CHAPTER 3

METHODOLOGY

Research is a purposeful and systematic study of a problem. For any systematic study, methodology is vital and it is science of orderliness. It is adopted for the purpose of arranging facts and principles in systematic way. Researchers use different methods in their investigation. The appropriate method selected helps the investigator to utilize time, money and energy in an efficient manner.

In this chapter the overall design of the study, description of the sample of the study, data collection instrument, pilot study of the data collection tool, data collection procedure and data analysis techniques are presented.

3.1 Overall Design of the Study

The overall design of this research study is survey. Fraenkel and Wallen (2003) describe survey as follows: 'Survey is an attempt to obtain data from members of a population to determine the current status of that population with respect to one or more variables. Educational Survey method was chosen for the present study. National Council of Educational Research and Training (NCERT) stated that these survey provide basic inputs to develop educational plans at micro-level as well as macro-level, to formulate educational policies, and to monitor the progress of various educational activities. The investigator selected a sample of respondents and administered the inventories to collect information on variables namely, metacognitive awareness and learning style preference of higher secondary school students. The survey was conducted on 14 higher secondary schools in Coimbatore city.

3.2 Description of Variables

The variables taken for the present study are learning style preference, metacognitive awareness and academic achievement. For analysing the first objective stated in chapter 1 the independent variables were metacognitive awareness and learning style preference and the dependent and continuous variable was the academic achievement. For the objectives 2,7,8,9,10,11 and12 the personal variables, academic variables and facilities available at home were the independent variables and the metacognition and

learning style preference were dependent variable and for the objectives 3,4,5 and 6 metacognitive awareness was the dependent variable and learning style preference was the independent variable. The personal variables selected for the study were gender, locality, type of family and monthly income of the family. The academic variables were medium of instruction, types of school and groups of study and the facilities available at home like separate study room, news paper, computer and internet facility were also considered.

3.3 Locale of the Study

The present study was undertaken in Coimbatore city in Tamil Nadu. Coimbatore is an educational hub of south India comprising of 67 engineering colleges, 3 medical colleges, 2 dental colleges, 28 polytechnic Colleges and more than 150 Arts and Science Colleges and 146 government schools and 85 corporation schools, and 188 matriculation (private) higher secondary schools. The city has reputed universities like Tamil Nadu Agricultural University (1971), Bharathiar University (1982), Anna University Coimbatore (2007) and Avinashilingam University (1987). In 1867, the first group of students appeared for the SSLC Examinations from Coimbatore. The Coimbatore Education District (not the same as the revenue district) is the unit of administration for education in the city. The literacy rate in the city is 80 percent.

3.4 Sample

The sample selected for the present study consisted of 1005 higher secondary school students from 4 government, 4 corporation and 6 private schools in and around Coimbatore city. Convenience sampling technique was used in the selection of participants.

Table 3.1, 3.2 and 3.3 provide the background information about the sample selected for the study. Figures 3.1 and 3.2 presents the personal and academic profile and Figure 3.3 presents the facilities available at home of the higher secondary students selected for the study.

Table - 3.1

Personal Profile of the Student Sample

S.No.	Particulars	Category	Number 1005	Percentage
1	**Gender**	Boys	420	42
		Girls	585	58
2	**Locality**	Rural	880	88
		Urban	125	12
3	**Type of family**	Nuclear	848	85
		Joint	157	15
4	**Monthly income of the family***	EWS- upto Rs.12,000/-	304	30
		LIG - Rs.12,001 to Rs.18,000	406	41
		MIG - Rs.18,001 to Rs.37,000	162	16
		HIG - Rs.37,001 to Rs.62,000	133	13
		SHIG - Rs.62,001 and above	NIL	NIL

Note: *Tamil Nadu Housing Board (TNHB) Classification (2011)
EWS=Economically Weaker Section, LIG=Lower Income Group, MIG=Middle Income Group, HIG=Higher Income Group, SHIG=Super Higher Income Group.

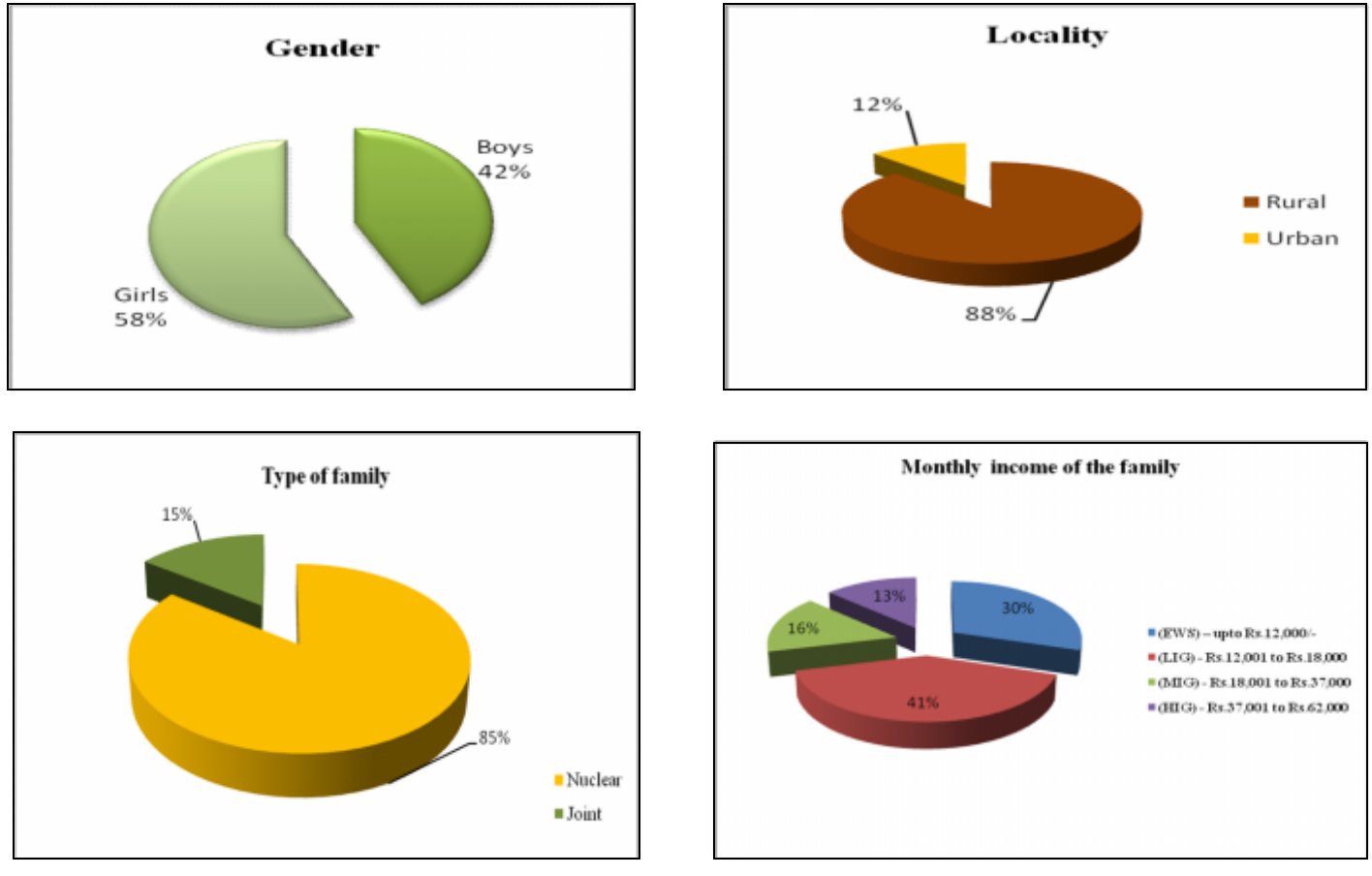

Figure 3.1 **Personal Profile of the Student Sample**

As seen in Figure 3.1, of the total sample, 58% constituted girls and 42% were boys, locale-wise distribution shows that majority of the students are from rural setting. It is also seen that students from nuclear family constitutes the majority of the sample and income-wise comparison shows that majority of the students selected for the study fall under the low income group and economically weaker section.

Table -3.2

Academic Profile of the Student Sample

S.No.	Particulars	Category	Number 1005	Percentage
1	Medium of instruction	Tamil	716	71
		English	289	29
2	Types of school	Government	400	40
		Corporation	400	40
		Private	205	20
3	Groups of study	Mathematics	83	8
		Science	103	10
		Computer science	274	27
		Commerce	346	35
		History	40	4
		Vocational	159	16

Table 3.2 presents the academic profile of the students. As most of the students in government and corporation schools opt for Tamil medium, the percentage of students in Tamil medium is more compared to the students who opt English as the medium of instruction. The graphical representation of data presented in Table 3.2 is given as a pie chart in Figure 3.2.

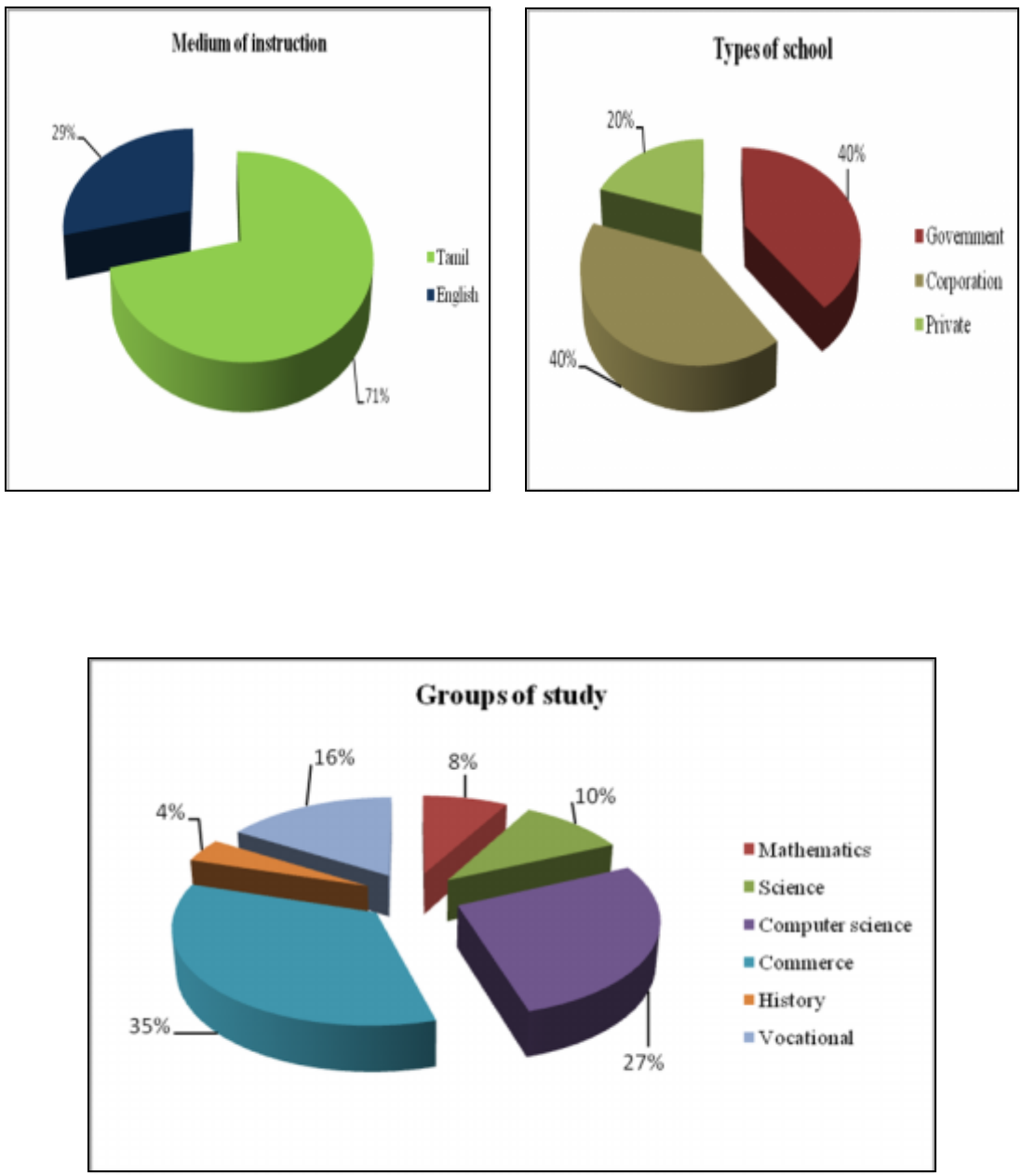

Figure 3.2 **Academic Profile of the Student Sample**

Table 3.3

Facilities Available At Home of the Students Selected for the Study

S.No.	Particulars	Category	Number 1005	Percentage
1	**Separate Study room at home**	Yes	228	23
		No	777	77
2	**Computer**	Yes	208	21
		No	797	79
3	**Internet Access**	Yes	130	13
		No	875	87
4	**News paper reading**	Yes	576	58
		No	429	42

Four important facilities related to learning were considered for the investigation, namely availability of separate study room, computer, internet access and news paper. Students who read newspaper daily were considered for the study. Table 3.3 shows that majority of the students do not have separate study room, computer and internet in their home. whereas majority of the students have the habit of reading newspaper at home. The graphical representation of the data is given in Figure 3.3

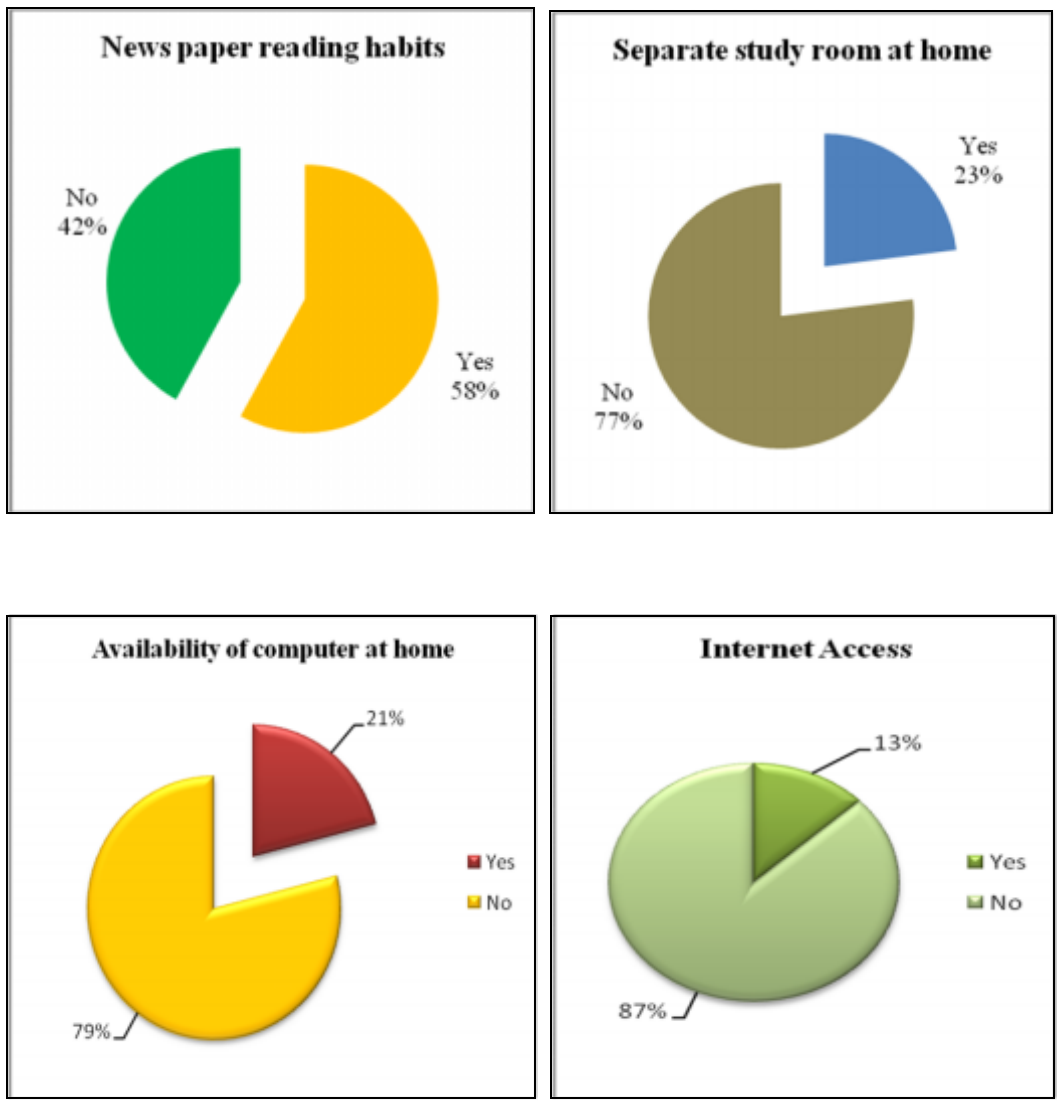

Figure 3.3: **Profile for Facilities available at home**

3.5 Data Collection Tools

The instruments that are employed to gather new facts or to explore new fields are called data collection tools. Selection of suitable tool is of vital importance for successful research. The choice of a particular method or tool depends on a variety of factors such as nature of the topic undertaken, nature of the subject involved, and the time and disposal of the investigation.

The data collection tools used for the present study were:

3.5.1 Personal data sheet (G. Vinitha and Indu H., 2013) (Appendix 1)

3.5.2 An Inventory on Learning Style Preference (G.Vinitha and Indu H., 2013) (Appendix 2)

3.5.3 Metacognitive Awareness Inventory (Schraw and Dennisen, 1994) (Appendix 3)

3.5.1 Personal Data Sheet

The Personal data sheet was used to collect the information such as gender, medium of instruction, groups of study, total marks scored in SSLC (Secondary School Learning Certificate), type of family, types of school, locality, monthly income of the family, and questions related to certain aspects like news paper reading habits, availability of computer, internet and a separate study room in the respondents' home. These demographic variables were chosen based on the ideas got from review of literature, experts opinion and investigator's own intuition. The respondents were provided the personal data sheet in person and were asked to read the items and make responses in the space provided in the personal data sheet

3.5.2 Learning Style Preference Inventory

The Learning Style Preference Inventory was developed by the investigator based on the Felder and Silverman Model (1988). Among the many learning style models proposed in the literature, the investigator selected Felder Silverman Learning Style Model (FSLSM) due to some reasons. FSLSM uses four learning dimensions: Active- Reflective, Visual- Verbal, Sensing- Intuitive and Sequential- Global with the assumption that each learner has a preference on each of the four dimensions. By using dimensions rather than types (as done in other models), students preferences can be described more accurately and in more detail. For these reasons learning style preference model by Felder-Silverman was chosen. The index of learning style by Felder and Silverman model (1988) was designed to assess preferences on four dimensions of learning styles: active-reflective, visual-verbal, sensing-intuitive and sequential-global. It classifies students as active (extravert, learn in groups, discuss and do it first, experimentalists) or reflective (introvert, learn by working alone, think first, theoreticians); visual (the ones that prefer pictures, diagrams, flow charts) or verbal (prefer written and spoken explanations); sensing (concrete, practical, oriented

toward facts and procedures) or intuitive (conceptual, innovative, oriented towards theories and meanings), sequential (linear, orderly, step by step) or global (holistic, learn in large leaps, system thinkers) (Felder, 1998, 2002).

The same dimensions were selected by the investigator, and the items were modified and prepared to suit the conditions of the sample of the present study. A Tamil (regional language) translation of the tool was also done as majority of the students selected for the study were in Tamil medium classes. For identifying the items for all the dimensions of learning style an exhaustive review of literature and different related scales were reviewed. The major steps followed in the construction of the Learning Style Preference Inventory are given below with details.

3.5.2 (i) Planning of the tool

To avoid over representations or neglect of any specific area, advance planning is necessary. After thoroughly analyzing the different views on learning style preference and referring journals and books on cognitive science and educational psychology, the investigator decided to choose Felder Silverman model of learning style preference for constructing the tool. Based on the Felder and Silverman model the items were prepared for different dimensions. The dimensions of the learning style preference are active-reflective, visual- verbal, sensing- intuitive and sequential-global. The dimensions and the characteristics of the learners are presented in Table 3.4

Table 3.4

Dimensions of the Learning Style Preference

Active Learning Style	**Reflective learning Style**
Learners who prefer active learning style tend to retain and understand information best by doing something actively and discuss it or apply it or explain it to others. They often enjoy group work because this enables them to do active things. Sitting through lectures with nothing to actually get involved can be particularly difficult for active learners.	Learners with this style prefer to think about new information first before acting on it. They often prefer to think through problems first on their own rather than discussing it in groups. Sitting through lectures can be difficult for reflective learners who often like to have sometime out to think through new information. Reflective learners prefer working alone.
Visual Learning Style	**Verbal Learning Style**
Learners understand new information best by seeing it in the form of pictures, demonstrations, diagrams, charts, films and so on.	Learners preferring this style of learning understand new information best through written and spoken words. They love to read and speak.
Sensing learning Style	**Intuitive learning Style**
Learners who prefer sensing learning style like learning facts and solving problems by well established methods. They are generally careful, practical and patient and like new knowledge to have some connection to the real world.	Intuitors don't like plug-and-chug courses that involve a lot of memorization and routine calculations. Intuitors may be better at grasping new concepts and are often more comfortable than sensors with abstractions and mathematical formulations. Intuitive learners often prefer discovering possibilities and relationships. Intuitors like innovation and dislike repetition.
Sequential learning Style	**Global learning Style**
Learners belonging to this style of learning understand new information in linear steps where each step follows logically from the previous one.	Global learners tend to learn in large jumps by absorbing material in a random order without necessarily seeing any connections until they have grasped the whole concept.

3.5.2(ii) Item writing

Based on the four dimensions (active-reflective, visual-verbal, sensing-intuitive and sequential-global) of learning style preference, the investigator prepared the items that could be easily understood by the respondents. An initial pool of 80 items was constructed, including 20 items in each of the four dimensions (active-reflective, visual-verbal, sensing-intuitive and sequential-global).

3.5.2(iii) Judgmental evaluation

After the initial set of items were written, it was submitted to a review panel consisting of two experts in the field of educational psychology and two in the field of psychological test construction to obtain an informal feedback regarding the language used, content and to find out if there is any ambiguous items. Based on the opinion of the experts 10 items were revised and the draft consisted of eighty items. After it was found appropriate to conduct, the instrument was piloted with 150 higher secondary students.

3.5.2(iv) Pilot testing

Pilot testing or item trial was carried out to improve the quality of items. The pilot study was carried out on 150 higher secondary students. 50 each from government, corporation and private school. The pilot test sample is representative of the target population who will be using the final form of the test. The data collected from the pilot study was used for gathering evidence about each item and finally it was subjected to item analysis.

The pilot study also helped to know about the time required to complete the draft scale of learning style and to incorporate certain necessary modifications in the tool. It was observed that 40-45 minutes time was taken by all the respondents to complete the draft scale.

3.5.2(v) Item analysis

Item analysis is a technique by which the test items are selected or rejected. An item-total correlation was performed to check if any item is inconsistent with the other items. Pearson's correlation coefficient was carried out and the items with correlation

value less than 0.3 (Pallant, J.2007, Briggs S.R. and Cheek, J.M. 1986) were dropped as they do not correlate well with the scale overall. The final scale consisted of 50 items.

3.5.2(vi) The Final Tool

The final tool consisted of 50 items designed to assess the four set of dimensions associated with learning style preference namely, active-reflective (13 items), visual-verbal (15 items), sensing-intuitive (11 items) and sequential-global (11 items). The items were of categorical nature with two response options "a" or "b". For each of the 50 statements, respondents were required to put a 'tick' (√) mark in either "a" or "b" category. "a" responses represent active, visual, sensing and sequential learners whereas "b" responses represent reflective, verbal, intuitive and global learners. The distribution of learning style preference items according to different dimensions are given in Table 3.5

Table 3.5

Distribution of Learning Style Preference Items According to Different Dimensions

Dimensions	Related Items
Active	1a 2a 3a 4a 5a 6a 7a 8a 9a 10a 11a 12a 13a
Reflective	1b 2b 3b 4b 5b 6b 7b 8b 9b 10b 11b 12b 13b
Visual	14a 15a 16a 17a 18a 19a 20a 21a 22 a 23a 24a 25a 26a 27a 28a
Verbal	14b 15b 16b 17b 18b 19b 20b 21b 22b 23b 24b 25b 26b 27b 28b
Sensing	29a 30a 31a 32a 33a 34a 35a 36a 37a 38a 39a
Intuitive	29b 30b 31b 32b 33b 34b 35b 36b 37b 38b 39b
Sequential	40a 41a 42a 43a 44a 45a 46a 47a 48a 49a 50a
Global	40b 41b 42b 43b 44b 45b 46b 47b 48b 49b 50b

3.5.2(vii) Establishing Reliability of the test

In the opinion of Best and Khan (2003), a test is reliable to the extent that it measures whatever it is measuring consistently. As the Learning Style Preference Inventory is bipolar, with mutually exclusive response to items, i.e. either (a) or (b), the use of standard statistic tests was difficult. Hence only scales for either (a) or (b) could be

considered. The responses were scored for the active, visual, sensing and sequential styles of learning by assigning a value of 1 to "a" items and 0 to "b" items and then test-retest method was used to find out the reliability of the inventory.

Internal Consistency Reliability of the Inventory was performed on the items for all 150 Learning Style Preference Inventory response sheets collected during pilot study. The internal reliability of the scales was found to range from 0.57 to 0.74. They were respectively equal to 0.59 (items on active scale), 0.74 (items on visual scale), 0.69 (items on sensing scale) and 0.57 (items on sequential scale).

To estimate the test-retest reliability, the same inventory was administered to 150 respondents of higher secondary students two times with a time lapse of 2 months and the Pearson's correlation was conducted on the score obtained in the tests. The values obtained are given in Table 3.6.

Table 3.6

Test-Retest Co-efficient for the Learning Style Preference Inventory

Active Score	Visual Score	Sensing Score	Sequential Score
0.59 ** n=400	0.74** n=400	0.69** n=400	0.57** n=400

**p< .01 level, 2 tailed.

Table3.6 shows a moderate to strong correlation between the test and retest scores.

3.5.2 (viii) Validity of the Test

A tool is said to be valid to the degree that it measures what it claims to measure. Face validity and content validity have been noted as evidence for the validity of the test. The inventory was given to a panel of experts consisting of two teacher educators and two educational psychologists to review and on the basis of their comment it was finalized. It was also opined by the experts that the test items were related to the dimensions of learning style preference. Hence the inventory was said to possess content validity and face validity.

3.6 Metacognitive Awareness Inventory (MAI)

In this research study, the Metacognitive Awareness Inventory (MAI) developed by Schraw and Dennison, 1994 was used to assess the metacognitive awareness. The tool was also translated to Tamil (Regional Language) for easy understanding of the items by the students.

The MAI which is a 52 item inventory is a comprehensive scale assessing various facets of metcognition, including Knowledge of Cognition and Regulation of Cognition (Schraw & Dennison, 1994).

The MAI was chosen because it is an easy to administer survey instrument and it taps into the two component model of metcognition, Metacognitive Knowledge and Metacognitive Regulation. Researcher can use MAI to analyse for relationships between metacognitive skills and broader measures of academic achievement such as CGPA, SAT scores and standardized scores (Young & Fry, 2008). As the investigator was also interested in finding the relationship between metacognitive awareness and academic achievement, metacognitive awareness inventory was used.

Items were classified into eight subcomponents under two broader categories, Knowledge of Cognition and Regulation of Cognition. Each component has different subcomponents. Knowledge of cognition includes three different kinds of knowledge: declarative, procedural, and conditional knowledge (Brown, 1987: Jacobs & Paris, 1987; Schraw & Moshman, (1995) and Regulation of cognition includes five subcomponents. All the eight sub components are described below.

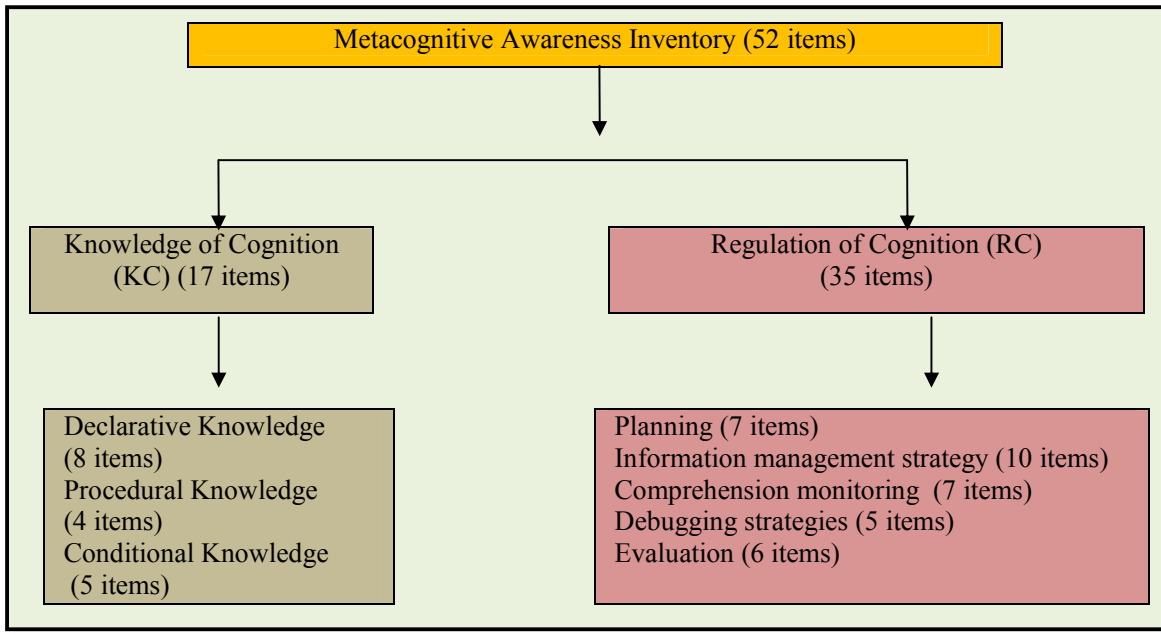

Figure 3.4 **Metacognitive Awareness**

(a) Knowledge of cognition

Knowledge of cognition or metacognitive knowledge refers to knowledge individuals have about themselves as cognitive beings, their capabilities, and limitations. The different sub components of knowledge of cognition are described below.

Declarative Knowledge: It is to know about oneself as a learner and the relationship between himself/herself and the tasks. It involves the ability of the learners to know about their own strengths and weaknesses, about the learning content and about their expectation of their own performance.

Procedural Knowledge: It refers to the application of knowledge for the purpose of completing a procedure or process. It involves knowledge about how to implement learning procedures. It requires students to know the process as well as when to apply process in various situations.

Conditional Knowledge: It involves time and situation such as when a particular strategy should be used, under what conditions they can learn better and when learners use

strengths to compensate for weaknesses. It involves knowledge about when and why to use learning procedures.

(b) Regulation of cognition

It refers to a set of activities that help students control their learning. This component has also five subcomponents: planning, information management strategies, comprehension monitoring, debugging strategies, and evaluation.

Planning: It is about goal setting, what to learn, when to learn and how to learn. It also involves allocating resources prior to learning. This involves what should be learnt, how and what goals should be set, and how to choose the best alternatives when solving problems.

Information Management Strategy: It shows skills and strategy sequences used to process information more efficiently. It involves organizing, elaborating, summarizing, selective focusing, the ability to refer to previous experience, and the ability to break down information into chunks.

Comprehension Monitoring: It means assessment of one's own learning or strategy use. It involves checking about one's own progress and comprehension, about what alternatives are available, and whether the strategies are useful to understand the content.

Debugging Strategies: It relates to strategies used to correct comprehension and performance errors. It involves the decision about learning when facing difficulties, such as what should be done if one does not understand.

Evaluation: It is the analysis of performance and strategy effectiveness after a learning episode. It is finding out whether learning process has been successful, whether goals have been achieved.

3.5.3 (i) Reliability and validity of MAI

Reliability and Validity of the standardized Metacognitive Awareness Inventory was found by the authors, Schraw and Dennison. Internal consistency for the instrument was found to be 0.95 with a test-retest reliability of 0.85. Schraw and Dennision (1994)

also found evidence for the Metacognitive Awareness Inventory's (MAI) structural validity through confirmatory factor analysis, in which a two factor solution explained 65 percent of the variance in one sample, and 58 percent of the variance in another. They also found evidence for the MAI's predictive validity. The face validity and content validity have also been noted as evidence for the validity of the test.

3.7 Conduct of the Study

The Personal Data Sheet, the Metacognitive Awareness Inventory and the Learning Style Preference Inventory were used to collect data from higher secondary students of 2012-2013 batch studying in 14 schools in Coimbatore city. The schools were personally visited by the investigator for the collection of data after seeking permission from the Head of the concerned schools. Participants voluntarily participated and were ready to fill out the inventories without pressure. Completion of inventories was anonymous and there was a guarantee of confidentiality.

Students were tested in groups of about 25-30. Rapport was created with the respondents before the administration of the tools. Before filling the Learning Style Preference Inventory and Metacognitive Awareness Inventory all the participants completed the personal data sheet containing a few basic demographic questions like gender, medium of instruction, locality, type of family, types of school, groups of study, monthly income of the family, news paper reading habits, availability of separate study room, computer and internet access at home, and the marks scored in SSLC.

After filling the personal data sheet, the investigator gave necessary directions to fill correctly the Learning Style Preference Inventory and Metacognitive Awareness Inventory. The time limit was fixed to be 45 minutes for each inventory. After all the items were completed by all the students, the investigator carefully collected the response sheets. Academic achievement marks (marks scored in SSLC) were collected from the office of the school. SSLC marks refer to the marks obtained by the students in X standard public examination conducted by the Government of Tamil Nadu. This examination is common for all students of Tamil Nadu studying in the government, government aided, matriculation and corporation schools. This marks forms the basis for the students to get admission in the higher secondary schools in various subject streams.

3.8 Scoring and Tabulation

The response sheets were scored systematically using the scoring key. In the Learning Style Preference Inventory 'a' and 'b' options were given and this inventory has four dimensions of learning style preference namely active-reflective, visual - verbal, sensing - intuitive and sequential - global. Number of 'a' responses and 'b' responses were counted separately for each dimension. There is no wrong answer. From this inventory the researcher can identify the learning style preference of the sample. In order to find the preferred learning style of students, the scores on each dimension were found by summing the total number of 'a' and 'b' responses. For example, in Active-Reflective dimension (13 items) if the learner had selected 2 'a' and 13'b' responses, the dominant learning style is reflective. The scores thus obtained helped the investigator to classify the learners in different dimensions.

Metacognitive Awareness Inventory items were having response of 'Yes' or 'No', type and a score of 1 was given for 'Yes' option and '0' for 'No' option. Within the inventory there were 17 questions related to knowledge of cognition and 35 questions related to regulation of cognition. The total metacognitive awareness score was calculated by adding the scores on questions related to knowledge of cognition and regulation of cognition. Higher scores in the 17 items correspond to greater metacognitive knowledge and in 35 items related to regulation of cognition corresponds to greater metacognitive regulation. In addition to the knowledge of cognition score and regulation of cognition score a MAI total score is derived by summing responses to all 52 items. All these three scores, total metacognitive awareness score, knowledge of cognition score and regulation of cognition score were used for statistical analysis.

3.9 Data Analysis

For the preliminary analysis of test scores, the basic statistical indices like mean, median, standard deviation, skewness and kurtosis were calculated. Pearson's Product Moment correlation was used to find out the relationship between the different components of Metacognitive Awareness, Learning Style Preference and Academic Achievement of higher secondary students. Chi square was applied to find out the association between learning style preference and the variables gender, medium of instruction, locality, type of family, news paper reading habits, availability of separate study room, availability of

computer and internet access at home, types of school, groups of study and monthly income of the family. Test of significance of difference between means (t-test) was used to compare the metacognitive awareness of higher secondary students classified on the basis of gender, medium of instruction, locality, type of family, news paper reading habits, availability of separate study room, availability of computer and internet access at home and also to find out the difference in metacognitive awareness of students with different learning style preferences. Analysis of Variance (ANOVA) was used to find out the metacognitive awareness of higher secondary students in relation to the variables types of school, groups of study and monthly income of the family.

Conclusion

The methodology chapter has presented in detail, the design and the description of the procedure to construct the tools and generate data for verifying the hypotheses formulated in the study. The chapter also dealt with the different stages of data collection and the statistical techniques to be used to derive the results and conclusion. The analysis of the data, its results and discussions are presented in the next chapter.