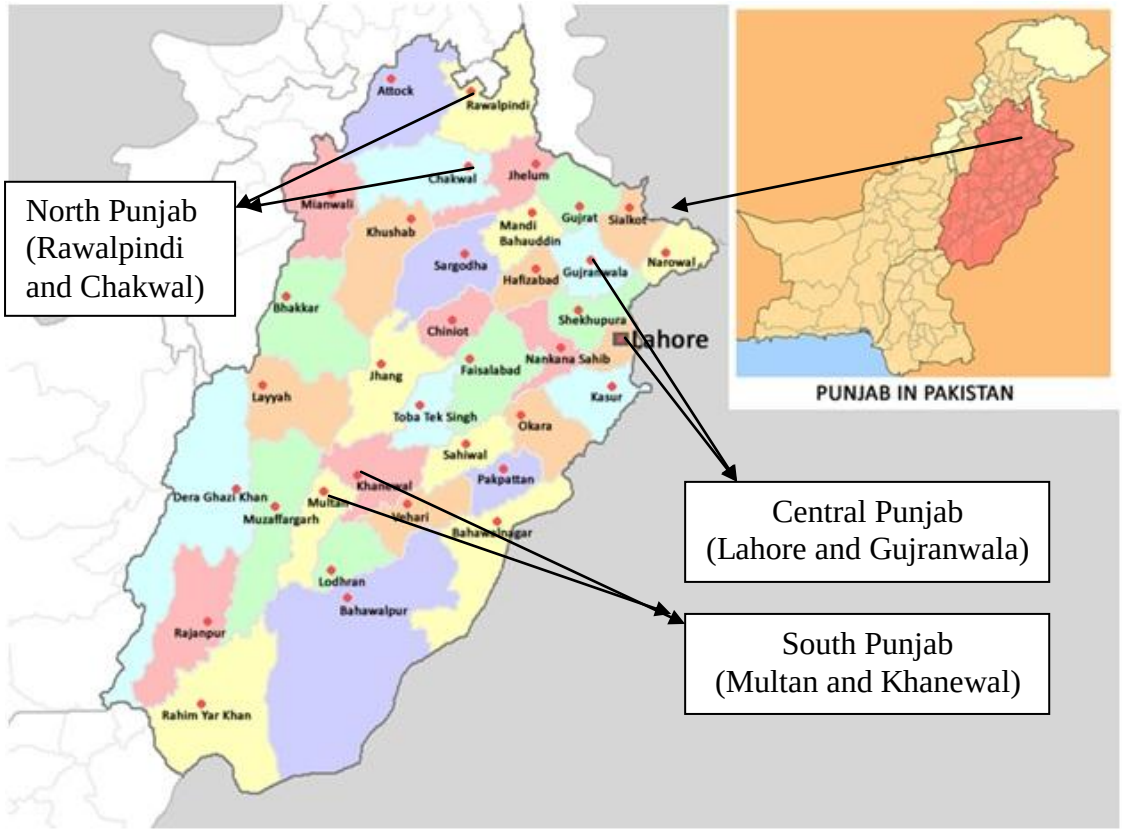

Figure 3. Districts selected for the study.

3.3 SAMPLE

Three-stagecluster sampling was used and 1200 students were selected as the sample of the study. Initially, at the first stage, two districts from each region were randomly selected. At second stage, one male and one female college from each district were selected. At third stage, from each selected college, fifty arts and fifty science students were randomly selected. There were, in all, twelve colleges of the six districts of Punjab province (Appendix-I). The sample distribution is tabulated in Table 1.

3.4 RESEARCH INSTRUMENT

Learning preferences of each respondentswere identified through theBarsch Inventory of Learning Preferences (Barsch, 1996). The researcher got permission from the publisher to use the tool (Appendix-II). There are three learning preferences in BILP which visual, auditory and kinesthetic. Visual learners are characterized by their aversionto oral lessons.Instead they need to see "it" to understand "it". Auditory learners like to listen people in order to get information. They like to listen rather than read and write. Kinesthetic learners prefer to learn by doing. It is difficult for them to sit still.They participate in physical activity to learn better (Barsch, 1996).For the better understanding of respondents, the research instrument was translated into Urdu language with the assistance of Urdu language experts.

The questionnaire askedin its first part, personal information about the students' name, class/group (science/arts), gender, college name and percentage of marks obtained in the Intermediate (F.A/F.Sc) annual examination. The

BarschLearning Preference Inventory (BLPI, 1996; Appendix "III")consisted of 24 items which were to be responded on the categories of response: “often”, “sometimes” and “seldom”. The main reason to choose this techniqueof collection of data from the individuals wasthis because they all wereeducated and can comprehend questions, in print. Questionnaire was preferred as an instrument of data collection due to following reasons:

1. When the number of respondents is larger and they are distributed widely then questionnaire is a more appropriate method.
2. Questionnaire is utilized because it is inexpensive.
3. Data obtained throughquestionnaire can be easily decoded and analyzed. The responses are more suitable for statistical analysis.
4. The questionnaire can be administered in short time, so that feedback can be obtained in a few minutes on many points.
5. The possibility of bias would be minimal, as respondents have no fear of any pressure on their observations (Ellington *et al.*, 2003).

Some of the limitations in theuse of questionnaire, according to the above scholars, are that:

1. Respondents have a little free time and fill in the questionnaire in a hurry method without concentrating and reading the items carefully. These limitations include:
2. In questionnaire individuals respond not on the basis of deep thinking.
3. Respondents are likely to fill in the questionnaires as the researcher wants them to fill.

4. The responses do not generally only contain respondent real status but their aspirations.
5. The respondents give their coloured responses reflective temporary feelings at that time when they are filling that questionnaire. If they are given same questionnaire to fill in, after some days, their responses would be different.

3.5 VALIDITY AND RELIABILITY OF QUESTIONNAIRE

In order to examine the validity and reliability of Urdu version of Barsch Inventory of Learning Preferences (BILP), it was administered to a sample of 60 students in which (30 male students, fifteenarts and fifteen science, from one govt. college boys and 30 female students,fifteen arts and fifteen science, from one govt. college for women of Mianwali district) presented in Table 2.

To check reliability of questionnaire,split-half method was used.The questionnaire's reliability coefficient was found to be 0.81.

Barsch Learning Style Inventory is a valid instrument because it has also been used by many other researchers (Erton, 2010; Beck, 2007; Kratzig and Arbuthnott 2006;Halsne and Gatta, 2002; Doyran, 2000). However its validity was determined because it was translated in national language of Pakistan. Makeover, it is required because of different context in which it was used. The respondents involved in pretest were briefed to point out the convenience with respect to reading and understanding the questionnaire. A few amendments were made in the questionnaire in the light of their opinions. They opined that there should be addition of alphabet "I" in start of every statement of questionnaire and the researcher did that. In original version of questionnaire, statement no.15 was

"Chew gum, smoke or snack during studies". According to the experts opinion the word "smoke" contradicts with our religious and cultural values therefore it should not be used in questionnaire because it is inappropriate to ask from a college level student in Pakistan.

3.6 DATA COLLECTION

Following steps were followed in procedure of data collection:

1. The researcher initiated to collect data w.e.f 2nd of January 2012 and visited every college personally.Govt. Emerson College for Boys Multanwas firstly visited in order to collect data from the students who had passed F.A/FSc and who were currently enrolled in B.A/BSc and BSprogrammes. First day of data collection, researcher approachedtwenty five male students (14 science & 11 arts) to brief them on the questionnaire. They were administered questionnaires and researcher received back questionnaires completely filled in. Next day, he revisited the college and approached other thirty male students (13 science & 17 arts). They refused to fill the questionnaires at that time due to their class work. But they returned the questionnaires after two hours because of their class work. On the third day, the researcherreceived the questionnaires from twenty five male students (12 science & 13 arts), twenty male students (11 science and 9 arts) those were selected randomly on the fourth day. In all 100 questionnaires were completed from Emerson college.

Table 1. Sampling frame of college students of Punjab province.

District	Male College		Female College		Total
	Science	Arts	Science	Arts	
Lahore	50	50	50	50	200
Gujranwala	50	50	50	50	200
Rawalpindi	50	50	50	50	200
Chakwal	50	50	50	50	200
Multan	50	50	50	50	200
Khanewal	50	50	50	50	200
Total	**300**	**300**	**300**	**300**	**1200**

Table 2. Sample of students selected for pre-testing the questionnaire.

College Name	**Male Students**		**Female Students**		**Total**
	Science	Arts	Science	Arts	
Govt. College for Boys Mianwali	15	15	___	___	**30**
Govt. College for Women Mianwali	___	___	15	15	**30**
Total	15	15	15	15	**60**

2. On the first day of next week, the investigator visited Govt. College for Women Multan and met 23 female students (10 science and 13 arts. They wereadministered the questionnaires and received back completely filled in. Next day, the researcherapproachedanother 31 female students (20 science and 11arts). All respondents returned the filled questionnaires on the same day. On second week's third day,the researcher delivered the questionnaires to another 21 female students (9 science and 12 arts)and received backquestionnaires completely filled in. Onthe fourth day, 25 more questionnaireswere administered and he administered these questionnaires to female students(11 science students and 14 arts), and got back all questionnaires completely filled in.Thus, students' data collection was completed in two weeks in Multan district. Dr. Parvez, Associate Professor at Govt. College Bosan Road, Multan helped the researcher in data collection from both colleges.In all 100 questionnaires were completed from Govt. College for Women, Multan.

3. During data collection's second phase, the researcher went to Govt. College for Boys Khanewal on 16th of January, 2012 in order to collect data from the students who had passed F.A/FSc and currently enrolled in B.A/BSc and BS programmes. On the first day, investigator met 30 male students(15 arts & 15 science). The researcher delivered questionnairesand briefed the students about questionnaire. All 30 students filled the questionnaires and returned these questionnaires to the investigator. On the next day, he was able to contact only 20 male students (15 arts& 5 science)and administered questionnaires to them. Due to their classes, they promised to return the questionnaires after one hour. They handed over those questionnaires in time. On the third day, researcher was able to

get the questionnaires filled in by 31 male students (15arts&16science). On the fourth day, 19 male students (5arts&14science) filled in questionnaires. In all 100 questionnaires were completed from Govt. College for Boys Khanewal.

4. On the first day of next week, the researcher visited the Govt. College for Woman Khanewal and met the29 female students (13 science & 16 arts) and administered questionnaires to them. They returned the questionnaires after some time. The investigator took fourmore days in getting the questionnaires filled in from the remaining 71female students (37 science&34arts).Entire procedure of data collection took two weeks by the help of Rana SanaUllah, Lecturer Govt. College for Boys Khanewal.In all 100 questionnaires were completed from Govt. College for WomenKhanewal.

5. After collecting data from the Multan and Khanewal districts of South Punjab region, the researcher visited North Punjab and started data collection from Govt.College for WomenChakwalon 7th of February2012. The researcher started data collection from female students by visiting their departments. The investigator had to face many obstacles due to social barriers in our society.The researcher got permission from college principal to collect data from female students because of social barriers in our society and in this entireprocedure, Dr. AbidKiani, Principal Govt. Boys High School No. 1 Chakwaland Assistant Malik MahboobHussainof Women College helped him very much. All the hundred questionnaires (50 science and 50 arts) were administered and got back in one week.

6. During the next week, data collection was started frommale students of Govt. Post Graduate College for Boys Chakwal in their departments. He

administered questionnaires to 100male students (50 arts and 50 science) in this week and got these questionnaires back fully completed.

7. On 20th of February,Govt. College for Boys,Satellite Town Rawalpindi wasvisited for data collection from students studying in graduation classes of science and arts. On the first day, the investigator got filled in questionnaires from 36 male students (12 science and 24 arts). On the next day, 27 male students (16 science and 11 arts)in questionnaires. It took total two weeks in getting responses from remaining 37 male students (22science and 15arts). In all 100 questionnaires were completed from Govt. College for Boys, Satellite Town Rawalpindi.

8. After completion of data collection from boys'college, the researcher visited Govt. Post Graduate College for Women 6thRoadSatellite Town Rawalpindi and started the data collection from female students on 5th March. The researcher got the permission from principal for administering the questionnaires. The whole process of data collection took 5 days from 100 female students (50 science and 50 arts).

9. On 14th of March, the investigator travelled to Central Punjab Region for collection of data. At first, he visited Gujranwala District and went to Govt. College for Boys Gujranwala and started the data collection from 100 graduate male students (50 science and 50 arts). On 20th of March he collected all the 100 administered questionnaires back from students.

10. On the 3rd day of next week, 21st of March,the investigator visited Govt. College for Women Gujranwala to collect therequired data. He met with the 39 female students (17 science and 22 arts) and delivered the questionnaires to them.

All 39 students returned the questionnaires to the researcher on the same day. The other remaining 61female students (33 science and 28arts) were contacted in next few days.It took almost more 5 days in collecting the data from the remaining respondents of this college. The data collection in Gujranwala district was completed on 29th of March 2012.In this whole process, Dr. Syed Ahmad Raza Shah and Dr. SamranaAtikahelped him too much.In all 100 questionnaires were completed from Govt. College for Women Gujranwala.

11. After collecting the data from the Gujranwala district, the investigator visited Lahore district on 3rd of April 2012 and started data collection from the male students of BS programme of Govt. Science College WahdatRoad, Lahore. On the first day, the researcher delivered the questionnaires to 33 male students (12 arts and 21 science). The next day, 25 male students (15 arts and 10 science) filled in questionnaires and remaining questionnaires were filled in by the 42 respondents (23 arts and 29 science) within almost three days.AsadNiazi, Assistant Professor Govt. Science College WahdatRoad, Lahore helped researcher in data collection.

12. On 9th of April 2012 the last college, GovtCollege for WomenCooper Road Lahore was visited by the researcher. Almost within a week, the investigatorcompleted data collection from all 100 female students (50 science and 50 arts).Muhammad Saqlain, Ph.D. Urdu (Scholar) from GC University Lahore helpedinvestigator too much in data collection.

Data were collected during four months, and the rate of response was hundred percent.

3.7 ANALYSIS OF DATA

Research instrumentwasscored through the responses obtained before the analysis and explanation.The under given process of measuring as deployed by Barsch (1996) was taken:

Often	5
Sometimes	3
Seldom	1

1. Summation of points on each item of learning preference was done which having the score at highest range was taken as the most dominant learning preference of individuals. The range of scores on each learning preference was from 8 to 40. Because of comparatively less number of items, the researcher selected to use Barsch Inventory.

2. On the basis quartile score obtained by the students in Intermediate (F.A/F.Sc) annual examination, the students were categorized as low achievers and high achievers. On the basis of first quartile point of 59.36 (Q1), students possessing below 59.36 achievement scores were ranked as low achievers and on the students having 70.27 basis of fourth quartile point of 70.27 (Q4) and above were identified as high achievers.

3. Under each learning preference, firstly, the summation of students' scores with respect to male and female, science and arts, low achieving and high achieving was done using Mean and SD. Secondly, their comparison was done by using z-test (two-tailed).

4. The categories of scores in three categories of low, medium and high were subjectively determined in the light of frequency distribution of scores of each learning preference. Therefore different categorization criteria was adopted in each learning preference asstudents possessingscores 12 to 21 out of 40 were considered as low, having scores in between 22 to 31 out of 40 were considered as medium and possessing scores 32 to 40out of 40 were considered as high in visual learning preference. Students possessing scores 12 to 20 out of 40 were considered as low, having scores in between 21 to 29 out of 40 were considered as medium and possessing scores 30 to 38out of 40 were considered as high in auditory learning preference. Students possessing scores 12 to 20 out of 40 were considered as low, having in between 21 to 29 out of 40 were considered as medium and possessing scores 30 to 38out of 40 were considered as high in kinesthetic learning preference.

5. In order to determine association in learning preferences of male and female, science and arts students, Chi-square contingency test was used.

6. To calculate relationship between learning preference of students and achievement scores, Pearson ‘r’ was used.

7. In order to test hypothesis, 0.05 as significance level was preset.

Chapter 4

RESULTS AND DISCUSSION

Analysis and interpretation of the collected data has been described in this section. Preferences of male and female students, studying in the subjects of science and arts at graduation level in public colleges, on visual, auditory and kinesthetic learning preferences, are tabulated, analyzed and interpreted in this chapter.

4.1 RESULTS

Table 3 presents that mean visual learning preference score on eight items of the questionnaire is range from 3.20 to 4.02 out of maximum score of 5. Table depicts that highest preference of visual learners is "I follow written directions better than oral directions". Second highest preference of visual learners is "I obtain information on an interesting subject by reading relevant materials" and the least preference being learning from "I can better understand a news article by reading about it in the paper than by listening to the radio".

As Table 4 depicts, mean auditory learning preference score on eight related items ranged from 2.72 to 3.66 out of maximum 5. Table depicts that highest preference of auditory learners is "I can remember more about a subject through listening than reading". Second highest preference of auditory learners is "I follow oral directions better than written ones" and the least preference being learning from "I learn to spell better by repeating the letters out loud than by writing the word on paper". The range bracket is less than visual learning preference.

Table 3. Arithmetic Means (M) and ranks for the items of visual learning preference of students at college level.

Statements Related to Visual Learning Preference	Mean	Rank
I follow written directions better than oral directions.	4.02	1
I like to write things down or take notes for visual review.	3.79	2
I obtain information on an interesting subject by reading relevant materials.	3.56	3
I am good at working and solving jigsaw puzzles and mazes.	3.49	4
I am skilful and enjoy developing and making graphs and charts.	3.45	5
I can understand and follow directions using maps.	3.42	6
I feel the best way to remember is to picture it in my head.	3.24	7
I can better understand a news article by reading about it in the paper than by listening to the radio.	3.20	8

Table 4. Arithmetic Means (M) and ranks for the items of auditory learning preference of students at college level.

Statements Related to Auditory Learning Preference	Mean	Rank
I can remember more about a subject through listening than reading.	3.66	1
I require explanations of diagrams, graphs, or visual directions.	3.45	2
I can tell if sounds match when presented with pairs of sounds.	3.23	3
I do better at academic subjects by listening to lectures and tapes.	3.14	4
I follow oral directions better than written ones.	3.06	5
I prefer listening to the news on the radio rather than reading about it in a newspaper.	3.02	6
I would rather listen to a good lecture or speech than read about the same material in a textbook.	2.83	7
I learn to spell better by repeating the letters out loud than by writing the word on paper.	2.72	8

Table 5. Arithmetic Means (M) and ranks for the items of kinesthetic learning preference of students at college level.

Statements Related to Kinesthetic Learning Preference	**Mean**	**Rank**
I bear down extremely hard with pen or pencil when writing.	3.39	1
I enjoy working with tools.	3.23	2
I remember best by writing things down several times.	3.05	3
I play with coins and keys in pockets.	2.86	4
I feel very comfortable touching others, hugging, handshaking, etc.	2.84	5
I grip objects in my hands during learning period.	2.76	6
I learn spelling by "finger spelling" the words.	2.66	7
I chew gum or snack during studies.	2.52	8

Table 6. Learning preferences of college students (N-1200)

Learning Preference	F	%
Visual	635	52.9
Auditory	211	17.6
Kinesthetic	102	8.5
Visual and Auditory	112	9.3
Visual and Kinesthetic	65	5.4
Auditory and Kinesthetic	32	2.7
Visual, Auditory and Kinesthetic	43	3.6
Total	**1200**	**100**

Table 5 reveals that mean kinesthetic learning preference score on eight related items ranged from 2.52 to 3.39 which is the lowest range meaning thereby the kinesthetic learning preference is the lowest preference, the visual preference being highest in the group and auditory learning preference being intermediary. Table depicts that highest preference of kinesthetic learners is "I bear down extremely hard with pen or pencil when writing". Second highest preference of kinesthetic learners is "I feel very comfortable touching others, hugging, handshaking, etc" and the least preference being learning from "I chew gum or snack during studies".

Table 6 indicates that 52.9% college students were visual learners, 17.6% students were auditory, 8.5% students were kinesthetic learners. But 9.3% college students preferred to learn with the combination of visual and auditory, 5.4% students preferred to learn with the combination of visual and kinesthetic, 2.7% students preferred to learn with the combination of auditory and kinesthetic and 3.6% college students preferred to learn with the combination of visual, auditory and kinesthetic learning preferences. Overall 79% college students preferred to learn with single learning preference, 17.4% students were bimodal and only 3.6% students were trimodel.

Table 7 depicts that statistically significant difference exists between mean visual learning preference scores of male and female students, the average female students having higher visual preference than average male students. Table reveals that statistically significant difference exists between mean auditory learning preference scores of male and female students, the average female students having higher auditory preference than average male students. This Table also depicts that

statistically significant difference exists between mean kinesthetic learning preference scores of male and female students, the average female students having higher kinesthetic preference than average male students.

Table 8 presents the association between gender and visual learning preference. Chi-square value (8.70) shows a significant association between gender and visual learning preference. Table indicates that more female students held visual learning preference than male students. It also presents the association between gender and auditory learning preference. Chi-square value (37.60) shows a highly significant association between gender and auditory learning preference. Table clearly indicates that more female students had auditory learning preference as compared to male students. Further, this Table presents the association between gender and kinesthetic learning preference. Chi-square value (276.9) shows a highly significant association between gender and kinesthetic learning preference. Above table clearly shows that more female students held kinesthetic learning preference than male students.

Table 9 reveals that statistically significant difference exists between mean visual learning preference scores of science and arts students, the average science students having higher visual preference than average arts students. This Table depicts that statistically significant difference do not exist between mean auditory learning preference scores of science and arts students, so science and arts students had similar auditory learning preference. As this Table also depicts that statistically significant difference exists between mean kinesthetic learning preference scores of science and arts students, the average science students having higher kinesthetic preference than average arts students.

Table 7. Significance of difference between mean learning preference scores of female and male students.

Category	N	M	S.D.	S.E. Mean	Z
1. Visual LP					
Female	600	28.82	4.67	0.19	3.676
Male	600	27.79	5.03	0.21	
2. Auditory LP					
Female	600	25.96	4.73	0.19	6.107**
Male	600	24.27	4.87	0.20	
3. Kinesthetic LP					
Female	600	25.98	4.31	0.18	22.285**
Male	600	20.66	3.95	0.16	

LP = Learning Preference z-value at 0.05 level = 1.96

Table 8. Significance of association between frequencies of learning preference of female and male students.

Gender	Low	Medium	High	Total	Chi-square	df	P
1. Visual LP							
Female	65	314	221	600	8.70	2	0.013*
Male	88	334	178	600			
Total	**153**	**648**	**399**	**1200**			
2. Auditory LP							
Female	93	361	146	600	37.60	2	0.000**
Male	153	372	75	600			
Total	**246**	**733**	**221**	**1200**			
3. Kinesthetic LP							
Female	92	398	110	600	276.9	2	0.000**
Male	329	257	14	600			
Total	**421**	**655**	**124**	**1200**			

LP = Learning Preference $\chi^2 = 5.99$

Table 9. Significance of difference between mean learning preference scores of science and arts students.

Category	N	M	S.D.	S.E. Mean	Z
1. Visual LP					
Science	600	28.65	7.98	0.20	2.43*
Arts	600	27.96	4.75	0.19	
2. Auditory LP					
Science	600	25.19	4.97	0.20	0.546
Arts	600	25.04	4.78	0.20	
3. Kinesthetic LP					
Science	600	24.44	4.96	0.20	8.10**
Arts	600	22.20	4.61	0.19	

LP = Learning Preference z-value at 0.05 level = 1.96

Table 10 presents the association between area of study of the students and visual learning style. Chi-square value (6.39) shows a significant association between area of study and visual learning preference. Table also shows that science students had more visual learning preference as compared to arts students. This Table presents the association between area of study and auditory learning preference. Chi-square value (5.37) shows non-significant association between area of study and auditory learning preference. It also shows the association between area of study and kinesthetic learning preference. Chi-square value (66.20) shows significant association between area of study of the students and kinesthetic learning preference. It means that more science students had kinesthetic learning preference as compared to arts students.

Table 11 depicts that statistically significant difference do not exist between mean visual learning preference scores of female science and female arts students, the average female arts students having higher visual preference than average female science students, whereas this difference is non-significant. It also reveals that statistically significant difference exists between mean auditory learning preference scores of female science and female arts students, the average female science students having higher auditory preference than average female arts students. Further, this Table shows that statistically significant difference exists between mean kinesthetic learning preference scores of female science and female arts students, the average female science students having higher kinesthetic preference than average female arts students.

Table 10. Significance of association between frequencies of learning preference of science and arts students.

Gender	Low	Medium	High	Total	Chi-square	df	P
1. Visual LP							
Science	67	317	216	600	6.39	2	0.057*
Arts	86	331	183	600			
Total	**153**	**648**	**399**	**1200**			
2. Auditory LP							
Science	120	354	126	600	5.37	2	0.06
Arts	126	379	95	600			
Total	**246**	**733**	**221**	**1200**			
3. Kinesthetic LP							
Science	161	341	98	600	66.20	2	0.000**
Arts	260	314	26	600			
Total	**421**	**655**	**124**	**1200**			

LP = Learning Preference $\chi^2 = 5.99$

Table 11. Significance of difference between mean learning preference scores of female science and female arts students.

Category	N	M	S.D.	S.E. Mean	Z
1. Visual LP					
Female Science	300	28.53	4.42	0.26	1.50
Female Arts	300	29.11	4.90	0.28	
2. Auditory LP					
Female Science	300	26.80	5.01	0.29	1.97*
Female Arts	300	25.12	4.42	0.26	
3. Kinesthetic LP					
Female Science	300	27.45	4.04	0.23	8.90**
Female Arts	300	24.51	4.06	0.23	

LP = Learning Preference z-value at 0.05 level = 1.96

Table 12. Significance of association between frequencies of learning preference of female science and female arts students.

Gender	Low	Medium	High	Total	Chi-square	df	P
1. Visual LP							
Female Science	35	165	100	300	3.55	2	0.202
Female Arts	30	149	121	300			
Total	**65**	**314**	**221**	**600**			
2. Auditory LP							
Female Science	46	161	93	300	15.18	2	0.001**
Female Arts	47	200	53	300			
Total	**93**	**361**	**146**	**600**			
3. Kinesthetic LP							
Female Science	31	171	98	300	56.18	2	0.000**
Female Arts	61	213	26	300			
Total	**92**	**384**	**124**	**600**			

LP = Learning Preference χ^2 = 5.99

Table 13. Significance of difference between mean learning preference scores of male science and male arts students.

Category	N	M	S.D.	S.E. Mean	Z
1. Visual LP					
Male Science	300	27.39	5.00	0.29	1.93
Male Arts	300	28.19	5.04	0.29	
2. Auditory LP					
Male Science	300	24.08	4.68	0.27	0.939
Male Arts	300	24.45	5.05	0.29	
3. Kinesthetic LP					
Male Science	300	21.43	3.83	0.22	4.83**
Male Arts	300	19.89	3.93	0.23	

LP = Learning Preference z-value at 0.05 level = 1.96

Table 14. Significance of association between frequencies of learning preference of male science and male arts students.

Gender	Low	Medium	High	Total	Chi-square	df	P
1. Visual LP							
Male Science	51	166	83	300	3.04	2	0.218
Male Arts	37	168	95	300			
Total	**88**	**334**	**178**	**600**			
2. Auditory LP							
Male Science	74	193	33	300	1.77	2	0.413
Male Arts	79	179	42	300			
Total	**153**	**372**	**75**	**600**			
3. Kinesthetic LP							
Male Science	130	170	-	300	32.03	2	0.000**
Male Arts	199	101	-	300			
Total	**329**	**271**	**-**	**600**			

LP = Learning Preference $\chi^2 = 5.99$

Table 15. Significance of difference between mean learning preference scores of low achievers and high achievers.

Category	N	M	S.D.	S.E. Mean	Z
1. Visual LP					
Low Achievers	301	27.88	5.08	0.29	2.08*
High Achievers	302	28.72	4.77	0.27	
2. Auditory LP					
Low Achievers	301	25.34	4.76	0.27	1.10
High Achievers	302	24.91	4.77	0.27	
3. Kinesthetic LP					
Low Achievers	301	23.49	5.08	0.27	1.70
High Achievers	302	22.81	4.64	0.27	

LP = Learning Preference z-value at 0.05 level = 1.96

Table 12 presents the association between female area study and visual learning preference. Chi-square value (3.55) shows a non-significant association between area of study and visual learning preference. Female arts and female science students had similar visual learning preference. This Table depicts the association between female area of study and auditory learning preference. Chi-square value (15.18) shows significant association between area of study and auditory learning preference. More female students of science group preferred auditory learning style as compared to arts female students. It also presents the association between female area of study and kinesthetic learning preference. Chi-square value (56.18) shows significant association. It means that more female science students had kinesthetic learning preference as compared to female arts students.

Table 13 reveals that statistically significant difference do not exist between mean visual learning preference scores of male science and male arts students. As Table 13 shows that statistically significant difference do not exist between mean auditory learning preference scores of male science and male arts students, so male science and male arts students had similar auditory learning preference. This Table also depicts that statistically significant difference exists between mean kinesthetic learning preference scores of male science and male arts students, the average male science students having higher kinesthetic preference than average male arts students.

Table 14 presents the association between male area of study and visual learning preference. Chi-square value (3.04) shows non-significant association between male students and visual learning preference. Male science students and

male arts students had similar visual learning preference. This Table shows the association between male area of study and auditory learning preference. Chi-square value (1.77) shows non-significant association between male students and auditory learning preference. Table shows that male science students and male arts students had similar auditory learning preference. It also reveals the association between male area of study and kinesthetic learning preference. Chi-square value (32.03) shows significant association between area of study and kinesthetic learning preference. Less number of male science students had low kinesthetic learning preference, whereas more male science students had medium level kinesthetic learning preference than male arts students.

Table 15 depicts that statistically significant difference exists between mean visual learning preference scores of low and high achiever students, the average high achiever students having higher visual preference than average low achiever students. This Table reveals that statistically significant difference do not exist between mean auditory learning preference scores of low and high achiever students. It also depicts that statistically significant difference do not exist between mean kinesthetic learning preference scores of low achieving and high achieving students.

Table 16 presents the association between academic achievement and visual learning preference. Chi-square value (9.72) shows a significant association between academic achievement and visual learning preference. High achievers had more preference of visual learning preference as compared to low achiever students. It also presents the association between academic achievement and auditory learning preference. Chi-square value (1.33) shows non-significant

association between academic achievement and auditory learning preference. This Table presents the association between academic achievement and kinesthetic learning preference. Chi-square value (1.33) shows non-significant association between academic achievement and kinesthetic learning preference.

Table 17 reveals that statistically significant difference do not exist between mean visual learning preference scores of low achieving and high achieving male students. This Table shows that statistically significant difference do not exist between mean auditory learning preference scores of low achieving and high achieving male students. It also depicts that statistically significant difference do not exist between mean kinesthetic learning preference scores of low achieving and high achieving male students.

Table 18 presents the association between academic achievement of male students and visual learning preference. Chi-square value (1.69) shows non-significant association between academic achievement of male students and visual learning preference. Low achieving and high achieving male students did not differ in visual learning preference. Table 18 also presents the association between academic achievement and auditory learning preference. Chi-square value (2.40) shows non-significant association between academic achievement and auditory learning preference, indicating that low achieving and high achieving male students did not differ in auditory learning preference. Further, this Table shows the association between academic achievement and kinesthetic learning preference. Chi-square value (0.236) shows non-significant association between academic achievement and kinesthetic learning preference. Low achieving and high achieving male students had similar kinesthetic learning preference.

Table 19 depicts that statistically significant difference do not exist between mean visual learning preference scores of low achieving and high achieving female students. This Table also shows that statistically significant difference do not exist between mean auditory learning preference scores of low and high achiever female students. Further, it reveals that statistically significant difference exists between mean kinesthetic learning preference scores of low achieving and high achieving female students, the average high achieving female students having higher kinesthetic preference than average low achieving female students.

Table 20 presents the association between academic achievement of female students and visual learning preference. Chi-square value (0.334) shows non-significant association between academic achievement of female students and visual learning preference. Low achieving and high achieving female students had similar visual learning preference. This Table also presents the association between academic achievement of female students and auditory learning preference. Chi-square value (0.514) shows non-significant association between academic achievement of female students and auditory learning preference. Low achieving and high achieving female students had similar auditory learning preference. It also shows the association between academic achievement of female students and kinesthetic learning preference. Chi-square value (9.45) shows significant association between academic achievement of female students and kinesthetic learning preference. More high achieving female students had preference of kinesthetic learning preference as compared to low achievers.

Table 16. Significance of association between low achievers and high achievers and learning preferences.

Gender	Low	Medium	High	Total	Chi-square	df	P
1. Visual LP							
Low achiever	65	161	75	301	9.72	2	0.011*
High achiever	13	153	136	302			
Total	**78**	**314**	**211**	**603**			
2. Auditory LP							
Low achiever	56	188	57	301	1.33	2	0.514
High achiever	62	193	47	302			
Total	**118**	**381**	**104**	**603**			
3. Kinesthetic LP							
Low achiever	101	162	38	301	1.33	2	0.514
High achiever	114	164	24	302			
Total	**215**	**326**	**62**	**603**			

LP = Learning Preference χ^2 = 5.99

Table 17. Significance of difference between the mean learning preference scores of male low achievers and male high achievers.

Category	N	M	S.D.	S.E. Mean	Z
1. Visual LP					
Male Low Achievers	171	27.35	5.19	0.40	1.01
Male High Achievers	157	27.91	4.92	0.39	
2. Auditory LP					
Male Low Achievers	171	24.49	4.90	0.37	0.632
Male High Achievers	157	24.15	4.78	0.38	
3. Kinesthetic LP					
Male Low Achievers	171	20.87	4.06	0.31	0.351
Male High Achievers	157	20.71	3.76	0.30	

LP = Learning Preference z-value at 0.05 level = 1.96

Table 18. Significance of association between male low achievers and male high achievers and learning preferences.

Gender	Low	Medium	High	Total	Chi-square	df	P
1. Visual LP							
Male Low Achievers	31	93	47	171	1.69	2	0.428
Male High Achievers	21	86	50	157			
Total	**52**	**179**	**97**	**328**			
2. Auditory LP							
Male Low Achievers	40	105	26	171	2.40	2	0.301
Male High Achievers	40	102	15	157			
Total	**80**	**207**	**41**	**328**			
3. Kinesthetic LP							
Male Low Achievers	88	83	-	171	0.236	1	0.354
Male High Achievers	85	72	-	157			
Total	**173**	**155**	**-**	**328**			

LP = Learning Preference $\chi^2 = 5.99$

Table 19. Significance of difference between the mean learning preference scores of female low achievers and female high achievers.

Category	N	M	S.D.	S.E. Mean	Z
1. Visual LP					
Female Low Achievers	130	28.58	4.87	0.43	1.78
Female High Achievers	145	29.59	4.46	0.37	
2. Auditory LP					
Female Low Achievers	130	26.46	4.35	0.38	1.32
Female High Achievers	145	25.74	4.64	0.39	
3. Kinesthetic LP					
Female Low Achievers	130	25.09	4.43	0.37	3.55**
Female High Achievers	145	26.94	4.15	0.37	

LP = Learning Preference z-value at 0.05 level = 1.96

Table 20. Significance of association between female low achievers and female high achievers and learning preferences.

Gender	Low	Medium	High	Total	Chi-square	df	P
1. Visual LP							
Female Low Achievers	14	68	48	130			
					2.19	2	0.334
Female High Achievers	12	67	66	145			
Total	**26**	**135**	**114**	**275**			
2. Auditory LP							
Female Low Achievers	16	83	31	130			
Female High Achievers	22	91	32	145	0.514	2	0.773
Total	**38**	**174**	**63**	**275**			
3. Kinesthetic LP							
Female Low Achievers	13	99	28	130	9.45	2	0.009**
Female High Achievers	29	72	44	145			
Total	**42**	**171**	**62**	**275**			

LP = Learning Preference $\chi^2 = 5.99$

Table 21. Significance of difference between the mean learning preference scores of science low achievers and science high achievers.

Category	N	M	S.D.	S.E. Mean	Z
1. Visual LP					
Science Low Achievers	173	27.25	4.97	0.38	1.79
Science High Achievers	142	28.25	4.93	0.41	
2. Auditory LP					
Science Low Achievers	173	25.21	5.03	0.38	1.36
Science High Achievers	142	24.45	4.85	0.41	
3. Kinesthetic LP					
Science Low Achievers	173	24.18	5.30	0.40	0.208
Science High Achievers	142	24.07	4.30	0.36	

LP = Learning Preference z-value at 0.05 level = 1.96

Table 21 depicts that statistically significant difference do not exist between mean visual learning preference scores of low and high achiever science students. This Table reveals that statistically significant difference do not exist between mean auditory learning preference scores of low achieving and high achieving science students. It also depicts that statistically significant difference do not between mean kinesthetic learning preference scores of low achieving and high achieving science students.

Table 22 presents the association between academic achievement of science students and visual learning preference. Chi-square value (2.80) shows non-significant association between academic achievement of science students and visual learning preference. Low achieving and high achieving science students had similar visual learning preference. This Table also reveals the association between academic achievement of science students and auditory learning preference. Chi-square value (2.28) shows non-significant association between academic achievement of science students and auditory learning preference. Low achieving and high achieving science students had similar auditory learning preference. Further, this Table shows the association between academic achievement of science students and kinesthetic learning preference. Chi-square value (5.03) shows non-significant association between academic achievement of science students and kinesthetic learning preference. Low achieving and high achieving science students had similar kinesthetic learning preference.

Table 23 indicates that statistically significant difference do not exist between mean visual learning preference scores of low achieving and high achieving arts students. It also depicts that statistically significant difference do not

exist between mean auditory learning preference scores of low achieving and high achieving arts students. Further, this Table shows that statistically significant difference do not exist between mean kinesthetic learning preference scores of low achieving and high achieving arts students.

Table 24 presents the association between academic achievement of arts students and visual learning preference. Chi-square value (5.13) shows non-significant association between academic achievement of arts students and visual learning preference. Low achieving and high achieving arts students had similar visual learning preference. This Table shows the association between academic achievement of arts students and auditory learning preference. Chi-square value (0.11) shows non-significant association between academic achievement of arts students and auditory learning preference. Low achieving and high achieving arts students had similar auditory learning preference. It also depicts the association between academic achievement of arts students and kinesthetic learning preference. Chi-square value (3.70) shows non-significant association between academic achievement of arts students and kinesthetic learning preference. Low achieving and high achieving arts students had similar kinesthetic learning preference.

Table 25 presents the correlation between different variables. Table shows that visual and kinesthetic learning preference scores had non-significant correlation with academic achievement of college students while auditory learning preference scores had significant correlation with academic achievement of college students.

Table 22. Significance of association between science low achievers and science high achievers and learning preferences.

Gender	Low	Medium	High	Total	Chi-square	df	P
1. Visual LP							
Science Low Achievers	30	96	47	173			
Science High Achievers	21	70	51	142	2.80	2	0.247
Total	**51**	**166**	**98**	**315**			
2. Auditory LP							
Science Low Achievers	35	102	36	173			
Science High Achievers	35	86	21	142	2.28	2	0.320
Total	**70**	**188**	**57**	**315**			
3. Kinesthetic LP							
Science Low Achievers	53	89	31	173			
Science High Achievers	36	90	16	142	5.03	2	0.081
Total	**89**	**179**	**47**	**315**			

LP = Learning Preference $\chi^2 = 5.99$

Table 23. Significance of difference between the mean learning preference scores of arts low achievers and arts high achievers.

Category	N	M	S.D.	S.E. Mean	Z
1. Visual LP					
Arts Low Achievers	128	28.73	5.14	0.45	0.680
Arts High Achievers	160	29.13	4.60	0.36	
2. Auditory LP					
Arts Low Achievers	128	25.52	4.40	0.39	0.353
Arts High Achievers	160	25.33	4.68	0.37	
3. Kinesthetic LP					
Arts Low Achievers	128	22.55	4.63	0.41	1.53
Arts High Achievers	160	21.70	4.65	0.37	

LP = Learning Preference z-value at 0.05 level = 1.96

Table 24. Significance of association between arts low achievers and arts high achievers and learning preferences.

Gender	Low	Medium	High	Total	Chi-square	df	P
1. Visual LP							
Arts Low Achievers	15	65	48	128	5.13	2	0.081
Arts High Achievers	12	83	65	160			
Total	**27**	**148**	**113**	**288**			
2. Auditory LP							
Arts Low Achievers	21	86	21	128	0.11	2	0.994
Arts High Achievers	27	107	26	160			
Total	**48**	**193**	**47**	**288**			
3. Kinesthetic LP							
Arts Low Achievers	48	73	7	128	3.70	2	0.157
Arts High Achievers	78	74	8	160			
Total	**126**	**147**	**15**	**288**			

LP = Learning Preference $\chi^2 = 5.99$

Table 25. Significance of relationship between learning preference scores and academic achievement scores of college students.

Groups	N	r	P
Visual Learning Preference Scores of All Students	1200	0.042	0.14
Auditory Learning Preference Scores of All Students	1200	0.066	0.02*
Kinesthetic Learning Preference Scores of All Students	1200	0.008	0.77

Summary Table

Categories	N		Z	chi-square
Gender and Visual Learning Preference	600	600	3.676**	8.70*
Gender and Auditory Learning Preference	600	600	6.107**	37.60**
Gender and Kinesthetic Learning Preference	600	600	22.285**	276.9**
Area of Study and Visual Learning Preference	600	600	2.43*	6.39*
Female Area of Study and Visual Learning Preference	300	300	1.50	3.55
Male Area of Study and Visual Learning Preference	300	300	1.93	3.04
Area of Study and Auditory Learning Preference	600	600	0.546	5.37
Female Area of Study and Auditory Learning Preference	300	300	1.97*	15.18**
Male Area of Study and Auditory Learning Preference	300	300	0.939	1.77
Area of Study and Kinesthetic Learning Preference	600	600	8.10**	66.20**
Female Area of Study and Kinesthetic Learning Preference	300	300	8.90**	56.18**
Male Area of Study and Kinesthetic Learning Preference	300	300	4.83**	32.03**
Low Achievers and High Achievers in Visual Learning Preference	301	302	2.08*	9.72*
Male Low Achievers and Male High Achievers in Visual Learning Preference	171	157	1.01	1.69
Female Low Achievers and Female High Achievers in Visual Learning Preference	130	145	1.78	2.19
Science Low Achievers and Science High Achievers in Visual Learning Preference	173	142	1.79	2.80
Arts Low Achievers and Arts High Achievers in Visual Learning Preference	128	160	0.680	5.13

Continued…..

Categories	N		Z	chi-square
Low Achievers and High Achievers in Auditory Learning Preference	301	302	1.10	1.33
Male Low Achievers and Male High Achievers in Auditory Learning Preference	171	157	0.632	2.40
Female Low Achievers and Female High Achievers in Auditory Learning Preference	130	145	1.32	.514
Science Low Achievers and Science High Achievers in Auditory Learning Preference	173	142	1.36	2.28
Arts Low Achievers and Arts High Achievers in Auditory Learning Preference	128	160	0.353	0.11
Low Achievers and High Achievers in Kinesthetic Learning Preference	301	302	1.70	1.33
Male Low Achievers and Male High Achievers in Kinesthetic Learning Preference	171	157	0.351	0.236
Female Low Achievers and Female High Achievers in Kinesthetic Learning Preference	130	145	3.55**	9.45**
Science Low Achievers and Science High Achievers in Kinesthetic Learning Preference	173	142	0.208	5.03
Arts Low Achievers and Arts High Achievers in Kinesthetic Learning Preference	128	160	1.53	3.70

4.2 DISCUSSION

This study shows that 52.9 percent students of colleges had visual preference, 17.6 percent of college students possessed auditory preference and 9.3 percent students were in favour of visual and auditory preference, 8.5 percent were kinesthetic learners, 5.4 percent were visual and kinesthetic learners, 2.7 percent were auditory and kinesthetic learners and 3.6 percent were visual, auditory and kinesthetic learners. In the study ofDunn and Dunn (1979), it was examined that just 20 to 30 percent school students held auditory and 40 percent of school students were visual, and 30 to 40 percent possessed kinesthetic, and also tactile and visual or other amalgamation of preference in learning. Inclination to two learning preferences in process of learning was 36.1 percent and fondness of three learning preferences was 63.9 percent among total 155 students found by Baykan and Nacar (2007).It was found that 23.3 percent had inclination to kinesthetic, 7.7 percent preferred auditory, 3.2 percent held visual, and 1.9 percent had read-write preference. While 30.3 percent students had bimodal, 20.7 percent had tri-modal and 12.9 percent had quadmodal preference. Lujan and DiCarlo (2006) stated that 36.1 percent had single approach to learn.Among these, 5.4 percent possessed visual learning, 4.8 percent favored auditory, 7.8 percent gave importance to words that were printed, and 18.1 percent were in favour of kinesthetic preference. Contrarily, 63.8 percent possessed multi styles: among these 24.5 percent held 2 styles, 32.1 percent had 3 styles, 43.4 percent held 4 styles.

The present study revealed that female college students more inclined towards visual, auditory and kinesthetic learninreferences as compared to male students of college.Ewing and Yong (1993) also found significant differences

among ethnic (although responsibility and motivation was present in all three ethnic groups), gender, and grades. There was clear difference in gender with respect to kinesthetic and intake modality as viewed by Ewing and Yong (1992). Intake modality and study orientationin the afternoon was found in African-American subjects whereas kinesthetic preference was found in Mexican-Americans. A very high level of visual preference was seen in Chinese-Americans. Many differences regarding gender were examined by Restak (1979). He examined that females have more sensitivity towards sounds and, at physical tasks, their performance was better than males whereas males were superior in visual orientation. Males were, on tasks like arranging a row of beads performed low but they showed excellence in full body coordination tasks.Dunn *et al.* (1993) found that both Mexican and Anglo female students had more determination and persistence than males; the strongest inclination towards kinesthetic preference of learning was found inmale Mexican-American students as compared to both groups of females, and females were found to be better in auditory learning than males. Dunn and Griggs (1998) found that the perceptual strengths of males are often visual, tactile, and kinesthetic, seemed easy in informal setting, in peers and in aloof situations. Whereas with more auditory inclination, silence in study situation, and work better in formal setting, they are more compliant, authority-oriented, as well as parent- and self- motivated than males.Resemblances as well as discriminations were examined to be nationality based and gender based, influence of social and environmental disparities were shown in Korean and the United States students in study conducted by Hong *et al*. (1995).According to a study by Dunn*et al*. (1993),Anglo Americans, Mexican-American had preference towards traditional planning of seating and there was much peer orientation. Gender based

differences were found in this study.According to Baykan and Nacar (2007), there was no learning preference difference in male and female students. Preference toward varied types of information and combinations in learning preferences were found with no difference in male and females in the study conducted by Slater *et al.*(2007). However more diversity in learning preferences was found in female students in comparison with males.

There was no correlation between performance in objective test and learning preference in research investigated by Kratzig and Arbuthnott (2006). Murphy *et al.*(2004) found that the two populations had much difference in visual or kinesthetic but there was no difference in aural or read/write preferences. There was variation in inter-class but with no difference in gender. Arslan (2003) held that there was dominant active learning and much sensing as compared to element of intuition, with no difference in gender based, department based, academic achievement based and learning preference based were found in students studying engineering. Akgün (2002) concluded that there was no discrimination with respect to learning preference, age and gender.No gender differences in the learning preferences found in secondary school students of Anglo, Filipino, Koreon, Chinese, and Vietnamese in study by Park (1997).

The present study indicated that science college students were more visual and kinesthetic learners in their learning preferences than arts college students whereas arts college students preferred more to learn with auditory learning preferences than science college students. There was variation in learning preferences in college students and who preferred analytical style in an Akgün

study conducted in 2002. Slaats*et al.* (1999) also found the vivid difference in learning preferences in various disciplines related to vocational perspectives.

This study revealed that high achieving college students also preferred more to learn with visual learning preference than low achieving college students. Low achieving college students were more auditory and more kinesthetic learners in their learning preferences whereas high achieving college students preferred less to learn with auditory and kinesthetic learning preferences.Dunn and Griggs (1998) also found that there are discriminations in learning preferences of high and low achievers. Similarly, if one method of teaching or learning is helpful to one group, it may not be helpful to other group.Park (1997) examined that more visual preference was present in high achievers than in low achievers. Students having middle and low achievement level possessed low inclination towards learning in groups while high achievers possessed negative inclination to group learning. Murphy*et al.* (2004) found that majority of students in dentist courses had more liking for the visual stimuli in comparison with kinesthetic preference in VARK website.

The present study found thatvisual and kinesthetic learning preference scores had non-significant correlation with academic achievement of college students while auditory learning preference scores and total learning preference scores had significant correlation with academic achievement of college students.Baykan and Nacar (2007) found that there was no obvious dissimilarity between grades and learning preferences of first semester students. There was no vivid discrimination in engineering students with respect to department in a study by Arslan (2003). In Jamie Cano's study (1999),it was found low academic

achievement in field-dependent college students as compared to field-independent college students and disciplinary action was taken against field-dependent college students due to their low performance. Conversely, Torres (1992) and Torres and Cano (1994) stated that there was much association in learning preferences and academic achievement in terms GPA in courses. Same result was found in students of different agriculture courses in a study by Garton*et al*. (1999), and similar findings were given by Cano and Porter (1997) and Cano (1999) in entire higher education.

Possible limitations in study are that the selection of only academic achievement in percentage obtained by students in annual examination. Supposing we could include academic performance as a whole for the measurement of students' performance, results could have been more authentic and may be relationship could have been found among other learning preferences (visual and kinesthetic) and academic achievement. The present research focused on college students. Study population comprised all students studying at graduation level in government colleges of Punjab province. Punjab is comprised of three strata north, south and central Punjab. Firstly, two districts were randomly selected from each strata of Punjab. Thus six districts were selected, from which total 12 colleges were selected in such a way that two colleges (one male and one female) from each district were taken as sample.Total 1200 students studying in Bachelor of Arts and Bachelor of Science from the selected 12 colleges of Punjab province were selected randomly in such a way that proportion of science and arts students was fifty fifty (total 100 students from each college among which 50 were arts and 50 were science students). It would have been better if we could select all public and private

sector colleges, like commerce institutes, management and computer science colleges of the Punjab province at graduation level of all three regions i.eNorth Punjab, South Punjab and Central Punjab for obtaining more authentic results. One of the main limitations of the study is that only quantitative method was used. The study, being quantitative in nature as narrowed down the results of the study. Had the quantitative analysis been supported by qualitative approach through conducting in depth interviews with selected students, the results could have been broader in nature and more authentic.

SUMMARY

Focus of this study was on visual, auditory and kinesthetic learning preferences of college students as given in Dunn and Dunn model and to examine their relationship with gender, area of study and academic achievement of students by adopting descriptive approach to research. The mainobjectives of the study were: to measure college students' learning preferences,to examine the difference between gender and learning preferences of students, to find out the difference between area of study and learning preferences of students, to explore the difference between high achievers and low achievers in their preferences for learning and to explore relationship between students' learning preferences and their academic achievement.

As the study was conducted in public sector colleges of Punjab province,all (male and female, science and arts) students who had passed Intermediate examination (F.A/F.Sc) who were currently enrolled/studying in B.A/B.Sc and BS programmes of all public sector colleges of Punjab province constituted the population of the study. The Punjab province of Pakistan was divided into three regions, North Punjab, Central Punjab and South Punjab. Six districts of Punjab province with two districts from each region were selected for this study.Three-stagecluster sampling was used and selected 1200 students as the sample of the study. Initially, at the first stage, two districts from each region were randomly selected. At second stage, one male and one female college from each district were selected. At third stage, from each selected college, fifty arts and fifty science students were randomly selected (from twelve colleges of the six districts of Punjab province).

In order to identify students' learning preferences, 24-item Barsch Learning Preferences Inventory (BLPI) (visual, auditory and kinesthetic) developed by Barsch (1996), was used as a research instrument. The researcher personally visited each college and collected data from the sample. The data about learning preference, thus obtained, was scored by allotting five marks to 'often' response, three marks to 'sometimes' response and one mark to 'seldom' response. The responses relating to visual, auditory and kinesthetic learning preferences items were summed up and visual preference score, auditory preference score and kinesthetic preference score of each student calculated. The students were identified as visual, auditory and kinesthetic on the basis of the highest score obtained by them. The students were identified as high achievers and low achieverswho were placed in the first quartile and third quartile of their distribution of academic achievement scores obtained by them in Intermediate (F.A/F.Sc) annual examination. On the basis of quartile method, students possessing 59.36% were ranked as low achievers and students having 70.27% marks and above were identified as high achievers.Under each learning preference, firstly, the summation of students' scores with respect to male and female, science and arts, low achieving and high achieving was done using Mean and SD. Secondly, their comparison was done by using z-test (two-tailed)at 0.05 level of significance. Furthermore, to calculate relationship between learning preference of students and achievement scores, Pearson 'r' was used.In order to determine association in learning preferences of male and female, science and arts students, Chi-square contingency test was used.

CONCLUSIONS

The conclusions of the study are as follows:

1. A number of52.9% college students preferred to learn with visual stimuli. The second learning preference of 17.6% college students was auditory, third learning preference of 9.3% college students was a combination of visual and auditory while fourth preference of only 8.5% college students was kinesthetic learning. 11.7% college students preferred to learn with the combination of visual-kinesthetic, auditory-kinesthetic or visual-auditory-kinesthetic styles.
2. Female students were inclined to be more visual, auditory and kinesthetic in their learning preferences than male students.Science students were found to be more visual and kinesthetic in their learning preferences than arts students.
3. Female science students turned out to be more auditory and kinesthetic in their learning preferences than female arts students.Male science students were found to be more kinesthetic in their learning preferences than male arts students but no difference was found among male science and male arts students in visual and auditory learning preferences.Science students, both male and female, were generally found to be more kinesthetic in learning.
4. High achieving college students were found to be more visual in their learning preferences but no difference was found among high achievers and low achievers in auditory and kinesthetic learning preferences.High achievers and low achievers did not differ among their learning preferences irrespective of gender except that female high achievers were more

kinesthetic in their learning preference than female low achievers.High achievers and low achievers among college students were similar in their learning preferences, irrespective of whether they are science students or arts students.

5. Auditory learning preference was found to be associated with academic achievement (r = 0.066) while visual and kinesthetic learning preferencesnot relate with academic achievement.

On the whole, the college students were found to be predominantly visual in their learning preference. Female, science, and high achieving students were also found to be more visual and kinesthetic. Female science, male science and female high achieving students were found to be more kinesthetic in their learning mode.Significant, positive, though low, relationship was found between auditory learning preference and academic achievement.

RECOMMENDATIONS

Following recommendations are derived from conclusions of the study:

1. As the sequence of preference among college students about their learning was visual, auditory and kinesthetic, teachers are expected to use sensory inputs while teaching according to these learning preferences. As majority of students preferred to learn through visuals, visual aids and allied teaching material be used more frequently during teaching.
2. As kinesthetic learning was found to be more preferred by female college students than other methods, teachers in female colleges ought to emphasize learning by doing in their teaching. Female students be provided opportunities to learn content through activities. It is also desired that female students are encouraged to learn with kinesthetic learning style so that female students shift to this useful mode of learning gradually. Female students who had inclination towards kinesthetic aspect may be given computer assisted instruction in order to obtain better results as they prefer tactile orientation.
3. Learning preferences differ and students may learn well if teachers employ varied instructional methods appropriate to students' learning preferences, e.g. cooperative learning, role-playing, simulated situations, statements on audio-tapes or computers. Therefore, teacher training be provided to college teachers about a variety of teaching styles and students' learning preferences so that they are versatile enough to use the teaching styles flexibly that coincide with their students learning preferences.

4. The present study was conducted on college students studying at graduation level (B.A./B.Sc./BS) in public sector colleges of the Punjab province. Further studies may be launched at graduation level like commerce institutes, management and computer science colleges in public or private sector at provincial or national level for confirmation or disconfirmation of results of this study. The present study was intended to identify college students' preference about visual, auditory and kinesthetic learning and to detect association of these learning preferences with gender, area of study and academic achievement. Further studies may be conducted to identify other cognitive styles like field-independence vs field-dependence, analytic vs thematic, divergent thinking vs convergent thinking, impulsiveness vs reflectiveness etc and find out such correlates as areas of specialization, students' study habits, ethnic background and socio-economic status.
5. In order to identify learning preferences, the questionnaire by Barsch (1996) was used as research instrument in this study. As the questionnaires have many flaws as a measurement instrument, performance on standardized tests may be used to find out the learning preferences and correlates of these preferences.As this study was descriptive survey in nature, further studies may be conducted by using experimental designs to explore effect of teaching methods emphasizing a specific learning preference on academic achievement of students with different learning preferences.
6. In future studies in which there should be much focus to examine a clear match between teaching styles and learning preferences. If proper consideration is given to students' learning preferences, keeping in view their like and dislikes, their convenient method of learning, which may be

helpful for teachers to teach in such a way adopting the most appropriate method of instruction to enhance effectiveness of teaching learning process.The present study used BILP (1996) mainly it was widely used in by such previous studies but no research could be found that verified the claim of its author that it really measures the three learning preferences. Therefore, its construct validity needs to be established in order to find out whether it measures the underlying factors it claims to measure. As the study was quantitative in nature, there should be support of qualitative method along with quantitative method in further studies in order to view the results more authentic.

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APPENDIX I

LIST OF PUBLIC SECTOR COLLEGES OF PUNJAB PROVINCE SELECTED FOR STUDY

1) North Punjab Region:

1. Chakwal District

v) Govt. Post Graduate College Chakwal

vi) Govt. College for Women Chakwal

2. Rawalpindi District

vii) Govt. College Satellite Town Rawalpindi

viii) Govt. Post Graduate College for Women 6th Road Satellite Town Rawalpindi

2) Central Punjab Region:

3. Gujranwala District

ix) Govt. Postgraduate College Gujranwala

x) Govt. College for Women Gujranwala City

4. Lahore District

xi) Govt. College of ScienceWahdatRoad, Lahore

xii) Govt. Post Graduate IslamiaCollege for Women Cooper Road Lahore

3) South Punjab Region:

5. Multan District

i) Govt. College Multan

ii) Govt. College for Women Multan

6. Khanewal District

iii) Govt. Post Graduate College Khanewal

iv) Govt. College for Woman Khanewal

Gmail by Google BETA

sher afgan <drafgan@gmail.com>

RE: Request for Permission

1 message

Nancy Martin <nancymartin@academictherapy.com> **Thu, May 13, 2010 at 10:15 PM**

To: drafgan@gmail.com

Dear Ms./Mr. Niazi,

Yes, you may use the Barsch Learning Preferences Inventory as part of your doctoral research

and we would be pleased if you would share your research findings with us.

We look forward to seeing your results!

Sincerely,

Nancy A. Martin, Ph.D.

Director, Test Development

Academic Therapy Publications

20 Commercial Blvd.

Novato, CA 94949

800-422-7249 (ext. 23)

530-613-6810 (cell)

From: sales
Sent: Wednesday, May 12, 2010 10:27 AM
To: Nancy Martin
Subject: FW: Request for Permission

From: sher afgan [mailto:drafgan@gmail.com]
Sent: Wed 05/12/2010 1:29 AM
To: sales
Subject: Request for Permission

University Institute Of Education and Research
Pir Mehr Ali Shah Arid Agriculture University Rawalpindi, Pakistan.

Dear Nancy Martin,
This email is to ask permission to use the Barsch Learning Preferences Inventory as part of my Doctoral Research. I am a PhD candidate in Education in University Institute of Education and Research, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan. My study is students' learning preferences in the light of Dunn and Dunn model. I would like to use Barsch Inventory because of its ease of use relatively short length and that fact it is widely used through out the higher education community.
I would really appreciate the permission to be able to use the Barsch LPI. The information that it can provide for my study is invaluable. I would also be very excited to share my findings with you as the publisher.
I look forward to hearing from you soon.

Sher Afgan Khan Niazi
Pakistan.

APPENDIX III

A STUDY OF STUDENTS' LEARNING PREFERENCES IN THE LIGHT OF DUNN AND DUNN MODEL

Questionnaire For Students
(For Research Purpose Only)

Name: _____ Class: B.Sc,/BS/B.A

College: _____ Group: Science/Arts

Gender: Male ☐ /Female ☐

Percentage of Marks Obtained in F.A/F.Sc Annual Exam: _____

The series of statements is designed to determine your relative learning preferences (visual, auditory and kinesthetic). Visual learning preference means learning through reading or writing, auditory learning preference means learning through listening or lecture method and kinesthetic learning preference means learning through practical work or doing. No preference of learning is better than another. However, each preference makes its own demands on the environment of the learner. Therefore please feel free to indicate your learning preferences openly and honestly. Place a check (✓) in the appropriate column after each statement.

S. No.	Statements	Often (اکثر)	Sometimes (بعض اوقات)	Seldom (کبھی کبھار)
1	I can remember more about a subject through listening than reading. میں کسی مضمون کے متعلق پڑھنے کی بجائے سننے سے زیادہ یاد رکھ سکتا /سکتی ہوں۔			
2	I follow written directions better than oral directions. میں زبانی ہدایات کی بجائے تحریری ہدایات بہتر انداز میں سمجھتا/سمجھتی ہوں۔			
3	I like to write things down or take notes for visual review. میں باتوں کو لکھ کر رکھنا پسند کرتا /کرتی ہوں یا ان پر نظر دوڑانے کے لیے ان کے نوٹس رکھتا/رکھتی ہوں ۔			
4	I bear down extremely hard with pen or pencil when writing. لکھنے کے دوران میں اپنا مؤقف بہتر انداز میں بیان کرتا/کرتی ہوں۔			
5	I require explanations of diagrams, graphs or visual directions. مجھے اشکال، گراف اور بصری ہدایات سمجھنے کے لیے وضاحت درکار ہوتی ہے۔			

S. No.	Statements	Often (اکثر)	Sometimes (بعض اوقات)	Seldom (کبھی کبھار)
6	I enjoy working with tools. مجھے آلات اور اشیاء کے ساتھ کام کرنے میں مزا آتا ہے۔			
7	I am skilful and enjoy developing and making graphs and charts. میں گراف اور چارٹس کی تیاری میں مہارت بھی رکھتا /رکھتی ہوں اور ان سے محظوظ بھی ہوتا/ہوتی ہوں ۔			
8	I can tell if sounds match when presented with pairs of sounds. جب مجھے دو دو آوازیں ایک ساتھ سنائی جائیں تو میں بتا سکتا /سکتی ہوں کہ کون کون سی آوازیں آپس میں ملتی جلتی ہیں۔			
9	I remember best by writing things down several times. میں چیزوں کو با ر بار لکھ کر بہتر طور پر یاد رکھتا /رکھتی ہوں			
10	I can understand and follow directions using maps. میں نقشوں کی مدد سے ہدایات کو سمجھ سکتا /سکتی ہوں اور اُن پر عمل کر سکتا /سکتی ہوں۔			
11	I do better at academic subjects by listening to lectures and tapes. میں لیکچر اور ٹیپ سن کر اپنے تعلیمی مضامین میں بہتر کارکردگی دکھا سکتا /سکتی ہوں۔			
12	I play with coins and keys in pockets. میں جیب میں موجود سکوں اور چابیوں سے کھیلتا رہتا /کھیلتی رہتی ہوں۔			
13	I learn to spell better by repeating the letters out loud than by writing the word on paper. میں کاغذ پر لکھنے کی بجائے لفظوں کو علیحدہ علیحدہ کر کے اونچی آواز میں بول کر بہتر انداز میں سیکھتا /سیکھتی ہوں۔			
14	I can better understand a news article by reading about it in the paper than by listening to the radio. میں کسی اخباری کالم یا خبر کے بارے میں ریڈیو سے سننے کی بجائے اخبار سے پڑھنے سے بہتر انداز میں سمجھتا /سمجھتی ہوں۔			
15	I chew gum or snack during studies. میں پڑھائی کے دوران سنیک اور چیونگم استعمال کرتا /کرتی ہوں ۔			
16	I feel the best way to remember is to picture it in my head. میرا خیال ہے کہ کسی چیز کو یاد کرنے کا بہترین طریقہ ذہن میں اس کی تصویر بنانا ہے۔			

S. No.	Statements	Often (اکثر)	Sometimes (بعض اوقات)	Seldom (کبھی کبھار)
17	I learn spelling by "finger spelling" the words. میں سپیلنگ انگلیوں پر گن کر یاد کرتا/کرتی ہوں۔			
18	I would rather listen to a good lecture or speech than read about the same material in a textbook. میں کسی میٹریل کو کتاب میں پڑھنے کی بجائے ایک اچھے لیکچر یا تقریر کے ذریعے سننا پسند کرتا /کرتی ہوں۔			
19	I am good at working and solving jigsaw puzzles and mazes. میں پہیلیاں بوجھنے اور لکڑی کے مختلف ٹکڑوں کو جوڑ کر تصویر مکمل کرنے میں اچھا /اچھی ہوں۔			
20	I grip objects in my hands during learning period. سیکھنے کے دوران میں چیزوں کو اپنے ہاتھوں میں مضبوطی سے پکڑ کر رکھتا /رکھتی ہوں۔			
21	I prefer listening to the news on the radio rather than reading about it in a newspaper. میں اخبار پڑھنے کی بجائے خبریں ریڈیو پر سننا پسند کرتا /کرتی ہوں۔			
22	I obtain information on an interesting subject by reading relevant materials. میں کسی دلچسپ مضمون پر معلومات حاصل کرنے کے لے لیے متعلقہ مواد پڑھتا /پڑھتی ہوں۔			
23	I feel very comfortable touching others, hugging, handshaking, etc. میں دوسروں کو چھونے،ان کے ساتھ ہاتھ ملانے اور بغل گیر ہونے میں آرام محسوس کرتا/کرتی ہوں۔			
24	I follow oral directions better than written ones. میں تحریری سے زیادہ زبانی ہدایات کو اچھی طرح سمجھ لیتا/لیتی ہوں۔			

Thank you very much for your cooperation.

With Best Wishes,
Sher Afgan Khan
(Research Scholar)

BARSCH INVENTORY OF LEARNING PREFERRENCES

SCORING PROCEDURE

SCORING PROCEDURE

OFTEN = 5 POINTS

SOMETIMES = 3 POINTS

SELDOM = 1 POINT

No.	Visual Points	No.	Auditory Points	No.	Kinesthetic Points
2		1		4	
3		5		6	
7		8		9	
10		11		12	
14		13		15	
16		18		17	
20		21		19	
22		24		23	
	VPS=		APS=		KPS=

VPS = Visual Preference Scores

APS = Auditory Preference Scores

KPS = Kinesthetic Preference Scores