RELATIONSHIP OF TEST ANXIETY AND WORKING MEMORY CAPACITY WITH ACADEMIC ACHIEVEMENT OF SECONDARY SCHOOL STUDENTS OF PUNJAB

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This thesis is submitted in partial fulfillment

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AUTHOR'S DECLARATION

I hereby declare that "Relationship of Test Anxiety and Working Memory Capacity with Academic Achievement of Secondary School Students of Punjab" is my own research work. The sources consulted or referenced are acknowledged properly in-text and out-text. The research is entirely my personal effort don under the sincere guidance of the respectable supervisors. No portion of the work presented herein has been submitted against a publication in any degree or qualification of the same or any other university or institute of learning.

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DEDICATION

I dedicate this research work to my sweet and beloved Mother and my Husband Mir Rashad Ul Hassan, for all their love, help and attention which has made it possible for me to make it.

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First of all, I am very grateful to Allah Almighty, the Most Beneficent, the Most Merciful Who bestowed upon human beings with the wisdom and courage to search for new horizons, with spiritual guidance from the Holy Prophet (PBUH). Due to His blessings and unlimited help, I have completed my thesis successfully.

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SAMINA SHAHAB

Abstract

The key purpose of the research study was to determine the relationship between test anxiety, working memory and academic achievements of the secondary school students of Punjab. The basic objectives of the study were to test the combined effect of test anxiety and working memory on the 10th class students' performance and to compare the test anxiety levels, working memory capacity and academic achievements in girls and boys of secondary level. All the students (17,45832) studying in public schools of Punjab were the population of the study. The sample of the study consisted of 504 secondary school students, among them 252 were male and 252 were female. A set of two tests (corsi block tapping test and the digit span test) together with test anxiety scale was administered. The final grade/scores of Board exams were taken as a criterion measure of academic achievement. Field based personal visits with partly participatory approach were used to collect the primary data from the sampled population. Analysis of the data was carried out by using SPSS 21 package for obtaining descriptive and inferential statistics. An equally divided 504 questionnaires were distributed among participants. The findings of the study showed that a significant difference at 0.05 level in the academic achievement of the anxious and non-anxious students. The study concluded (i) a significant correlation between the test anxiety and academic achievement, (ii) a non-significant correlation between the academic achievements and working memory, (iii) gender variation in academic achievements and test anxiety, where as the working memory capacity of both genders was almost similar, (iv) a significant negative correlation between the test anxiety and working memory. On the basis of the conclusions, the major recommendations were formulated. i) the prevailing system of

general secondary education needed to be gradually replaced with more productive, interesting and meaningful skill-oriented education to reduce study pressure which causes anxiety, ii) a link could be created between theory and practice, so that rote memorizing of material might be reduced and powerful learning be enhanced on more permanent level, iii) The diversified curriculum at secondary level might be revisited and refined to deliver both cognitive and practical components thoughtfully, iv) instituting guidance and counseling program at zero cost and special cells for the treatment of psychological issues of young learners might be introduced. v) Comparative studies of public and private sector; explaining working memory as predictive variable; finding backward effect of digit span capacity and specialized investigations on data gain from all the five senses for further studies were identified.

Keywords: *Working memory, Central executive, Phonological loop, visuospatial scratch pad, Attentional control theory,*

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LIST OF ABBREVIATIONS

WM	Working Memory
STM	Short-Term Memory
LTM	Long-Term Memory
TA	Test Anxiety
ADHD	Attention Deficit Hyperactive Disorder
VWM	Visual Working Memory
RT	Response Time
PET	Processing Efficiency Theory
ACT	Attentional Control Theory
CTRS	Conners' Teacher Rating Scale
BRIEF	Behavior Rating Inventory of Executive Function
MA	Math Anxiety

CHAPTER 1

INTRODUCTION

1.1 Background

The memory system of human operates on the combination of two parts: 1) temporary storage and 2) information processing under the service of cognition; called working memory system; having a limited capacity of storage. A component of the working memory system which holds information without manipulation is short term memory. Long-term memory and working memory differ from each other in a sense that long-term memory has the ability to store, hold and manipulate a vast variety of information in stable form than the working memory. The multi-component model of memory includes working memory; it consists of the central executive controller which at a time separately interacts with both auditory verbal and visuospatial data into the instant store. In the area of individual differences in cognition, neuropsychology, child development, and neuro-imaging; the concept of working memory has provided useful information, techniques and methods to understand and address problems relating these areas (Miyake et al, 2008).

Working memory is the type of brain system. It provides temporary storage; and carries out manipulation of the necessary information required for multifaceted cognitive tasks like language learning, conception, and logic. The definition of working memory has developed from the concept of a unitary short-term memory system. Both storing and processing of the information at a time are carried out in working memory. There are three subcomponents of working memory, they are: 1) central executive also called

attentional controlling system, based on skills required for such as chess playing and inclined to the consequence of Alzheimer, it has two slaves systems, 2) visuospatial scratch pad used to store and manipulate visual information and 3) the phonological loop, which is meant for storage and processing speech-based information. Phonological loop plays an essential role in both native and second language learning (Miyake, 2008).

1.1.1 Working Memory

Working memory is temporal storage and place where subconscious processing occurs. In the theory of information proeessing model, working memory is considered as a worktable; on which users can build, rework ideas and later apart. Any process in working memory requires focus and attention. Working memory takes inputs from both sensory motor activities and from long-term memory. Studies on brain imaging showed that the frontal lobe is required in the working memory process, although other parts may also be called during work (Sousa, 2006).

There are two views about working memory; some psychologists are in view that working memory is STM and main focus of WM is its functionality rather than its interval, other cognitive psychologists say that WM and STM are two different brain systems, according to them short-term memory is a brief storage whereas working memory is not only a storage but also a workplace for manipulation of information. Working memory involves a person being mentally attentive. It is a temporary workplace where a person stores and manipulates information. Although psychologists did not define any physical location in the brain: which can be said directly responsible for the

working memory process. It seems that several parts of the brain contribute to the process of working memory as it belongs to cognitive structure (Lepine & Camos, 2005).

1.1.2 The Baddeley-Hitch Model: Working Memory

The main idea of "working memory"—as contradicted to the other in a way from claiming; an arrangement that consists for two transient saves and a central executive, different from a simple data store—is in the heart of the Baddeley-Hitch model. Three crucial characteristics discriminate this model from the Atkinson-Shiffrin model, originally designed in 1968.

In the Baddeley-Hitch model (1974) approach position of WM is the capacity of short-term storage where mainly most of the data in transit in long term memory. Instead of claiming working memory as transitory storage the main most important job is to empower complex cognitive activities that oblige the integration, coordination, and control for numerous bits of rational data. Working memory performs two tasks (1) hold a mental representation about the two letterpresses also their spatial relationship to each other, (2) provide a workspace for analysing the explanation "B doesn't take after A" and choosing that it infers that "A follows B," and (3) empower correlation of the mental representations of the letterpress and statement (Baddeley, 2000).

Second, in the Baddeley-Hitch model, there was an essential analytics association among a control system—a vital supervisory—that legislates the confirmation and evacuation information from temporary storage and the storage buffers themselves. This compact level of association is responsible for empowers the short-term storage to provide similarly as compelling workplaces for psychological forms (Baddeley, 2000).

Third, the model proposes (as intimated prior) no less than two unique short-term memory buffers, one for verbal data (phonological sphere) as well as the other for visuospatial data (visuospatial scratchpad). In short, these short-term stores are independent; there is more terrific adaptability in memory capacity. Thus, indeed if one support is locked in for storing information the opposite at present a chance to be used on full viability. The supervision of these capacity frameworks by a central executive suggests that most of the data might be quickly shuttled the middle of those two slaves and facilitated crosswise over them (Baddeley, 2000).

The Baddeley-Hitch model (1974) is significantly different from earlier theories (Miller's theory, 1956, Atkinson & Shiffrin, 1968) about short-term memory. Baddeley model neither emphasized on working memory duration nor its relationship with long-term memory; rather it defines the flexibility and critical importance of on-going cognition. Baddeley's conceptualization for working memory is still exceedingly convincing serves as a sourball for a gigantic amount about research work. Those introductory thoughts of a central executive cooperating for double transient-memory buffers need to be tested over the years so that the viewpoints of the model also needed to be further expounded for the worth of effort carried out by painstaking investigators. Alongside these powerful observations are needed to keep tabs on capacity inside verbal working memory, and the phonological loop because to such an extent of regular discernment (especially to learners) appears to depend on this cognitive capacity (Miyake, 2008).

1.1.3 Test Anxiety

According to different psychologists anxiety refers toward "the feeling of fear, worry, nervousness and dread, these feelings have a direct connection with physiological systems, like anxiety became the cause to increase in blood pressure, sweating, weakness, desiccation of mouth and rapid heartbeat" (Seligman 2001).

Seligman, Walker and Rosenhan (2001) characterized anxiety as an upsetting state for internal turmoil often went with sensory practices, for example, pacing goes and forth, physical protestation and reflection. It is an inclination of worry; fear and agitation which populace has the same as an after effect of over-rejoinder to be instinctively perceived threatening. However extreme anxiety could a chance to be greatly weakening hosting a genuine effect with respect to our everyday existence. Exam anxiety, resting on the other side, maybe an expression tantamount by means of expectant unease, execution worry, conditional anxiety, and assessment nervousness blending of discerned physiological over provocation, the inclination of stress and fear. Anxiety is viewed similarly as a general cause to few issues that reason agitation, fear, and stress (Beilock & Holt, 2004).

Test anxiety is an agitation or fear encountered prior to, throughout or following exam due to concern, stress, or dread of questionable matter. It might have been characterized by as a set from claiming phenomenological, physiological, and behavioural reactions that go with concern around workable negative outcomes or disappointment looking into an examination or comparative evaluative circumstances (Zeidner, 2007). It is an inclination that circumstance the place execution generally

checks or the place the weight will do well may be compelling. Test anxiety is not always terrible. Indeed, a low level about test anxiety is important around those people in place to look after concentrate and with electrifying them under movement preparing, plotting perfecting methodologies that are surety ideal prosperity in the examinations.

1.1.4 Academic Achievements

Academic achievement refers towards the degree to which a student, teacher or institution has accomplished their educational goals. Successful completion of educational benchmarks such as secondary school diplomas and bachelor's degrees represent academic achievement.

1.2 Rationale of the Study

Test anxiety sometimes proves helpful in achieving goals and sometimes hinders in accomplishing goals by affecting the working memory and achievement of the students. This study was undertaken to investigate the role of anxiety along with working memory on the academic attainment of secondary school students. The foremost objective of this study was to determine the effects and function of the anxiety along with working memory in the academic achievement of the young learners. A higher level of anxiety creates many problems and issues (Zeidner, 2005, Putwain, 2010, Eysenck & Derakshan 2011) not only for the stress perceivers but also for teachers and parents because it has a direct relationship with a person's achievement.

There was the need of time to find out the effects of test anxiety and remedies for anxiety controlling and techniques for enhancing working memory capacity. This study

would contribute to identify the effects of anxiety and working memory on academic achievement of secondary school students.

Psychologists believe that working memory is the pure and authentic measure of learning potential because the prior experiences and socio-economic background of the child do not strongly influence it. It only shows the learning capacity of the child (Alloway, Gathercole, Willis, & Adams, 2005), whereas other school-based assessments or intelligence quotient tests only compute already learned knowledge of the scholars.

Empirical evidence shows that working memory capacity confines the academic achievements of a learner. Now researchers have clearly established a strong link between pupils' achievement and working memory capacity (Alloway, Gathercole, & Lamont, 2005).

Working memory has proved helpful in identifying children with learning difficulties, from minor to severe problems. A wide range of researches by teachers, psychologists and researchers has been carried out in the area of test anxiety and its effects on students' achievement in Pakistan; but the role of working memory in learning has not much been explored. In fact, this area is not being touched may be due to its novelty in local educational culture. Keeping in mind the above-mentioned impact of the working memory and its effect on learning of the students, it is the need of time to establish a tangible link between test anxiety, working memory and academic achievement of the secondary school students in Pakistan in general and Punjab in particular.

1.3 Statement of Problem

Educationalists and psychologists always remain in search of approaches, methods, and techniques for better learning and strong connection between learning and intelligence. They observed a plausible link between mental capacity and learning during the 19th century. New researches awoke the concept of pure learning measure and different experimental studies were concurrently carried out. A new phenomenon 'working memory' and its' model was introduced. As it was deemed that previous learning experiences affect intelligence so it cannot be a pure measure of learning. There are a huge number of researches seeking the link between working memory capacity and learning whereas the concept of working memory is still novel in our teaching community, psychologists, and researchers. Investigations are being conducted in the domain of memory, recall, retention, intelligence, and measures of learning; but the field of working memory is not yet prioritised to provide vast literature from Pakistan.

On the other hand, different researches have established a negative relationship between test anxiety and academic achievement of the students. Anxiety according to established searches hinders the learning process in some way as well as boost up the learning depending on its volume and nature of the given task. Although in Pakistani context many types of studies were conducted to check out the effect of test anxiety on academic achievement or learning of the students but combined effects of test anxiety and working memory are not considered. In Pakistan, studies on working memory were carried out but they were limited in number, scope, and area; also, their link was not established with learning and anxiety. There is a range of studies in Pakistan, establishing the effects of test anxiety on academic achievements. It is now time to take into

consideration the role of test anxiety in the processing of working memory and in consequence its' effects on students' achievement.

The current study, in this perspective; attempted to ascertain the extent to which test anxiety and working memory affect secondary school students' achievement in Pakistan. Also, to what extent test anxiety or working memory affects the learning process of the student?

In focusing on the problem, the study considered the following three types of variables, which were covered in the survey.

1) Test Anxiety,

2) Working Memory,

3) Academic Achievement.

This investigation focused on the effects of test anxiety and working memory capacity on academic achievement of secondary school students.

1.4 Objectives of Study

Following were the objectives of the study

1. To investigate levels of test anxiety in students of secondary level.
2. To explore the working memory capacity of the secondary level students.
3. To check the combined effect of test anxiety and working memory on the 10^{th} class students 'achievement.

4. To explore how test anxiety is related to working memory and academic achievement.
5. To compare the test anxiety, working memory capacity and academic achievements in girls and boys of secondary level.

1.5 Hypotheses of Study

Subsequent were the hypotheses of the study:

H_o1. There is no significant effect of test anxiety on students' academic achievement at the secondary level

H_o2. There is no significant correlation among levels of test anxiety and students' academic achievement at the secondary level.

H_o3. There is no significant effect of working memory capacity on 10^{th} class students' achievement.

H_o4. There is no significant interrelation between test anxiety and working memory.

H_o5. There is no significant combined effect of test anxiety and working memory on students' academic achievement at the secondary level.

H_o6. There is no significant difference in the working memory capacity between both genders at secondary level.

H_o7. There is no significant difference in the levels of test anxiety between both genders at the secondary level.

H_o8. There is no significant difference in the academic achievement between both genders at secondary level.

1.5.1 Rationale of Null Hypotheses

Null hypotheses were formulated as suggested by Creswell (2011) on the following grounds:

1. Statistical assumptions of the research can only be tested unbiased by null hypothesis.
2. For advancement of any theory null assumptions are considered best, because it yields true results
3. Tests of homogeneity are used to verify the consistency of the experiment's results.
4. Equality of effects of two different treatments is assumed in null hypothesis for gaining true results.

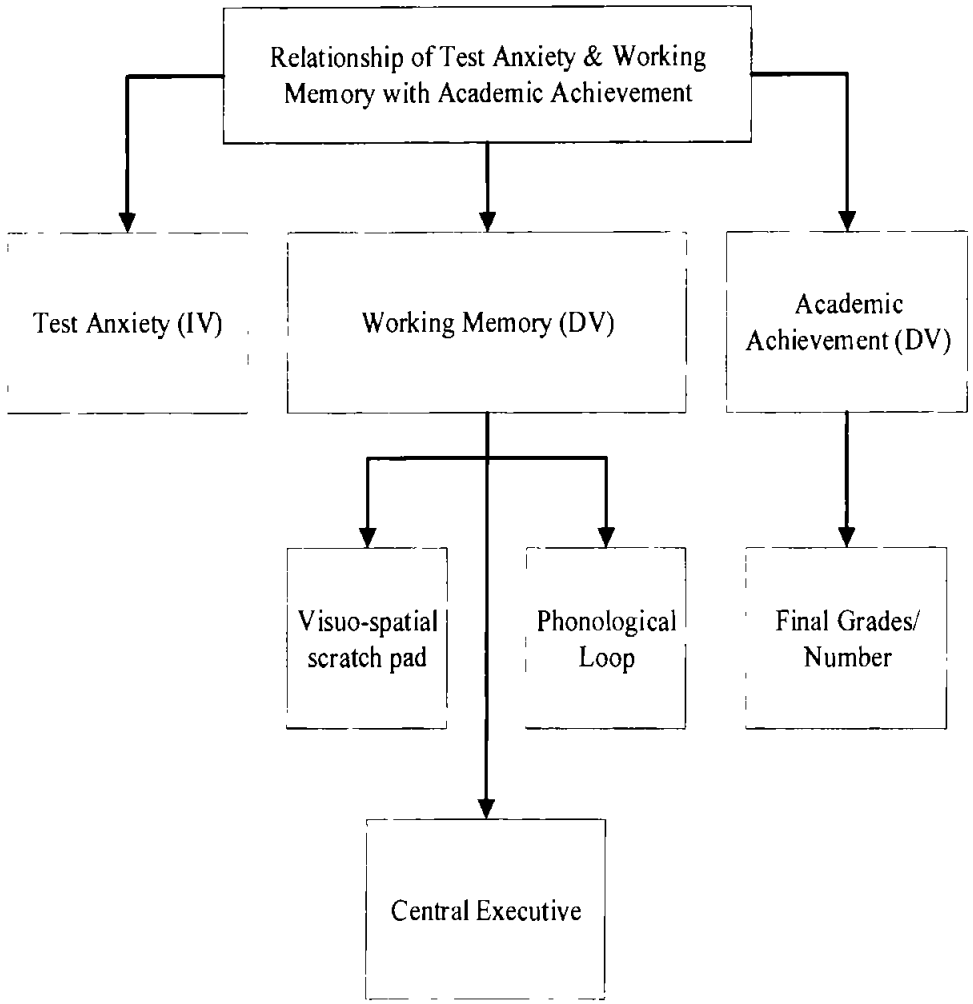


Figure 1.1 *Conceptual Framework*

1.6 Significance of the Study

The main focal point of the research study was to establish the effects of test anxiety on students' academic achievement and part of working memory in students' academic achievement. Many kinds of research were carried out on the connection linking test anxiety as well as academic attainment of the students working memory with academic achievements and their results provide enough evidence to conclude that exam anxiety

and working memory have direct link with achievement of the students, e.g. often anxious students perform low on the achievement test than the non-anxious or low anxious students and this leads to poor academic achievements.

This was the growing need of time to give awareness to teachers about test anxiety, its effects, manifestations, and its role in increasing or decreasing students' achievement and working memory; so that they can tactfully deal with this problem. The results of this research would be powerfully helpful for teachers, in dealing with test anxiety specially the message reflect to classroom instructional situations. By design, one needs to use better techniques where possible integrate with teaching methodologies for enhancing the efficiency of working memory: guiding and motivating students according to their natural needs, cultural requirements, and background. Teachers must focus proportionally on declarative procedural and conditional knowledge in classroom teaching learning situations. These levels of instructions must be integrated with the technology of testing for enhancing of working memory capacity with goal directed instructions, leading to powerful achievement. This study addresses these operational issues. The results of this study can be utilized in enhancing instruction for the classroom and introducing the techniques which would enhance the working memory capacity and achievement. For this purpose DSD, department of education and ministry of education have to introduce awareness programs for teachers and equipped them with proper testing materials so that they can check students' anxiety, working memory and other psychological factors which effect teaching learning process for better results.

As far as students are concerned it would be helpful for them to know about their level of test anxiety. With the help of this awareness, they could try positively to

overcome their anxiety and get training to better utilize their working memory capacity. To facilitate students school management team, must provide counselling services at zero cost for students so that they can be aware of their problem and reach to the best solution with the help of teachers and counsellor.

The result of this study would help the school administration to identify and deal with this problem within the school management system. This study would be proved helpful in discovering the special effects of exam anxiety, as a part of managerial teaching, teacher behaviour, given the poor home environment and highly content ridden public examination which cause the anxiety. Thus, the results of this study develop dimensional awareness on the part of teachers and school management for increasing working memory leading to tangible results. Problems are sought through system solutions, where school is the linchpin. Anxiety is a psychological issue. Its party originates from physical bases. On the whole results of this study would provide data and substance; how the school, administrative department and board of exams need to work together to formulate their plausible policies and programs to serve their primary clients i.e. students, the nation of tomorrow.

1.7 Delimitations of Study

1. Public (Government) schools of Punjab were taken into survey.
2. All nine Boards of Intermediate and Secondary education (BISE) operating in Punjab were included.
3. The students studying in the public schools of these main towns in which these Boards are situated were sampled.

1.8 Variables

Three variables were employed in this study:

1) Test Anxiety

2) Working Memory

3) Academic Achievement

Where test anxiety is the independent variable and working memory and academic achievement are dependent variables. This study also sought the gender differences of the learners in test anxiety, working memory capacity and their academic achievements of boys and girls. The contents of each component are described in the paradigm of the study.

1.9 Ethical Considerations of the Study

Following ethical considerations were kept in mind during the study:

1. In conceptualise a research proposal all realistic possible issue relating to proposal formulation, cultural conditions, freedom of expression were well-calved in terms of ethical considerations as stipulated by American Psychological Association (1992) for research.

2. In literature review: proper citation and referencing were followed while considering the plagiarism policy.

3. In Data Collection personal disclosure, authenticity, credibility in cross cultural parameters, gender, social, economic, personal backgrounds, primary and secondary data issues were kept in mind during the data collection procedure.

- Integrity of institutions, department and cultural environment was kept in mind.
- Physical, mental, and psychological risks involved in participating with primary (students) and secondly (teachers) were catered.
- Informed consent, confidentiality of the participants, proper rapport for favourable test administration, respect for respondents and following the guidelines for research were carried out with high integrity.

4. In Data Analysis authentic relevant tests validity and reliability of the tests, fair treatment in groups/ individual's reciprocity was assured.

- Collaborative studies from research design to data analysis and discussion were well considered and articulated. Accurate interpretations and objectivity in results reporting formed the key consideration.

1.10 Operational Definition of Variables

1.10.1 Test Anxiety

Test anxiety is a mixture of supposed physiological over-stimulation, the feeling of fear, fret, nervousness and terror, sweating, trembling of the body, forgetting, shivering, tension, dryness of mouth and rapid heartbeat as well as somatic indications so as to take place for the duration of exam circumstances.

1.10.2 Working Memory

Working memory is the capability toward storing and process information within the brain intended for a concise time-period. It refers toward the cerebral workplace which is utilized during day to day life activities and measured with the help of complex span tasks, which requires simultaneous short-term memory and processing the latest information.

1.10.3 Academic Achievements

Students' academic achievement refers to the final grades/numbers of Board results of their class 9

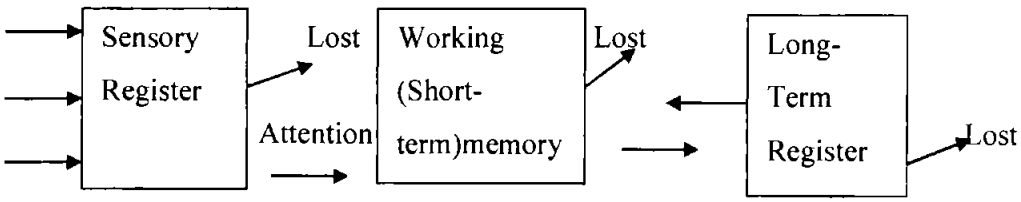
CHAPTER 2

LITERATURE REVIEW

This chapter deals with the review of the related literature. Through this review, a comprehensive theoretic background, details about working memory capacity, its' elements and processing system, test anxiety and the relationship of these variables with academic achievements are highlighted. This chapter caters the details information about the variable from their origin to up till now.

2.1 Introduction of the Variables

In the chronology of learning, behaviourists stressed on external directly observer able indicators of human learning. The information processing theorists focused on the processing inside the brain that allows human beings to learn and remember. Atkinson and Shiffrin (1968) generated a model of memory and storage. They claimed through their model that the brain contains structures that process information as computer device.



Rehearsal, Meaningful Learning, Organising Elaborating, Imagery (RMOEI)

Source: Atkinson, and Shiffrin, (1968)

Figure 2.1: *A model of human memory system*

According to this model the brain contains certain structure that processes the information. It is a computer- based mind model; having three kinds of memory or stores: sensory register (take five senses as the ways of learning), STM (working memory) and LTM having unlimited capacity and holding information indefinitely. This model causes learning through three facets: sensory (working natural senses that gate way) information can be saved or used before entering STM if attention is not paid; information is lost. STM serves as a mid-way. Processing and practicing cause it to transfer to LTM, also using information theory demands linking new information to provide knowledge: available in LTM. Saved information in LTM can be lost if not used regularly. In this case RMOEI serve as the bridge between STM and LTM.

This leads to a point that working memory is a subjective procedure. It enables a man to perform multitask, or all the while consider and holding data in the meantime as finishing different ventures. It is a framework in charge of briefly putting away and controlling data. Working memory is characterized as the capacity to keep most of the data online, regularly to a couple of seconds. Those credentials between "primary" memory, for a set capacity, and "long-term" memory might have been to begin throughout the 19th century but established as model in late 19th. Shiffrin and Atkinson suggested their model, "short-term memory" as the earlier model, similarly as continuously a unitary store to most of the data and the passage toward long term memory (Atkinson & Shiffrin, 1971).

The need for determining the ability to the farthest point from claiming working memory on account of numerous instruments; was felt. For example, a particular case can hold over 2 seconds before discourse through quiet practice (Baddeley & Hitch, 1974).

The unitary short memory was later tested by Alan Baddeley in the multi-compartment display (Baddeley & Hitch, 1974). This model proposes rather that WM involves a visuospatial scratch pad, used to store visual data, a phonological circle, used to store verbal data, and a central executive, that regulates and organizes data. In Baddeley's words, working memory manages all the arrangements to both brief storing and control for information, which may be important to an extensive variety of cognitive assignments (Baddeley, 2000).

Working memory is STM (Short Term Memory): For sharing a different type of information, in working memory, there are different systems and stores. A central executive control and coordinates all this process and its two sub-systems, the phonological sphere and the visuospatial sketchpad (Miyake, 2000).

In the past, it was perceived that human has a limited capacity of information processors, which was identified as working memory during the last thirty years. The different aspects of human cognition related to working memory; received the great attention of researchers. At that time, it was found that working memory capacity decreased with age usually after 35. Individual differences become the main explainer of difference in working memory capacity in three ages, child, adult and older. Regarding a tremendous range of tasks, like language comprehension, production, discourse recall and variety of reasoning tasks like recognition of declarative memory, procedural errors, learning skills and so on. Due to the pervasiveness of this phenomenon; some researchers claimed that individual differences in cognitive abilities relied on working memory capacity. Clear shreds of evidence were found on the role of working memory in

understanding human interaction with other information systems, especially the errors that users made during interaction (Cowan, 2001).

Working memory is capable to hold within running-duration measures; mainly the fresh 3 to 5 digits that can be recalled (fewer than 2 seconds' value). Finalized alongside such measures, those members do not realize when a rundown will limit and, when it does, must recall a few things starting with those end of the rundown (Cowan, 2001). Specific cases solicit how people vary to working memory capacity. However, there are also procedures that might impact how this varying working memory can be utilized. A critical case is in the utilization of consideration regarding plug working memory for those things one's quit offering that one must further join the recall of idea (say, the ideas constantly demonstrated to a class).

There is an ongoing debate on the topic of distinction between short-term memory and working memory; some scholars claimed that performing a task through working memory required some sort of manipulation of stored information, so the repetition of some presented information in same order would be a task of short term memory and repeating it in reverse order would be the task of working memory. On the other hand, Cowan (2001) gave a different point of view about the memory tasks. He claimed that passive storage of the information in which rehearsal of information is prevented; it referred to as short term memory and its capacity limited to four digits or letters; whereas when with controlled attention rehearsal of information is carried out, then it refers toward working memory tasks and its capacity limits is up to seven items.

To parallel with those contributions, advance cognitive psychology, the WM remained the main subject of research. Here working memory manages all the data keeping in the brain without whatever control from claiming this data. Investigations for non-human primates have shown that throughout the delay majority of the data is kept on the mind; there is managed action beforehand, neurons in the prefrontal and parietal cortex, both combine work for this. Such delay-specific movement is practically showing the exact depiction of the neural premise of working memory (Gathercole, 2004).

Similarly, as contradicted to fill it with distractions, (say what person may be arranging to do then afterward class). As stated by one kind of the point of view presented by (Vogel, Machizawa, & McCollough, 2005; Kane, Conway & Engle, 2008), low-span people recall less quantity as they use up a greater amount of their storage limit considering data that is unimportant for the allocated errand. It can be concluded from this work that the capacity of the working memory/ span of the working memory is a basic determinant of cognitive performance. Memory span directly effects on the central executive process of storing and manipulating of the data.

2.2 Working Memory Theory

Baddeley (1974) and colleagues carried out a series of experiments and finally drew the conclusion that working memory consists of numerous components. These mechanisms are 3 modalities-based storages in addition to the central executive, to control them. These three stores are: **1) Articulatory Loop 2) Visuospatial Scratchpad 3) Primary Acoustic Store 4) Central Executive**

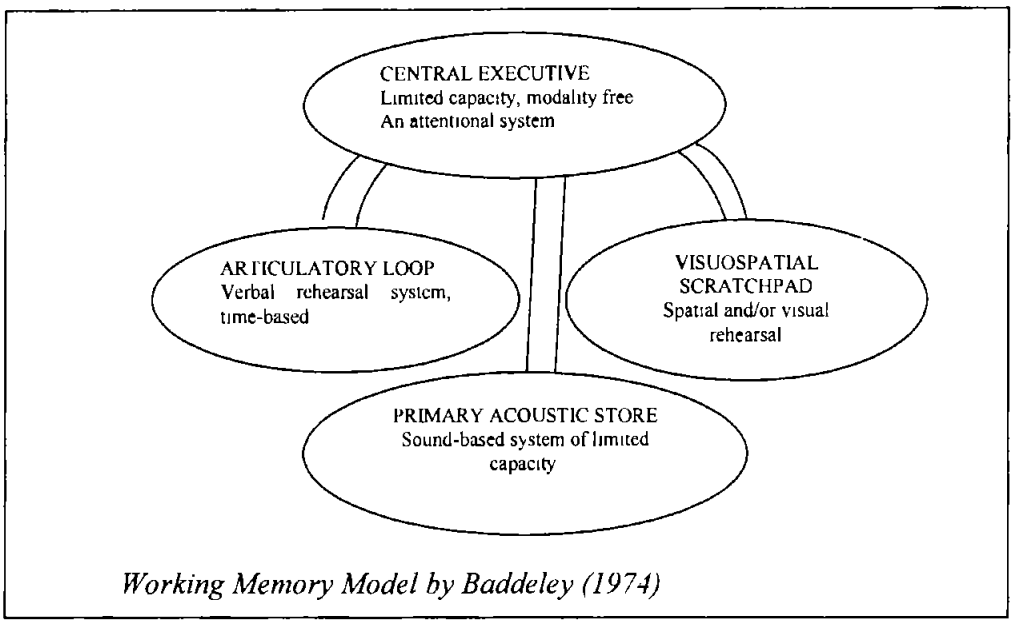


Figure 2.2 *The Working Memory System*

Working memory assumes a fundamental part of mind judgment. "Working memory" is that hypothetical build that needs to be utilized within cognitive brain science and of the framework alternately system underlying for support of the task-relevant majority of the data throughout that execution of cognitive chore (Baddeley & Hitch, 1974). The recall (the couple provisionally active thoughts); is the utmost point essential since it determines what is termed working memory (Baddeley & Hitch, 1974). Up to date hypotheses for memory found that the working memory framework was separated under various components: each part needs distinctive competencies to manage specific sorts of most of the data. A sample of the multi-part approach is Baddeley's exploration (1981; 1990; 1992). He separated working memory under three significant parts: the vital executive, that articulator alternately phonological loop, and the visuospatial sketchpad. The central executive determines both how to use cognitive assets entryway and to smother unimportant data that might expend the individuals' assets (Baddeley, 1986). It

was suggested that the central executive in working memory plays a managing role: it is the control focus of the system it hence selects works for those proper cognitive techniques. Additionally, the central executive needs the capacity to work for the data to bring about shortages that ability confinements are appropriate to this framework only. Storage also occurs elsewhere in the system; the articulatory loop administers verbal material through sub-vocal practice and the visuospatial sketchpad supplies symbolism and spatial material through visualization. Lately, a modality-neutral storage component, that wordy buffer, needed to be placed ahead to manage conceptual representations for occasions (Baddeley, 2000).

Working memory works like an active store that is used to hold information and manipulate it, often called a short-term store. Working memory requires an active focus of consciousness, so it can be said that it holds information which is being processed. A good example of working memory is cognitive mathematical operations like adding, subtracting, problem-solving, reasoning and extracting meaning from what you listen to or study or carrying out of a chain of operation like backing cake. Working memory can hold information derived by five wits and information salvaged from long-term recall and can work on both new and stored information at a time (Baddeley, 2000).

Excessive demands are placed in terms of storage and information processing on working memory called cognitive load. Psychologists identified two types of loads I) built-in load, which is originated by the temperament of tasks and ii) extrinsic load, caused by the format of directions. According to the cognitive load theory, overloading of working memory is due to traditional instructional techniques because they do not bother or consider intrinsic and extrinsic load. While learning new tasks the demand placed on

working memory is called germane load because it requires attention and conscious processing to construct schemata. The germane load and learning process has positive correlation. an increase in germane load will assist the learning process (Baddeley, 2000).

The three parts of the Baddeley-Hitch model are connected upon data gained thorough workspace to cognitive movement. Applying these three components to those Baddeley-Hitch model for the "A–B" task, the phonological loop might have been involved storing those digits, and the visuospatial scratchpad energizes assessing those spatial connections up to the true-false assignment. Coordination might have been supplied by that central executive, which changed most of the data from perusing that articulation (essentially in the verbal store) under a mental picture on the visuospatial scratchpad. These associations intended that execution on the thinking undertaking did not decay extraordinarily the point when digit remembrance might have been included. The Baddeley-Hitch model might have been a major take off from sooner hypotheses about short-term memory in that it emphasized not only its span or its association to long-term memory, but it also explains its adaptability and basic imperativeness with progressing discernment. In quite some time since the model presented, Alan Baddeley became a major figure over the field of working memory research. In those days' proceedings involved on the initial conception of the working memory model and giving work to an incredible bargain of experimental support for its legitimacy convenience (Baddeley, 2001).

According to the Klingberg et al, (2002) concluded in research that training has significant effects on the working memory capacity. In three studies they used twenty-

five days computerized adaptive training for improving working memory capacity and generalized the research findings for cognitive tasks that rely on working memory.

The part that determinedly differentiates the clue about working memory starting by means of the prior conceptions of short-term memory is the central executive. In the model only, the central executive can (1) determine when majority of the data is stored in the capacity buffers; (2) determine which buffer the phonological circle to verbal data alternately those visuospatial sketchpads for visual is chosen to storage; (3) integrate and coordinate data among those two buffers; and, practically important, (4) give a gadget which majority of the data held in the buffers. This could be inspected, transformed, and overall, cognitively manipulated. These works rely upon those central executive's controlling and allocating consideration. That central executive determines what does the "work" to working memory. And a significant number of the capacities connected with those central executives might make just by implication identified with working memory itself (Baddeley, 2003).

The conception of a central executive may be underpinned via investigations that show differentiation among the capacities recorded over and the operation of the two capacity frameworks. These investigations frequently include those issues for dual-task coordination, that is, those procedures about at the same time performing two unique tasks, which commonly includes storing data on working memory and manipulating it (Baddeley, 2003).

Working memory is an ability in which information is kept online typically for a few seconds. William James was the first person who proposed the distinction between

primary memory with a limited capacity and long-term **mem**ory in the 19th century. Atkinson and Shiffrin introduced their model of short-term memory as being a unitary store for information which is linked with long term memory in 1971. Later, Alan Baddeley challenged Atkinson's model of the unitary store and proposed his multi-component model of working memory. Baddeley model of working memory consists of three components, visual-spatial scratch pad, the phonological loop, and the central executive. According to Baddeley working memory is a systematic process of temporal storage and manipulation of information for cognitive tasks (Baddeley, 2003). These mechanisms are 3 modalities-based storages in addition to the central executive, to control them. These three stores are:

2.2.1 Visuospatial Scratchpad- it is used to hold information got through sight. The capacity to develop, inspect, and explore through a mental picture may be the possibility of a chance to be a fundamental capacity about visuospatial working memory. A considerable number of different investigations recommended that the mental route is a naturally spatial methodology (Logie, 1995). Researchers concluded that spatial working memory is concerned for upgrading preparing mind districts that help visual perceptual transforming for the individual areas.

2.2.2 Primary Acoustic Store- used to hold auditory-related information; inputs are in terms of acoustic features (Baddeley, 2003).

Cognitive neuroscience, therefore, indicated that vital neurotransmitters found on prefrontal parietal areas; are responsible for up and down of working memory capacity. Impairments in working memory were discovered over a few clinical studies on which these frameworks were implicated, for example, such that afterward stroke, traumatic

cerebrum damage and over attention-deficit/hyperactivity confusion (ADHD) (Klinberg, 2005).

Working memory is utilized within mental tasks, for example, language comprehension, issue unravelling (into mathematics, moving a numeral starting with those lines from tens section the same time recollecting the numbers), arranging. Many investigations showed that working memory ability varies around people, and it predicts individual contrasts on educated supportability, and progression over the exclude aggregation extent (Cowan, 2005).

2.2.3 Articulatory Loop- it is time-based store and used to store the information driven by speech, it is also intended for oral practice. According to Atkinson and Shiffrin's short-term memory can grasp 7 objects at an instant (Baddeley, 2007).

That dynamic stimulant hails' through articulatory rehearsal and gives notifications through internal speech. When those verbal data are spoken internally toward those mind's voice to rehearsal it, at that point notification got by those mind's ear and supported in the phonological store. In this manner, a nonstop circle assumes for length those verbal material necessities which make upheld on working memory. Those principles scheme of the process translation under a phonological code is obviously fundamental and main to outwardly exhibited material. Sound-related information for example speech initial entry of the phonological store is programmed (Baddeley, 2007).

In verbal working memory abilities if rely upon those level for difficulty for both "phonological processing" (translating verbal data under a sound-based code) and "articulatory processing" (translating verbal data under a speech-based code) is affected. Second, in light of working memory model, if the execution of verbal working memory

assignments won't make catastrophically concerned; for reasons unknown that phonological loop part is unusable: in that case, different components, that central executive and the visuospatial scratchpad, break-in. Third, the phonological loop model proposes that the two elementary parts about verbal working memory—phonological capacity and articulatory rehearsal—are sub served by functionally autonomous systems (Baddeley, 2007).

2.2.4 Central Executive: It controls all the processes of working memory as well as allocates records toward the sub-systems. Also, it is responsible for carrying out cognitive tasks such as problem-solving and mental arithmetic.

The theory might have been that drastically of the cognitive hinder exhibited toward people to early phases of Alzheimer's sickness is because of a useless central executive. In the single-task phase, members performed only one type of task from two tasks, which is sound-related or visual, independently. In the dual-task phase, members performed the two errands all the while. A dominant characteristic to think over might have been that the challenge for each errand a chance to be balanced to each member separately empowered; alternately will arrive at a changed level about behavioural execution. There comes about clear obstruct demonstrating by Alzheimer's patients were markedly more awful over those members in the dual-task condition. The outcomes of the research studies helped that clue that the coordination about working memory capacity requires that engagement of the central executive. Maintenance versus control over working memory, differentiating the cerebrum action occurring in tasks the place the main data needed to make quickly put away recalled (maintenance) against a

comparative assignment for which those put away data need to be mentally changed somehow (manipulation) (Gilchrist, 2008).

Working memory is required for cognitive processes and any change in working memory capacity or its functioning has a gigantic impact on the child's overall cognitive abilities. Knowledge stored in long term memory has an effect on working memory because this stored knowledge is a basic factor that has to affect the interpretation and processing of the information gained from sensory-motor activities (Kane et, al., 2008).

Working memory increases or decreases with age. However, this change in working memory is not clear. If information is being presented in meaningful chunks, it will increase the capacity of working memory. Researchers have proved that we can increase the capacity of working memory with the help of different strategies for example rehearsal and organized information like domain-specific knowledge. The information, which is not part of cognitive processing, decayed after 15 to 30 seconds, whereas needed information kept in working memory as a long time of period as required for processing (Kane, et, al., 2008).

As imitated toward the way that is marked "the centre for cognition" proclaimed perhaps the majority of gigantic accomplishment about an individual's mental progression (Gilchrist, Cowan & Naveh-Benjamin, 2008), it is a focal build over cognitive brain science recently called as cognitive neuroscience.

2.3 Mechanisms of Working Memory

The original model for multiple working memory was projected via Alan Baddeley and Hitch in 1974 and this model was further modified by Logie 1995, he suggested that

there are multiple temporal memory systems and these systems are domain-specific: for coding and retaining phonological inputs, a visual cache for the visual inputs, a spatial rehearsal system for spatial information there is a range of executive functions to support these systems.

In recent years, the working memory model received a number of criticisms; one of them is that it does not give a clear explanation about how visual and phonological information combined and linked to the long-term memory. Baddeley (2000) thus introduced another loop with the name of the episodic buffer, which has to integrate information received from different sources and provide a link between working memory and long-term memory. Not surprisingly, WM will be essential for completing academic tasks, for example, perusing perception of math (Gathercole, Pickering, Knight, & Stegmann, 2004). Catch up investigations affirmed that the quicker an individual's discourse rate, things might have a chance to be recalled effectively starting with working memory (Cowan et al., 2005). Build in his new model 2000 Baddeley introduced another component of memory with the name of the episodic buffer, which must store information into long-term memory (Sousa, 2006).

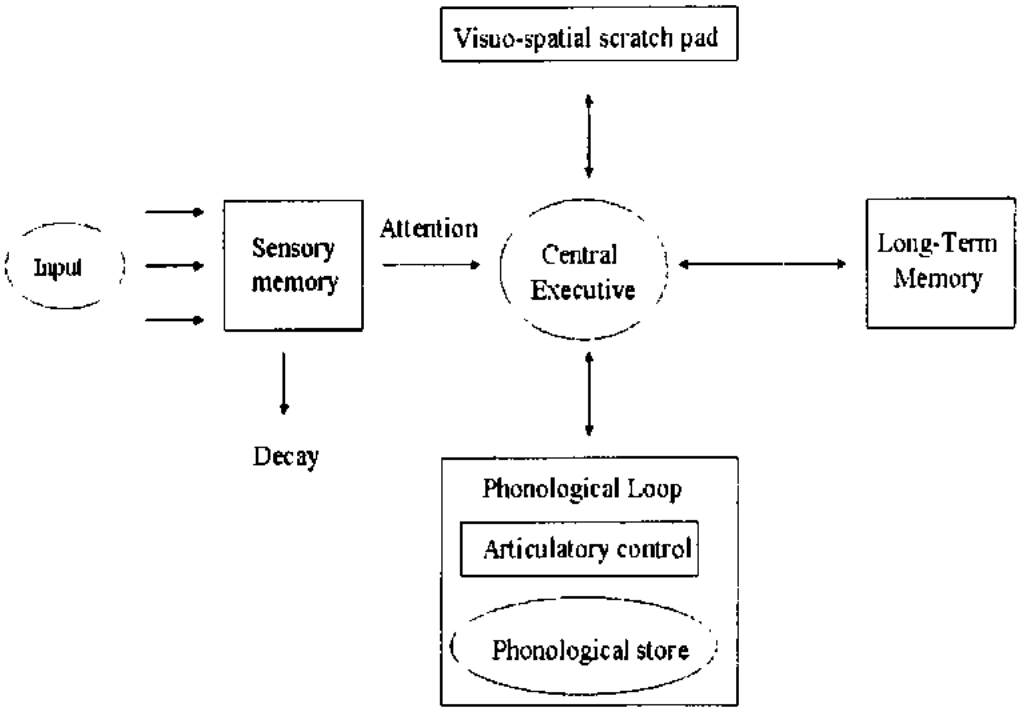


Figure 2.3 *Baddeley-Hitch Model*

2.3.1 Visuospatial Sketch Pad: it is responsible to store and process data in the visuospatial form. It also takes care of navigation.

2.3.2 Phonological Loop: it is used to collect information from oral and printed material and used to memorize phone numbers. It has two parts

2.3.3 Phonological Store: it is used to hold information got through speech and having duration of 1-2 seconds.

2.3.4 Articulatory Control Process: -it is for speech production and rehearsal. It stores oral information commencing the phonological store (Baddeley, 2007).

The opposite and only those phonological loops, articulator processing, or those "speaking" about exhibited things the internal voice, may be reflected in the word-length

impact. That phonological loop model accounts for those word-length effects suspicion that pronunciation period influences that velocity for quiet rehearsal, which obliges speech-based preparing. Furthermore, it takes practice to set objects in working memory, the less reluctant those objects needed to be dropped from the phonological store (Baddeley, 2007).

Under these conditions, termed articulatory suppression, execution may be significant, despite not catastrophically, obstruct demonstrating that in spite of working memory may be incompletely disrupted, and it is even working. Yet all the auditory introduced, majority of the data on those scratchpads is off very little help: the initial data must be transformed phonologically proceeding to be translated to a visuospatial code (Baddeley, 2007).

It ought to further bolster a chance to be conceivable to figure out practical liberty in light of designs for behavioural execution. Whether expression length (which influences rehearsal) phonological comparability (which influences storage) target autonomous segments of the phonological loop, that controls about expressions period and phonological similitude ought to further bolster not cooperation with one another (Baddeley, 2007).

Working memory assumes a key point part in anticipating the capacity of mankind's achievement, the thing that psychologists think around how the human working memory framework really works. It turns out that a few significant components have been identified, for example, decay. That is, the more drawn out is needed since an object might have been required over working memory. Likewise, new things enter under working memory; there would, in any event, two outcomes to whatever remains of that

system: other things tend with getting harder and the cognitive framework turns into efficient or adequately moderately down. Similarly, as an after effect of effort on determining the object that makes those age-related decrease in working memory capacity, specialists have uncovered, that there is a solid connection between straightforward transforming speeds and memory limit (Kane & Engle, 2008).

Regardless of the centrality for working memory, mental development and how it works, there may be at present no formal/computational hypothesis that integrates these components under a sound total, which can be used to anticipate client execution. For the cognitive tasks, working memory is used to work as a temporal storage of information needed. For tasks like problem-solving, concluding or comprehending written or listen material; working memory not only maintains but also updates information for direct access. For any given purpose, these information's are being processed by attention (Kane & Engle, 2008).

According to Baddeley's definition, WM may be necessary to an extensive variety for cognitive errands, there is a need to keep most of the data beforehand consciousness information. Indeed, WM could make those single into the vast majority imperative calculate in deciding all brainpower. Although they vary, correlations ordinarily around r = 0. 7, which implies that regarding half of the difference among the different people in all brainpower might be clarified toward contrasts for WM ability (Conway, Kane, & Miyake, 2008).

2.4 Working Memory Capacity/Duration

As discussed earlier working memory is temporal storage it can hold and process items for a limited time. Ebbinghaus Hermann (1885-1964) was the first person who started work on the time limit of working memory. According to his findings, the period of intently information processing in working memory is up to 45 minutes. But the results of his study cannot be generalized on mass because he used himself as a subject.

Miller (1956) summarized the limit of cut-off points on a well-known article, "The supernatural amount seven"; seven was that ability breaking point around which storing solitary digits, letterpress alternately spatial positions took place. For retrieval in addition to transfer, there is a constant transition of data among long-term memory as well as working memory. For making sense from new information, old in the sequence is retrieved from long-term memory toward working memory. New information is first attending and incorporates in our information than reassigned or prearranged and captivated into long-term memory (Baddeley, 2000).

Cowan 2001 demonstrated that the indifferent capacity limit is closer on four when dynamic practice would be kept. In a good deal of articles, he utilized those term short-term memory as opposed to working memory. That modification between these two ideas may be a progressing discussion. Researchers concluded that aid may require for those working memory assignments in which remembering most of the data is required. Those refinements aggravated by Cowan; were an elective method for grouping memory tasks: short term memory might result of the covert capacity from claiming most of the data at practice is kept for capacity limit around four things.

Table: 2.1

Working Memory Capacity

Changes in Capacity of Working Memory with Age			
Approximate Age Range in Years	The capacity of working Memory in Number of Chunks		
	Minimum	Maximum	Average
Younger than 5	1	3	2
Between 5 and 14	3	7	5
14 and Older	5	9	7

Source: Miller (1956) and Cowan (2001)

In past searches, many questions have been raised on the capacity of working memory. Some studies mentioned as low as four items, few other studies suggested it was a challenging task to state the exact number of items. Many factors like delayed time, interest and distraction might differ in individuals and invalidate the results in this regard. Most of the researches supported the magic seven number as a workable limit for adult (Cowan, 2001).

Those fundamental thought about people similarly as limited-capacity majority of the data processors dives again no less than concerning those 1950's bit by bit developed under the build we currently realize as "working memory". Especially in the last decade, working memory is accepted as an incredible deal of consideration starting with analysts' deception by diverse parts about human judgment. A standout amongst those general discoveries in the cognitive maturing writing may be that working memory ability by decreases with the period of grown-ups. Studies were carried out to discover working

memory limit, which has been used to clarify distinctive differences in children population, also congregate contrasts in middle of youth and more experienced grown-ups a vast reach about tasks, including common language use (comprehension, production, talk recall, and so on.), a totally mixture of thinking tasks, distinguished for ultimate memory, procedural errors, ability acquisition, etc. This wonder is thus enveloping that some scientists bring guaranteed that working memory ability is that essential source of distinctive contrasts in cognitive abilities outside for domain-specific information gaps. It appears to be reasonable that working memory additionally assumes a basic part for seeing the connection from claiming people with many of the data systems, particularly overseeing the errors exaggerate (Cowan, 2005).

Those authors, Nelson Cowan (2005), bring change in the meaning and suggested that the WM is only the tip of the iceberg faultlessly portrayed similarly as a latent store component and attentional control. A few scholars considered that bring memory into additionally controlled, is crucial. Thus, it could not be reasonably expected to differentiate working memory control from attention.

Miller was the first person who proposed the capacity of working memory and suggested that working memory can only hold limited items at a time. According to him working memory capacity in infants are up to two items, pre-adolescents can hold three to seven items and it can go up to nine items (Sousa, 2006).

As recent studies determine it limits up to 5 to 10 minutes for preadolescents and for adults 10 to 20 minutes. Mainly this time limit depends on mental fatigue or boredom,

along with this sometimes any unsolved question, trouble or work decision remains in working memory for hours or perhaps for days (Sousa, 2006).

Working memory has a small capacity for holding information at a time. A common view held that it could only hold 4 to 5 elements of additional information at a time. Some psychologists agree with Miller's plus-minus 7 bits in the process of new learning experiences. The capacity of working memory differs in people, so it effects in the assimilation of information at a time. Grouping of the essentials or chunks and their traits also affect the capacity of working memory, for instance, we will be able to easily grasp additional numbers and small words in working memory than alphabets as well as long terms. If the person is utilizing his long-term memory than the limitation of working memory will disappear that is because the information in LTM is saved in an organized way or schemata which reduce the overloading of working memory (Engle, 2008).

New information in working memory remains for a short time than either transferred into long-term memory, replaced, or decomposed. The duration of working memory is 10-15 seconds unless this information is keenly rehearsed or concentrated to (Goldstein, 2010). The other issue with working memory along with its capacity is utilization of mental efforts to hold information and this became the cause of cognitive overwhelm.

For the time limit of working memory motivation is the main factor which is being calculated in the studies. According to the research studies motivation for any object or subject can be increased or decreased the time of reading and processing, the same is the case for students. According to Putwain (2010), this time span is very limited

and age dependent. His findings match with other researches on a time limit for working memory.

2.5 Working Memory in Childhood/ Adolescent

Children working memory capabilities were nearly identified with their execution on key stage appraisals of the national educational module. Working memory abilities were evaluated through a test for six-seven-years of age (Gathercole & Pickering, 2000). Those youngsters who were expected to fizzle on levels for accomplishment to their period or if marked precise inadequately ahead working memory procedures were taken. It is concluded that people for extreme deficits about working memory ought to experience difficulties in taking challenges; assuming, that poor working memory aptitudes would farthest point a child's limit on gaining complex aptitudes and acquiring new knowledge.

There may be significant proof that working memory assumes a paramount part in learning, particularly throughout the learning spare. Many investigations bring in light those connections among the children's working memory limit and their role in achievements in the areas, for example, literacy, lingo, as well as math. Working memory ability is as a rule calculated via mind daggling memory range assignments for that youngster needs to both store and transform most of the data at the same time. In particular case, the essential characteristic about working memory limit throughout adolescence may be the degree with which it varies generally over people of the same ageists (Cowan, 2003).

The affiliation between working memory and aptitudes has been replicated and developed to an agreement from claiming further investigations. Gathercole, Pickering, Stegmann and Knight (2004) discovered that working memory aptitudes be fantastic forecasters of children' learning about getting low, normal or high secondary scores.

Over two studies, it was discovered that the vast majority of extreme deficits for working memory need extra instructional assistance to incorporate learning in both education and math (Gathercole & Pickering, 2004; Alloway, Gathercole, Adams, & Willis, 2005). Alloway (2005) proposed that reasonable suggestion that youngsters for altogether poor working memory work harder to encounter challenges.

Teenage is that the most vital age as throughout this era one develops the memory forming a definite structure. Teenagers must be compelled to apply to recollect higher approach. Memory-strategies would facilitate in the process the knowledge and would help in increasing it. The organization is vital because it helps to organize all the knowledge properly. This could facilitate the brain to recall the required info whenever required simply. Understanding is vital. If one understands well, it becomes straightforward for the brain to recollect. Thus, to create the memory of a teenaged a lot of economical one must confirm the on top of four key things. This could, sure enough, facilitate in the development of memory in juvenile person (Wolfe, 2001).

Memory booster would facilitate developing good memory in teens. It might conjointly facilitate organizing the data in a very higher approach also apply skills that are essential for effective learning. This might facilitate teens to remember info that's kept in their brains simply. The potency of it differs from one person to a different. Some

could have smart short-term-memory whereas the others may have good long-term-memory. If the juvenile person improves his or her memory it may well be helpful (Wolfe, 2001).

Some useful methods for children are as following:

1. A young adolescent brain can hold seven items of information, plus or minus two items, in working memory.
2. The addition of emotion can help students remember.
3. The brain is social and requires interaction to develop properly.
4. Practice/rehearsal is critical to learning for the long term.
5. We take in more information visually than through any other sense.
6. Storytelling
7. Reciprocal Teaching – Think, Pair, Share
8. Metaphor, Analogy and Simile
9. Visuals/Graphics
10. Mnemonics
11. Hands-on / Simulations
12. Wait Time
13. Rhythm, Rhyme, and Rap
14. Chunking

2.6 History of Working Memory Research in Education

From 1950 to up to 1970 researchers worked on measuring the limit of storage in short term memory. During this period, Atkinson and Shiffrin introduced a classic

information processing model (1971) the primary focus of this model was on the role of short-term memory in learning. The term working memory refers to the ability to store and control most of the data against short periods of time (Baddeley & Hitch, 1974). It takes three decades for reaching to the conclusion that working memory is not a unitary store, yet the entire memory framework consists of distinguishable components. There is a range for alternative theoretical accounts about working memory ability.

Baddeley and Hitch (1974) anticipated a multi-element model of working memory, now his model has accepted a range of models which is assumed as the expedient formation model intended for recapitulating research work on working memory. It worth noting the concept of working memory first emerged in the study of animal learning, where it was considered a type of learning or memory thought to strengthen the given tasks, which required cognitive processing and use of long-term memory together (Oberauer, et al., 2000).That central executive may be the part accountable for controlling assets and observing information transforming over informational domains. This framework may be also liable for administrative tasks, as well as the recovery about most of the data starting with LTM and attentional control. In this model, storage for storing the majority of the data is interceded by two field definite slave systems: that phonological loop, which supplies temporary capacity about oral information, and that visuospatial sketchpad, specific for the preservation and control for visual-spatial representation. The fourth part from this model recently has been added, the wordy buffer, accountable for tying data over informational spheres and memory subsystems under integrated chunks (Baddeley, 2000).

A few analysts recommend that working memory based on a domain-general perspective that brings together information in two autonomous domain-specific storage sections to oral and visuospatial codes. Others contend rather that memory assets are differentiated under oral and visuospatial assembles (Miyake, Friedman, et al., 2001). A voluntary record of working memory capacity is given by Miyake and his colleagues (2001), who have suggested that working memory ability is shored up two divided pools of domain-specific assets to oral and visuospatial information. Every area may be freely fit of manipulating by keeping most of the data dynamic.

Different researchers according to their own interest and area either their field is neurobiological, psychometric, neuropsychological, or oriented; with the help of different approaches, provided practical guidance on human factors like anxiety or working memory. Although all above-mentioned researches in different area studied working memory in very different theoretical framework, methods, and styles, but they agree on the need of measuring, exploring and defining the role of central executive controller. It is having limited attentional capacity, temporary storage system and separate processing operational systems for visual and verbal storage (McNamara, 2001).

Early research on working memory was initiated by George Miller in 1956. He wrote an article on the capacity of working memory and concluded that the capacity of short-term memory is round about seven digits, letter, or words and in special cases plus minus two. He used the term short term memory instead of working memory and perimeter it ranges from five to nine items. For describing the basic unit of memory Miller introduced the term chunk. According to the Cowan et al, (2004); chunk means a

unit which consists of mutually exclusive several components and which working memory can hold up to seven chunks at a time.

However, working memory ability cannot settle around seven items. It ranges different from person to person. WM capacity measured for instance that visuospatial span-board task; widens throughout adolescence and gain the maturity to the greatest toward around twenty-five a considerable length of time of age. This limit at that point bit by bit decreases throughout the maturing transform. Generally, it is measured through visuospatial span board tasks (Cowan et al., 2004).

It was Atkinson's model which paved the way for the cognitive approach in psychology. According to Atkinson information can only remain in short term memory for 30 seconds without repetition and with repetition, time duration can be prolonged (Margaret, 2009).

2.7 Individual Differences in Working Memory

Those mutual trademark involving this model and the Baddeley and hitch (1974) working memory might be that there is a general part that limits concerning representation and organizing between constant changing of information (controlled thought and the general executive, previously, their sportive models)

Although working memory had a short capability it is vital for information dispensation, there are differences within working memory capability are expected to appear in achievement. The difference in the array of cognitive chores, i.e. problem solving, logic, reading comprehension, learning novel terminology showed sufficient evidence to build up the case of difference in working memory capacity in individuals.

Baddeley (2000) concluded from his research that it has a possible factor that working memory showed difference in the efficiency of using skills, and strategies in processing information than the difference in the capacity of working memory. So, it can be concluded that in practice there is a difference exist in both, skill efficiency and capacity of working memory of individuals.

It is the fact that still psychologists do not fully understand and define the role and work of working memory span tasks, but it could advantageously be used in research. Susan Gathercole and colleagues (2000) developed a working memory battery from the multi-component working memory model for children of school age, in which a range of complex working memory span errands was employed to determine the capacity of central executive and phonological and visuospatial subsystems.

Conway and Bunting (2002) carried out a study on the functions of working memory. For this purpose, they built up a task-based test, which they named as working memory span, in which respondents must concurrently hand out sentences while remembering the very last utterance of all. According to the results of this study, working memory span and reading comprehension were highly correlated with each other in college students. They replicated this predictive capacity many times and generalized it to a wide diversity of errands in which both temporary storage space and dispensation of information took place at a time.

Factor analysis was carried out and it was concluded that with the development of the child, the structure of working memory also developed accordingly. The working memory system is stable with child development and its capacity increase with age

(Gathercole, Pickering, Ambridge & Wearing, 2004). Along with this with the age a considerable developmental change/ growth in the subsystem of working memory was also seen; that was range expansion of phonological loop, started from the capability of inside verbal communication and practice within children toward a wider range of aspects of administrative managed within grown-up (Saeki & Saito, 2004).

To establishing its predictive capacity, they used quite complex tasks along with simple tasks and both complex and simple tasks correlate with scholastic achievement measures (Lepine et al, 2005). In further researches, a high level of correlation between these tasks and traditional intellect test resting on logic capability was established. These results promoted a wide range of research work for finding out the essential capacity, which can predict a range of cognitive skills. There was a very close link between expansion transformations and the ways working memory be utilized. In favour of instance with the growth of the child as he learns complex intellectual operations, his capacity of the central executive also increased (Hitch, 2006).

An attempt was made toward determining the difficulty of the prediction made by working memory duration on cognitive errands Engle and his partners concluded that the capability of prediction was not only based on memory tasks but attentional control paradigms involved in anti-saccade-task might also affect it (Kane et al. 2008). The type of tasks is based on the ability of the participant to rapidly move his eyes from fixation point to a target. The same as there be storage propensity for the eyes in the direction of automatically shifted from one point toward a novel incentive, minor warning light at the target point was used to facilitate achievement; whereas in the second condition, the warning light signalled indirectly toward the contrary surface. This facilitation proved

helpful with high duration but not proved helpful for squat working memory duration. Engle and colleagues resting on the variety of additional readings concluded that the capacity to maintain attention against direction was a crucial feature of working memory, whether the person had to focus on perceptual or information comes from other sources e.g. long-term memory.

Engle (2008) argued about the strong correlation between working memory and attentional control system hold back distracting stimulus, but still, it was not obvious so as to the attention control was the merely characteristic that determines the working memory capacity. It might be just one example of several functions, a versatile attentional control system had. In addition to the physiological and psychological level, the concept of inhibition bore a range of explications.

Domain-general accounts from claiming working memory capacity need additionally been propelled toward other scholars. Engle and colleagues (Conway, Kane, & Engle, 2008) have recommended that the working memory limit was restricted by regulated attention; the limit ought to allocate attentional assets despite redirection or impedance. Engle et al. (2008) utilized a domain terrific classification to extract the normal difference imparted by oral working memory assignments for example, such that digit span, and verbal working memory assignments reading span. They found that the remaining difference in oral working memory imitated controlled processing, which might have been particularly interfaced for general fluid brainpower. Both models also blend domain specific storage components: one to verbal information and another for visuospatial data.

2.8 Working Memory and Academic Achievement

The framework for working memory underlies that this ability of WM can store and control data for short periods for time. (Baddeley & Hitch, 1974; Baddeley, 2000), it may recognize as of short-term memory while it includes the collaboration of storage with long-term memory for specific informational fields or tasks. Individual distinction abilities within working memory limit had dominant consequence projection of youngsters' capability required for acquiring new information.

Another thing which is concluded from research that memory capacity has a continuing link with the achievement from primary to onward other grade levels to college students (Gathercole & Pickering, 2000). Throughout the academic career of the students, working memory has a strong influence and linkage with the progress of the individuals. Despite questions, estimate units for VWM are (Wheeler, 2000), those classifications of a graphic entity maybe not obvious. Usually, visual working memory is being assessed/measure by unpredictable visual staff; individuals must identify, rectify or differentiate these items as asked.

Three studies of Seyler, Kirk, and Ashcraft, 2003; Gathercole, Pickering, Knight, and Stegmann, 2004 showed a negative relation between working memory and academic achievement. A high span of working memory is considered a guarantee of better or best academic achievement whereas in other cases wise versa. Many researchers and experts focused on providing insight into the behaviour and mental process of learners. With the help of research findings, some guidelines were also developed for effective learning.

According to the National Research Council following strategies can be adopted for effective learning.

1. Shaping and investigating the pattern and features of information processing in working memory.
2. The congregation and systematizing more content knowledge
3. Efficient retrieving strategies
4. Effective methods for better consumption of working memory

Previously, in a later study, Beilock, and Kulp (2004) investigated the ability of VWM about unpredictable visual stuff, and colours, calligraphy, Chinese typescript, arbitrary polygons. At that test objects of different nature were presented, and subjects had to judge if it might have been indistinguishable or twin of the test. It was discovered individuals might remember twice a significant number of shades as shaded cubes. These consequences put forward that VWM is weak not best for the heavy amount of graphics stuff, as well as of the surface multifaceted in nature.

One striking finding from Beilock (2004) study might have been that the changeability of VWM capability was exceedingly associated with a separate graphic pursue slope measure for perceptual complexity. In the second measure, subjects seen a show of a few things of the same kind searched for a pre-specified target. The quantity of things on the show varied, permitting those slopes of quest reaction time (RT) likewise a capacity of set measure to be assessed. Those inclined for shade quest might have been shallower than that to polygon search, which might have been thus shallower than those slants for 3d shape scan.

Results of different studies found that adolescents with low levels of educational achievement indicated low working memory on measures of central executive and visuospatial memory. This recommends compound working memory abilities should be connected toward children' scholastic advancement in the school. Gathercole et al. (2004) evaluated and presented the concept of connection among working memory abilities as well as completing scheduled general educational program evaluations. Empirical studies discovered a close relationship between youngsters' attainments resting on working memory procedures in the achievement of their national educational module evaluations. As it were, the children who scored ineffectively on the evaluation possessed meagre working memory. Reduced working memory limit constrains a person's capacity to meet the necessities of putting away and handling information that may lead to more mistakes.

Evidence shows that working memory capacity can confine the academic achievements of a child. Now researchers clearly established a strong link between pupils' achievement and working memory capacity (Alloway, Gathercole, & Lamont, 2005). Working memory capacity positively or negatively affects students' achievement at school level and on the ward.

Working memory proved helpful to identify from minor to severe learning difficulties of children (Alloway, Gathercole, Willis, & Adams, 2005). Children of special needs are having more working memory deficits than those who are recognized as needed special instructive assistant. It is considered as working memory deficits might support students' malfunctioning from making usual instructive growth. Reduced working memory abilities predict education 2 years afterward of children with learning

impairments, regardless of their intelligence quotient score. Working memory has been playing a very important role in many academic areas, wide-ranging research work establishing a link between working memory and academic achievement especially in mathematics. Visual working memory (VWM) permits us toward grasping graphic information for a couple of moments. It upholds perceptual consistency crosswise over interruptions and saccades of eyes; thus, it is extremely restricted into the specific limit. Just nearly 4 visual questions can be preserved simultaneously (Vogel & Machizawa, 2005).

The poor capacity of working memory hurdle in the acquisition of complex skills and knowledge by delaying and disrupting learning, and as a result escort to meagre scholastic achievement (Alloway, 2006). Often teachers characterized this type of behaviour in students as attentional or motivational problems and concerns, yet although these types of students demonstrate a little proof about attentional shortfalls (Alloway, 2006).

Students, who are identified as working memory impaired, must have to struggle more in class because it is problematic for them to hold information in mind for sufficient time to complete the tasks. These deficits of working memory caused losing crucial information from the mind and forgetfulness of many important things, like, instructions which they must follow, details of their tasks and so on. Due to this type of forgetting and working memory deficits, they must struggle hard to attain a common pace of education and create meagre common school achievements (Gathercole & Alloway, 2008).

Poor working memory leads toward disappointments for basic errands, for example, remembering classroom instructions to add multiple actions linking storage and preparing from claiming data execution for challenging errands (Gathercole & Alloway, 2008). Working memory span not only garnered the achievements level throughout the academic life span but it can also cause stress, anxiety, and disappointment in individuals in case of low achievement.

Although working memory stakes a neuro-anatomical acquaintanceship with those frontal lobes; youngsters with ADHD were compared for the individuals with working memory deficits from claiming cognitive measures. Those discoveries show that the children with ADHD shown raised levels about incautious on rule-breaking behaviour to an extent from and have the higher chance of committing errors on attentional tasks (which required to sustain attention for a little bit longer period of time) as compared to their low level working memory capacity fellows (Gathercole & Alloway, 2008).

Researchers concluded that there are 10-15% of children are suffering from working memory deficits in the mainstream and that will put at risk their academic success. Common problems of working memory impaired children are placed keeping errors, forgetting lengthy sentences and failure of storage and manipulation of information (Alioway & Gathercole, 2009). Working memory shortfalls increase the likelihood of low academic achievement because students recognized as working memory impaired, demonstrate inattentive behaviour and often forget the task which hampers their education (Alloway, Gathercole, Kirkwood, & Elliott, 2009).

Psychologists believe that working memory is a complete and authentic assessor of learning potential because the prior experiences and socio-economic background of the child do not strongly influence it. It only shows the learning capacity of the child (Alloway, Doherty, & Forbes, 2012), whereas other institute-based assessment or else intelligence quotient tests only assess already learned an understanding of the child.

Chunks can be utilized for hierarchical and highly organized knowledge structure for domain specific items. Researcher (Alloway, Forbes, et al., 2012) concluded that the subject matter in which students are interested; students and readers showed very good memory and vice versa. Teachers can polish students' working memory utilization by organizing and understanding patterns and features of the memory. So is the case with curriculum development; if the curriculum is developed and organized in a meaningful way according to the mental and cognitive abilities of students, it would be more helpful in parting knowledge. A lot of efforts are required by the novices for retrieving relevant information from memory and from written material. Fluency of reading is an essential prerequisite of better understanding. A skilled teacher can reduce these efforts of students by developing the abilities of scan and skim into the literature.

2.9 Working Memory and Teaching Strategies

A student with memory difficulties desires methods to stay on learning. 3 kinds of methods are effective: compensative strategies, recall methods. and memory aids. A strong correlation has been found between LDs and dealing with memory difficulties. In Understanding working memory: A Classroom Guide (2007), psychologists Gathercole and Alloway report that 70% more or less of scholars with LDs in reading scored low

on memory assessments. Working memory difficulties are common among students with different kinds of LDs such as language deficits, problem with writing and arithmetic. Gathercole and Alloway found that a lot of students having the problem of attention deficit hyperactive disorder (ADHD) have memory difficulties also. It is vital to notice that not all students with LDs have memory difficulties (Thorne, 2006).

For helping these types of students some strategies are as following:

1. Work on visualization skills.
2. Try games that use visual memory.
3. Play cards.
4. Encourage active reading.
5. Chunk information into smaller bites
6. Make it multisensory
7. Help make connections
8. Give directions in multiple formats
9. Teach students to over-learn material
10. Teach students to use visual images and other memory strategies
11. Give teacher-prepared handouts prior to class lectures
12. Teach students to be active readers
13. Write down steps in math problems
14. Provide retrieval practice for students
15. Help students develop cues when storing information
16. Prime the memory prior to teaching/learning
17. Review material before going to sleep

2.10 Test Anxiety and Academic Achievement

Anxiety while contemplating is a noteworthy indicator of scholastic execution (McCraty, et al., 2000) and different investigations had verified its' harming outcomes. Anxiety not only affects the scholastic achievement but also cause sometimes hazardous effects on the anxious person. Exam nervousness particularly stress have negatively affected on scholastic execution, and working memory (Eysenck, 2001). Moreover, he established to test nervousness diminishes the ability to focus, recall and fixation, thus go to low scholastic execution. Test anxiety hammered the cognitive abilities of individuals while performing a given task and it resulted in disappointment regarding execution and attainment. A research conducted by Ormrod (2001) resulted that the relationship between anxiety and academic achievements cannot easily explicate. This relationship is complex in the sense that it can hinder as well as foster the academic achievements.

People with higher levels of anxiety were discovered with serious issues in working memory like decreased memory span, losing concentration, low certainty level, and poor thinking capacity. Hence, participants bring the issue in their scholastics point when they face on edge experience throughout their contemplate procedure. Studies on anxiety show up that when learners are finishing their class work, exams, assignments, alternately presentations at the end of the day at whatever point they need aid required to perform in front of others (Richards, & Davis, 2004). Eysenck (2001) explained that test anxiety creates academic difficulties by thinking irrelevant thoughts, obsession with reduced concentration as well as attentiveness. In calculation exam anxiety has a direct connection with the recall, thus by affecting memory efficiency, in a sense that it impacts attention and concentration capacity and ability in a result caused low achievement.

Eysenck (2001) set up that exam-anxiety makes unimportant contemplations, distraction, and diminished attention and focus on this manner; prompts scholarly troubles. Test anxiety psychologically disturbs the individuals by creating irrelevant thoughts, attention diversion, and stress of unknown. Moreover, exam-anxiety upset the process of recall and causes actuate consequences for scholarly achievement. Whenever attention and focus are weakening, this upsets memory and similarly, it added to low scholastic accomplishment. For instance, Eysenck (2001) builds up a noteworthy connection amongst test anxiety and school accomplishment where exam anxiety brought about lesser psychological execution. Test anxiety weakens the psychological processing of tasks so resulted in lower grades or marks.

If anxiety increases the achievement of students decreased and vice versa. Further exploring cognitive anxiety, Ashcraft (2002) identified contemplations which bring about higher examine anxiety, for example, fizzling in exam or test, predictions for failure, self-degrading thoughts, getting bring downgrades, keeping within contact by means of coherent within ones' calculation that they have overlooked.

Deliberate anxiety might affect in a different way to separate routes including physiological, behavioural, and cognitive approaches. The physiological manifestations of the anxiety incorporate sweaty palms, fast shallow breathing, high temp flushes, nervousness, agitation, expanded heartbeat, low voice tone, fidgeting, stuttering, trembling irritated stomach, etc. Behaviourally, test anxiety might have a chance to be delineated similarly as those shirking about execution situations, class refusals, and poor academic accomplishment (Aron, Fletcher, & Bullmore, 2003).

There are five important components of the cognitive ability which are directly related to academic progress and these are working memory, processing speed and spatial ability. As mentioned by Thompson while at that place it is a solid relationship between general cognitive capacity and scholastic accomplishment, but these two things cognitive abilities and academic achievement can only predict each other up to fifty percent the rest of other fifty percent variance regarding academic achievement may be unaccounted not meant for via procedures of common intellectual capacity single-handedly (Thompson, 2003).

Masson, Hoyois, Pcadot, Petit and Ansseau (2004) set up those students of the secondary institution by means of higher test wariness showed meagre school execution. At that point, test-anxiety added to scholastic accomplishment considering weakness to distraction and impedance experienced by the researchers. Davis (2008) studied the effects of anxiety; his findings showed that test anxiety caused a decrease in attention span, concentration, and memory which became the basis of low academic achievement. Anxiety affects both physical and mental process of individual and leaves him/her with poor execution of tasks.

The modest link was found in existing potential linking with an abnormal state of anxiety and low scholarly execution of participants. Psychologists found those high degrees of anxiety impact resting on the lessening of working memory, diversion, as well as sensible logic within participants; anxiety directly affect the central executive and as a result, slow down or sometimes stop the logical process of thinking within students (Aronen et al., 2004). The tested effect of TA might be additionally vague, as measures in fact examination psychological and cognitive-affective parts of TA. In any case, these

have not been the only main situation within which test anxiety had seen toward the effect, by means of weak points found during the learning of test related matter, and otherwise called study skills (Cassady, 2004).

Richards and Keogh (2004) articulate that anxiety creates an obstacle for students' educational accomplishments. Different research works concluded that anxious students got more chance to be distracted and took more time on the way to change concentration as of one chore toward the next than those students who are identified as less anxious.

Test anxiety is general in school students only in the USA all most one-fourth of the whole population is affected by it. It is a huge number of students reported by different researchers. A study carried out by Chapell, Blanding, and Silverstein (2005) on 5,551 students in Pennsylvania and Illinois concluded that there is a crucial distinction of academic attainment between the three levels of anxiety less anxious students showed higher academic achievement than the students with moderate and higher level of anxiety and moderate level of anxious students showed high academic attainment than student by means of high level of nervousness. The difference in anxiety level meant many more regarding academic achievements. As the level of anxiety increases, it decreases the achievement level. Test anxiety and academic achievement have a strong negative relationship with each other.

Anxiety/Uneasiness is a subjective sentiment strain, dread, anxiety, and stress related to the excitement of the neural framework. The higher phase of uneasiness is the source of man's typical survival being upsetting, for example, meddling exercises and social soul. Nervousness is one of the outgoing ranges of the enthusiastic and direct issue

(Brown-Chidsey, 2005). That cognitive manifestation about reflects uneasiness is the part that influencing academic execution at a greater amount negatively over passionate behavioural manifestation of pondering anxiety (Robb, 2005). Robb (2005) recommended that cognitive anxiety might need negative correspondence with execution same time physiological tension need curved association with execution.

Exam anxiety is restlessness or else fear encountered prior to, throughout and following exam due to apprehension, stress, and dread of questionable matter. It might have been characterized by the same as a series from claiming phenomenological, physiological and behavioural reactions so as to go with anxiety around workable pessimistic outcomes or disappointment looking into an examination or comparative evaluative circumstances (Zeidner, 2005).

An abnormal state of anxiety in its every form causes low academic achievements. A reasonable quantity of past works had discovered the meaningful connection among scholarly accomplishment and anxiety, and the strong connection was also noted down that where academic achievements were higher squat anxiety was also found (El-Anzi, 2005). Squat levels of anxiety facilities students to work up to mark for higher achievements regarding the academic field. A low level of anxiety makes the students sit tight for studies and preparation of exams. Anxious students required some help from the experienced person to come over their evaluative anxiety. Anxiety might interfere with their academic advance (Rinck & Becker, 2005). Academic advancement and progress highly affected by test anxiety. Anxiety interferes in the sense that it hampers working memory to work properly.

Test anxiety is common amongst the learner; exceptionally test-anxious scholars score something like 12 percentiles below than their low anxious companions. It was contemplated formally since the time 1950s, at that point regular examination for test anxiety was held, which clear up the relationship between the impacts of test anxiety, different manifestations of anxiety, and the effects of its outcome on learning. Martin, 2005; Robb, 2005 recommended so as to subjective nervousness would take in pessimistic connection with the execution and physiological anxiety had a curved association by means of execution. Assumed anxiety from a specific object, thing or event has a negative correlation with the given tasks, whereas results of Robb study showed a bell-shaped relation between anxiety and achievements. Bell-shaped relationship meant positive and negative both types of effects; when the independent variable (test anxiety) is at its lowest point it will increase the dependent variable (achievements), with the incensement in test anxiety an obvious decrement would be acquired in achievements.

The psychological unease is a factor to mainly unambiguously influenced execution (Robb, 2005). As indicated by Keoghi and Bond (2004) that psychological worry had a certain association with execution whenever physiological excitement is squat, it causes a rise in the achievements. An analyst exhibited that students by means of the high altitude of nervousness have a tendency toward bringing down scores within their finish of semester assessment (Hamzah, 2007). A continuing state of anxiety in university students causes low grades at the end of the semester because throughout the semester they found themselves bound to full employment of their abilities in given tasks. The psychologist had directed toward deciding the connection of nervousness and its

impact on scholastic accomplishment a study was carried out by McCraty on secondary school students which resulted that by a higher state of test unease/anxiety scholarly accomplishment bring down (McCraty, 2007). Two more studies were carried out and they articulated the view that abnormal state of anxiety is connected by means of squat scholastic execution (Luigi et al., 2007, & Sena et al., 2007).

Writing starts to develop the idea of the associations amongst anxiety and specific parts of the working memory framework. The existing model of test anxiety considers the multidimensional idea of building as well as illustrating bio-psychosocial aspects in showing an overall model of test anxiety (Lowe et al., 2007). In any case, hypothesis offering clarifications on the effect of TA on subjective variables offers the most search for successful mediation, as the intellectual perspective of TA is by all accounts the key factor adding to inadequate work, narrowed the ability to prepare for the exam. Test-anxiety affected the pre-adult's scholastic accomplishment. It diminishes youths' learning abilities and obstructs phenomenal scholastic execution. Test anxiety affects the inspiration towards the capacity for consideration, focus and most exceedingly it effects for scholarly disappointment. Test anxiety has multidimensional effects, which hinders the attentional span and cognitive process of the anxious person. In the result of high-test anxiety, academic achievements and task execution suffer a lot. Anxiety not only effects the attainments of individuals, but it also creates disappointment in students.

Anxiety has been acknowledged as both giving confidences and to weakening consequences for scholarly achievement. Scientists have been showing up on the connection of anxiety and the result of scholarly execution among understudy institutes, they build up that higher phases of anxiety had brought downward scholastic execution in

these institutes (McCraty, 2007). As stated by the different investigations regarding anxiety of students, the circumstances particular condition responsible for anxiety that is encountered that methodology which hinders the academic execution of a learner (Zeidner, 2007). Separate investigations resulted that those larger amounts of anxieties need to relate with more level of academic execution (Hamzah, 2007; Whitaker Sena, 2007). Different levels of anxiety (normal, moderate, and high) related to different levels of academic achievements; meant different levels may affect differently on academic achievements.

While the cognitive manifestations for considering anxiety incorporate memory disturbances, feeling apprehensive in front of the class, panicking, setting off spotless in exam, over the top worrying, a sense of fear, restlessness, negative thinking, inclination defenceless same time finishing assignments, or absence of enthusiasm toward a challenging liable (Ruffin, 2007). Anxiety effect human in two ways; physically and mentally and symptoms of both are clearly different from each other. Regarding physical symptom extreme stomach suffering is one of the indications of a high level of anxiety whereas cognitive symptoms are concerned; disappointment is an indication of too much high anxiety.

Anxiety is an additional component while anticipating scholastic accomplishment; studies demonstrate that stressing is a factor that connects emphatically with scholarly execution (Whitaker Sena, & Lee, et al, 2007). Participants experiencing higher exam anxiety ends up with occupied by stress reactions as well as emotionally over arousal, their attention is less dedicated to the exam that they are thinking about. Composed reports that look at the impact of test anxiety on scholarly achievements for the most part

of the research reinforce the finding that test anxiety relates to poorer scholastic execution.

Research by Whitaker Sena, Lee, et al, (2007) explored link connecting exam anxiety and scholarly working during school, impacts subjective capacities as well as worry resting on scholastic accomplishment. A huge decrease was found in scholarly achievements amongst the individuals who are identified with higher exam anxiety contrasted with the individuals who are found with low exam anxiety. There are two states associated with test anxiety; state of stress and state of restless, individuals experiencing these states during the exam circumstances are unable to focus on the task at hand. Overviews of research studies hold the view that anxiety during test situation influence the achievement on given tasks and assignments. Anxious person dwells in task-irrelevant thoughts rather than the solution of the task.

Eysenck, Santos, Derakshan and Calvo (2007) suggested a hypothesis on diversion principle which they knew as attention control hypothesis. The attention control hypothesis expects that anxiety fundamentally influences attentional control which is a magic capacity of the central executive. Attention control is that equality the focal point of the two attentions structure, first the ambition-directed method, impacted the individual's ambitions, and second stimulate obsessed scheme, impacted via notable jolts. Anxiety dislocates that harmony linking these 2 frameworks. That incentive-motivated framework turns into powerful in the disbursement of the goal-bound for classification, thus prejudice that effectiveness of command moving works of the central executive.

Test anxiety additionally marked similarly to expectant anxiety. A normal percentage of tension is frequently all the supportive to remain rationally and physically caution. Anxiety; however, brings about enthusiastic or physical distress, trouble concentrating, passionate stress. Secondly, it raises not only scholarly issues but also poor academic preparation. Test anxiety in testing circumstances make a feeling from claiming risk for the individuals; in the form of tension coming about because those feeling disrupts consideration and memory work. Analysts propose that among twenty-five to forty percent of learners practice exam worry. People with learning disabilities tend to halter rates from claiming test uneasiness. People whose background test anxiety tend to make effortlessly diverted throughout a test, knowledge challenge for comprehending moderately straightforward instructions, arranging, or recalling important data (Ying, 2008). Test anxiety hampers the learning of cognitive tasks like language learning. Anxious individuals waste most of their abilities in thinking irrelevant issues, their attention diverted towards other tasks than the task on hand.

Moreover, it was found that a person's examination of evaluative circumstances that add to the experience of anxiety, adverse desires and worries about outcomes earlier, amid and after the valuation undertaking. The two components have appeared to be reasonably free of each other with the subjective part of the TA display thought to provoke the most grounded relationship with test execution results. For instance (Cassady & Johnson, 2002; Putwain, Connors, & Symes, 2010), found that while controlling for the psychological parts of TA, the connection between TA and execution vanishes. These researchers controlled the test anxiety symptoms (like stress, worrying, attention

diversion and irrelevant thoughts) in individuals and in result correlation among test anxiety and academic achievements were weakened or disappeared in some cases.

Test anxiety affects the attentional control process of working memory and causes mala-working of it so resulted in low achievement and attainments (Chen, 2009). Eysenck (2009) in an investigation found that anxiety has negative effects on achievement and controlling attention and in a result caused a low level of attainments. Gender differences have also been documented, for females reporting higher levels about test anxiety over guys (Khalid & Hasan, 2009; Richardson, 2010). Females tend to be more anxious than the male; so, they experience more anxious feelings like dread, fear, sweating palms, shivering and starring.

It may be required to provoke and assistance the students to sit tight for physical caution (Birjandi & Alemi, 2010). A moderate level of anxiety may help students to be active physically and mentally; however, a large amount of test anxiety is hazardous about passionate or physical suffering, focus challenges, and enthusiastic worries. It meddles for students' capacity to get ready to perform looking into tests. Test anxiety or execution uneasiness may be as a relatable point to almost every part for a human trial. A few hopefuls looking for jobs discover it troublesome to recall considerably their names in meetings for exceedingly paid employment (Putwain & Symes, 2010). It is test anxiety that makes a student sweat profusely furthermore inappropriate practically at the perspective about scare in giving the same time inaugural address to a gathering of people.

Test anxiety is not always being terrible; indeed, a low level about test anxiety will be important around those people to concentrate and can electrify them under movement preparing, plotting perfect methodologies that will guarantee ideal prosperity in the examinations. It may be required to stir up and assist the participants to sit tight for physical caution (Birjandi & Alemi, 2010). However, a large amount of test anxiety is risky about zealous or else corporal suffering, focus challenges and enthusiastic uncertainties. It interferes on learners' capacity to get ready to perform looking into tests. Test anxiety or exam uneasiness may be as a relatable point to almost every part for the human try.

Test anxiety is a consolidation from claiming physiological over-arousal, strain, physical symptoms, worry, dread, the dread of failure, that happen throughout test circumstances. It is a physiological stipulation on which people practice extreme strain, anxiety, uneasiness throughout or preceding while taking a test. This uneasiness makes noteworthy obstructions taking in the exam. Research prescribes those large amounts for test anxiety need an immediate correspondence on decreased academic execution also higher generally leading towards learner drop-out rates. Test anxiety needs more extensive consequences, negatively influencing a student's social, enthusiastic, and behavioural development, and also their sentiments around themselves in school (Putwain, 2010).

More prominent nervousness might relate to low scholarly accomplishment. Participants by means of higher purposes of anxiety, causes diminished recall to navigate, lose fixation, in addition, to need affirmation, and reduced thinking capacity. For the most part, an abnormal state of anxiety was even more intently connected with weak

execution among low capacity participants. Studies have shown that anxiety affects students' education and accomplishment around the academic life span (Putwain, 2010).

A study on anxiety finds out that, on a specific point these sentiments of stress and anxiety can be extreme and cause a mind blockage state and physiological disturbance (Kargar, Tarmizi, & Bayat, 2010). A normal or moderate level of anxiety sometimes proves helpful in achieving the targets, but a paramount state of test anxiety jams the mind and creates psychological problems in individuals.

On that point are a few elements influencing scholarly accomplishment, 1 of these is examination worry. According to Pacheco-Unguetti and et al. (2010), exam-nervousness is multidimensional symbols that can subsist recognized the same as the gathering of phenomenological, physiological, and behavioural responses toward show up by means of conceivable pessimistic outcomes otherwise disappointment resting on exam or else comparable judgmental circumstance. . Likewise, a study conducted by the Pacheco-Unguetti, Acosta, Callejas, and Lupianez (2010) they build up an unfriendly result of high trait anxiety on the central executive in students. Trait anxiety affects the central executive in a way that its working hampered so in consequences the achievement also decreased.

Anxiety is defined as an unpleasant inner state of confusion and followed by panicky behaviour, such as ponderings, pacing back and forth and somatic complaints. An anxious person sometimes has subjective feelings of something dreadful to happen, such as the feeling of looming misfortune. Anxiety is characteristic as unrealistic, uneasiness, worry, fear, sometimes generalized and unfocused and caused feelings of

restlessness, problems in concentration and muscular apprehension and fatigue. Anxiety is not perceived as a normal reaction. An overwhelming and distressing state of anxiety falls under psychiatric problems and named as an anxiety disorder. Feeling of anxiety and fear are not same in any sense because fear comes from pragmatic danger and considered as apt reaction just before a danger, whereas anxiety is the condition of being anxious and overreaction toward a condition that is sometimes not real or subjectively seen as alarming (Eysenck & Derakshan, 2011).

Gibson and Adams (2012) concluded test anxiety as an enthusiastic state includes emotion, sprain, nervousness, and its impacts resting on the sensory scheme. State anxiety is a temporary unpleasant enthusiastic situation which affects intellectual abilities in a negative way. A survey of inscriptions had demonstrated test anxiety emerges as of sentiments of unease during evaluative circumstances so that a person encounters within 2 outgoing measurements of disturbing and discernments (stress). Enthusiastic part of test anxiety, at the present named as physiological hyper-arousal, incorporates physiological-full of feeling elements, for example, expanded heart rate, sweating, unsteadiness, and queasiness notwithstanding sentiments of frenzy, apprehension, and pressure. It is concluded from research that exam anxiety lead toward poor academic accomplishment in addition estimation was given that with reference to twenty-five percent of primary and secondary pupils within America, approximately ten million pupils suffer because of test anxiety and show low achievement (MacLeod, 2012).

In another investigation including 9-to 12-year-olds, Ursache and Raver (2014) demonstrated that more elevated amounts of trait (not state) anxiety were related to

poorer execution on moving and hindrance in cognitive undertakings. Trait anxiety hinders in cognitive multitasking which resulted in poor execution of tasks.

In many reviews, the idea has revealed coordinate impeding impacts of characteristic anxiety on working memory. In two examinations, Ng and Lee (2010, 2015) surveyed 11-year-olds' attribute test anxiety and tentatively controlled state anxiety to look at the free and joint commitments of these factors to WM achievement. In both studies, children who revealed more prominent amounts of test anxiety performed all the more inadequately on the WM tasks; on the other hand, there were no huge impacts of state anxiety.

2.11 Test Anxiety and Working Memory

A good working memory proves helpful in learning math and science. Gathercole and Pickering (2000) additionally inspected the connection among participants' WM capacities and their scores on tests. Specially, attainments on vocabulary, science, and education tests were estimated. The appropriate responses demonstrated that aptitudes on working memory assignments related by score on proficiency, vocabulary, and number juggling exams (Gathercole & Pickering, 2000). Furthermore, working memory has a strong impact on vocabulary learning, science, and number management.

In grown-up participants, a link is found out at different stages between working memory capacity and low grades. Each of the examinations presumed to facilitate working memory was nearly and adversely connected toward educational execution. Gathercole and Pickering (2000) studied and gave an overview of working memory capacities which relate to accomplishments on institutionalized measures of examines,

conception, and math. On standardized measures, a clear link was determined for working memory capacities and task completion.

The two assumptions propose working memory (WM; Baddeley, 1986, 2001) as the component supporting the impacts of anxiety on intellectual working. As indicated by PET, anxiety prompts an expansion in migraine (i.e., comprehensions about how one's achievement might be considered by others), which consume WM limit and leaves a little useful limit with respect to the task at hand. The ACT develops this record by determining that anxiety builds the designation of attentional assets to mind, in this manner decreasing the attentional spotlight on the present task. The ACT additionally indicates that stress brought people on edge to review for the confined accessibility of WM by expanding their exertion (e.g., assign extra handling assets) and utilizing helper assets or systems (e.g., repetition learning or articulator practice). Thus, anxiety ordinarily hinders productivity to a more prominent degree than it does viability. Working memory comprises of 1 essential framework, central executive and two sub-slaves' frameworks: the phonological loop and the visuospatial scratch pad (Baddely, 2000).

Eysenck (2001). considered anxiety as an obstacle which set up psychological weakness within working memory limit in individuals going through a higher exam-anxiety. Participants by means of higher exam-nervousness had experienced assignment unessential musings, for example, stresses and restless or so self-evaluative parts of disappointment. This is because of restricted working memory limit and irritating review of earlier education in addition to brought about diminished scholastic execution.

Two reviews led and detailed via Ashcraft and Kirk (2001) checked and bring into being a pessimistic connection among math anxiety and working memory and established the fact that proximity of math worry might confine working memory. A study was organized to check whether arithmetic unease disturbs working memory between 3 gatherings of fifteen college participants of differing levels of math anxiety (Ashcraft & Kirk, 2001).

In conclusion, in the model of working memory, the central executive oversees coordinating data from various frameworks when required. Working memory is the ability to remember, handling and controlling, brief data in the relevant store and make it possible to retrieve the required data transformation when needed (Baddeley, 2003). Working memory abilities play a powerful role in helping to manage tension level during challenging tasks. It may be common information that cognitive aptitudes, for example, WM, processing speed, consideration about self-control are essentially needed for the setting for scientific challenges taking (Fletcher et al., 2003). Those cognitive results of math anxiety have been portrayed previously by a few studies, which connected MA with a hampered WM capacity. Dickerson, Mayes, and Calhoun (2003) observed connection among oral working memory assignments and language understanding of children with mental imbalance; and the results showed that anxiety, bring down oral working memory scores anticipated lesser scores on language appreciation exams. Anxiety affects the ability of novel learning like new terms of the second language and taking input from oral instructions.

Due to the high level of test anxiety capacity of working memory is affected and resulted in attentional downfall in the task in hand. Miller and Bichsel (2004) explored

the impact of science anxiety on arithmetic execution and working memory abilities, it was found that math nervousness was a strong indicator of arithmetic execution as well as affected on working memory assignments. Some other studies by Gathercole, Pickering, Knight, and Stegmann, (2004) demonstrated comparable impacts. Children that were capable of arithmetic and English were wise to WM aptitudes than the individuals who were more terrible in those fields. Students with low working memory also perform low on English and math tests. Relationships were especially high amongst arithmetic and science achievement levels and WM assignments. The connection between English and these procedures was less strong.

Besides, Keoghi, (2004) identified exam-anxiety as a distraction, and this has brought about poor scholastic accomplishment. In view of past studies, test anxiety is connected to bring down scholarly execution. Constant test/exam anxiety obliterates mental abilities and leads toward poor achievement. The negative association indicates that as exam-anxiety expands, participants' scholastic accomplishment diminishes. Poor working memory causes a serious issue in academic achievement due to absent-mindedness. Crosswise over the review of composed reports resting on working memory demonstrated the connection between under-grades and working memory limits within matured participants at different stages (Gathercole, Pickering, Knight, & Steggman, 2004).

The stun of anxiety after working memory is getting progressively clear the same as the past test anxiety models to have obsessed on psychological impedance include not pressed into description poor encoding of test-related material (Cassady, 2004). Attentional control hypothesis, in any case, gives a moderate point by a point system of

the effect that anxiety, all in all, has after working memory assets. This grants for the guided choice and utilization of mediation that would be enabled to give successful intervention to TA. Mediations that lessen the weight of anxiety on working memory or better working memory assets with regards to attentional control hypothesis would be foreseen to affect emphatically on the working issues of people with TA.

An outcome affirmed by Masson et al., 2004, Stober, 2004 and Chapell et al., 2005 who set up the view that learners by way of squat exam anxiety have high scholastic accomplishment than students by means of normal and high exam-anxiety. At the end of the day, participants with direct exam-anxiety have high scholarly accomplishment than participants by way of high exam-unease. One reason which exam–anxiety affected on scholastic working has its impact resting on attention and focus that afterward affects memory and academic working.

Chapell, Blanding, and Silverstein (2005) carried out a study amongst 5,551 undergrad and graduate participants in Pennsylvania and Illinois; they originated a huge uniqueness of scholastic accomplishment with 3 distinct ranks (low, normal, and higher) exam– anxiety. Results showed, participants by way of squat exam-anxiety have high scholarly accomplishment than participants through normal and high exam-anxiety. Additionally, participants by means of shortest test-anxiety have high scholarly accomplishment than participants by means of high exam-anxiety. Past works had distinguished primary components recognized with scholastic accomplishment by and large, which conduce to the representation of principle variable test-anxiety. In an investigation by Alloway, Gathercole, Willis, and Adams, 2005; the impact of psychological capacities and unease on scholastic accomplishment short scores on

working memory assignments were connected to 6 deficiencies in math and sciences examine. According to the studies, WM undertakings the most intense indicators of science and perusing parts.

As indicated by Eysenck, 2001, Sansigiry and Sail, 2006, exam-nervousness, hindered the focus, consideration, and recall, and these turned into variables that affected scholastic execution. Test anxiety hampered three main abilities of student's attention, focus, and recall, which are crucial for better achievement at school.

The impact of anxiety resting on working memory had been broken down as well as the appropriate responses demonstrate that the individuals who have high scores on anxiety, experience the ill effects of shortfalls in working memory along with of poorer quality working into working incidents (Oei & Bermond, 2006). Working memory is a subjective procedure which enables man toward multitasking otherwise all the while considers and holds data in the meantime as finishing different ventures. It is a framework in charge of briefly putting away and controlling data (Alloway, 2006).

Working memory has been observed to be crucial in numerous zones of scholastic achievements, and many studies have associated working memory and scholarly achievements, particularly in math. A student accompanied by meagre working memory limit faces regularly battle inside schoolroom through the achievement of compound information and aptitudes via disturbing and suspending adaption, in this way, adding to deficient scholastic progress (Alloway, 2006). Students with low working memory have to face more problems and to work hard for daily routine and success.

Results of said examination affirmed that with higher arithmetic anxiety people experience issues with expansion towards the task at hand. 5 vital parts of general

psychological cognitive abilities were identified which play a vital role in scholastic accomplishment (Rohde & Thompson, 2007). Those variables are working memory, visuospatial capacity, phonological loop, central executive, and speed processing. As indicated by Rohde and Thompson (2007), common intellectual capacity and scholastic accomplishment cannot perfectly predict each other and over half of the variety in scholarly achievement isn't clarified by general psychological capacity alone.

The phonological loop has a crucial character said to keep the sub-vocal practice of the material to keep up the information in working memory, which is as crucial characters in language cognizance and gaining vocabulary (Kane & McVay, 2007). Therefore, on the whole, discoveries demonstrate that the impact of test anxiety on WM tasks completion is moderately dynamic and advance additionally support to the hypothetical idea that increased volume of anxiety is connected with hindered/ WM process (Eysenck et al., 2007). Research studies showed that increased anxiety hampered the cognitive processing of the central executive so reducing the capacity of working memory. People with limited or low working memory and exceeding anxiety remained backward in attentional management and challenging task management. It may be common information that cognitive aptitudes, for example, WM, speed up processing, consideration about control is crucial in taking scientific challenges (Fletcher et al., 2003).

Looking into measuring technique, on which measuring memory deficits are typically judged; later on, examination for identifying ADHD on the CTRS and BRIEF pointed towards these instructor's testament appraisals scales distinguished a significant percentage of the children for ADHD by identified them as defective or short memory

capacity. Same time in other observations they showed behavioural issues in the classroom. In disparity, low working memory is dominantly differentiated via issue practices of working memory difficulties, including arranging majority of the data. A large amount of test anxiety is a source of decrements in cognitive tasks (Whitaker Sena, 2007). In the above mention test, two things were also differentiated that is low working memory capacity from difficulties in using working memory in challenging tasks, which is sometimes considered as same.

Over further terms, anxiety lifts an individual's attention regarding threat-related jolts. As stated by those ACT approach, the opposed impacts about tension on effectiveness might accordingly be undifferentiated from directing, including attentional control affecting (Eysenck et al., 2007). Attentional control theory also differentiated the effects of anxiety on the effectiveness of different cognitive abilities like recall and focus. That doesn't denote that the nature about execution (as normally evaluated by method for standard behavioural measures for example, such that reaction accuracy) may be so much impaired, particularly if their anxiety prompts the utilization for compensatory methodologies (e. g., a greater amount of effort, or more amazing utilization of preparing resources). Some other overview demonstrated that achievements on working memory tests had a higher connection with numerical execution between youngsters by scientific troubles; (Anderson & Lyxell, 2007).

In likewise manner, the attentional control hypothesis predicts that stress-related discernments are enacted especially in upsetting circumstances that became reasons for obstruction with psychological procedures. Lowe et al., 2007 studied on the bio-psychosocial model of test anxiety and concluded that anxiety is associated with

psychological bends and in addition to their effect leading subjective capacity. As attention is routed to this anxiety inciting and discouragement inner occasions, this thus weakens processing productivity by utilizing attentional assets. As indicated by the attentional control hypothesis, this raises an endeavour reaction for limiting the effect of anxiety/unease on consideration/attention all the way through compensatory measures, for example, working and assistant handling assets to the assignment.

Open introduction of anxiety is guided by two hypothetical systems: attentional control hypothesis (ACT; Eysenck, Derakshan, Santos, & Calvo, 2007) and processing efficiency hypothesis (PET). Even though the two speculations were advanced to represent the impacts of general anxiety on intellectual working, they have been utilized to test anxiety (Eysenck et al., 2007). An essential commence of the two hypotheses is that task execution can be assessed regarding adequacy and proficiency. Power attaches to the nature of task execution and is ordinarily operationalized as reaction accuracy.

Test anxiety is subjective and affected upon situational variables, for example, levels about motivation, assignment complexity, and useful results of secondary or low achievement. It varies clearly starting with one representative with an alternate. Higher test anxiety prompts a dire series of low self-worth, depressed, anger liking of misery and meagre academic evaluation. The meagre academic review might prompt expanded extreme test anxiety leads towards withdrawal (Zeidner, 2007). Anxiety is believed to advance the base up framework over best down procedures, bringing about an attentional tendency and failure to withdraw from apparent danger related jolts (Derakshan & Eysenck, 2009).

A standout hypothesis among influential hypotheses expecting with this relationship Eysenck (Derakshan & Eysenck, 2009) established the results in his research that, working memory limit is answerable for those decrements within cognitive execution about exceedingly exam-anxious people in exam circumstances. These people experience duty- unrelated thoughts such that doubts concerning self-judging viewpoints of disappointment which lead towards incompletely possess of working memory ability. In simple errands, that long-term memory ability might sufficient toward satisfying undertaking prerequisites, in compound errands, however, it might not.

Derakshan and Eysenck, (2009) concluded that common anxiety upsets progressing working memory forms because on edge people dedicate attention regarding their intrusive thoughts and stresses, instead of the job needing to be done. Anxious individuals remain busier in their irrelevant thoughts like the perception of failure, unknown fear, and stress of evaluation rather than actually performing the given tasks. Children because of working memory shortfalls surrounded by an exceedingly soaring danger of deficient academic execution and exhibit preoccupied conduct and absent mindedness that upsets learning (Alloway, Gathercole, Kirkwood, & Elliott, 2009). In the field of the cognitive domain, the latest theory is attentional control theory which focuses on the factors affecting attention and consternation (Derakshan, 2009). The main focal point of ACT is studying about attentional span, attentional control theory explains how anxiety affects central executive and in consequence, affects working memory by decreasing the competency of the central executive which specifically related with working memory and attentional control system.

As per the attentional control hypothesis, anxiety influences the working memory framework, chiefly the central executive, which is believed to be basic to consideration linked activities. The impudence of anxiety leading consideration is under arrest to be real in seeing how anxiety influences examination. The attentional control hypothesis offers a point by point record of the components of the working memory framework that are weakened by anxiety, and in spite of the fact that it uses anxiety as a rule to help its claims, the theory can be connected similarly to TA (Calvo, 2007 & Eysenck, 2009). A vast range of researches discussed the impact of anxiety on different components of working memory and cognitive ability, which causes low achievements in individuals.

The visuospatial sketchpad is believed to be responsible for the transitory storage and treatment of visual information, while the central executive oversees coordination with related parts. As per the attentional control hypothesis, anxiety principally effect on two of these central executive capacities; first ability to incorporate hindrance (the control of undertaking unessential jolts), second attentional moving (capacity to move consideration between different assignments), and the phonological loop (Derakshan & Eysenck, 2009) however not the visuospatial sketchpad. The elements of working memory have been appeared to work in as a vital part in academic results (Alloway, 2011).

The effect of anxiety on working memory turns out to crucial especially when it has appeared that it significantly effects on scholarly accomplishment (Alloway, 2011). Anxiety is considered to influence the attentional control elements of the central executive, whereby two frameworks are much of the time communicating with each other: top-down objective determined consideration along with support upbeat jolt. In

attentional control hypothesis, WM is taken as an institutionalized style toward managing common tensions as well as to incorporated attentional management whereas TA is required as adding tension on the central executive.

Anxiety is considered to influence the attentional control elements of the central executive, whereby two frameworks are much of the time interfacing with each other: top-down objective has driven consideration and base up (Alloway, 2011). Anxiety affects the attentional control in a way that its ability to secure mind from any shock got weaken, so coping with the novel, shocking and at somewhat fearful situation became difficult for an anxious person. Eysenck, 2009, Pacheco-Unguetti, Acosta, Lupianez, Roman, and Derakshan 2012 studied the relationship between anxiety levels and memory capacity and concluded that anxiety affects the working memory capacity and reduce the efficiency of information processing. Effects for normal and moderate levels of anxiety are rather minor or somehow helpful but whereas high anxiety is concerned; efficiency of working memory hampered at a significant level.

Hypotheses with respect to effectiveness and attentional control propose a paramount part for WM on directing cognitive exhibitions (Richards, 2004; Eysenck et al., 2007). Attentional control theory proposes that all cognitive tasks are directed by the working memory capacity. As stated by attentional control theory (ACT) anxiety (which is that cognitive part from worry) is responsible for causing effectiveness. It can be aided through enhancing competency, thereby decreasing those WM limit accessible for supplementary errands (Ashcraft & Kirk, 2001; Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011). Many, researches showed that those competency abilities which are required for cognitive tasks negatively affected by the anxiety. In some studies

psychologists (Eysenck & Derakshan, 2011) accept that anxiety interferes through the productive working of the goal-directed attentional classifications, and also decreasing attentional control.

Here are features that might increase exam anxiety in the participants. Two features are important one the outcome or result of the given task and the other is the surroundings of the test centre; in conclusion, achievement on a test may be affected by test situation and its expected results (Gibson, & Adams, 2012). Intrinsic and extrinsic both factors play a significant role in developing anxious feelings in students. Reasons for test anxiety in participants described via Salend (2012) dread of disappointment, panic for exam groundwork, past meagre exam achievements, squat courage and in addition qualities of test surroundings for example, such that way of the task, level about difficulty of the task, atmosphere, the long-period restrictions, analyst characteristics, mode for test organization and physical settings. On the association between math anxiety and cognitive tasks; past investigations demonstrated that people for constrained working memory (WM) limit might be dropped behind in managing their tension levels during challenges (Hoffman, 2012). Proficiency is resolved as the relationship amongst exactness and the assets utilized to complete the undertaking; it can be assessed by the proportion of accuracy of response time on modify trials (Hoffman, 2012). The detailed depiction of anxiety upon intellectual execution that attentional control hypothesis and supporting writing furnish gives a managing system with which to choose successful intercession.

A broad range of research gives observational help to the proposed negative connections between nervousness and WM working (Eysenck & Derakshan, 2011;

Berggren & Derakshan, 2013). Anxiety has curved relation with working memory capacity; meant if anxiety increases working memory capacity decreases consequently. A person with better working memory capacity and speed up the processing of information is considered more reliable and successful in taking scientific challenges. These cognitive results of working memory and anxiety were also studied by Ramirez with special reference to math anxiety and concluded that typical math anxiety hampered WM capacity (Ramirez et al., 2013). Mathematics studies involve logical thinking, which is a crucial part of working memory, but in an anxious person, this ability of logical thinking is hampered due to poor work of the central executive.

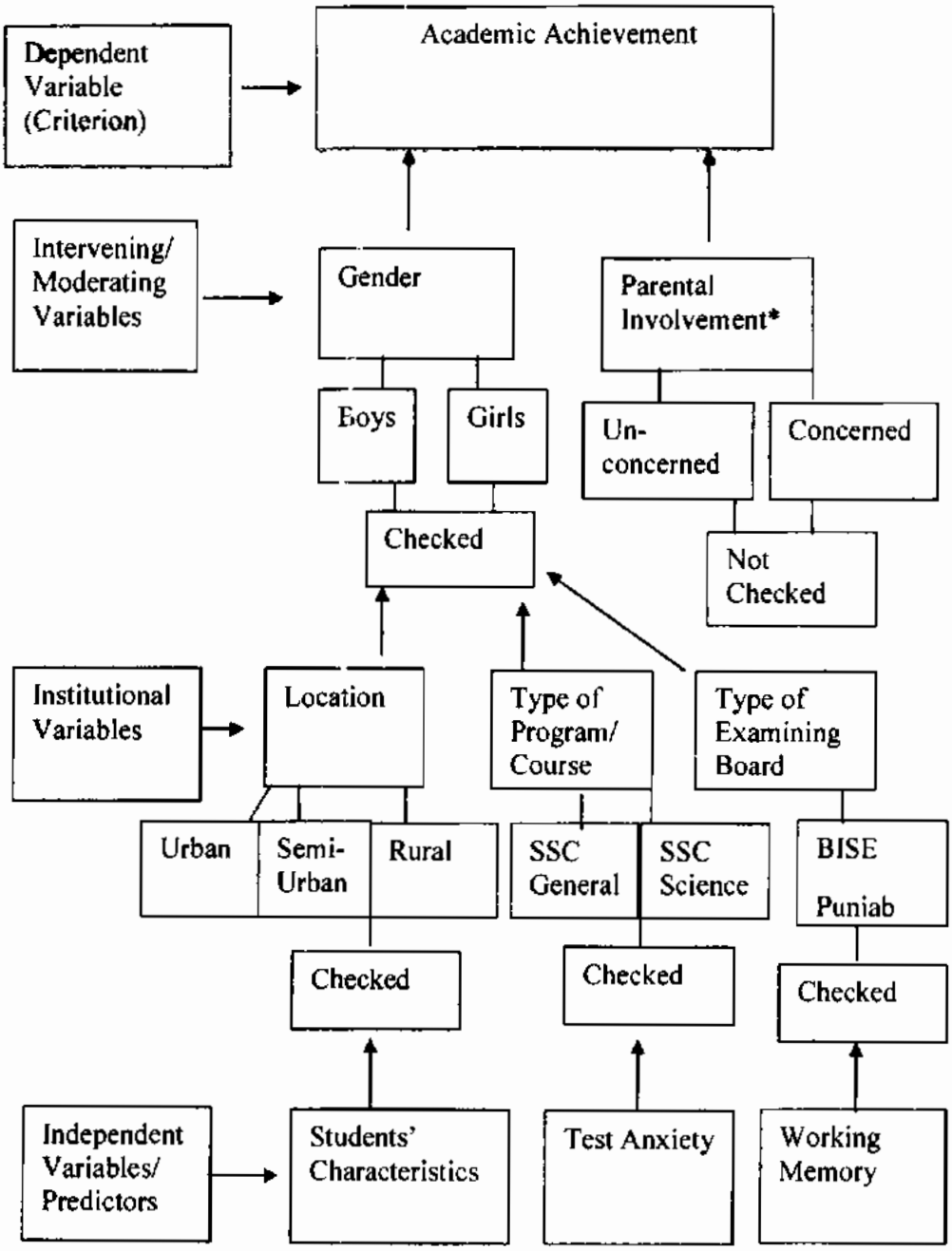
Deteriorating thoughts, tension and physical manifestations that happen throughout test circumstances are due to test anxiety. It has been characterized by Berggren and Derakshan (2013) as a subjective emotional state encountered in front of a particular assessment identifying with the demonstration about finishing those assessments itself, the risk for neglecting and the discerned negative results. It might additionally make a physiological condition, when people encounter extraordinary stress and anxiety in taking a test. Pioneering looking into test anxiety emerged the concept that those causes however hindered on performing while anxiety stuff the majority.

On the association between math anxiety and cognitive tasks; past investigations demonstrated that people for constrained working memory (WM) limit might backward in managing challenges to be done due to their tension levels (Hoffman, 2012, Eysenck et al., 2007; Mammarella et al., 2015). Furthermore, anxiety/worry might diminish their WM assets. Anxiety is considered to influence the attentional control elements of the

central executive, whereby two frameworks are as often as possible cooperating with each other.

After the review of the related literature, it can be said that working memory is a newly emerged concept. Psychologists and researchers are in constant search of facts, techniques, features of working memory and its' relationship with cognitive development. Working memory is said to be an authentic measure of the learning potential of the students; a great deal of research work is carried out in this regard. Alan Baddeley proposed a working memory model with four distinctive elements, among which the central executive plays a vital role during cognitive processing. Research studies showed a good working memory capacity is the prediction of good achievement in cognitive tasks and learning and vice versa. Learning impaired students showed low working memory capacity. Test anxiety is another factor that affects the learning and working memory of the students.

Separate studies were carried out to determine the effect of test anxiety on learning and working memory. After skimming and scanning of the literature need of checking the combined effect of test anxiety and working memory on the academic achievement of the students was felt. There is also very rare literature on gender comparison of especially working memory capacity. So, this investigation was equally planned to contribute to the working memory literature.



*Not included in the design of the study

Figure 2.4 *Paradigm of the study*

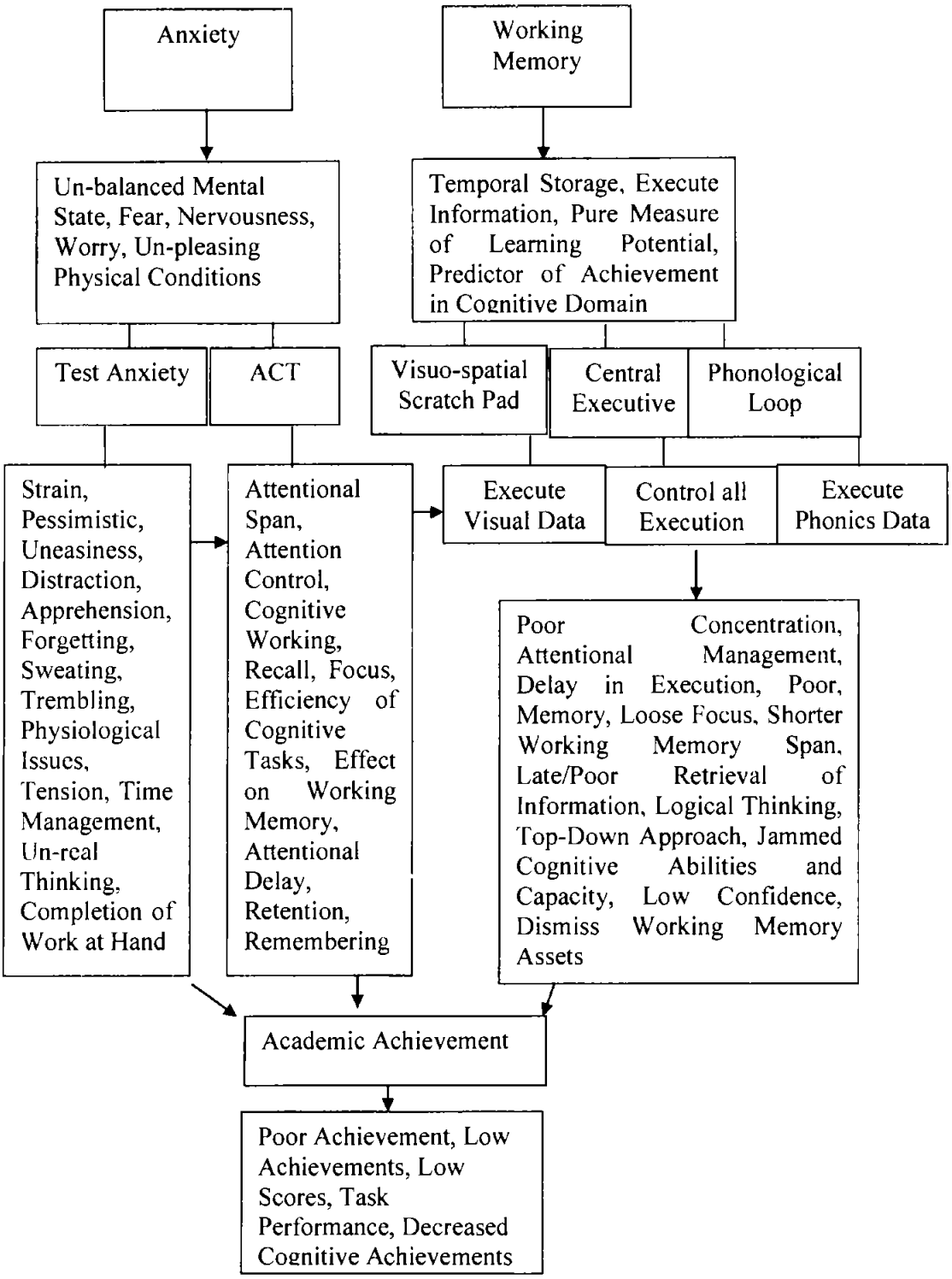


Figure 2.5: *Research-based contents of Paradigm variables/constructs*

CHAPTER 3

RESEARCH METHODOLOGY

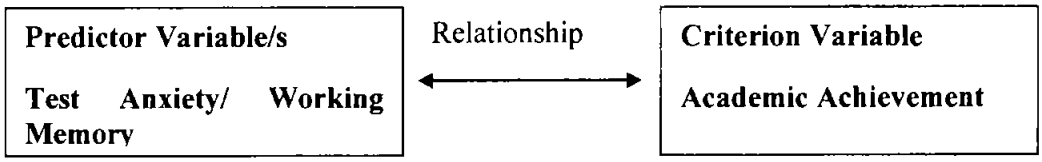
The major focus of this chapter is to present a detail methodological framework of the study. Under the headings of research design, population, sampling, and its' technique, data collection tools, their reliability and data analysis method are explained. All the possible description is given below.

3.1 Research Design

This research study comes under the domain of post positive philosophy, in which quantitative research approach was used. The present research was a correlational study. The correlation research is non-experimental research. It studies the direction and strength of relationship among variables. It generally gathers data on two or more quantitative variables from the same group (or even from two or more logically related groups). Later, it determines the correlation among variables. Correlation methods are widely used in educational and psychological investigations. They enable the researcher to better understand the complex phenomena and to infer the predictions. Correlations are to be interpreted in judicial ways. It requires adequate sample size, the magnitude of the correlation co-efficient and statistical treatment and practical significance. The most critical and serious error happens to interpret correlation as an indicator of causation.

In this investigation data on the variable of interest, predictor variable (Test Anxiety and Working Memory) and a criterion variable (Academic Achievement) was collected through test anxiety scale and memory tests. The co-relational method is a

complicated method of research which not only finds out the possible quantifiable relationship between two or more variables, but it also predicts the direction and intensity of the effect. The co-relation method describes the existing conditions but does not manipulate it (Creswell, 2011; Mertens, 2005).



Source: (Creswell, 2011)

Figure 3.1: *Correlation Research Design*

3.2 Population

Population is the large group, the group of interest to the researchers. It is here from where the results of the study are generalized. Accessibility or availability forms the prime and realistic choice, not an idealistic one. As a manageable group thus, one or more characteristics in common is a group of individuals in which the researcher is especially interested.

In this study the young learners of secondary school studying in the Punjab formed the population. According to the School Education Department, Government of Punjab, in their institutions listed in the year 2013; 3491665 students both boys and girls were studying in secondary classes. There are 9 academic boards of education operating in Punjab. Organically, they are known as Boards of Intermediate and Secondary Education (BISE). They are situated in Lahore, Rawalpindi, Gujranwala, Multan,

Faisalabad, Sargodha, Bahawalpur, DG Khan, and Sahiwal. The population was all boys' and girls' students who were studying in Public schools of Punjab.

Table 3.1

Population

Division	Boards	Boys Schools	Girls Schools	Both	Total	Male Enrolment	Female Enrolment	Total
9	9	3295	2547	76	5918	2013899	1477766	3491665

3.3 Sample Size

The 9 BISES were included in the investigation. The students studying in public schools in and around the location of the boards were sampled. As per board data, there were round about 17, 45832 students studying in 10^{th} class (having passed Boards' 9^{th} class). At first stage, the sample was drawn according to the sample size table proposed by Krejcie and Morgan (1970). According to them on the population size of a 100000a sample size of 384 would be enough and for a population above 100000, a sample size of 400 would be sufficient. At second stage the corrected sample size was determined by using Yamane's Formula. Population size of both genders was different; so, this formula was calculated for both genders separately. According to this formula calculated sample size for boys was 251.889, and for girls calculated size was 251.866 which were rounded about 252 for both genders; so a total of 504 students (252 boys, 252 girls) formed the

sample for the study. The sample was divided into two groups by gender. Both groups were given equal representation.

Table 3.2

Sampling Scheme

S.N.	Board	City	Male	Female	Total
1	Lahore Board	Lahore	28	28	56
2	Rawalpindi Board	Rawalpindi	28	28	56
3	Gujranwala Board	Gujranwala	28	28	56
4	Multan Board	Multan	28	28	56
5	Faisalabad Board	Faisalabad	28	28	56
6	DG Khan Board	DG Khan	28	28	56
7	Sahiwal Board	Sahiwal	28	28	56
8	Sargodha Board	Sargodha	28	28	56
9	Bahawalpur Board	Bahawalpur	28	28	56
Total	9	9	252	252	504

3.4 Sampling Technique

Multistage sampling technique is used for selecting the required sample. At first stage from the province Punjab 9 operating boards of intermediate and secondary education were selected as universal sampling. At second stage the cities where these boards were situated were taken as purposive sampling. No special criteria (except secondary level and public school) for school section (like medium, type, urban, rural) was adopted. Schools were chosen through systematic random sampling from the list at

third stage; for this Kth number was calculated with the formula. At fourth stage students studying in these schools were randomly selected. A simple stratified random sampling technique was employed. In stratified random sampling, the sample is being selected from the subgroups of the population. In this research equal-sized stratified sampling technique was used. 2 strata 1) boys 2) girls were determined. Another consideration was location where the exam boards were located. The students were drawn from the relevant towns/cities, as the area was large. In that case only one class (grade 10) of secondary stage was sampled. This element would also facilitate to arrive at generalization. The sampling scheme was as under.

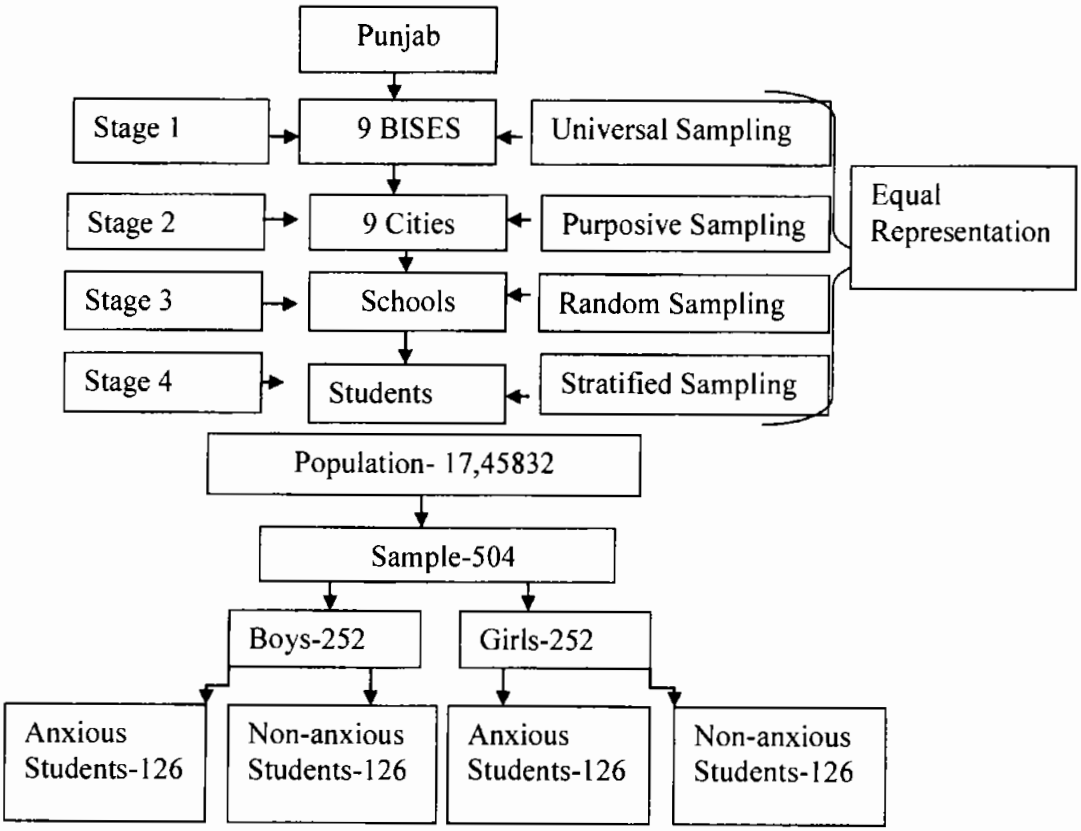


Figure 3.2: *Sampling Technique*

3.4.1 Data Collection

Data were personally collected by the researchers by visiting the selected schools from selected cities. Equal representation was given to male and females as well as cities for selecting data. For getting equal number and boys and girls as anxious and non-anxious students a total of 630 sample was randomly selected: 70 from each city (35 from each gender). After the tests administration the completely filled and falling under the categories of anxious and non-anxious 504 students were selected as final sample.

Equal presentation was given to boys and girls regardless of their population size. In the comparison study single point makes the difference, which can be cause of error type 1 and II. To check and control these errors researcher took equal number of genders as well as equal number of anxious and non- anxious students.

3.5 Data Collection Tools

Consultation with experts was planned for selecting tools for this research. For test anxiety scale an expert of behavioral research from the department of psychology Dr. Seema Gull was consulted and for working memory tests advice was seek from the expert of working memory professor Alan Baddeley. A detail discussion with both experts; standardized tests and scale were selected for data collection.

3.5.1 Test Anxiety Scale

3.5.1.1 Categories of Anxiety Phenomena

Prior to data collection, the researcher considered the extent for forming and classifying the students as anxious or less/non anxious. In the framework of anxiety some conditions included:

I) State-Trait Anxiety: Some students tend to become anxious before the test is administered. They became nervous. This temporary feeling of anxiety is a condition of state anxiety. This is also known threat but leaves a chance of succeeding.

But some students get highly nervous before test taking and cannot concentrate; this pattern of anxiety shows 'trait anxiety'. Achievement of such category of students is hampered by anxiety.

II) Anxiety Affecting Achievement: A small amount of anxiety sometimes improves achievement. A little anxiety spurs action thoughtful and reflective. This is 'facilitating anxiety' yet too much anxiety often interferes with effective achievement. It is 'deliberating anxiety'. An excessive level of anxiety in different situations tends to interfere with memory processes critical for successful achievement.

III) Levels of Anxiety and Levels of Achievement: Anxiety is a critical quality to interfere with a set of processes when a task seeks heavy demands on working memory or long-term memory, like creativity or problem solving.

Thus, highly anxious students tend to achieve at level lower than those of which they are capable of achieving. They become underachievers. Highly anxious students are

so often pre-occupied about doing poorly, and they simply cannot get their minds on what they need to accomplish.

Taking cognizance of same categories of anxiety and their conditioning following scale was identified for classifying anxious and non- anxious students.

Table 3.3

Variables in Test Anxiety Scale

SN	Range of variables reflected in the Test Anxiety Scale	
1	Closer Time	Concentration
2	Worry	Memory
3	Exam	Fear to Failure
4	Loosing Focus	Forgetting Material
5	Recalling Material	After Exam
6	Worrying Much	Too Worn out to Deliver
7	Forgetting Self	Exam Time
8	In Concentration	In Test Taking
9	After Exam Scenario	Worry About Achievement in Exam
10	Struggling Avoiding Work	Lack of Confidence

The Westside Test Anxiety Scale (2004) developed by Richard Driscoll, Ph.D. American Test Anxiety Association; is a widely used valid and reliable measure of test anxiety: It contains of ten items. Also, the instrument is designed to identify the levels of anxiety in students. A student scoring 2.9 and more than 2.9 is considered anxious and blow than 2.9 would be normal (Appendix B). The reliability of this test was measured in

the Pakistani context. The above mention scale was open access scale placed on website mentioned in references. http://www.amtaa.org/scalewest.html

3.5.2 Working Memory Scale

A set of tests was used to measure working memory; forward digit span for the Phonological loop, backward digit span for the executive task and Corsi Block Tapping to measure the visuospatial sketch pad (Tests for measuring working memory were taken on the advice of Prof. Alan Baddeley). THE DIGIT MEMORY TEST by Martin Turner and Jacky Ridsdale (2004) consists of 15 items. DMT is a combination of both forward and backward digit span test and was used for loop and executive tasks. This test was adopted and used intact.

Corsi Block-Tapping Test by Corsi (1972) is an online test for measuring visuospatial sketch pad. The original Corsi Block-Tapping test was adopted by the researcher; some items extracted from original Corsi Block-Tapping-Test for the purpose of the study. This test consists of 8 items to forward digit span. Number sequence and scoring pattern of this test totally based on the original Corsi Block-Tapping Test. The reliability of this test was measured in the Pakistani context.

The working memory capacity of the participants was determined on the combined score of these three tests. For assessing working memory both visual and auditory tests were used. The participants were required to reproduce the listened and observed items (Appendix C).

3.5.2.1 Scoring Process:

Scoring on each test was terminated after 2 successive wrong responses. The individual's score was the total number of items correctly repeated on backward and forward digit span test and for the Corsi Block-Tapping test. The discrete score of value a completely correctly repeated sequence was scored as correct. The combined raw score of this set of tests was converted into the standard score and then in Percentile equivalent according to the tables given by Martin Turner Jacky Ridsdale (2004).

3.5.3 Students Academic Achievements:

The final score of students in the Board exam of 9^{th} was taken as students' academic achievements. For this purpose, schools' record results cards, periodical register and gazettes were concurrently consulted.

3.5.4 Pilot Survey/Study

The adopted scale of test anxiety and tests of working memory were subjected to a well-organized pilot study in order to determine the reliability of research instruments. 10% of sample 54 (27 from each gender) student were taken for a pilot study. The reliability of the test anxiety scale and working memory tests were measured through SPSS 21 software. The reliability of the test anxiety scale was .782, which is considered as sufficient evidence.

The reliability of the digit memory test was .767, which is also considered as sufficiently reliable. And for the Corsi Block-Tapping Test reliability was established at .789.

Procedure for data collection on working memory tests was also decided after pilot study. It was observed during pilot survey that students were facing problem regarding working memory tests, so detail instructions and plan of action were developed. Number of students given test at same time was limited to five to save time or encounter any problem.

3.5.5 Time Frame for Data Collection:

Data collection is the hub of the study, following identification of the population, sampling, and refining instruments. The field work commences the researcher is halfway through. The study has to focus what questions to be asked, data about variables/ hypotheses gathered in a transparent way. The dimensions of the study were meaningful. It related transient (personal) factors (health, fatigue, motivation, stress etc.,) sift factors (distractions); and testing factors (familiarity, institutional environment) and ethical considerations of young learners. The researcher planned a codebook to avoid these pitfalls.

As working memory test was to be administered individually, taking into consideration one by one case. The following framework was observed in this exercise:

Table 3.4

Time Schedule

S.N.	City/Site	Sample size	Estimated Time
1	Lahore	56	1 Month
2	Rawalpindi	56	1 Month
3	Gujranwala	56	1 Month
4	Multan	56	1 Month
5	Faisalabad	56	1 Month
6	DG Khan	56	1 Month
7	Sahiwal	56	1 Month
8	Sargodha	56	1 Month
9	Bahawalpur	56	1 Month
Total	9	504	9 Months

3.6 Data Analysis Methods

Regression analysis was run to discover the correlation of the variables for the rationale of analysis and assembling inferences. Regression analysis was used as it allows predicting some one's scores on one variable, on the bases of one's' score on several other variables. This was human behaviour study having more than one predictor: (like human feelings, actions, anxiety, stresses, memory, and emotions). Further regression measures naturally accruing scores on a number of predicting variables and attempt to establish which set of observed variables gives rise to the best prediction of the criterion

variable. Also, the use of the statistical techniques fit in with the paradigm of the study. For the purpose of comparison t-test was applied.

Table 3.5

Data Analysis

Correlation	Test	Comparison	Test
Test Anxiety and Academic Achievements	Pearson r Analysis	Test anxiety, Male, Female	t-test
		Working Memory Capacity, Male, Female	t-test
Working Memory and Academic Achievements		Academic Achievement, Male, Female	t-test
Test Anxiety Working Memory Academic Achievements	Regression Analysis		

CHAPTER 4

DATA ANALYSIS AND INTERPRETATION

This study focused on the effects of test anxiety and working memory capability on the scholastic achievement of secondary school students. For drawing out the conclusions; Descriptive and Inferential Statistics were used. In descriptive statistics, mean and standard deviation were utilized and in inferential statistics t-test, Pearson r and regression analysis were used. Students scoring more than 2.9 were grouped as anxious and less than 2.9 were as non-anxious. The presentation and analysis of data are given below.

Table 4.1

Levels of test anxiety

Anxiety Levels	Female	Male	
Low test anxiety 1.0-1.9	9	30	
Normal test anxiety 2.0-2.4	50	49	Non-anxious Level
High normal test anxiety 2.5-2.9	67	47	
Moderately high 3.0-3.4	10	12	
High test anxiety 3.5-3.9	99	102	Anxious Level
Extremely high anxiety 4.0-5.0	17	12	
Total	252	252	

According to the result of this table students fall in to six levels of test anxiety (these levels were identified according to the test anxiety scale). As per mentioned in test anxiety scale, a score of 2.9 and more than 2.9 is considered anxious level and blow than 2.9 would be taken as normal anxiety level. Table statistics showed that more female students (67) than the male students (47) fall in moderate level of test anxiety which can also be describe as facilitating level of test anxiety which may become cause of a bit better academic achievement scores for female students. In some levels number of students was low so, these six levels were merged into two levels which is anxious and non-anxious.

Table 4.2

Comparison between academic achievements of anxious and non-anxious female (n=126)

	N	Mean	SD	t	Sig.
Anxious Female Academic Achievement	126	364.65	68.662	59.614	.000
Non-Anxious Female Academic Achievement	126	376.21	50.724		

According to the results of the t-test table, there is a significant difference in the academic achievement scores of the anxious and non-anxious female students. The mean score for anxious female students academic achievement (364.65) and SD ((68.662) which shows deviation of individual score from the mean score) is largely different from the non-anxious female students' academic achievement for whom the mean score is (376.21) and SD (which shows deviation of individual score from the mean score) (50.724). A one-sample t-test was conducted to compare the academic achievement scores of the anxious and non-anxious female students. The p-value (.000) showed a significant difference in the variables. There is a significant difference in the academic achievement scores of the anxious female (M=364.65, SD=68.662) and non-anxious female students (M=376.21, SD=50.724), t (126) =59.614, p=.000. So, the null hypothesis (No.1) of the study which stated that the "there is no significant effect of test anxiety on students' academic achievement at secondary level" was rejected.

Table 4.3

Comparison between academic achievements scores of anxious and non-anxious males (n=126)

	N	Mean	SD	t	Sig.
Anxious Male Academic Achievement	126	322.83	76.261	47.517	.000
Non-Anxious Male Academic Achievement	126	305.06	76.872		

According to the results of the t-test table, there was a significant difference in the academic achievement scores of the anxious and non-anxious male students. The mean score for the academic achievement scores of anxious male students (322.83) and SD (which shows deviation of individual score from the mean score) (76.261) was largely different from the non-anxious male students' academic achievement scores mean score (305.06) and SD (which shows deviation of individual score from the mean score) (76.872). A one-sample t-test was conducted to compare the academic achievement scores of the anxious and non-anxious male students. The p-value (.000) showed a significant difference in the variables. There was a significant difference in the academic achievement of the anxious male students (M=322.83, SD=76.261) and non-anxious female students (M=305.06, SD=76.872), t (126) =47.517, p=.000. So, the null hypothesis (No.1) of the study which stated that the "there is no significant effect of test anxiety on students' academic achievement at secondary level" was rejected.

Table 4.4

Correlation between test anxiety scores, and academic achievement scores of secondary school students (n=504)

	N	Mean	SD	r	Sig
Academic Achievement	504	342.18	74.702	.082	.032
Test Anxiety	504	31.73	6.391		

According to the results of the Pearson r table, there was a significant correlation between the test anxiety scores and academic achievement scores of the students. The r value (.082) showed a significant correlation between the variables. There was a significant correlation between the test anxiety scores and academic achievement scores of the students (M=31.73, SD=6.391) (which shows deviation of individual score from the mean score) and academic achievement scores (M=342.18, SD=74.702), r (504) =.082 Sig=.032. These results are significant at the 0.05 level. So, the null hypothesis (No.1) of the study which stated that the "there is no significant effect of test anxiety on students' academic achievement at secondary level" was rejected.

Table 4.5

Correlation between working memory scores, and academic achievement scores of students (n=504)

	N	Mean	SD	r	Sig.
Academic Achievement	504	342.18	74.702	.007	.882
Working Memory	504	19.26	3.510		

According to the results of the Pearson r table, there was a non-significant correlation between the academic achievements scores and working memory scores of the students. The r value (.007) showed an insignificant weak correlation between the variables. There was an insignificant correlation between the academic achievements

scores of the students (M=342.18, SD=74.702) (which shows deviation of individual score from the mean score) and working memory scores (M=19.26, SD=3.510), r (504) =.007, Sig=.882. This result was insignificant at 0.05 levels. So, the null hypothesis (No.3) of the study which stated that the "there is no significant effect of working memory capacity on 10th class students' achievement" was failed to reject.

Table 4.6

Correlation between test anxiety scores, and working memory scores of students (n=504)

	N	Mean	SD	r	Sig.
Test Anxiety	504	31.73	6.391	-.273	.000
Working Memory	504	19.26	3.510		

According to the results of the Pearson r table, there was a significant correlation between the test anxiety scores and working memory scores of the students. The sig. value (.000) showed a significant correlation between the variables. There was a significant negative correlation between the test anxiety scores of the students (M=31.73, SD=6.391) (which shows deviation of individual score from the mean score) and working memory scores (M=19.26, SD=3.510), r (504) =-.273, Sig=.000. These results were significant at the 0.05 level. So, the null hypothesis (No.4) of the study which stated that the "there is no significant inter-relation between test anxiety and working memory" was rejected.

Table 4.7

Comparison between test anxiety scores of male and female students (n=252)

	N	Mean	SD	t	Sig.
Male Test Anxiety	252	31.04	6.928	3.762	.000
Female Test Anxiety	252	32.41	5.737		

According to the results of the t-test table, there was a significant difference in the test anxiety scores of the female and male students. The mean score for the male students' test anxiety (31.04) and SD (6.928) (which shows deviation of individual score from the mean score) was significantly different from the mean score of female students' test anxiety (32.41) and SD (5.737) (which shows deviation of individual score from the mean score). A paired samples t-test was conducted to compare the test anxiety scores of the male and female students at the secondary school level. The p-value (.000) showed a significant difference in the variables. There was a significant difference in the test anxiety scores of male (M=31.04, SD=6.928) and test anxiety scores of female (M=32.41, SD=5.737), t (252) =3.762, p=.000. So, the null hypothesis (No.7) of the study which stated that the "There is no significant difference in the levels of test anxiety between both genders at secondary level" was rejected.

Table 4.8

Comparison between male and female students' working memory scores (n=504, Female=252, Male= 252)

	N	Mean	SD	t	Sig.
Male Working Memory	252	19.42	3.208	-1.026	.306
Female Working Memory	252	19.11	3.788		

According to the results of the t-test table, there was no significant difference in the working memory scores of the female and male students. The mean score for the male students working memory (19.42) and SD (3.208) (which shows deviation of individual score from the mean score) was slightly different from the working memory scores of female students (19.11) and SD (3.788) (which shows deviation of individual score from the mean score) but this difference was not significant. A paired samples t-test was conducted to compare the working memory scores of the male and female students at the secondary school level. The p-value (.306) showed an insignificant difference in the variables as it was larger than the alpha value which was .05. There was an insignificant difference in the working memory scores of males (M=19.42, SD=3.208) and female students (M=19.11, SD=3.788), t (252) =-1.026, p=.306. So, the null hypothesis (No.6) of the study which stated that the "There is no significant difference in the working memory capacity between both genders at secondary level" was failed to reject.

Table 4.9

Comparison between male and female students' academic achievement scores (n=504)

	N	Mean	SD	t	Sig.
Male Academic Achievement	252	313.94	76.931	8.658	.000
Female Academic Achievement	252	370.43	60.520		

According to the results of the t-test table, there was a significant difference in the academic achievements scores of the female and male students. The mean score for the male students (313.94) and SD (76.931) (which shows deviation of individual score from the mean score) was significantly different from the mean score of female academic achievement scores (370.43) and SD (60.520) (which shows deviation of individual score from the mean score). A paired samples t-test was conducted to compare the academic achievements scores of the male and female students at the secondary school level. The p-value (.000) showed a significant difference in the variables. There was a significant difference in the academic achievements scores of male students (M=313.94, SD=76.931) and academic achievements scores of female students (M=370.43, SD=60.520), t (252) =8.658, p=.000. So, the null hypothesis (No.8) of the study which stated that the "There is no significant difference in the academic achievement between both genders at secondary level" was rejected.

Table 4.10

Regression analysis for inter-correlations between test anxiety scores, working memory scores and academic achievement scores (n=504)

	r	R Square	B	Beta	DF	t	Sig
			295.543		2	10.183	000
Constant	0.88[a]	.008					
Test Anxiety			1.064	.091	501	1.968	.050
Working Memory			.669	.031	503	.680	.497

a. Predictors: (Constant), WM, Test Anxiety

Multiple linear regressions were calculated to predict academic achievement scores based on working memory scores and test anxiety scores. A significant regression equation for test anxiety scores and academic achievement scores was found t= (2,501) =1.968, 10.183 p = .050, 000), with an R^2 of .008. Participants' predicted academic achievement scores was equal to 295.543 – .669 (working memory scores) + 1.064 (test anxiety scores), where working memory was measured as less than or equal to 15= low working memory, above 15= moderate working memory, and test anxiety scores was measured as 0-2.9= normal test anxiety, greater than 2.9 =high test anxiety. Academic achievement scores increased 1.064 points for increase in each point of test anxiety scores and for working memory scores this ratio was .669.

Analysis of the data yielded both predictors have combine effect on dependent variable the value of r(.088) showed significant relationship between the three variables, whereas test anxiety scores was significant predictor of academic achievement scores but

working memory scores resulted as weak predictor for this research. According to the value of Beta (0.91) significant change in dependent variable was observed due to test anxiety scores but the second predictor working memory scores (.031) is causing minor change. So, the null hypothesis (No. 5) of the study states "there is no significant combined effect of test anxiety and working memory on students' academic achievement at secondary level" was rejected.

Table 4.11

Correlation between levels of test anxiety, and academic achievement scores of students (n=504)

	N	Mean	SD	r	Sig.
Non- Anxious Students Anxiety Score	252	26.73	5.312	.144	.022
Academic Achievement of Non- Anxious		340.63	74.127		
Anxious Students Anxiety Score	252	36.72	1.873	.046	.472
Academic Achievement of Anxious		343.73	75.387		

According to the results of the Pearson r table, there was a significant correlation between the levels of test anxiety and academic achievement scores of the students. The

sig. value (.022) for non-anxious students and their academic achievement scores showed a significant correlation between the variables. There was a significant correlation between the level of test anxiety (M=26.73, SD=5.312) (which shows deviation of individual score from the mean score) and the academic achievement of non-anxious students (M=340.63, SD=74.127), r (252) =.144, Sig=.022. These results were significant at the 0.05 level.

Along with the significance value (.472) for anxious students and their academic achievement scores showed a non-significant correlation between the variables. There was a non-significant correlation between the level of test anxiety (M=36.72, SD=1.873) (which shows deviation of individual score from the mean score) and the academic achievement scores of anxious students (M=343.73, SD=75.387), r (252) =.046, Sig= .472. These results were non-significant at the 0.05 level. So, the null hypothesis (No.2) of the study which stated that the "there is no significantly correlation among levels of test anxiety and students' academic achievement at the secondary level" was rejected for non-anxious students whereas the same hypothesis is failed to rejected for the anxious students.

CHAPTER 5

SUMMARY, FINDINGS, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents a summary, findings and based on research findings critical cross-sectional discussion for generating conclusions and recommendations of the study.

5.1 Summary

The main purpose of the present study was to find out the relationship between test anxiety scores, working memory scores and their combined effects on academic achievements scores of the secondary school students of Punjab. A productive education reformer (Alan smith) while working on education in war torn areas in Syria stated that "education can be a part of the problem as well as part of solution." This implies that policies and practices at all levels within the education system need to be analysed in terms of their potential to aggravate or ameliorate conflict. So is the case with anxiety, which like its mother field educational psychology lands to create mental problems and then heals the brain wounds. Anxiety is not only a concept variable but also a construct: constructs are observable and intervening variables. The term invented to account for interval and directly unobservable psychological processes, interconnecting cause and result of behaviour. Intervening is as in the head variable, can't be seen. It is inferred from behaviour examine tests. Learning is inferred from test scores, so as anxiety from test scores too. So, the scientific research uses constructs in reality: inferred from behaviour (Kerlinger, 2000). In this perspective anxiety sometimes proves helpful in

achieving target goals and sometimes hinders in accomplishing goals by affecting the working memory and achievement of the students.

This study focused on fair objective investigating levels of test anxiety, explaining the working memory capacity, their combined effect on students' academic achievement with gender differences on accomplishments. Eight hypotheses were formulated and tested. The study utilized working memory model developed by Baddeley and Hitch (1974) followed by a body of research over decades. The study measured the effects of test anxiety on working memory and academic achievements of the secondary school students of Punjab. It was a comparative and correlation study. The directional objective was to test the combined effect of test anxiety and working memory on the 10^{th} class students' achievement and to explore the role of working memory in establishing success for school students. The literature supported that at the age of 16-year-old working memory capacity is on full level; until and unless some factors affect or impair it.

Students of grade 10studying in Punjab; under the jurisdiction of 9 examining boards formed the population. A sample size of 504 secondary school students was drawn using simple stratified technique, among them 252 were male and 252 were female students. Series of standardized tests for working memory and scale for test anxiety were used to collect the required data and information on variables of interest. Data were collected by personal visits of the researcher to the targeted sample. It was analysed using SPSS 21, for obtaining descriptive and inferential statistics. For analysis and interpretation according to the need different descriptive and inferential tests were used. In descriptive statistics mean and SD was used, whereas in inferential statistics Pearson r, regression analysis and t-test were used.

5.2 Findings

Analysis of the data yielded the following results:

1. According to table 4.1, six levels of test anxiety were found. Three levels form low to moderate level of test anxiety; three levels form high anxiety to an extreme level of test anxiety. These levels were ladled according to the test anxiety scale. For further researcher work, these levels were merged into two levels named as anxious and non-anxious students.
2. According to the results, there was a significant difference in the academic achievement scores of the anxious and non-anxious female students (t= 59.614, p= .000) and male students (t=47.517, p=.000). Non-anxious male and female students tended to perform better in tests and exams as compared to their anxious fellows (Table 4.2 & 4.3).
3. A significant correlation between the test anxiety scores and academic achievement scores of the students (r=.082, p=.032) was found. Test anxiety had a direct impact on the intellectual abilities of the students which impaired achievement. A low and moderate level of test anxiety facilitated better achievement but a high level of it hinders. If test anxiety increased in terms of point, it lowered the academic achievement in consequence and vice versa (Table 4.4).
4. A non-significant correlation (r=.007, p=.882) between the academic achievements scores and working memory scores of the students were observed. Although the relationship between working memory and academic achievements

was there the degree of the relationship was not as strong as to affect academic achievement on a massive level (Table 4.5).

5. There was a significant negative correlation (r=. -273, p = .000) between the test anxiety scores and working memory scores of the students. The findings showed a high level of test anxiety impaired the cognitive achievement of the participants. Anxious students due to their anxiety shorter their working memory span, which plays a powerful role in performing tasks (Table 4.6).
6. According to the results (t=3.762, p=.000), there was a significant difference in the test anxiety scores of the female and male students. Female students tended to show more anxious behaviour than male students (Table 4.7).
7. The finding of this research also showed that there was no significant difference (t= -1.026, p= .306) in the working memory scores of the female and male students. Male and female students differed in working memory capacity. But this difference was insignificant. No gender gap of significant effect in terms of working memory capacity was observed (Table 4.8).
8. According to the results, there was a significant difference (t= 8.658, p=.000) in the academic achievements scores of the females and males. Female students tended to perform better than male students in academic achievements. Male students (M=331.94, SD= 76.931), Female students (M370.43, SD=60.520) (Table 4.9).
9. Academic achievement scores can be predicted based on test anxiety scores and working memory scores. A significant relationship (r= 0.88) was found among test anxiety scores, working memory scores, and academic achievements scores.

If test anxiety scores increase, it would impair working memory, which could cause low academic achievements (Table 4.10).

10. According to the results, there was a significant correlation (non-anxious students, r= .144, p=.022, and anxious students, r=.046, p=.472) between the levels of test anxiety and school achievement of the students. Levels of test anxiety and students' academic achievement scores at the secondary level partly correlated. A significant relationship was found between non-anxious students and their academic achievement scores, but anxious students and their academic achievement scores did not significantly differ (Table 4.11).

5.3 Discussion

The motivation behind this work was to investigate the transaction connecting test anxiety scores and working memory scores (WM) on scholastic accomplishment in secondary school participants. A sample of 504 secondary level students finished a test battery comprising a test anxiety scale and WM tests. The essential impacts of exam anxiety and WM and the two-path association between test anxiety and WM on academic achievement scores were found. Concurrently, tripartite impacts were tried independently for exam anxiety scores and academic achievement scores, exam anxiety scores and working memory scores and working memory scores with academic achievement scores. Test anxiety scores negatively affected academic achievements scores. The stun of test anxiety leading working memory is getting progressively more synonymous with the literature go aboard on. It renovates the temperament of the relations connecting anxiety and particular parts of the working memory structure. The latest models of test anxiety

took into consideration the multidimensional character of the bio-psychosocial features to build a worldwide model of test anxiety.

The consequences of this investigation collaborated with the investigation of Eysenck (2001) who set up an enormous connection between anxiety and academic achievement where a high level of test anxiety brought about lower intellect. The outcome of this study showed no concurrence with the work of Keoghi, et.al, (2004) and Chapell et al. (2005). They set up a connection among levels of exam anxiety and scholastic accomplishment. Intended for example, participants with little exam-anxiety had high scholastic accomplishment than the participants with higher test-anxiety. Calvo and Eysenck (2007) studied the relationship between anxiety level and memory capacity and concluded that anxiety bore an effect on the working memory capacity and reduced the efficiency of information processing.

Besides, the results of the current investigation affirmed the findings of the study carried out by Eysenck (2001). He demonstrated that anxiety disabled the execution by decreasing feasible working memory ability, which consequently was connected to poor academic achievements. Therefore, it can be concluded that exam-anxiety or stress over test and assessment diminishes scholarly execution. Eysenck (2001) established that taxonomy of exam-anxiety makes unimportant contemplations, distraction, and diminished consideration and focus on this manner, prompts scholarly troubles. Moreover, exam-anxiety is identified with memory and be able to actuate consequences for scholarly achievement. Therefore, on the whole, discoveries demonstrate that the impact of characteristic test anxiety on WM errand execution is moderately vigorous and loan additionally supports to the hypothetical idea that increased quality anxiety is

connected with hindered WM working (Eysenck et al., 2007). These results also supported by the study of Ormord (2000) in the sense that the relationship between anxiety and academic achievements are complex and cannot be easily explicated. Davis (2004) studied the effects of anxiety on test-taking; his work showed that test anxiety is caused by a decrease in attention span, concentration, and memory which became the basis of low academic feat.

The findings of the current study were consistent with the results of Zeidner, 2005. He proposed that anxiety influences the working memory and thus acts like an anxiety obstruction whereby participants who have enough acclimatized exam-related data preceding the test, encounter a debilitated capacity to recover that data amid an exam-type circumstance. Although in this research working memory was a weak predictor of academic achievement scores (and that is due to very less variation in working memory scores) but the combined effect of test anxiety scores and working memory scores showed significant results. Memory (Rinck & Becker, 2005) considered as logical factors in different models of TA. It focuses on the impacts of anxiety resting on intellectual, attentional procedures, which have beforehand imagined as subsisted a centre component of psychological test anxiety. Besides, test anxiety has a direct link with memory, thus by affecting memory efficiency, in the sense that it impacts attention and concentration capacity and ability and caused low achievement. Elevated amounts of test anxiety exhibited to meddle through the phonological circle, including the handling of oral data, therefore possibly diminishing the capacity to predetermine exam-related matter (Lee, 2010; Owens et al., 2005).

Cross-sectional studies have established that anxiety is inherent in several factors both internal and external ones. The internal factors are associated with physical growth which is directly related to mental and social growth. Emotional growth is directly related to social growth and indirectly depends on physical growth. The teachers/ educators relate to the whole child: height, weight, moral and emotional characteristics. They need references and norms. Studies have also yielded that although individuals do grow at the same rate, their curves indicate that there is a general pattern of physical growth. Studies of motor development indicate that complex motor skills develop out of simple grasp motor skills. Here the sequence is involved with age level. At the elementary and secondary level, there is a marked degree dependent upon practice. Until puberty boys and girls compare favourably with one another in many motor skills after puberty, however, boys tend to excel especially in the gross motor skills. The fact remains that girls are nearly equal to boys or may surpass them in complex activities that do not depend upon gross strength beans important implications for education. The schools tend to hold conventional ideas about gender variations, contrary to the results the scientific studies relative to the development of boys and girls. The schools tend to develop policies and learning programs that are aggravated to gender differences rather than capitalized on common abilities.

Recent studies hold that a student with regular physical activity and exercise can gain satisfactory academic results in various subjects such as math, reading and sciences (Asigbee, Whitney & Peterson, 2018). Result aptly, unvarying physical activity among students often leads to stress; depression and anxiety level as a result student joyful and spur their academic achievement (Chomitz et al., 2009).

Another set of collaborative studies demonstrate students are a victim of various stresses associated with academic pressure, irregular sleep pattern, financial stress, and hassle of living away from home etc, that results in adverse educational outcomes (Ormord, 2000). In the discrete case, anxiety among graduate students has reported a significant issue in study history that can influence their life outcomes and lower their academic achievement (Schwartz, & Smith, (2013). Consciously, anxiety is a form of pressure that affects students' cognitive achievement.

Another set of conditions associated with test anxiety have been considered by Gibson and Adams (2012).Here the educators have drawn some lessons as the anxiety leads to stress, the severity of stress is the resulting phenomena from an imbalance between demands and resources or pressure exceeds ones' personal ability to cope.

Educators need to examine both physical and psychological effects. On the physical side, the educators must mobilize energy to support body functions, concentrate effects and increased defensive reactions, presence of physical reactions serve as moderator. Excessive reactions generate abnormal functions and in extremism, it affects physical health. The psychological factors take many forms in learner: creates mental and cognitive problems (decline in memory, inattention, and increased forgetting), causes depression (sloppy, lethargic), anxiety (progressive worse), worthlessness (unable to face people), low self-esteem. This leads both students and teachers/educators to become a victim: leading to drug-taking, absenteeism, sleep patterns, disinterested show negligence. The educators must utilize manifold ways to identify stresses by taking quantitative psychological tests and qualitative studies

through observation, case studies and interviews etc. More importantly, educators must address risk cases for stress management.

The comparison results of this study consisted of the research findings of Khalid and Hasan, (2009) who documented gender differences, for females reporting higher levels about test anxiety over guys (Khalid & Hasan, 2009, Richardson, 2010). In this research female participants also report a bit higher test anxiety and better academic achievement scores than the male participants. Test anxiety scores seemed to be work like facilitator method for female. The current research was poles apart from preceding studies in a way that earlier studies focused on test anxiety working memory and academic achievements, whereas the present research focused on correlation and comparison of test anxiety scores, working memory scores and academic achievements scores of male and female students. This explains a slight variation of the results of the present study was slight from the past ones.

5.4 Conclusions

The research study was undertaken to investigate the effects of test anxiety scores on students' working memory scores and academic achievement scores and to compare test anxiety, working memory and academic achievement scores of male and female students. Based on the findings and discussion in preceding sections following conclusions were drawn.

1. It was concluded that test anxiety scores have a strong negative effect on the academic achievement scores of the students. If the level of test anxiety increased consequently academic achievement would decrease. On the other hand, when test

anxiety decreased consequently academic achievement would increase. The same was the case with the relationship between test anxiety scores and working memory scores.

2. Working memory did not affect the academic achievement scores of the students in this study. The link between working memory scores and academic achievement scores is missing; it might be due to the minor variation in the working memory of students.
3. Differences were observed among test anxiety scores and academic achievements scores of the male and female. However, on working memory test male and female students tend to respond similarly.

5.4.1 Generalizations of the Study

Advanced research over a long time need to search for generalization: it amounts to make predictions based on recurring experience. New trends in searches go beyond data independent of vigorous and classical definitions. There are three types of generalizations taking into account by the educational researchers; interact to produce probability models. All of them involve generalizing a treatment or measurement to the population outside of the original study. This set applied here. One refers to the specific treatment producing the same or comparable results in different circumstances. It looks at the aspect within the original environment a factor beyond the treatment generalizing the particular result. It establishes the flexibility of the treatment adapts to new situations. Here, the environment is an institutional environment. All schools of secondary education are offering common curriculum and instructional programs, curriculum, and textbooks of Provisional Punjab Government. All nine BISES work with a close network of

government. Thus, instructional programs and examination standard are uniforms, based on a top-down approach. This further qualifies the criterion variable.

The second form of generalization focuses on measurements rather treatment. Hence, the essential measuring instrument was instructional test anxiety, also the elements of executive memory. In terms of the heuristic approach, the findings would be more generalized either with same or similar results with questions or scale slightly different, or when we use by point scale or unit point scale. The third form of generalization deals with the subjects of the test situation. Here, there was a larger population and randomly selected in terms of clusters (anxious, non-anxious and gender).

The other considerations included statistical treatment using inferential and regression analysis which allow predictability and precision, both are of utmost importance.

5.5 Recommendations

Following recommendations are formulated on the bases of study findings and the conclusions.

1. Test anxiety is a powerful predictor of academic achievement scores as non-anxious students tend to perform better in the exam; it is therefore suggested that the school management may provide some facilities (testing, before, during and at the end of the session and counselling throughout the session) to the teachers which can help in measure, minimize and utilizing test anxiety as a supportive tool for better learning as well as can help in reducing study pressure which causes anxiety (Findings 2,3).

2. Although in this research working memory scores are a weak predictor of academic achievement scores but the importance of working memory in learning is established through many studies so it is suggested that; firstly teachers have to identify students with working memory problems through proper testing and diagnostic techniques than at second step they have to use different strategies for enhancing working memory (like Storytelling, Reciprocal Teaching – Think, Pair, Share, Visuals/Graphics, Mnemonics and Chunking) on daily, weekly or monthly bases depending on the requirement of students along with the test anxiety-reducing tact; so that students can be trained in a proper way to control their test anxiety and positively use (as literature showed the facilitating effect of test anxiety) it for achieving higher goals (Findings 4).
3. The secondary school curriculum and learning activities need to be restructured in consonance with revised Bloom's and Solo taxonomies of measuring learning so that it can be used to test anxiety controlling tool. The present secondary school curriculum is a standard-based curriculum with a set of benchmarks both top-down and bottom-up dimensions must be radically balanced for streaming examination system concurrently.
4. Certain examination-oriented anxiety issues relate to format or type of questions. Objective and structured essay questions need a system based on hardcore or rigorous reform. The examining boards must construct research-based 'test bank' at three levels factual, definitional and conceptual questions of both objective and essay type. They could be further translated into test booklets. The item bank formats of the test may continue to be refined, adding on new blood and process

of standardization. Thus, the system-based testing system forms the vita reforms (Finding 3, 9).

5. Female students tend to be better in academic achievement scores than the male students although in this research test anxiety level of female students is a bit higher than male students. It has seemed that female students are more familiar with the facilitator effects of test anxiety as far as the male students are concerned, the case is reverse. Male students are in need to be trained by the teachers on weekly bases to use their test anxiety as a facilitator for learning by using different techniques like peer learning, oral repetition and before test preparation (Finding 6,8).

5.6 Recommendations for Future Researches

A set of future studies relevant to this area include:

1. In this study only the public sector was focused, future studies can be planned on comparison of private and public-school systems in promoting levels of students learning and levels of measuring learning.
2. This study focused test anxiety scores as an independent variable, causing effects on working memory scores and academic achievement scores; future studies may take working memory as the independent variable and study its' relationship with anxiety and academic achievement.
3. Further studies can be carried out particularly on the back-ward digital span capacity of the students.
4. Separate studies can be planned to carry out on phonological loop function, central executive and visuospatial scratchpad.

5. After an intense review of literature, it is observed that working memory model only assesses and deals with visual and auditory data and the data gained from other three senses are ignored, whereas we see that blind segment of our society take input through touch so the working memory model may be caused for revision. More empirical evidence is desirable.
6. An experimental research study for controlling stress and anxiety during exam like situation may be carried out to check the effectiveness of stress managing strategies.

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Appendix A

INTERNATIONAL ISLAMIC UNIVERSITY
ISLAMABAD – PAKISTAN
FACULTY OF SOCIAL SCIENCES
Department of Education
P.O. Box No. 1243 Telegram ALJAMIA Telex.54068 IIU PK, Tel: 9258008, Fax No.9258008

No. IIUI/FSS/ -2014- Date: September 30, 2014

TO WHOM IT MAY CONCERN

M.S Samina Shahab Reg No. 94-FSS/PHDEDU/S12 is a student of PhD Education program in Department of Education: International Islamic University Islamabad. She is conducting a research on the topic " **Relationship of Test Anxiety and Working Memory Capacity with Academic Achievement of Secondary School of Punjab"** her research work is in progress and she required to collect data from schools of Punjab from the following cities:

1. Rawalpindi
2. Lahore
3. Gujranwala
4. Multan
5. Faisalabad
6. DG Khan
7. Sargodha
8. Bahawalpur
9. Sahiwal

Kindly facilitate her in this regard.

Dr. Samina Malik
Dy. Dean F.C (FSS)
Chairperson, Dept. of Education

DR. SAMINA MALIK
Chairperson,
Department of Education
International Islamic University
Islamabad

NO.EDU(E&A)Misc/2014(Data)
GOVERNMENT OF THE PUNJAB
SCHOOL EDUCATION DEPARTMENT

DATED: OCTOBER 23, 2014

To,

THE EXECUTIVE DISTRICT OFFICERS (EDUCATION),
RAWALPINDI, LAHORE, GUJRANWALA, MULTAN, FAISALABAD, D.G. KHAN,
SARGODHA, BAHAWALPUR AND SAHIWAL.

SUBJECT: - **RELATIONSHIP OF TEST ANXIETY AND WORKING MEMORY CAPACITY WITH ACADEMIC ACHIEVEMENT OF SECONDARY SCHOOL OF PUNJAB.**

I am directed to refer to the subject noted above and to enclose herewith a copy of letter No. IIUI/FSS/-2014 dated 30.09.2014 of International Islamic University, Islamabad – Pakistan, Faculty of Social Science in respect of M.S Samina Shahab Reg No. 94-FSS/PHDEDU/S12, a student of PhD Education Program with the request to facilitate her in collecting data from the Schools (male & female) of Government of the Punjab.

SECTION OFFICER (ADMN)

CC:

- M.S Samina Shahab, Reg No. 94-FSS/PHDEDU/S12, PhD student of International Islamic University, Islamabad – Pakistan, Faculty of Social Science with reference to her request dated 21.10.2014.

Appendix B

Made By: Richard Driscoll, American Test Anxiety Association
Made In: 2004
Westside Test Anxiety Scale

Rate how true each of the following is of you. from extremely or always true, to not at all or never true. Use the following 5 point scale.
5 4 3 2 1 extremely true highly or moderately slightly true not at all true or always true usually or sometimes or seldom or never true
1) The closer I am to a major exam: the harder it is for me to concentrate on the material.
2) When I study, I worry that I will not remember the material on the exam.
3) During important exams, I think that I am doing awful or that I may fail.
4) I lose focus on important exams, and I cannot remember material that I knew before the exam.
5) I finally remember the answer to exam questions after the exam is already over.
6) I worry so much before a major exam that I am too worn out to do my best on the exam.
7) I feel out of sorts or not really myself when I take important exams.
8) I find that my mind sometimes wanders when I am taking important exams.
9) After an exam, I worry about whether I did well enough.
10) I struggle with writing assignments, or avoid them as long as I can. I feel that whatever I do will not be good enough.
_____ Sum of the 10 questions
_____ Divide the sum by 10. This is your Test Anxiety score.
What does your test anxiety score mean?
1.0—1.9 Comfortably low test anxiety
2.0—2.5 Normal or average test anxiety
2.5—2.9 High normal test anxiety
3.0—3.4 Moderately high (some items rated 4=high)
3.5—3.9 High test anxiety (half or more of the items rated 4=high)
4.0—5.0 Extremely high anxiety (items rated 4=high and 5=extreme)

Appendix C

6/4/2014 marvi_sarv123 - Yahoo Mail

Compose | Delete | Move | Spam | More

Re: Hello

Alan Baddeley

Dear Marvi,
I suggest you use keyword digit span for the task. Backward digit span as an executive task and Corsi block tapping to measure the sketch pad.
Good luck with your project.
Alan Baddeley

On 1 June 2014 18:31, Marvi <marvi_sarv123@yahoo.com> wrote:

Dear Sir Good Day
I am student of PhD Education and working on my synopsis these days. Sir I need your help; my research topic is "RELATIONSHIP OF TEST ANXIETY AND WORKING MEMORY CAPACITY WITH AGADEMIC ACHIEVEMENT OF SECONDARY SCHOOL STUDENTS"and I am using your model of working memory. I am trying to get a tool which measures general working memory(not based on any subject like math and chemistry etc) and covers your model of working memory but didn't find yet. Mine problem is this that I can't use any digital test as population for this research is not computer literate; so i have to use manual test for measuring working memory capacity, and the other problem is i didn't find any test yet which covers both phonological loop and visuospatial sketch pad at a time and includes alphabets, numbers and picture span. I shall be very thankful to you if you guide/help me in this regard. Thanks alot
Regards
Regards
Allah Hafiz
Marvi Shah

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THE DIGIT MEMORY TEST

An assessment procedure for specialist teachers to investigate verbal memory difficulties in children's learning. Both parts are administered.

Digits forwards

Start Item A

Finish Failure on both trials of a pair.

Directions "Listen carefully as I say some numbers. When I finish, you say them."

Delivery Digits should be given at the rate of one per second. Administer both trials of each item. Recite digits in an even monotone without any variation in pitch of voice.

Scoring The individual's score is the total number of items correctly repeated forwards.

WORKED EXAMPLE

Item	First Trial	√ or X	Second Trial	√ or X
A	43	√	16	√
B	792	√	847	√
C	5941	X	7253	√
D	93872	X	75396	X

In this example, the total correct is 5.

Digits Backwards

Directions Administer as above but say, "Repeat these numbers after me but this time I want you to say them backwards." Give two practice trials of two digits first – any two numbers If the child gets them wrong - correct her or him. If the child repeats the digits *forwards*, give a reminder that they should be reversed.

Score As for digits forwards.

Final score Total number managed (ticks) backwards and forwards *added together.* Consult Table 1 for standard score. This can also be expressed as a percentile equivalent: consult Table 2.

Comparison Most people can remember two more digits forwards than they can backwards. If the gap is larger than three, or smaller than one, this may be worthy of note.

Table 1

Table 1: Estimated standard scores for digit memory performances from six years to adult

Age	6	7	8	9	10	11	12	13	14	15	16	Adult
Raw score 4	74	57	60	58	54	55	50	48	52	52	51	50
5	79	63	65	61	59	59	55	53	56	56	55	54
6	85	69	70	66	64	64	59	57	60	60	59	57
7	90	75	75	71	69	68	64	61	64	64	63	61
8	96	81	80	76	74	73	68	66	68	68	66	64
9	101	87	85	81	79	77	73	70	72	72	70	68
10	106	93	90	86	85	82	77	74	76	75	74	71
11	112	99	95	91	90	86	81	78	80	79	78	75
12	117	105	100	96	95	91	86	83	84	83	82	79
13	123	111	105	101	100	95	90	87	88	87	86	82
14	128	117	110	106	105	100	95	91	92	91	89	86
15	134	123	115	111	110	105	99	96	96	95	93	89
16	139	129	120	116	115	109	104	100	100	98	97	93
17	144	135	125	121	121	114	108	104	104	102	101	96
18	150	141	130	126	126	118	112	109	108	106	105	100
19	155	147	135	131	131	123	117	113	112	110	108	104
20	161	153	140	136	136	127	121	117	116	114	112	107
21			145	141	141	132	126	122	120	118	116	111
22			150	146	146	136	130	126	124	121	120	114
23			155	151	152	141	134	130	128	125	124	118
24			159	156	157	145	139	134	132	129	127	121
25						150	143	139	136	133	131	125
26						154	148	143	140	137	135	129
27						159	152	147	144	141	139	132
28						163	157	152	148	144	143	136
29								156	152	148	147	139
30								160	156	152	150	143
31									160	156	154	146
32									164	160	158	150
33												154
34												157
35												161
36												164

TABLE 1

Standard score	%ile equiv	Standard score	%ile equiv	Standard score	%ile equiv	Standard score	%ile equiv
54	0.1	77	6	100	50	123	94
55	0.1	78	7	101	53	124	95
56	0.2	79	8	102	55	125	95
57	0.2	80	9	103	58	126	96
58	0.3	81	10	104	61	127	96
59	0.3	82	12	105	63	128	97
60	0.4	83	13	106	66	129	97
61	0.5	84	14	107	68	130	98
62	0.6	85	16	108	70	131	98
63	0.7	86	18	109	73	132	98
64	0.8	87	19	110	75	133	99
65	1	88	21	111	77	134	99
66	1	89	23	112	79	135	99
67	1	90	25	113	81	136	99.2
68	2	91	27	114	82	137	99.3
69	2	92	30	115	84	138	99.4
70	2	93	32	116	86	139	99.5
71	3	94	34	117	87	140	99.6
72	3	95	37	118	88	141	99.7
73	4	96	39	119	90	142	99.7
74	4	97	42	120	91	143	99.8
75	5	98	45	121	92	144	99.8
76	5	99	47	122	93	145	99.9

Corsi Block-Tapping Test 1973

http://www.millisecond.com/download/library/CorsiBlockTappingTask/

Application
Measuring the storage capacity of spatial short-term memory and of learning in spatial working memory.

Administration
In the test of immediate block span nine irregularly distributed blocks are displayed on the screen. A pointer in the form of a hand "taps" on a certain number of blocks one after the other. The respondent's task is to tap the blocks either in the order shown or in reverse order. After three items the number of blocks increases by one. The test is terminated if the respondent answers three successive items incorrectly.
To calculate the supra-block span, the respondent's immediate block span is first determined. Items are then presented that contain the number of blocks in the immediate block span + 1 (SBS=UBS+1). The test contains 24 items and includes a sequence that is repeated eight times (the target sequence). The test ends when the respondent reproduces the target sequence correctly.

Reliability
The reliabilities for the immediate block span are consistently high; internal consistency on the basis of the norm sample assessed is $r = .76$.

Validity
The block-tapping test is regarded as the gold standard (Baddeley, 2001; Piccardi et al., 2008) for measurement of the spatial memory span. For more than three decades the validity of this test has been repeatedly confirmed in the neuropsychological literature and it has been widely used in clinical contexts.

The Corsi Block-Tapping Task is widely used for the assessment of visuospatial short-term memory, originally developed by Corsi (1972), this test entails simple measurements that can be administered quickly and easily. The task consists of nine cubes mounted on a board. The examiner taps a sequence of blocks, which the participant has to repeat subsequently in the correct sequential order Cutoff scores were calculated on the basis of these data, which can be applied as a clinical criterion. That is, following the **criteria of Lezak (1995)**, a performance level of more than 1.3 *SD* below the control mean is regarded as "borderline," and a performance level of more than 2 *SD* below the control mean is classified as "retarded" (p. 159). The test was terminated if the participant failed to reproduce two sequences of equal length. Only a completely correctly repeated sequence was scored as correct; self-corrections were permitted here.

8–5
6–4
4–7–2
8–1–5
3–4–1–7
6–1–5–8
5–2–1–8–6
4–2–7–3–1
3–9–2–4–8–7

3–7–8–2–9–4
5–9–1–7–4–2–8
5–7–9–2–8–4–6
5–8–1–9–2–6–4–7
5–9–3–6–7–2–4–3
5–3–8–7–1–2–4–6–9
4–2–6–8–1–7–9–3–5

The sequences with a length of four or greater are reported in Smirni et al. (1983). The other sequences are derived from Capitani, Laiacona, and Ciceri (1991).