CHAPTER – III

RESEARCH METHODOLOGY

The pursuit of knowledge is an exciting journey characterised by inquisitiveness, investigation, and methodical exploration. In this chapter, we embark on the methodological journey that forms the basis of our research endeavour. A well-structured methodology creates the framework for our research, thereby ensuring its rigour, validity, and reliability, in the same way that a compass guides an explorer through uncharted territory.

Hence, it is an important chapter which defines the research by providing all the required information, detailed description of the procedures, techniques, and methodologies used to collect and analyse data, ensuring that your research is reliable, valid, and reproducible. This section enables the reader to assess the validity of our research and comprehend how we reached our conclusions.

Research methodology, in simple words, means the way to methodically addressing the research subject.

In it, we examine the different stages that a researcher usually undergoes to logically examine his research problem. When discussing RM, we take into account the rationale behind the approaches we employ in connection with our research investigation and clarify why we are using or not using a specific approach or technique to ensure that the outcomes of research can be analysed by us or by other individuals.

For the current research in verbal component of working memory, all attempts are made to outline the methodology after due deliberations on various aspects of the research process. All care has been taken to select the most suitable and appropriate options where ever available to ensure that the methodology is more specific to the subject matter and provide a guiding direction to the researcher.

Consequently, the topic of the research has been arrived at by the researcher after a lot of in-depth analysis of the literature available on the topics related to Working Memory (verbal component only). During course of the initial investigation and knowledge acquiring spree, the idea of conducting the research and the logic behind doing so will become more and more clear.

With such clarity of thoughts, it will be easy for the next phase when the data is assimilated and analysis is done. The whole concept of giving back to the society starts making more and more sense.

Our study explores the various facets of the relationship between verbal working memory, achivement motivatoin, study habits and the academic performance among the students.

3.1 Scope of the study

The scope of the study establishes the limits and parameters within which the research was conducted. It describes the precise aspects of the topic that will be covered. For this research we have defined the scope as under:

a) Since verbal working memory is considered as main the criteria which influences the cognitive activities of any individual, hence emphasize was laid to assess and measure verbal working memory in students (age 15-20 years) using specific test of working memory.
b) The scope of study is also to assess the effects of verbal working memory in relation to achievement motivation, academic performance and study habits in students.
c) Also, the endeavour of the study was to see the effects of study habits in students and to understand how achievement motive plays an important role in escalating academic performance in students.

The research scope ensures that the research remains focused, manageable, and in line with the overall research objectives which are detailed in the next section.

3.2 Objectives of the study

This part clarifies the purpose and aims of our investigation and provides a roadmap for our research endeavour. They serve as guiding beacons that illuminate the path to a deeper comprehension of the topic. They define the specific outcomes and insights we hope to achieve with this research.

In this part, we outline both the research's overarching objective and the specific, measurable objectives that will contribute to its accomplishment. Each objective is designed to address a specific aspect of the research questions, ensuring a thorough examination of the investigated phenomenon.

We have outlined the following objectives for this research:

1. To study verbal working memory status of school /college students.
2. To study the achievement motive of school/college students.
3. To study the academic performance of school /college students.

4. To study the study habits of school /college students.
5. To study the effect of gender on achievement motive.
6. To study the effect of gender on academic performance.
7. To study the effect of gender on study habit.
8. To study the effect of verbal working memory on achievement motive.
9. To study the effect of verbal working memory on academic performance.
10. To study the effect of verbal working memory on study habit.

In addition, these objectives serve as a basis for evaluating the study's effectiveness and influence. At the conclusion of the journey, they will serve as benchmarks against which we measure our progress and evaluate the depth of our understanding.

3.3 Hypotheses to be tested

This section signals the beginning of our scientific inquiry, as we enter the domain of informed speculation. Hypotheses serve as the heart of empirical inquiry, providing testable propositions that steer our research towards significant conclusions.

In this section, we outline the hypotheses underlying our research. These assertions express our expectations regarding the relationships, effects, or consequences we anticipate observing, based on available knowledge and theories.

Each hypothesis is meticulously crafted with the goal of being specific, measurable, and verifiable. This allows them to be rigorously evaluated against empirical evidence. In the long run, the acceptance or rejection of these hypotheses will contribute to the corpus of knowledge surrounding our research questions.

It is essential to keep in mind that hypotheses are not eternal truths, rather they are provisional assertions subject to empirical scrutiny, as we proceed. They serve as a framework for research, inviting us to analyse, interpret, and infer meaningful conclusions from the collected data.

For our research, we have crafted the following hypotheses:

- There is no significant difference in achievement motive between boys and girls.
- There is no significant difference in academic performance between boys and girls.
- There is no significant difference in study habit between boys and girls.
- There is no significant effect of verbal working memory on achievement motive.

- There is no significant effect of verbal working memory on academic performance.
- There is no significant effect of verbal working memory on study habit.

3.4 Geographical coverage

This research was conducted on students from the city of Udaipur, Rajasthan. The data collection was done from schools and colleges in the urban area.

3.5 Sample

A total sample of 200 students between the age group of 15-20 years, from secondary, higher secondary school and degree students. The above sample will then be categorized into 3 groups of Verbal Working Memory (VWM) – high, medium and low and which will be taken for the study. The number of male and female students are equally divided into 100 each with each having equal numbers from schools and colleges i.e., 50 boys from schools and 50 from colleges, and the same for girls sample population.

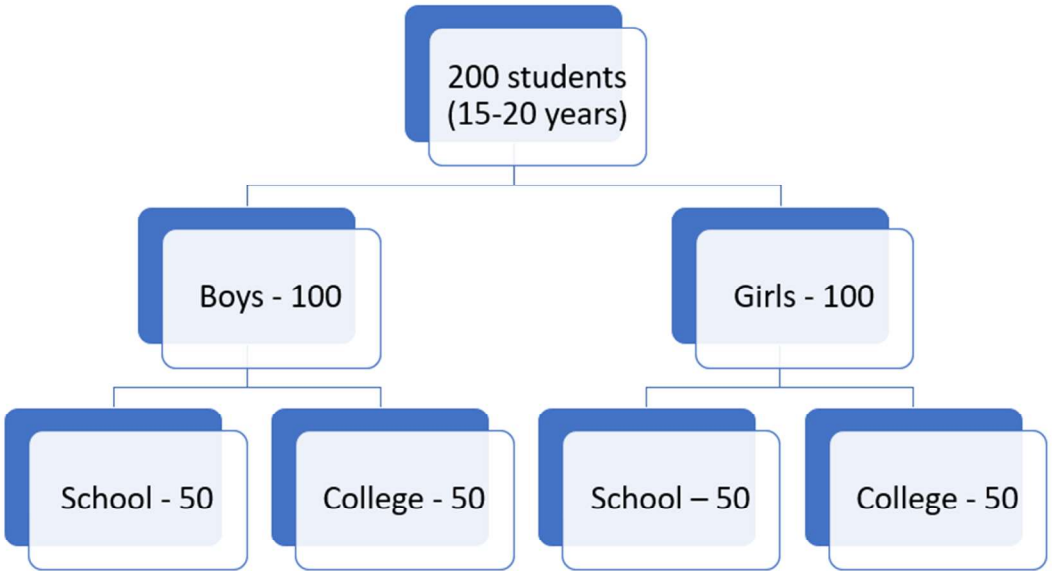

Fig. 3.1 : Sample size and its break up

Inclusion and Exclusion Criteria:

- Inclusion of secondary, higher secondary and degree students
- Inclusion of English medium school students
- Exclusion of rural students
- Exclusion of Hindi medium school students
- Exclusion of students with Learning disabilities

3.6 Research Design

2x3 Factorial design was chosen to accomplish the study's objectives. In this research, as we have 2 independent variables (Verbal Working Memory & Gender) and amongst which one (Gender) has two levels, i.e., male & female and the other one (Verbal Working Memory) has three levels of High, Medium and Low, we will use a 2X3 factorial design to understand the effect of them on each dependent variable, i.e., Achievement Motive, Academic Performance and Study Habits.

Table 3.1 : 2X3 Factorial design

		Gender	
		Male	Female
Verbal Working Memory	Low	Group 1 Low Verbal Working Memory / Males	Group 4 Low Verbal working memory / Females
	Medium	Group 2 Medium Verbal working memory / Males	Group 5 Medium Verbal working memory / Females
	High	Group 3 High Verbal working memory / Males	Group 6 High Verbal working memory / Females

3.7 Variables

The following variables have been identified for the study:

Independent Variable

Level of Verbal working memory

1. Low
2. Medium
3. High

Type of Gender

1. Boy
2. Girl

Dependent Variable:

1. Achievement Motivation
2. Academic performance
3. Study habits

Controlled variable:

1. Age of students – 15 years to 20 years
2. Area of institutions – Urban

Table 3.2 : Information of tests used for the research

Aspects of the study	Test	Developed by
Verbal Working Memory	Digit Span Subtest (WISC)	David Wechsler
Achievement Motive	Achievement Motivation Test	V.P. Bhargava (2009)
Study Habits	Palsane Sharma Study Habits Inventory (PSSHI)	M.N Palsane and Sadhna Sharma

3.8 Description of test and tools used

A bio data document was created for students to be filled up before taking any test. It included the personal details and the students were apprised that their personal details would only be utilised for the research purposes.

Standardized Psychological tests of Verbal working memory, achievement motive and study habit available in the field:

1. **Digit Span Subtest** – It is a subtest of the standard Wechsler Intelligence Scales for Children - (WISC). Digit Span (DGS) is a measure of **verbal short term and working memory** that can be used in two formats, Forward Digit Span and Reverse Digit Span.
2. Achievement Motivation Test (ACMT) by V.P. Bhargava (2009)
3. Study habit inventory PSSHI (Palsane & Sharma)

The data collected from the above tests were analysed using SPSS version 21.0 in addition to the Microsoft Excel and Microsoft power point applications. Few images from MS Power Point source were used to create figures to enhance the discussion at several places.

Let's take a detailed look with respect to the above tests and questionnaires which were used to collect the data for this research.

Wechsler Intelligence Scales for Children (WISC) -Digit Span (DGS)

The Digit Span test is a primary instrument created for evaluating **verbal working memory.** It is also used as a neuropsychological measure to test attention and working memory. It consists of forward recall part and backward recall part for digit sequences. The backward digit span gives more precise evaluation of overall working memory capacity than the forward digit span. This is because it requires not only storing the numerals but also cognitively reversing their order, which places a substantial strain on the cognitive aspect of working memory. A child with low scores (more than 1 SD below the mean, for example) on the backward digit recall test is likely to have a deficient verbal working memory.

The Digit Span test is a widely utilised instrument in psychology and neuropsychology for assessing the verbal working memory capacity of an individual. It assesses an individual's capacity to briefly retain as well as manipulate an exact series of numerals. Here is a description of the Digit Span test, as well as information regarding its validity and reliability:

Typically, the Digit Span test consists of 2 sections:

- forward digit span and
- backward digit span

In the forward digit span, the person taking the test reads a series of numerals audibly at a consistent speed, and the test taker must recall those digits sequentially. In the backward digit span, the examiner will call out a sequence of numerals, and the examinee is required to recite the digits in reverse order.

Reliability:

The reliability of test results refers to their consistency and stability. The Digit Span test has demonstrated excellent reliability across multiple studies. The Digit Span test has demonstrated moderate to high test-retest reliability. It signifies the consistency of results over a period of time.

Validity:

It is the degree to which a test measures what it is designed to measure. It has been determined that the Digit Span test has acceptable construct validity, meaning that it accurately measures verbal working memory capacity. It is supported by theoretical

models of working memory and has been utilised extensively in research and clinical settings to assess working memory abilities.

Additionally, the Digit Span test has demonstrated excellent criterion-related validity. It has been established that it correlates with other assessments of working memory, such as complex span activities and other tests assessing similar cognitive functions.

Notably, the reliability and validity of the Digit Span test can vary based on test administration procedures, demographics of the population, and scoring methods. When utilizing the Digit Span test in assessments, researchers and practitioners should use standardized administering procedures while considering any particular psychological characteristics reported in the literature.

Achievement Motive Test by V.P. Bhargava. (2009)

The Achievement Motivation Test was created in 1994 by V.P. Bhargava. It is a test of sentence completion with fifty incomplete sentences. Each item has three options, and respondents must select one by placing a checkmark next to it.

This test is designed to determine the individual's N Ach score. The test is founded on lines that follow the design created by Bishwanath Mukherji as well as the Sentence Completion Test technique. The evaluation consists of 50 partially completed sentences that must be finished by selecting any of the three alternatives that are supplied for each item. The children are given instructions on how to confirm the alternative by selecting one of the potential replies that most accurately reflects what he really feels in response to the query put forwarded by the item. It is anticipated and expected that, while scrutinising the object, the subject would consider all conceivable aspects that could be thought at that time. Therefore, his checkmarks on the other replies (which he chooses) would disclose his true emotions. By highlighting each item, his answers on the entire examination will be marked. For the purpose of determining the subject's accuracy in responding to the inquiries from the test, the exam comprises repetitive questions. Comparable responses to comparable test questions indicate consistency in test-taking. This was done to prevent the time interval gap effect that usually occurs when an experiment is carried out after an interval of time. Efforts have been made to encompass as many facets as are administratively practical and feasible. The average time required to administer a test is 30 minutes, including the time required to give students instructions. While administering the exam to the subjects, it is preferable for the person taking the test to

seat them in a manner that prevents them from communicating or consulting with one another about the responses they should evaluate. This is sufficient to detect the response feigning that typically occurs when a test is given in a group setting. The author believes that language variable effect and the social desirability or acceptance influences cannot possibly be reduced. It might always exist.

Following the procedure of collecting items from various sources (via experts), combining them, and then selecting them based on their individual merits, the test was constructed. The same procedure was used to determine potential alternative responses with similar competitive appeal value. When an initial design of the test (which comprised of 75 items) was completed, an initial assessment session was carried out on 35 subjects to assess the practical feasibility of the test and to identify which of the questions are 'not acceptable' and could be deleted without compromising the validity of the test.

As a consequence of the preliminary test, 25 items with low acceptability and feasibility were eliminated, and 50 items were kept for the final version.

Standardization of the achievement motive test

The final version of the 50-item Achievement Motive Test was administered to 600 college-bound students (300 of each gender and 300 female and 300 males) between the ages of 16 and 22.

Reliability

The Achievement Motive Test's reliability was determined using the test-retest method.

The reliability of the Hindi and English versions was determined independently by administering the AMT (Hindi version) to 100 college-aged male and female students and then to the same sample 30 days later. The correlation coefficient found was 0.87, which is statistically significant at the 1% level of significance.

The English version of the Achievement Motive Test was given to a sample of 100 female college students who spoke English as their primary language. The Achievement Motive Test was administered to this sample again 30 days later. The correlation coefficient was 0.91, which was significant at the.01 level of significance.

Palsane and Sharma Study Habits and Inventory (PSSHI)

To measure the study habits among students the **Palsane and Sharma Study Habits and Inventory (PSSHI),** standardized by M N Palsane (Pune) & Sadhana Sharma (Agra) was administered.

The PSSHI is founded on the premise that effective study practises and abilities are essential for academic success. The inventory seeks to assess different aspects of study habits, including time management, focus, taking notes, literature comprehension, test preparation, and self-evaluation.

Typically, the PSSHI consists of a succession of statements regarding various study habits and abilities. Respondents indicate the extent to which they engage in each behaviour or possess each characteristic using a Likert scale. The inventory captures positive study habits (e.g., "I allocate specific time for studying each subject") as well as negative study habits (e.g., "I waste time during study hours"). The results of the inventory may give information about a person's study habits and potential improvement areas.

In research and educational settings, the PSSHI has been used to evaluate the study habits and abilities of students across different ages and academic levels. It can aid educators and researchers in identifying areas in which students may require assistance in developing effective study techniques.

Notably, although the PSSHI can provide insightful information, it is a self-assessment which depends on individuals' perceptions and reports of their study patterns. In conjunction with other tests and observations, it may be beneficial for gaining an in-depth knowledge of students' study habits and abilities.

It is made up of 45 items which assess various aspects of study habits. It measures students' study habits in eight domains, including:

1. Budgeting time (5)
2. Learning motivation (6)
3. Memory (4)
4. Note-taking (3)
5. Physical conditions (6)
6. Reading ability (8)
7. Taking exams (10)

8. Health (3)

Answers rely on a three-option Likert scale comprising "always or most of the time," "sometimes," and "rarely or never," and they are respectively scored as 2,1 and zero.

Inverse scoring is applied to 11 of these items. The total marks which can be obtained lie in the 0 to 90 range, with scores of 60 or more demonstrating an appropriate level of study habits, scores between 31 and 60 suggesting reasonable or moderate study habits levels, while 30 or lower scores signaling an undesirable study habit levels. Possible score range for each subcategory is as follows:

- Time management: 0 to 10;
- Physical conditions: 0 to 12;
- Learning motivation: 0 to 12;
- Reading ability: 0 to 16;
- Note-taking: 0 to 6;
- Memory: 0 to 8;
- Taking tests: 0 to 20; and
- Health of study: 0 to 6

Utilising the 3-part continuum technique, a rating was determined for each subcategory. This was accomplished by subtracting the lowest score from the top score and dividing it by 3. The resultant value represents the gap in the 3 grades representing the desirable, relatively desirable, and undesirable levels within all the subcategories.

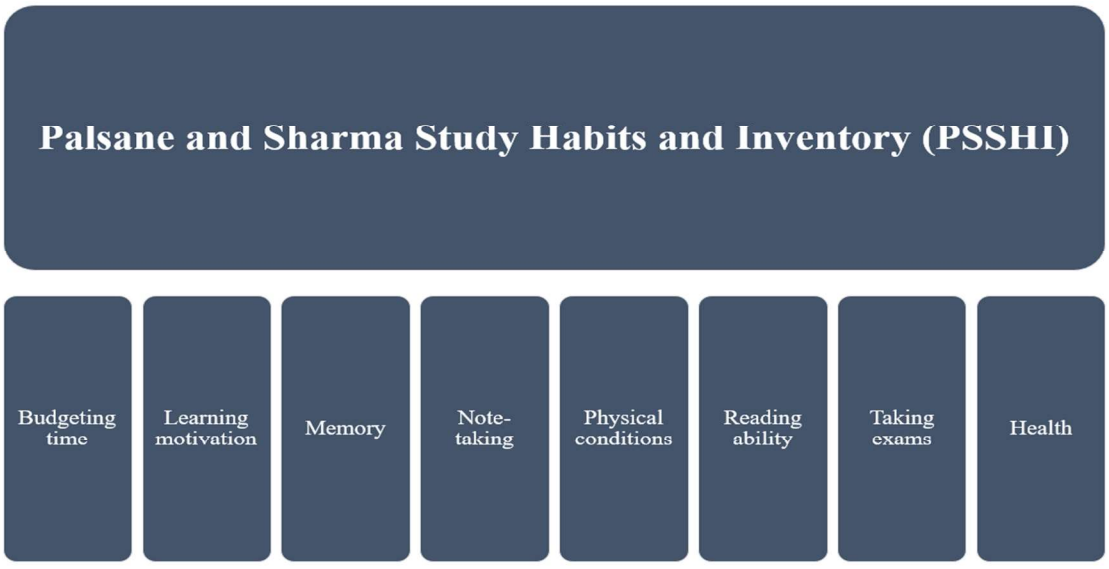

Fig. 3.2 : Domains of Study habit test

Reliability: The PSSHI is more reliable than other study habits assessments hence it has been used in numerous researches to determine the connection between study habits and academic performance. The test-retest (with a gap of four weeks) reliability co-efficient is 0.88.

Validity: This inventory of study habits is an itemised list with only face validity. Face validity is the degree to which a measurement or assessment purports, on the surface, to gauge what it is intended to measure.

ACADEMIC PERFORMANCE

Academic achievement was measured using the percentage/grade from the prior term/class. To categorize, a score of 82% or greater was deemed "good academic achievement," 68%-81% was deemed "moderate academic achievement," and a percentage below 68% was deemed "poor academic achievement" or high, average and low, respectively.

3.9 Procedure and administration of test

A total sample of 200 students between the age group of 15-20 years, from secondary; higher secondary school and degree students. The sample was taken from Udaipur, Rajasthan. The data was collected through Convenient Sampling. The study was conducted on 200 students administering verbal WM tool. Basis which the students will be categorized into 3 groups – High, Medium and Low. Each group were then administered the achievement motive tool and study habit tests and the results will be collated to test the hypotheses.

Administration of the Digit Span Test

Once the student is seated comfortably in a well-lit room with no distractions, and rapport was built to make him/her feel safe and secure. The goal and directions of the digit span test were explained to the student who was instructed to attention to the numbers which were read out. Once this is done, they had to repeat the same.

Procedure:

The student is expected to remember a series of digits (numbers) in the right sequence right after the person taking the test has spoken out each number or sequence in a monotone manner. The total number of the series is gradually increased by one digit till the participant can no longer recall it accurately. The above continues till the test

participant fails. When an individual misses two numbers in a row, the examination is terminated.

Scoring:

The score of an individual is the cumulative number of items reiterated forwards appropriately.

Example:

Table 3.3 : Example of scoring for Digit Span test

ITEM	FIRST TRIAL	TICK MARK OR CROSS	SECOND TRIAL	TICK MARK OR CROSS
A	43	√	16	√
B	792	√	847	√
C	5941	X	7253	√
D	93872	X	75396	X

The total correct answers are 5 in the above instance.

The exam is also administered in reverse order, using the identical procedure as for the forward sequence.

Backward series:

Similar instructions are given for the backwards series but this time the student has to remember and repeat the numbers in the exact opposite sequence. The student is given two trials of 2-digits and if he/she recalls the numbers in the forward manner, he/she is then reminded to give the numbers in the reverse order.

Procedure: In reverse series, the person taking the exam speaks the numbers out loud in a monotone tone. The individual who participates is required to recite each number or series in reverse order after hearing them. To aid the participant's comprehension of the examination, an example is provided.

Scoring: Same as digit forwards.

Final Score: All the correct answers (both backwards and forwards) are added together. Table 3.3 is referred for scoring. The same can be calculated as percentile equivalent by referring to table 3.4.

FINAL SCORE:

Table 3.4 : Example of final scoring for Digit Span test

Total forwards and backwards:	
Standard score:	
Percentile equivalent:	

Norms for catergorization of verbal working memory levels were as follows:

- Students with score of 124 or above were considered to possess high verbal working memory
- Students who scored between 106 till 123 were considered as students with average verbal working memory
- Students with a score of 105 or less were considered to possess low verbal working memory

The above norms were arrived at by calculating the mean score of all the students and standard deviation (SD). The lower range value was calculated by subtracting 1SD from the mean, while the higher range value was calculated by adding 1SD to the mean. The middle range was categorized as average score. The same method was used for the remaining three variables as well.

Administration of the Achievement Motive test

This was the second test conducted on same sample of students who had completed attempting Digit span test. The students were asked to fill the socio demographic details on the first page of the test booklet. It was ensured that no personal details would be disclosed and all personal details of the students would be kept confidential.

This was done in small batches where students were given instructions to listen carefully and an example was explained to ensure that they have understood the right way of completing the test.

Instructions:

On the following pages 50 incomplete sentences have been given. For each incomplete sentence three alternative answers which may complete the sentence have been given. Select the most appropriate alternative answer sentence and put a tick mark√ in its box. Please do complete all the 50 incomplete sentences. Remember to give honest feedback and complete the booklet. You will be given 30 minutes to complete the whole test.

Procedure:

Once the students are seated comfortably and ready to listen to instructions, the subjects are given 30 minutes to complete the test without leaving any question unanswered. Subjects are then explained how to start the test. They are asked to read the statements carefully which has three options a, b, c and select the alternative response that best reflects their true emotions. It is anticipated and presumed that the subject, while involved with the process of examining the item, would take into account all conceivable elements of the item that could be considered at that moment.

Scoring:

The scoring procedure is straightforward and can be accomplished using an evaluation key. One mark for every correct answer.

Each of the items demonstrating Achievement motivation (N-Ach) is assigned a score of 1 for every correct answer, and the sum of all scores is the N-Ach score. The range of score is 00 to 50.

Norms for catergorization of achievement motivation levels were as follows:

- Students with score of 24 or above were considered to possess high achievement motivation
- Students who scored between 17 till 23 were considered as students with average achievement motivation
- Students with a score of 16 or less were considered to possess low achievement motivation

Administration of the Palsane and Sharma Study Habit Inventory (PSSHI)

After completing the two tests on verbal working memory and Achievement motive, the third test was conducted to determine the study patterns and routines.

After a short break same set of students were handed over the PSSHI test sheet which contains 45 statements. Each statement has 3 alternatives and the students is asked to read the statement carefully and then place a tick on the correct statement which suits them as the best option or which they practice in their studies. Again, they are asked to respond honestly and complete all the question without leaving any of them.

Following instructions were given to the students - the manner in which you prepare for tests in school and college can have a significant impact on how well you do on those tests. The statements that follow describe the ways in which you typically

engage in academic pursuits. We are interested in learning about your study habits so that we may better assist you in achieving the desired results on your upcoming test.

Therefore, the active participation of yourself and others is vitally necessary.

Once the students are seated comfortably and ready to listen to instructions, the subjects are given 30 minutes to complete the test without leaving any question unanswered. Subjects are then explained how to start the test. They are asked to read the statements carefully which has three alternatives (a) Always or Mostly, (b) Sometimes and (c) rarely or Never and choose one of the alternative responses which holds good for them and is true to their way of studying. It is expected that students will give fair responses and do justice to the test by attempting all the questions with honesty.

An example was given which was also present in the questionnaire as part of the instructions and the students were asked to follow the same way of completing the test. They were also informed that in case they had any doubts in any of the questions/statements. Though this test is not restricted by time limit, but still it is expected that the students would respond to all the statements with complete honesty within 20 minutes.

Scoring:

The simple statement and dotted statement table are used for scoring.

Simple statement table

Table 3.5 : Simple statement table scoring for Study Habits

Response	Score
Always/ mostly	2
Sometimes	1
Rarely or never	0

Dotted statement table

Table 3.6 : Dotted statement table scoring for Study Habits

Response	Score
Always/ mostly	0
Sometimes	1
Rarely or never	2

The minimum possible score was 0 and the highest was 90.

- Total scores of 81 and above were considered High study habits score.
- Total scores between 66 and 80 were considered average study habits.
- Total scores 65 and below were considered as low study habits score.

In this chapter, we have methodically defined the research methodology that will serve as the backbone of our research and also have established a robust framework for inquiry by employing a well-thought-out research design, exhaustive data collection methods, and stringent ethical considerations. The stated scope, objectives, and hypotheses provide distinct direction for our investigation. It is essential to acknowledge and rigorously address the inherent limitations and constraints. As we progress into the empirical phase, this methodological foundation will serve as our compass, guiding us to valuable insights and a deeper understanding of the topic.