

## CHAPTER 4

### RESULTS AND DISCUSSION

This chapter deals with the statistical analysis of the data and is devoted to the results of the study. The data collected were analyzed, interpreted and presented in tables. The analysis and interpretation of the data involve the objective material in possession of the researcher and his subjective reactions and desires to derive from the data inherent meanings in their relation to the problem. The purpose of analysis and interpretation is to provide substantive answer to research questions by testing hypothesis. In the present study, data were collected from 1005 higher secondary school students using a Personal Data Sheet, Learning Style Preference Inventory and Metacognitive Awareness Inventory. The information gathered from the sample through the Inventories were quantified and is interpreted here. The results are discussed under different sub heads.

#### 4.1 Descriptive analysis

#### 4.2 Correlation analysis

#### 4.3 Differential analysis

#### **4.1 Descriptive Analysis**

Descriptive analysis gives an overall idea about the sample distributed in the given population. It limits generalization to the particular group of individuals observed. No conclusions are extended beyond this group, and any similarity to those outside the group cannot be assumed. The data describe one group and that group only. Descriptive analysis provides valuable information about the nature of a particular group of individuals (Best and Kahn, 2006).

Descriptive analysis helps for describing the quantitative data collected. It is done with different descriptive statistical methods. In the present study, descriptive statistics is used to describe the number and percentage of students with different types of Learning Style Preferences and Metacognitive Awareness components.

### 4.1.1 Descriptive Analysis for Learning Style Preference

The descriptive analysis was carried out by finding the mean, median, mode, variance, standard deviation, range, skewness and kurtosis of all the 1005 higher secondary students in the four different dimensions of Learning Style Preference. The results are presented in Table.4.1

**Table 4.1**

#### **Descriptive Analysis for Learning Style Preference**

Statistics	Learning Style Preference dimensions							
	1		2		3		4	
	Active	Reflective	Visual	Verbal	Sensing	Intuitive	Sequential	Global
<b>Mean</b>	8.37	5.63	6.90	8.10	5.46	5.54	5.34	4.66
<b>Median</b>	9.00	5.00	7.00	8.00	5.00	6.00	6.00	4.00
<b>Mode</b>	6.00	8.00	6.00	9.00	5.00	6.00	7.00	3.00
<b>Variance</b>	4.93	4.93	6.15	6.15	3.36	3.36	3.67	3.67
<b>Standard Deviation</b>	2.22	2.22	2.48	2.48	1.83	1.83	1.92	1.92
<b>Range</b>	14.00	14.00	15.00	15.00	11.00	11.00	10.00	10.00
<b>Skewness</b>	-0.15	0.15	0.23	-0.23	0.16	-0.16	-0.15	0.15
<b>Kurtosis</b>	-0.53	-0.53	0.14	0.14	0.20	0.20	-0.85	-0.85

From Table 4.1, maximum mean score is found for active learning style preference (8.37) and verbal learning style preference (8.10). Having considered the descriptive statistics for the outcome variables, especially the mean, standard deviation, skewness and kurtosis, the statistics indicated a close to normal distribution as indicated by skewness values within the value of (-1, +1) and kurtosis within the value of (-3,+3).

#### **4.1.2 Descriptive Analysis of Metacognitive Awareness**

Descriptive Analysis was carried out for total metacognitive awareness and for components and subcomponents of metacognitive awareness. Table 4.2 reports the values obtained for mean, median, mode, variance, standard deviation, skewness and kurtosis for metacognitive awareness and for the components namely knowledge of cognition and regulation of cognition and also for the sub components declarative knowledge, procedural knowledge, conditional knowledge, planning, information management strategies, comprehension monitoring, debugging strategies and evaluation. Higher mean scores indicate the more predominant metacognitive awareness among the group. The Information Management Strategies mean score value (M=6.35, SD=2.19) show a better value in metacognitive awareness in the group. The mean score of the sub component Declarative Knowledge (M=5.86, SD=1.61), is the second most used metacognitive awareness and the sub component procedural knowledge has the lowest mean scores, (M=2.35, SD=1.16), indicating that it is the least aware sub component among the various sub components of metacognitive awareness of the higher secondary students.

**Table 4.2****Descriptive Analysis of Metacognitive Awareness**

Statistics	Metacognitive Awareness Dimensions										
	Knowledge about Cognition			KC Total	Regulation of Cognition					RC Total	MCA Total
	DK	PK	CK		P	IMS	CM	DS	E		
<b>Mean</b>	5.86	2.35	3.47	<b>11.68</b>	4.80	6.35	4.56	3.38	4.02	<b>23.12</b>	<b>34.78</b>
<b>Median</b>	6.00	2.00	4.00	<b>12.00</b>	5.00	7.00	5.00	4.00	4.00	<b>23.00</b>	<b>35.00</b>
<b>Mode</b>	7.00	3.00	4.00	<b>10.00</b>	6.00	6.00	5.00	4.00	4.00	<b>20.00</b>	<b>34.00</b>
<b>Variance</b>	2.60	1.35	2.07	<b>9.40</b>	3.36	4.79	2.74	2.25	2.16	<b>35.07</b>	<b>67.86</b>
<b>Standard Deviation</b>	1.61	1.16	1.44	<b>3.07</b>	1.83	2.19	1.65	1.50	1.47	<b>5.92</b>	<b>8.24</b>
<b>Range</b>	9.00	9.00	8.00	<b>17.00</b>	10.00	10.00	9.00	10.00	7.00	<b>35.00</b>	<b>45.00</b>
<b>Skewness</b>	-0.68	0.12	-0.83	<b>-0.32</b>	-0.91	-0.61	-0.49	-0.51	-0.75	<b>-0.36</b>	<b>-0.24</b>
<b>Kurtosis</b>	0.12	0.65	0.38	<b>-0.15</b>	0.49	0.17	-0.22	0.15	0.41	<b>0.28</b>	<b>-0.098</b>

*Note* : DK=Declarative Knowledge, PK=Procedural Knowledge, CK=Conditional Knowledge, KC=Knowledge about Cognition, P=Planning, IMS=Information Management Strategies, CM=Comprehension Monitoring, DS=Debugging Strategies, E=Evaluation, RC=Regulation of Cognition, MCA= Metacognitive Awareness

From Table 4.2, it is clear that the skewness is found to be negative and the kurtosis is found to be positive for declarative knowledge, conditional knowledge, planning, information management strategies, debugging strategies and evaluation. For procedural knowledge of metacognitive awareness both the skewness and kurtosis are found to be positive.

#### 4.1.3 Percentage Analysis

An attempt was made to analyse and classify the percentage of students based on Metacognitive Awareness and Learning Style Preference. The results obtained are given in Table 4.3 to Table 4.8

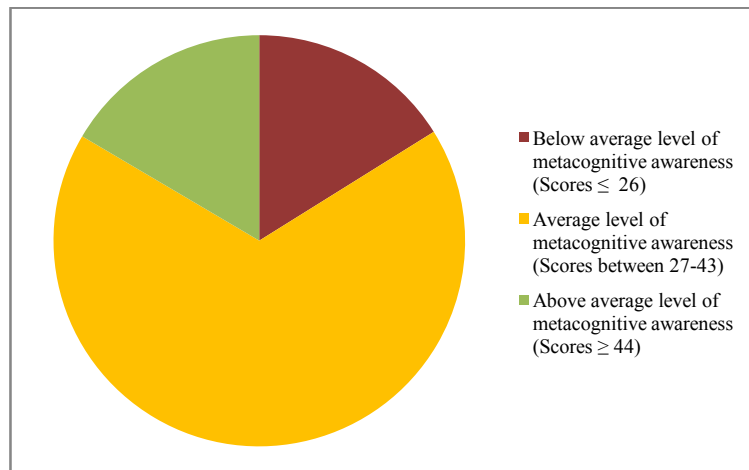
##### 4.1.3.1 Classification of students based on Metacognitive Awareness

After analyzing data descriptively, an attempt was made to group the sample into different levels based on their performance in Metacognitive Awareness Inventory. The sample was divided into three groups based on the statistical measures of mean and standard deviation. The three groups were students with above average, average and below average level of metacognitive awareness. Table 4.3 shows the percentage of students belonging to the three levels of metacognitive awareness.

**Table 4.3 Metacognitive Awareness Levels of Higher Secondary Students**

Level	Number	Percentage
<b>Below average level of metacognitive awareness (Scores <math>\leq</math> 26)</b>	162	16.12
<b>Average level of metacognitive awareness (Scores between 27-43)</b>	677	67.36
<b>Above average level of metacognitive awareness (Scores <math>\geq</math> 44)</b>	166	16.52
<b>Total</b>	<b>1005</b>	<b>100</b>

As can be seen from Table 4.3 majority of the students (67.36 %) possess average level of metacognitive awareness and (16.52%) possess above average level of metacognitive awareness and 16.12 percent of students possess below average level of metacognitive awareness. These results seems to closely resemble a normal probability distribution. The percentage of the students with different levels of metacognitive awareness is presented as a pie diagram in Figure 4.1.



**Figure 4.1 Metacognitive Awareness Levels of Higher Secondary Students**

#### **4.1.3.2 Learning Style Preference**

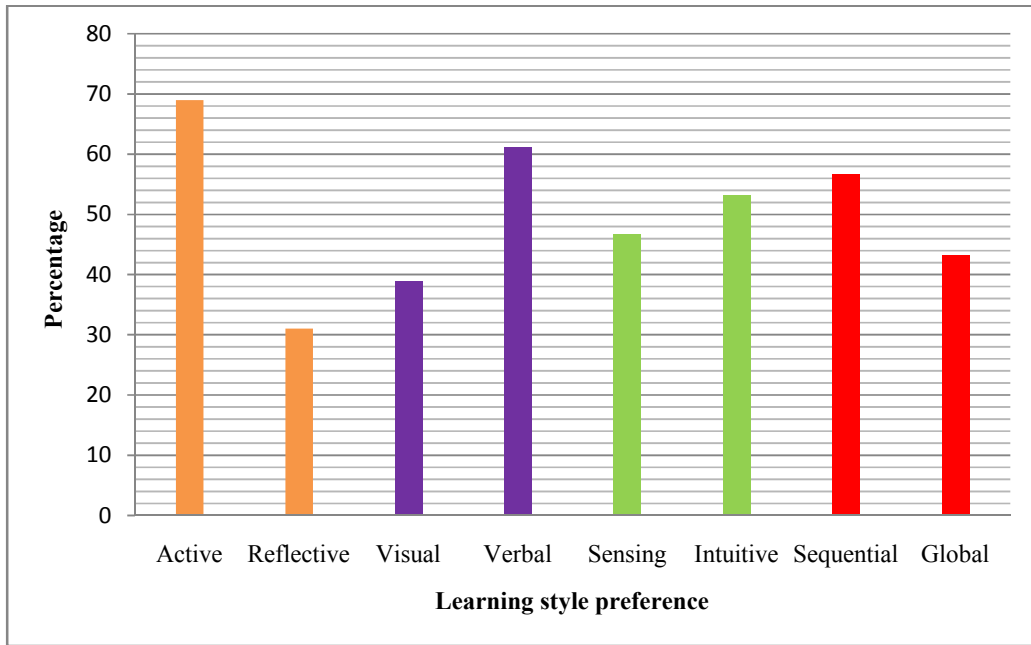
The different learning style preference taken in the present study are active-reflective, visual -verbal, sensing- intuitive and sequential- global. The exact number and percentage of students possessing different learning style preference are presented in Table 4.4.

**Table 4.4****Percentage Analysis of Learning Style Preference**

<b>Learning Style Preference</b>		<b>N= 1005</b>	<b>Percentage</b>
1	<b>Active</b>	693	69.0
	<b>Reflective</b>	312	31.0
2	<b>Visual</b>	391	38.9
	<b>Verbal</b>	614	61.1
3	<b>Sensing</b>	470	46.8
	<b>Intuitive</b>	535	53.2
4	<b>Sequential</b>	570	56.7
	<b>Global</b>	435	43.3

*Note* : N=Number of students

Table 4.4 shows that of the total students, 69 percent of students prefer active learning style and 31 percent prefer reflective style of learning. It is also seen that 38.9 percent possess visual learning style preference and 61.1 percent have verbal style of learning. Analysing sensing – intuitive style of learning 53.2 percent were of intuitive type whereas 46.8 were found to be sensing type of learners. Percentage analysis also showed that 56.7 percent of learners were of sequential type and 43.3 percent were found to be global learners. Hence percentage analysis brings out the fact that of 1005 higher secondary students selected, majority of the sample are found to be active, verbal, intuitive and sequential learners. These values are represented graphically in Figure 4.2 which clearly depicts that majority of the students are active learners.



**Figure 4.2 Percentage of Learning Style Preference**

#### **4.1.3.3 Learning Style Preference of students based on Personal variables**

The different learning style preferences based on the personal variables taken in the present study namely, gender, locality, type of family and monthly income of the family were analysed and number of students and the percentage are given in Table 4.5

**Table 4.5**

**Percentage analysis of Learning Style Preference of Students based on Personal variables**

Personal variables	LSP	Active		Reflective		Visual		Verbal		Sensing		Intuitive		Sequential		Global	
	Category	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Gender	Male (N=420)	290	69	130	31	167	39.8	253	60.2	181	43.1	239	56.9	214	51	356	60.9
	Female (N=585)	403	68.9	182	31.1	224	38.3	361	61.7	289	49.4	296	50.6	206	49	229	39.1
Locality	Rural (N=880)	606	68.9	274	31.1	320	36.4	560	63.6	393	44.7	487	55.3	491	55.8	389	44.2
	Urban (N=125)	87	69.6	38	30.4	71	56.8	54	43.2	77	61.6	48	38.4	79	63.2	46	36.8
Type of Family	Nuclear (N=848)	597	70	251	30	327	38.6	521	61.4	402	47.4	446	52.6	493	58.1	355	41.9
	Joint (N=157)	96	61.1	61	38.9	64	40.8	93	59.2	68	43.3	89	56.7	77	49	80	51
Monthly Income of the family	EWS - upto Rs.12,000/-	205	67.4	99	32.6	113	37.2	191	62.8	136	44.7	168	55.3	162	53.3	142	46.7
	LIG - Rs.12,001 to Rs.18,000	287	70.7	119	29.3	143	35.2	263	64.8	183	45.1	223	54.9	236	58.1	170	41.9
	MIG- Rs.18,001 to Rs.37,000	114	70.4	48	29.6	68	42	94	58	83	51.2	79	48.8	89	54.9	73	45.1
	HIG- Rs.37,001 to Rs.62,000	87	65.4	46	34.6	67	50.4	66	49.6	68	51.1	65	48.9	83	62.4	50	37.6

Note: LSP=Learning Style Preference, N=Number of Students, EWS=Economically Weaker Section, LIG=Lower Income Group, MIG=Middle Income Group, HIG=Higher Income Group.

From Table 4.5 it is seen that of the 420 male students selected for the study 290 (69%). Students are found to be active and 130 (31%) are found to be reflective type of learners, 167 (39.8%) are found to be visual and 253 (60.2%) are found to be verbal type of learners, 181 (43.1%) are found to be sensing, 239 (56.9%) are found to be Intuitive, 214 (51%) are found to be sequential and 356 (60.9%) are found to be global learners.

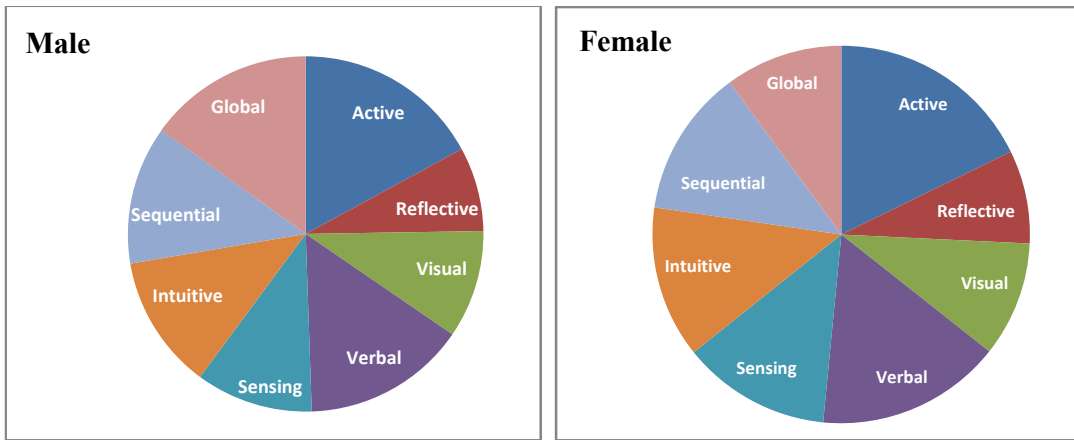
The learning style preference of the female students indicates that 68.9 per cent are active and 31.1 per cent prefer reflective learning style. 38.3 per cent of female students prefer visual learning style, 61.7 per cent of female students prefer verbal type of learners. 49.45 per cent of students prefer sensing learning, 50.6 per cent of students prefer intuitive learning, 49 per cent of female students prefer sequential learning and 39.1 per cent of female students prefer global learning style.

Analysis of the learning style preference of the rural students indicated that 68.9% are active, 63.6% are verbal type of learners, 55.3% are intuitive learners and 55.8% are sequential learners.

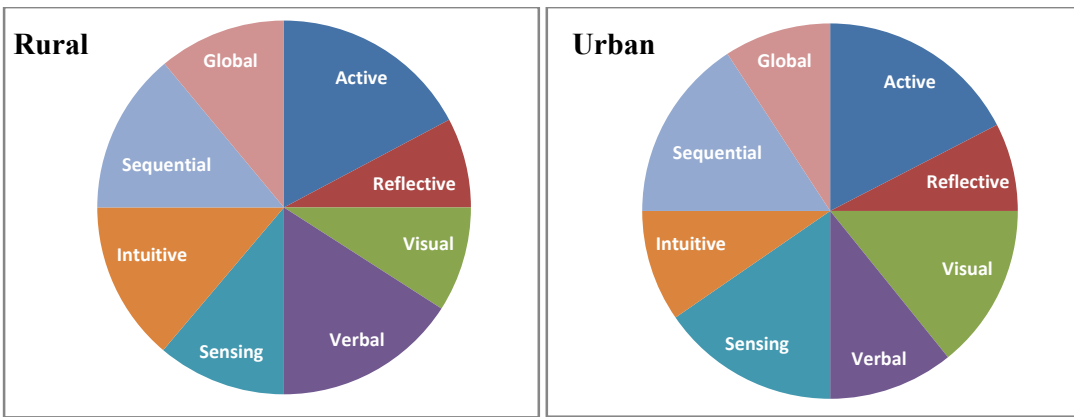
When the learning style preference of students were analysed based on their type of family, it was found that 70 per cent of students from nuclear family were active, 61.1 per cent verbal, 52.6 percent were intuitive and 58.1 percent of students were sequential in nature. Majority of the students from the joint family were found to be active, verbal, intuitive and sequential learners.

The analysis of learning style preference of students based on their income of the family, reveals that majority of the students were active, verbal, intuitive and sequential learners, only difference was seen in Middle Income Group and Higher Income Group. In Higher Income Group majority of the students were visual in visual-verbal dimension and in sensing-intuitive dimension students from Middle Income Group and Higher Income Group were found to be sequential type whereas students from Economically Weaker Section and Lower Income Group were intuitive type of learners. The graphical representation of percentage analysis is given in Figure 4.3.

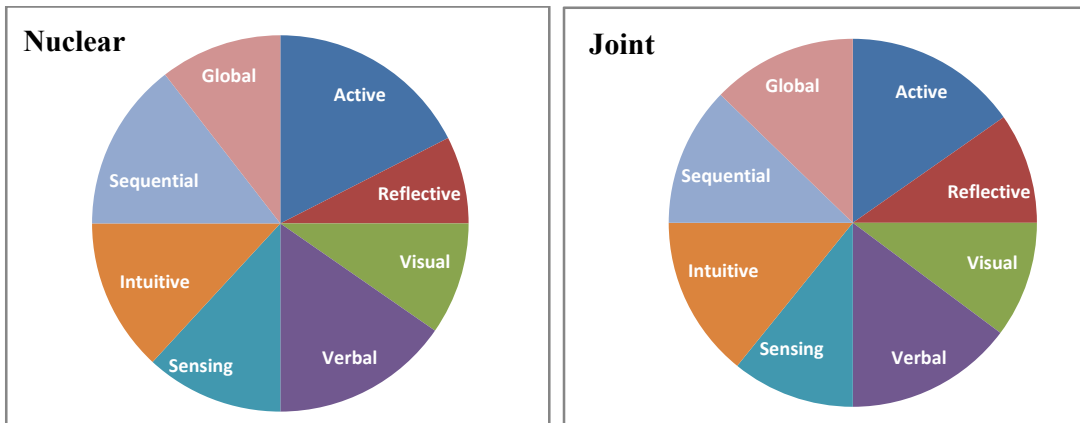
### Gender



### Locality



### Type of family



**Figure 4.3** Percentage analysis of Learning Style Preference of Students based on Personal variables

### Monthly Income of the Family

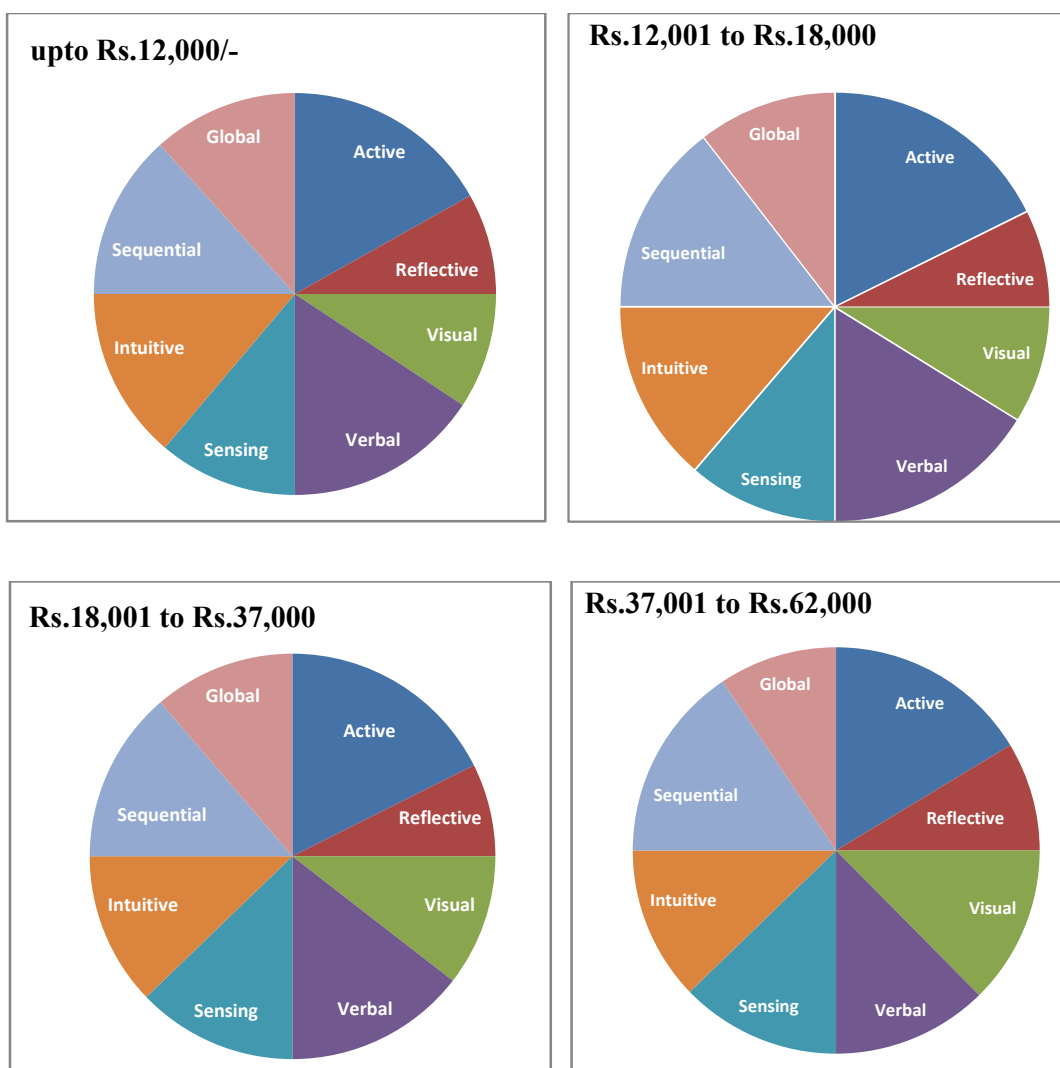


Figure 4.3. continued....

### Percentage analysis of Learning Style Preference of Students based on Personal variables

#### 4.1.3.4 Learning Style Preference of students based on Academic variables

An attempt was made to analyse the learning style preference of students based on academic variables namely medium of instruction, types of school and groups of study. The number and percentage of students with the learning style preference namely active-reflective, visual-verbal, sensing-intuitive and sequential-global are given in Table 4.6

**Table 4.6**

**Percentage Analysis of Learning Style Preference of students based on Academic variables**

Academic variables	LSP	Active		Reflective		Visual		Verbal		Sensing		Intuitive		Sequential		Global	
	Category	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Medium of Instruction	Tamil (N=716)	490	68.4	226	31.6	246	34.4	470	65.6	318	44.4	398	55.6	384	53.6	332	46.4
	English (N=289)	203	70.2	86	29.8	145	50.2	144	49.8	152	52.6	177	47.4	186	64.4	103	35.6
Types of School	Govt. (N=400)	265	66.3	135	33.8	104	26	96	74	162	40.5	238	59.5	178	44.5	222	55.5
	Corporation (N=400)	282	70.5	118	29.5	182	45.5	218	54.5	186	46.5	214	53.5	262	65.5	138	34.5
	Private (N=205)	146	71.2	59	28.8	105	51.2	100	48.8	122	59.5	83	40.5	130	63.4	75	36.6
Groups of Study	Mathematics (N=83)	60	72.3	23	27.7	35	42.2	48	57.8	45	54.2	38	45.8	44	53	39	47
	Science (N=103)	76	73.8	27	26.2	40	38.8	63	61.2	54	52.4	49	47.6	55	53.4	48	46.6
	Computer Science (N=274)	187	68.2	87	31.8	120	43.8	154	56.2	131	47.8	143	52.2	171	62.4	103	37.6
	Commerce (N=346)	235	67.9	111	32.1	139	40.2	207	59.8	162	46.8	184	53.2	213	61.6	133	38.4
	History (N=40)	27	67.5	13	32.5	10	25	30	75	19	47.5	21	52.5	17	42.5	23	57.5
	Vocational (N=159)	108	67.9	51	32.1	47	29.6	112	70.4	59	37.1	100	62.9	70	44	89	56

Note: LSP=Learning Style Preference, N=Number of students

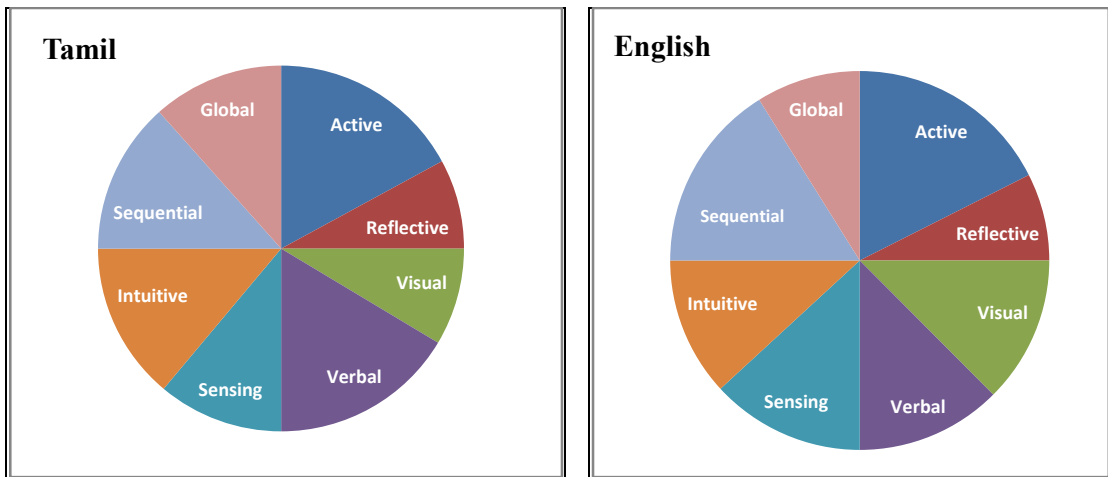
Percentage analysis of learning style preference of students based on their medium of instruction revealed that majority of the Tamil medium students prefer active, **verbal**, intuitive and sequential styles of learning whereas English medium students were found to be active, **visual**, intuitive and sequential learners.

Majority of the government school students were found to be active, verbal, intuitive and **global** learners, whereas majority of the corporation school students preferred active, verbal, intuitive and **sequential** learning styles. Percentage analysis brought out the fact that major percentage of the private school students were active, **visual**, **sensing** and sequential learners.

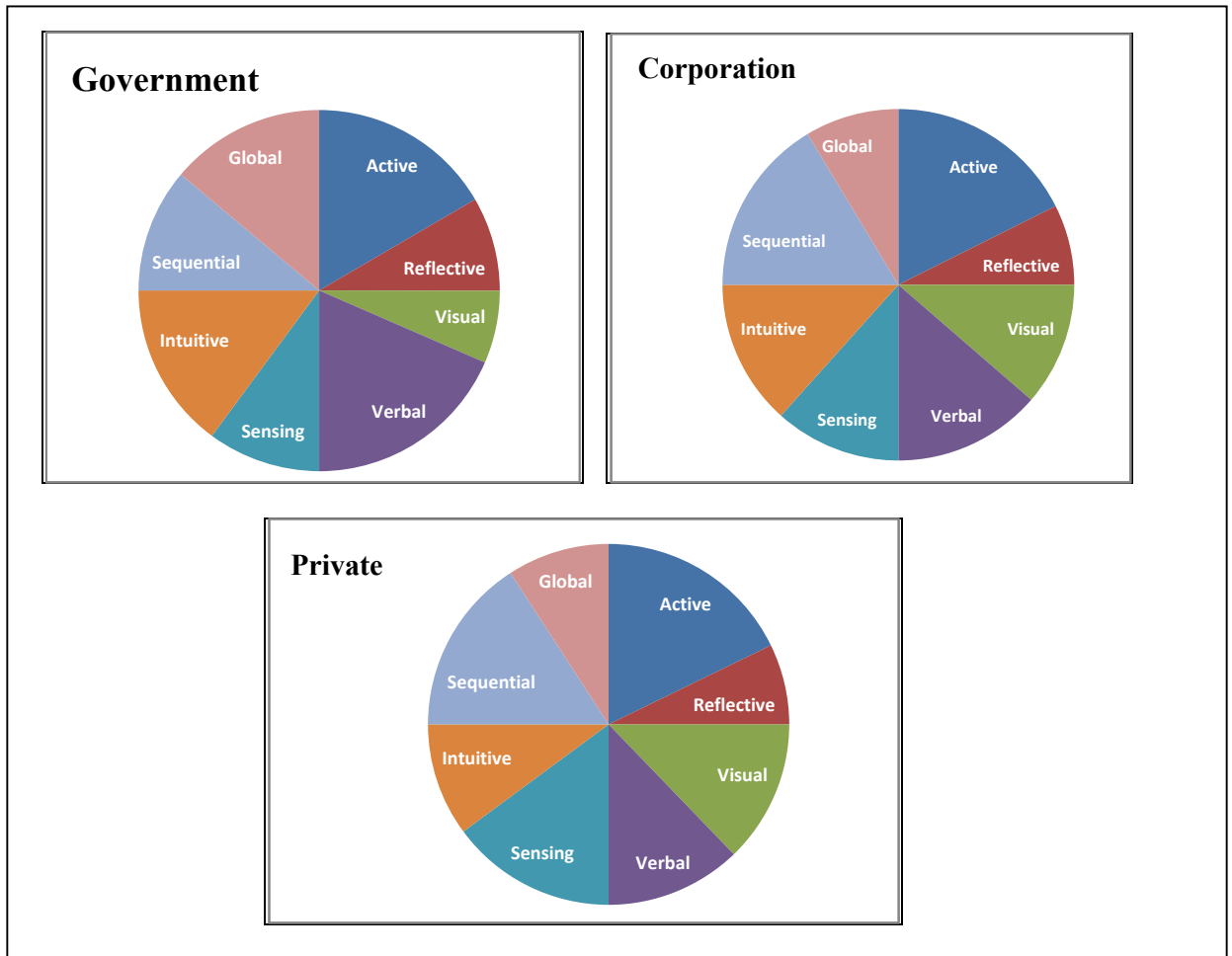
The results of Table 4.6 explains that major percentage of students specializing in mathematics and science groups of study were found to be active, verbal, sensing and sequential learners. Students of computer science and commerce groups of study were found to prefer active, verbal, intuitive and sequential learning styles. Comparison of percentage of learning style preference of students specializing history and vocational group depicted that majority of them are active, verbal, intuitive and global learners.

Figure 4.4 shows the percentage of students preferring different learning styles based on the academic variables considered for investigation.

### Medium of Instruction

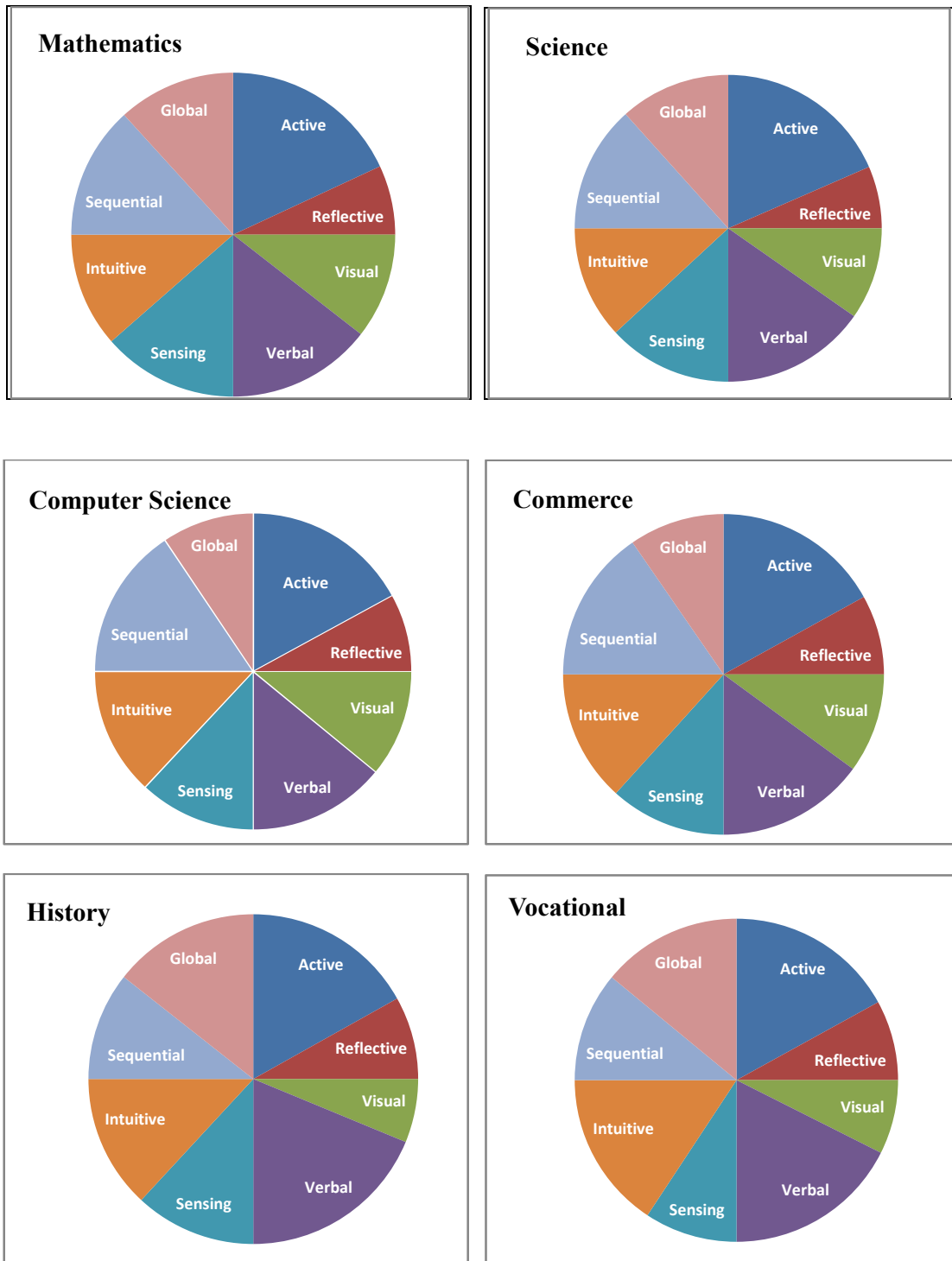


### Types of School



**Figure 4.4. Percentage Analysis of Learning Style Preference of students based on Academic variables**

## Groups of Study



*Figure 4.4. continued ....*

**Percentage Analysis of Learning Style Preference of students based on Academic variables**

#### 4.1.3.5 Learning Style Preference of Students based on Facilities available at home

An attempt was made to find out the percentage of students with different learning style preferences based on facilities available at home like separate study room, news paper, computer and internet access. The results obtained are given in Table 4.7 and the graphical representation is given in Figure 4.5.

The percentage analysis of learning style preference of students based on the availability and use of internet facility at home brings out the result that students who do not have internet access at home are active, verbal, intuitive and sequential learners whereas majority of the learners are found to be active, **visual**, intuitive and sequential who have internet facility to work at home.

Percentage analysis revealed that majority of the students who have separate study room and computer to work were found to be active, verbal, intuitive and sequential learners whereas students who were not having news paper reading habit were are found to be **active, verbal, sensing and sequential** learners; whereas learners who read newspaper daily were found to be **active, verbal, intuitive** and **sequential** learners.

**Table 4.7**

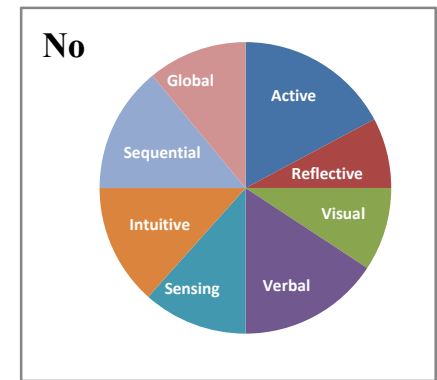
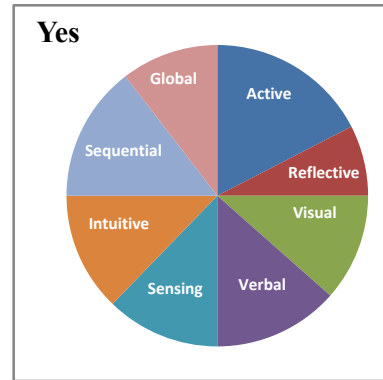
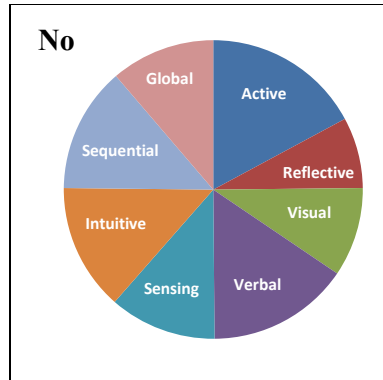
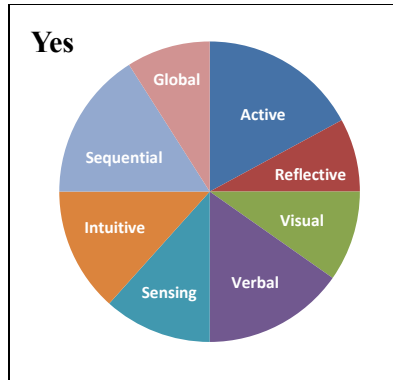
**Percentage analysis of Learning Style Preference of Students based on Facilities available at home**

Facilities	LSP	Active		Reflective		Visual		Verbal		Sensing		Intuitive		Sequential		Global	
	Category	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Separate study room at home	Yes (N=228)	156	68.4	72	31.6	89	39	139	61	106	46.5	122	53.5	146	64	82	36
	No (N=777)	537	69.1	240	30.9	302	38.9	475	61.9	364	46.8	430	55.2	424	54.6	353	45.4
Computer	Yes (N=208)	145	69.7	63	30.3	96	46	112	54	100	49	108	51	121	58.2	87	41.8
	No (N=797)	548	68.8	249	31.2	295	37	502	63	370	46.4	427	53.6	449	56	348	44
Internet Access	Yes (N=130)	91	70	39	30	68	52.3	62	47.7	62	47.7	68	52.3	77	59.2	53	40.8
	No (N=875)	602	68.8	273	31.2	323	37	552	63	408	46.6	467	53.4	493	56.3	382	43.7
News paper reading	Yes (N=576)	404	70	172	30	217	37.7	359	62.3	254	44	322	56	322	56	254	44
	No (N=429)	289	67	140	33	174	41	255	59	216	50.3	213	49.7	248	57.8	181	42.2

Note: LSP=Learning Style Preference, N=Number of students

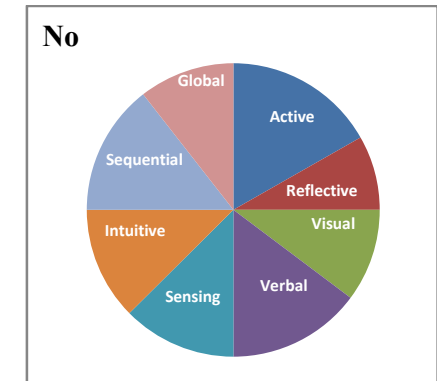
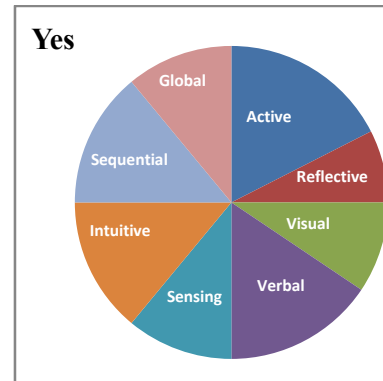
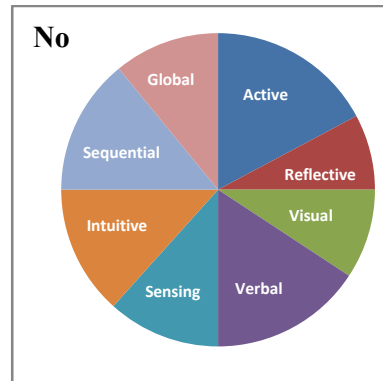
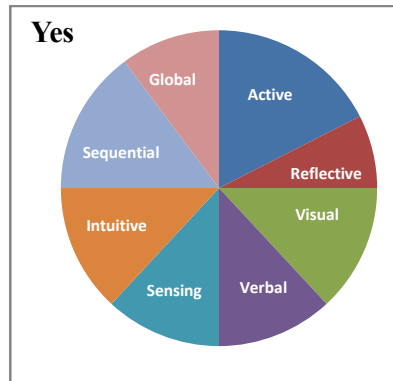
**Separate study room at home**

**Computer at home**



**Internet access**

**News paper reading**



**Figure 4.5 Percentage analysis of Learning Style Preference of Students based on Facilities available at home**

#### 4.1.3.6 Percentage of students with different levels of Metacognition showing the different learning styles

An attempt was made to analyse and classify the percentage of students with different learning style preference on the basis of levels of Metacognition. The results obtained are given in Table 4.8.

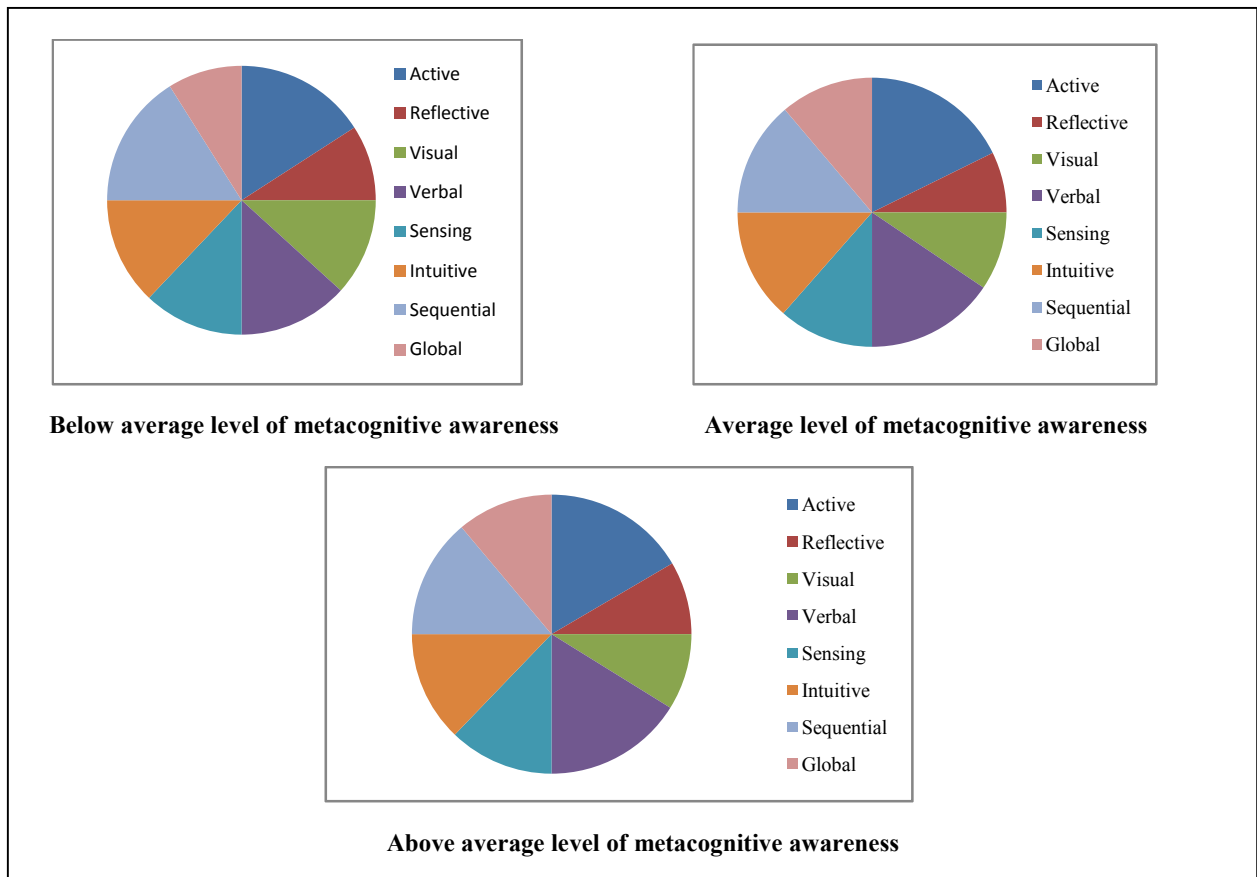
**Table 4.8**

#### Percentage of students with different levels of Metacognition showing the different learning styles

Learning Style Preferences Levels of MCA	Active		Reflective		Visual		Verbal		Sensing		Intuitive		Sequential		Global	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
	<b>Below average level of metacognitive awareness (Scores ≤ 26) N=162</b>	103	63.6	59	36.4	76	46.9	86	53.1	78	48.2	84	51.8	104	64.2	58
<b>Average level of metacognitive awareness (Scores between 27-43) N=677</b>	480	70.9	197	29.1	256	37.8	421	62.2	311	45.9	366	54.1	374	55.2	303	44.8
<b>Above average level of metacognitive awareness (Scores ≥ 44) N=166</b>	110	66.27	56	33.73	59	35.5	107	64.5	81	48.8	85	51.2	92	55.4	74	44.6

*Note:* MCA=Metacognitive Awareness, N=Number of students

The analysis of type of learning style preference possessed by the students based on their levels of metacognition namely, below average level of metacognitive awareness, average level of metacognitive awareness and above average level of metacognitive awareness reveals that majority of the students in all the three categories are found to be active, verbal, intuitive and sequential learners.



**Figure 4.6. Level of metacognitive awareness**

Figure 4.6 shows pie charts with the learning style preference of students based on metacognitive awareness level.

## 4.2 Correlation Analysis

The relationship among different variables can be studied by the method of correlation. Correlation is a method of summarizing the relationship between two sets of data. When two attributes have a positive correlation coefficient, an increase in the value of one attribute indicates a likely increase in the value of the second. In the present study correlation analysis is done to find the relationship between the Learning Style Preference, Metacognitive Awareness and Academic achievement.

### 4.2.1 Relationship between Learning Style Preference and Academic Achievement.

Correlation analysis was done to find out the relationship between learning style preference and academic achievement scores obtained by the students. Pearson's correlation coefficient was carried out and the results obtained are given in Table 4.9

**Table 4.9****Correlation between Learning Style Preference and Academic Achievement Scores**

Learning Style Preference		Academic Achievement Scores
1	Active	-0.015
	Reflective	0.015
2	Visual	0.861**
	Verbal	-0.861**
3	Sensing	0.723**
	Intuitive	-0.723**
4	Sequential	0.182
	Global	-0.182

Note: \*\*P< .01

From Table 4.9 it is seen that, there is a highly significant correlation ( $p < .01$ ) between visual- verbal learning style preference and academic achievement scores of the students, it is also evident that visual learning style preference is positively correlated to academic achievement of the students and verbal learning style preference is negatively correlated to academic achievement scores.

The correlation coefficient 0.723 ( $p < .01$ ) shows that there is a highly significant correlation between sensing- intuitive style of learning and academic achievement scores and further it is clear that the positive sign indicates that sensing learning style is positively correlated to the academic achievement of the students and intuitive learning style preference is negatively correlated to academic achievement. The correlation coefficient reveals that there is no significant correlation between active, reflective, sequential and global learning style preference and academic achievement of the students.

Hence the null hypothesis that **“there is no statistically significant relationship between learning style preference and academic achievement”** is rejected for visual-verbal and sensing- intuitive learning style preference and accepted for active- reflective and sequential- global learning style preference.

#### **4.2.2 Correlation between the Components of Metacognitive Awareness and Academic Achievement**

The relationship between metacognitive awareness and academic achievement of higher secondary students was examined using Pearson's Correlation co-efficient. The investigator was also interested to see whether there is any statistically significant relationship between the different subcomponents of metacognitive awareness and academic achievement of the students. Pearson's Correlation co-efficient was carried out and the results are reported in Table 4.10.

From Table 4.10 it is seen that there is a significant positive relationship between the metacognitive component namely regulation of cognition and academic achievement of students. It is seen that there is no statistically significant relationship between academic achievement and total score of metacognitive awareness and the component knowledge of cognition.

Hence the null hypothesis that, **“there is no statistically significant relationship between metacognitive awareness and academic achievement”** is accepted for total metacognitive score and knowledge of cognition and rejected for the component regulation of cognition. The result that there is positive relationship between regulation of cognition and academic achievement can be associated with Young and Fry (2008) and Narang (2013) study results. In their study also the sample showed positive correlation between regulation of cognition and academic achievement.

It is also seen that there is a positive significant relationship between the subcomponent evaluation and academic achievement of the students. This is in congruence with results of Sendurar (2011) whose sample also showed a positive significant relationship between evaluation and academic achievement. Further, it is seen that there is no significant correlation between the other subcomponents of metacognitive awareness and academic achievement. Hence the null hypothesis that **“there is no statistically significant relationship between the subcomponents of metacognitive awareness and academic achievement”** is rejected for the subcomponent evaluation and is accepted for all other subcomponents of metacognitive awareness.

**Table 4.10**

**Correlation between Components of Metacognitive Awareness and Academic Achievement**

Components	MC	KC	RC	DK	PK	CK	P	IMS	CM	DS	E	A.A
MC	1.00	0.837**	0.96**	0.613**	0.583**	0.626**	0.645**	0.738**	0.698**	0.549**	0.613**	0.036
KC	0.837**	1.00	0.65**	0.763**	0.653**	0.747**	0.428**	0.509**	0.508**	0.377**	0.363**	0.025
RC	0.96**	0.65**	1.00	0.459**	0.474**	0.484**	0.677**	0.765**	0.709**	0.570**	0.666**	0.70*
DK	0.613**	0.763**	0.459**	1.00	0.245**	0.306**	0.345**	0.326**	0.397**	0.214**	0.269**	0.005
PK	0.583**	0.653**	0.474**	0.245**	1.00	0.310**	0.201**	0.398**	0.377**	0.330**	0.305**	0.024
CK	0.626**	0.747**	0.484**	0.306**	0.310**	1.00	0.363**	0.398**	0.333**	0.298**	0.227**	0.027
P	0.645**	0.428**	0.677**	0.345**	0.201**	0.363**	1.00	0.354**	0.397**	0.195**	0.308**	0.052
IMS	0.738**	0.509**	0.765**	0.326**	0.398**	0.398**	0.354**	1.00	0.419**	0.291**	0.382**	0.041
CM	0.698**	0.508**	0.709**	0.397**	0.377**	0.333**	0.354**	0.419**	1.00	0.248**	0.357**	0.001
DS	0.549**	0.377**	0.570**	0.214**	0.330**	0.298**	0.195**	0.291**	0.248**	1.00	0.319**	0.007
E	0.613**	0.363**	0.666**	0.269**	0.305**	0.227**	0.308**	0.382**	0.357**	0.319**	1.00	0.636**
A.A	0.036	0.025	0.70*	0.005	0.024	0.027	0.052	0.001	0.001	0.007	0.636**	1.00

Note: MC=Metacognition, KC=Knowledge of Cognition, RC= Regulation of Cognition DK=Declarative Knowledge, PK= Procedural Knowledge, CK=Conditional Knowledge, P=Planning, IMS=Information Management Strategy, CM=Comprehension Monitoring, DS= Debugging Strategies, E=Evaluation, A.A= Academic Achievement  
 \*p< .05, \*\*p< .01

### 4.3 Differential analysis

Differential analysis is done for the comparison of two or more groups. This statistical technique helps in the inference and prediction of results. The primary objective of differential analysis is to enable the investigator to generalize from a sample to some larger population of which the sample is a part. Generalizations are done by using differences in means, standard deviations and standard errors. Among the various techniques, t- test and ANOVA were used for the present study.

The test of significance of difference between two means is known as t-test. Since a mean is probably the most satisfactory measure for characterizing a group, researchers find it important to determine whether the difference between means of samples is significant. The t-test involves the computation of the ratio between experimental variance and error variance. The t-test for large independent samples have been applied (two tailed tests) as the sample size of all the categories are exceeding thirty. Differential analysis is carried out under four sections.

#### Section A: Metacognitive Awareness and Academic Achievement

An attempt was made to find out whether different levels of Metacognitive Awareness contributes towards the academic achievement of the students. As there are 3 groups of students based on metacognitive awareness level, namely, above average, average and below average level of Metacognitive Awareness based on the scores obtained in the Metacognitive Awareness Inventory. ANOVA was carried out to find out if there is any significant difference in academic achievement of the students based on the levels of metacognitive awareness. The result obtained is given in Table 4.11

**Table 4.11**

#### Metacognitive Awareness and Academic Achievement

Academic Achievement	Sources of variation	Sum of Squares	df	Mean Square	F
	BG	407.32	261	1.561	0.751
	WG	1513.551	728	2.079	

Note : BG=Between Group, WG=Within Group, df=degrees of freedom, df=1(BG), df=1001(WG).

From Table 4.11 It is seen that there is no statistically significant difference in academic achievement based on the levels of Metacognitive Awareness. Hence the null hypothesis that “**there is no statistically significant difference in the academic achievement of students based on levels of Metacognitive Awareness**” is accepted.

### **Section B: Metacognitive Awareness and Learning Style Preference**

This section deals with the difference in metacognitive awareness if any based on the different learning style preference of the students. To analyze the difference in metacognitive awareness and its subcomponents of learners with different learning style preference, t-test was conducted for active-reflective, visual-verbal, sensing-intuitive and sequential-global learners and the results obtained are presented in Table 4.12 to Table 4.19

#### **4.3.1. Comparison of Metacognitive Awareness of Active and Reflective Learners**

An effort was made to compare the metacognitive awareness of students based on their Learning style Preference namely active and reflective. The results are given in Table 4.12.

**Table 4.12**

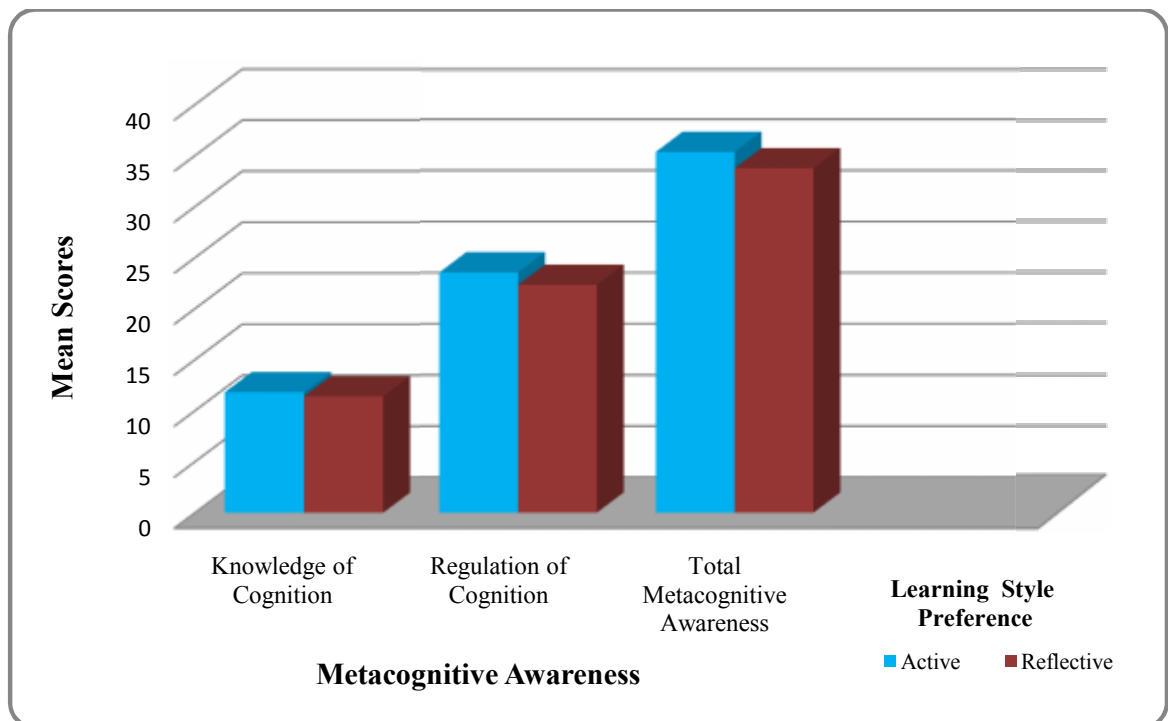
#### **Metacognitive Awareness of Active and Reflective Learners**

<b>Metacognitive Awareness</b>	<b>Learning Style Preference</b>				<b>t-value</b>	<b>df</b>
	<b>Active (N=693)</b>		<b>Reflective (N=312)</b>			
	<b>Mean</b>	<b>SD</b>	<b>Mean</b>	<b>SD</b>		
<b>Knowledge of Cognition</b>	11.80	3.07	11.41	3.04	1.85	1003
<b>Regulation of Cognition</b>	23.49	5.89	22.28	5.91	3.04**	
<b>Total Metacognitive Awareness</b>	35.29	8.22	33.69	8.23	2.86**	

*Note:* SD=Standard Deviation, df=degrees of freedom

\*\* p< .01

From Table 4.12 it is seen that there is a highly significant difference in the total metacognitive awareness and regulation of cognition of active and reflective learners and the mean value suggest that active learners possess more metacognitive awareness and regulation of cognition than the reflective learners. Hence the null hypothesis that “**there is no statistically significant difference in metacognitive awareness of active and reflective learners**” is rejected for total metacognition and regulation of cognition and accepted for the component knowledge of cognition.



**Figure 4.7. Metacognitive Awareness of Active and Reflective Learners**

#### **4.3.2. Comparison of Sub Components of Metacognitive Awareness of Active and Reflective Learners**

The investigator compared the eight sub components of metacognitive awareness of students based on their Learning Style Preference namely active and reflective. The results obtained are given in Table 4.13.

**Table 4.13**

**Sub Components of Metacognitive Awareness of Active and Reflective Learners**

Sub Components	Learning Style Preference				t-value	df
	Active (N=693)		Reflective(N=312)			
	Mean	SD	Mean	SD		
<b>Declarative Knowledge</b>	5.91	1.59	5.75	1.66	1.52	1003
<b>Procedural Knowledge</b>	2.37	1.21	2.29	1.04	0.92	
<b>Conditional Knowledge</b>	3.52	1.43	3.38	1.46	1.44	
<b>Planning</b>	4.94	1.82	4.52	1.83	3.41**	
<b>Information Management Strategies</b>	6.42	2.16	6.19	2.24	1.51	
<b>Comprehension Monitoring</b>	4.60	1.66	4.49	1.64	0.98	
<b>Debugging Strategies</b>	3.45	1.49	3.23	1.51	2.11*	
<b>Evaluation</b>	4.10	1.48	3.84	1.44	2.47*	

Note: SD=Standard Deviation, N=Number of students, df=degrees of freedom

\*p< .05, \*\*p< .01

It is seen that there exists no statistically significant difference in the subcomponents of metacognitive awareness namely declarative knowledge, procedural knowledge, conditional knowledge, information management strategies and comprehension monitoring of active and reflective learners. But it is seen that there is a highly significant difference in the planning of active and reflective learners and a significant difference in debugging strategies and evaluation skills of active and reflective learners. The mean values suggest that active learners possess better planning, debugging strategies and the evaluation skills than the reflective learners. Hence the null hypothesis stated that **“there is no statistically significant difference in the subcomponents of metacognitive awareness of active and reflective learners”** is accepted for the subcomponents declarative knowledge, procedural knowledge, conditional knowledge, information management strategies and comprehension monitoring and rejected for planning, debugging strategies and evaluation.

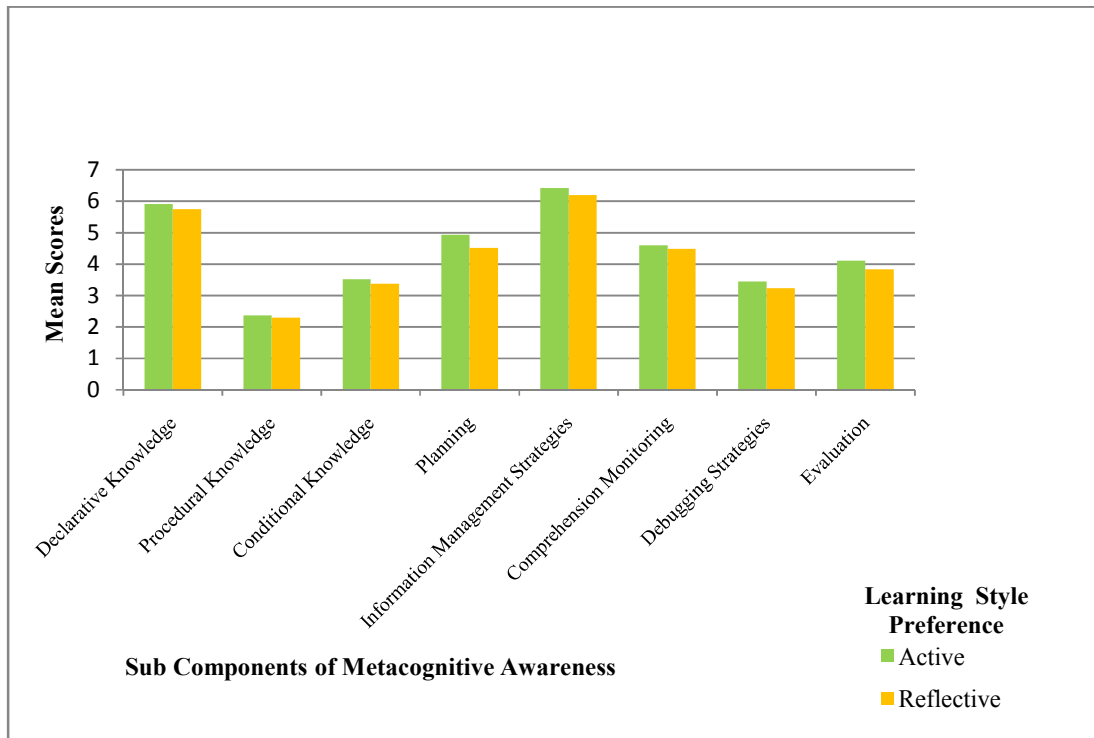


Figure 4.8 Sub Components of Metacognitive Awareness of Active and Reflective Learners

#### 4.3.3. Comparison of Metacognitive Awareness of Visual and Verbal learners

A comparison of metacognitive awareness of students based on the Learning style Preference namely visual and verbal was done and the results are presented in Table 4.14.

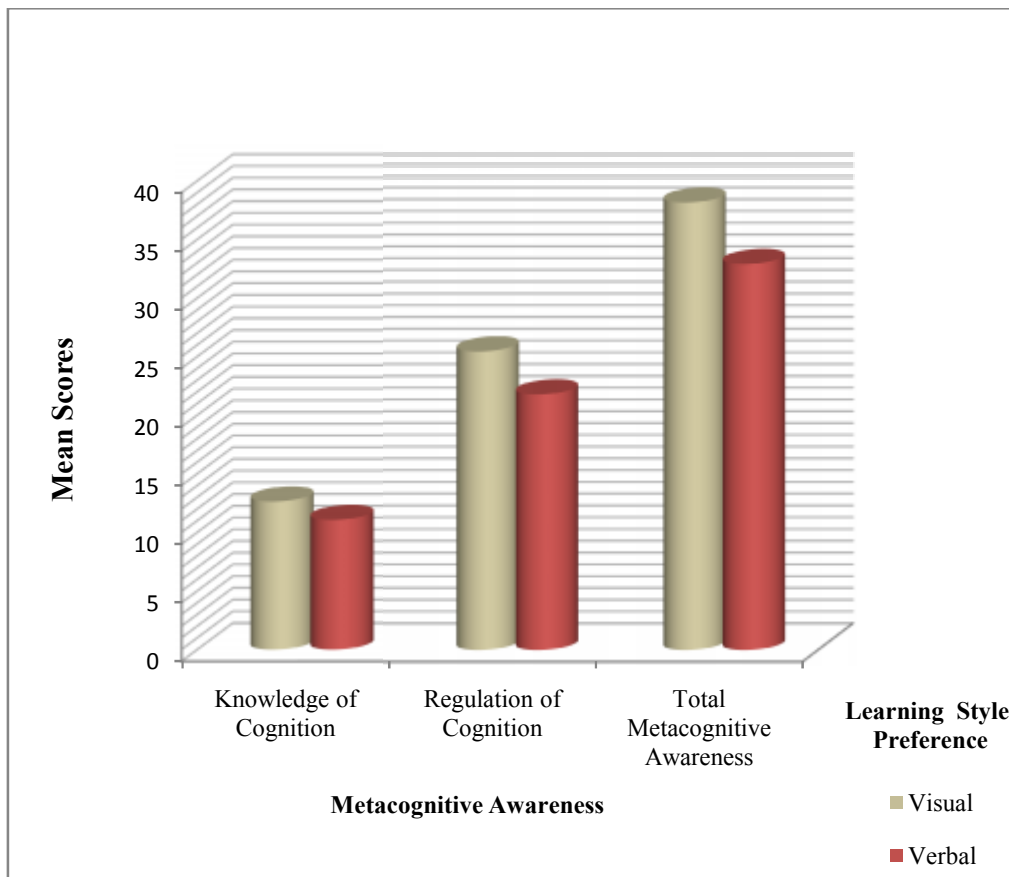
Table 4.14 Metacognitive Awareness of Visual and Verbal Learners

Metacognitive Awareness	Learning Style Preference				t-value	df
	Visual (N=391)		Verbal (N=614)			
	Mean	SD	Mean	SD		
Knowledge of Cognition	12.64	2.79	11.07	3.08	8.17**	1003
Regulation of Cognition	25.35	5.19	21.70	5.92	9.99**	
Total metacognitive awareness	37.99	7.29	32.77	8.18	10.28**	

Note: SD=Standard Deviation, df=degrees of freedom

\*\*p< .01

Table 4.14 indicates that there is a highly significant difference in the total metacognitive awareness, and the components knowledge of cognition and regulation of cognition of visual and verbal learners and the mean values suggest that visual learners possess more metacognitive awareness, knowledge of cognition and regulation of cognition than the verbal learners. Hence the null hypothesis that **“there is no statistically significant difference between visual and verbal learners in their Metacognitive Awareness”** is rejected.



**Figure 4.9. Metacognitive Awareness of Visual and Verbal Learners**

#### **4.3.4. Comparison of Sub Components of Metacognitive Awareness of Visual and Verbal Learners**

A comparison of sub components of metacognitive awareness of students based on the Learning Style Preference namely visual and verbal was carried out and the results obtained are presented in Table 4.15.

**Table 4.15****Sub Components of Metacognitive Awareness of Visual and Verbal Learners**

Sub Components	Learning Style Preference				t-value	df
	Visual (N=391)		Verbal (N=614)			
	Mean	SD	Mean	SD		
<b>Declarative Knowledge</b>	6.09	1.52	5.72	1.66	3.63**	1003
<b>Procedural Knowledge</b>	2.68	1.18	2.13	1.10	7.49**	
<b>Conditional Knowledge</b>	3.87	1.19	3.22	1.53	7.10**	
<b>Planning</b>	5.42	1.45	4.42	1.94	8.79**	
<b>Information Management Strategies</b>	6.92	1.97	5.98	2.24	6.74**	
<b>Comprehension Monitoring</b>	4.90	1.53	4.35	1.70	5.22**	
<b>Debugging Strategies</b>	3.71	1.29	3.17	1.58	5.68**	
<b>Evaluation</b>	4.40	1.33	3.78	1.51	6.61**	

Note: SD=Standard Deviation, df=degrees of freedom

\*\*p< .01

From Table 4.15 it is seen that there is a highly significant difference in all the subcomponents of metacognitive awareness of visual and verbal learners. The mean values indicate that the visual learners possess better declarative knowledge, procedural knowledge, conditional knowledge, planning, information management strategies, comprehension monitoring, debugging strategies and evaluation than verbal learners. The results imply that visual learners possess better knowledge of how to perform tasks or procedures, what strategies should be used under different conditions, set goals and plan for achieving it and they are also good at judging the performance and strategy effectiveness after the completion of a task. As there is a highly significant difference in the metacognitive awareness subcomponents of visual and verbal learners, the null hypothesis stated that **“there is no statistically significant difference in the sub components of metacognitive awareness of visual and verbal learners”** is rejected.

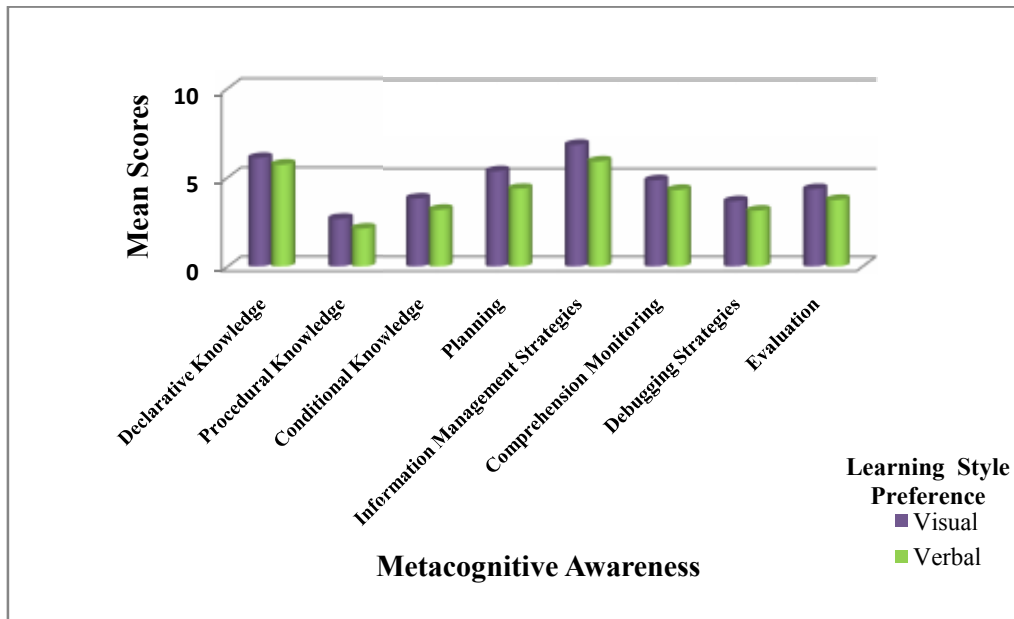


Figure 4.10. Sub Components of Metacognitive Awareness of Visual and Verbal Learners

#### 4.3.5. Comparison of Metacognitive Awareness of Sensing and Intuitive Learners

t-test was conducted to compare the metacognitive awareness of the students based on the Learning Style Preference namely Sensing and Intuitive and the results are presented in Table 4.16.

Table 4.16

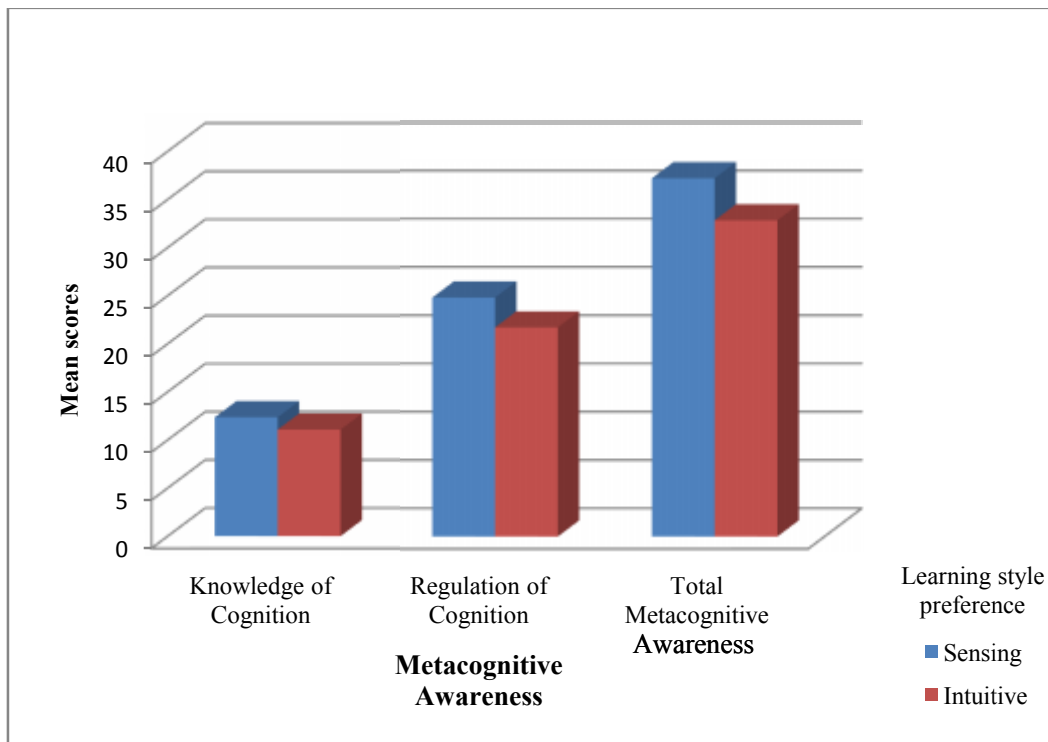
#### Metacognitive Awareness of Sensing and Intuitive Learners

Metacognitive Awareness	Learning Style Preference				t-value	df
	Sensing (N=470)		Intuitive (N=535)			
	Mean	SD	Mean	SD		
<b>Knowledge of Cognition</b>	12.36	2.91	11.08	3.08	6.76**	1003
<b>Regulation of Cognition</b>	24.76	5.46	21.67	5.93	8.53**	
<b>Total Metacognitive awareness</b>	37.12	7.66	32.76	8.21	8.68**	

Note: SD = Standard Deviation, N=Number of students, df=degrees of freedom  
\*\*p< 0.01

Table 4.16 indicates that there is a highly significant difference in the total metacognitive awareness, knowledge of cognition and regulation of cognition of sensing and intuitive learners and the mean values suggest that sensing learners possess better metacognitive awareness, knowledge of cognition and regulation of cognition than the intuitive learners. Hence the null hypothesis stated as **“there is no statistically significant difference in the metacognitive awareness of sensing and intuitive learners”** is rejected.

The obtained mean valued on metacognitive awareness and its components by the sensing and intuitive learners are presented graphically in Figure 4.11.



**Figure 4.11 Metacognitive Awareness of Sensing and Intuitive Learners**

#### **4.3.6. Comparison of Sub Components of Metacognitive Awareness of Sensing and Intuitive Learners**

t-test was conducted to compare the sub components of metacognitive awareness of the students based on the Learning Style Preference namely Sensing and Intuitive and the results are presented in Table 4.17 and the graphical representation of mean scores in Figure 4.12.

**Table 4.17****Sub Components of Metacognitive Awareness of Sensing and Intuitive Learners**

Sub Components	Learning Style Preference				t-value	df
	Sensing (N=470)		Intuitive (N=535)			
	Mean	SD	Mean	SD		
<b>Declarative Knowledge</b>	6.05	1.52	5.69	1.68	3.54**	1003
<b>Procedural Knowledge</b>	2.57	1.19	2.15	1.10	5.73**	
<b>Conditional Knowledge</b>	3.74	1.30	3.24	1.51	5.66**	
<b>Planning</b>	5.25	1.66	4.42	1.89	7.41**	
<b>Information Management Strategies</b>	6.77	2.02	5.98	2.26	5.84**	
<b>Comprehension Monitoring</b>	4.83	1.56	4.33	1.70	4.76**	
<b>Debugging Strategies</b>	3.61	1.37	3.17	1.58	4.67**	
<b>Evaluation</b>	4.30	1.37	3.78	1.51	5.70**	

Note: SD=Standard Deviation, N=Number of students, df=degrees of freedom  
 \*\*p< .01

The results in Table 4.17 shows that there is a highly significant difference in all the subcomponents of metacognitive awareness of Sensing and Intuitive learners. The analysis of mean values obtained by the learners indicate that sensing type of learners that is learners who like to learn facts and solve problems by well established methods and who are more patient with details possess better metacognitive awareness than the Intuitive type of learners who are more creative.

Hence the null hypothesis stated that **“there is no statistically significant difference in the sub components of metacognition of Sensing and Intuitive learners”** is rejected for all the sub components of metacognitive awareness.

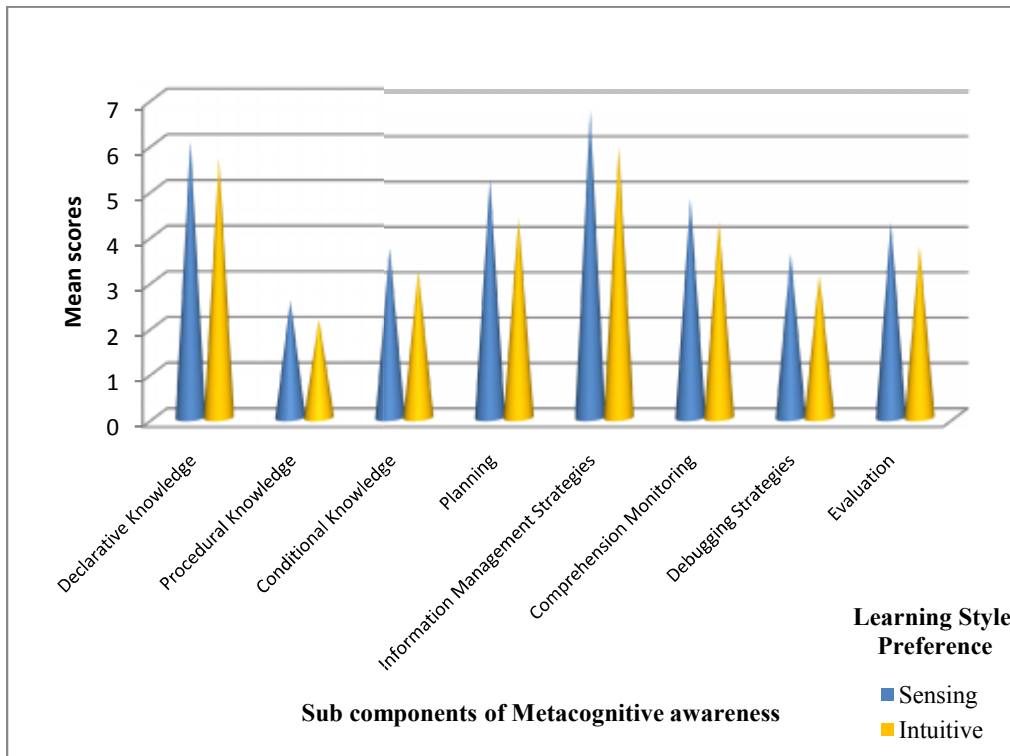


Figure 4.12 Sub Components of Metacognitive Awareness of Sensing and Intuitive Learners

#### 4.3.7. Comparison of Metacognitive Awareness of Sequential and Global Learners

The ‘t’ values obtained by comparing the metacognitive awareness of sequential and global learners are given in Table 4.18

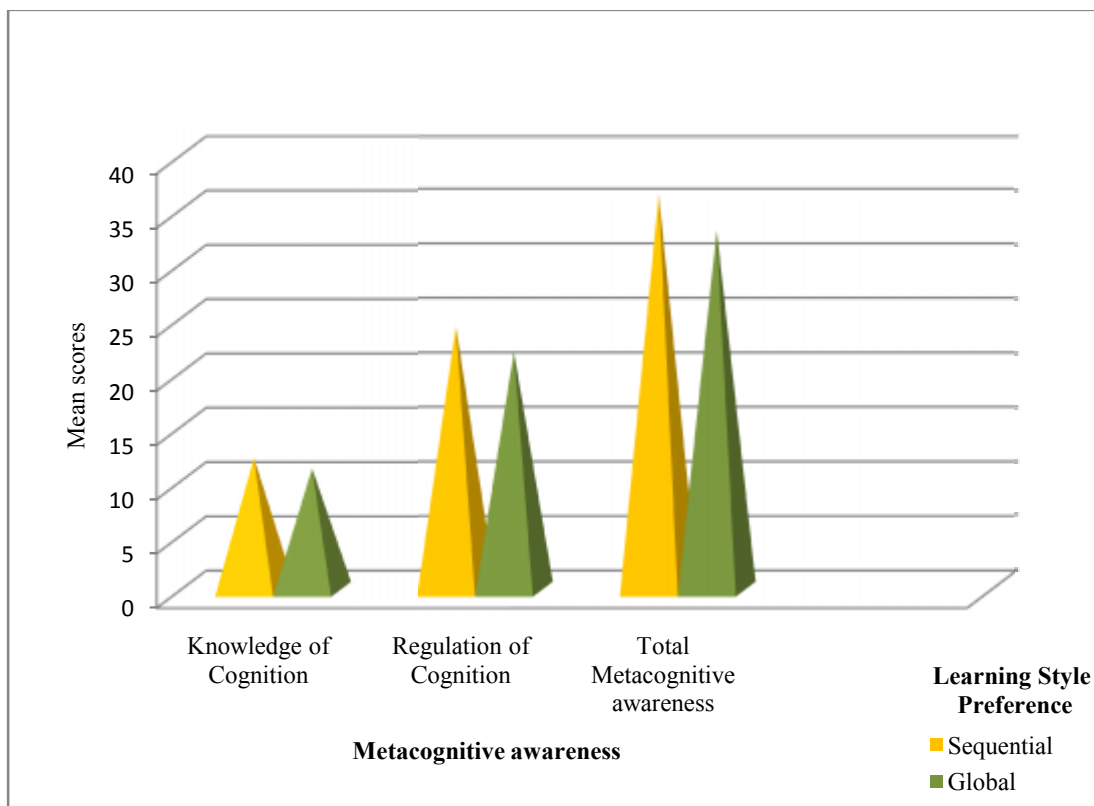
Table 4.18 Metacognitive Awareness of Sequential and Global learners

Metacognitive Awareness	Learning Style Preference				t-value	df
	Sequential (N=570)		Global (N=435)			
	Mean	SD	Mean	SD		
<b>Knowledge of Cognition</b>	12.10	2.96	11.13	3.12	5.04**	1003
<b>Regulation of Cognition</b>	24.14	5.76	21.78	5.87	6.38**	
<b>Total Metacognitive awareness</b>	36.24	7.96	32.90	8.25	6.47**	

Note: SD=Standard Deviation, N=Number of students, df=degrees of freedom  
 \*\*p< .01

From Table 4.18, it is seen that there is a highly significant difference in the total metacognitive awareness, knowledge of cognition and regulation of cognition of sequential and global learners and the mean values suggest that sequential learners possess better metacognitive awareness, knowledge of cognition and regulation of cognition than the global learners. Hence the null hypothesis that **“there is no statistically significant difference in the metacognitive awareness of sequential and global learners”** is rejected.

The mean scores obtained by sequential and global learners in knowledge of cognition and regulation of cognition and total metacognitive awareness are depicted in Figure 4.13.



**Figure 4.13. Metacognitive Awareness of Sequential and Global Learners**

#### 4.3.8. Comparison of Sub Components of Metacognitive Awareness of Sequential and Global Learners

An endeavor was made to compare the sub components of metacognitive awareness of students based on their Learning Style Preference namely Sequential and Global. The results obtained are given in Table 4.19 and the graphical representation of mean scores in Figure 4.14.

**Table 4.19**

**Sub Components of Metacognitive Awareness of Sequential and Global Learners**

Sub Components	Learning Style Preference				t-value	df
	Sequential (N=570)		Global (N=435)			
	Mean	SD	Mean	SD		
<b>Declarative Knowledge</b>	6.00	1.57	5.69	1.66	3.04**	1003
<b>Procedural Knowledge</b>	2.45	1.20	2.17	1.09	4.09**	
<b>Conditional Knowledge</b>	3.63	1.36	3.27	1.52	3.95**	
<b>Planning</b>	5.09	1.78	4.44	1.84	5.66**	
<b>Information Management Strategies</b>	6.61	2.11	6.00	2.24	4.45**	
<b>Comprehension Monitoring</b>	4.73	1.62	4.35	1.67	3.59**	
<b>Debugging Strategies</b>	3.54	1.45	3.17	1.54	3.88**	
<b>Evaluation</b>	4.17	1.47	3.82	1.45	3.78**	

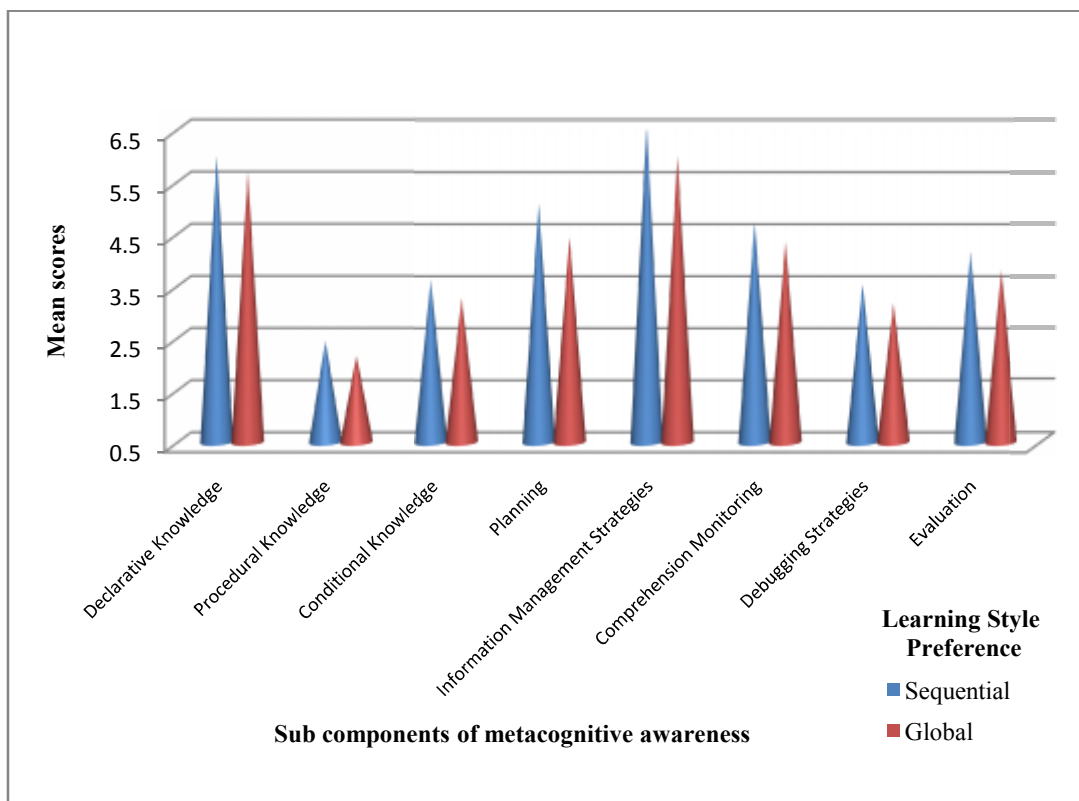
Note: SD= Standard Deviation, N=Number of students, df=degrees of freedom

\*\*p< .01

From Table 4.19, it is seen that there is a highly significant difference in all the subcomponents of metacognitive awareness of sequential and global learners. The mean values reveal the fact that the learners who learn logically and in small incremental steps (sequential learners) possess better declarative knowledge, procedural knowledge,

conditional knowledge, planning, information management strategies, comprehension monitoring, debugging strategies and evaluation than the global learners. This implies that the sequential learners know better about themselves, their strengths and weakness, apply knowledge for the purpose of completing a process, know better under which condition certain strategies may be effective, they are good at goal setting, organizing elaborating and summarizing than the global learners.

Hence the null hypothesis stated that **“there is no significant difference between sequential and global learners in the sub components of metacognition”** is rejected.



**Figure 4.14 Sub Components of Metacognitive Awareness of Sequential and Global Learner**

**Section C: Analysis of Learning Style Preference based on Personal Variables, Academic Variables and facilities available at home**

In this section the association between learning style preference of students and Personal Variables, Academic Variables and Facilities available at home were found and the results are given in Tables 4.20 to 4.30. As both the variables are categorical and the

sample size is very large the non-parametrical Chi-square ( $\chi^2$ ) test was used to find out the association between Learning Style Preference and the variables considered. The Personal Variables considered in this study are gender, locality, type of family and monthly income of the family. The academic variables considered were medium of instruction, types of school and groups of study and the facilities considered are separate study room in their home, availability of computer, internet access and news paper to read at home.

#### 4.3.9. Association between Learning style Preference and Gender

Table 4.20 shows the association between Learning style Preference and gender of higher secondary students.

**Table 4.20**

**Association between Learning style Preference and Gender**

Learning Style Preference	Gender				$\chi^2$
	Male (N=420)	%	Female (N=585)	%	
Active	290	69.0	403	68.9	0.003
Reflective	130	31.0	182	31.1	
Visual	167	39.8	224	38.3	0.165
Verbal	253	60.2	361	61.7	
Sensing	181	43.1	289	49.4	3.906*
Intuitive	239	56.9	296	50.6	
Sequential	214	51.0	356	60.9	9.366**
Global	206	49.0	229	39.1	

Note: df=1, Number of students, N=Number of students

\* p< .05, \*\*p< .01

The value obtained for sensing intuitive (3.906) is greater than the table value at .05 level (3.841), which indicates that that there is a significant association between gender and learning style preference namely sensing and intuitive.

From Table 4.20 it is seen that the chi square value obtained for sequential and global learning style preference (9.366) is greater than the critical value at .01

level (6.635), which shows that that there is a highly significant association between gender and learning style preference namely sequential and global.

It is seen that the chi square values obtained for active-reflective (0.003) and for visual-verbal (0.165) are less than the table value (3.841), which indicates that there is no significant association between gender and these learning style preferences. Hence the null hypothesis stated that **“there is no statistically significant association between gender and learning style preferences”** is rejected for Sensing–Intuitive and Sequential–Global and accepted for the learning styles dimension Active-Reflective and Visual-Verbal.

#### 4.3.10. Association between Learning Style Preference and Locality

The association between learning style preference of the rural and urban students were found using Chi-square and the results obtained are presented in Table 4.21.

**Table 4.21**

#### **Learning Style Preference and Locality**

Learning Style Preference	Locality				$\chi^2$
	Rural (N=880)	%	Urban (N=125)	%	
Active	606	68.4	87	70.2	0.004
Reflective	274	31.6	38	29.8	
Visual	320	34.4	71	50.2	18.38**
Verbal	560	65.6	54	49.8	
Sensing	393	44.4	77	52.6	11.95**
Intuitive	487	55.6	48	47.4	
Sequential	491	53.6	79	64.4	2.15
Global	389	46.4	46	35.6	

Note: df = 1, N=Number of students

\*\*p< .01

From Table 4.21 it is evident that the chi square value obtained for visual-verbal (18.382) and for sensing – intuitive (11.946) are greater than the table value at 0.01 level

(6.635), which shows that there is a highly significant association between locality and the learning style preferences namely, visual-verbal and sensing-intuitive.

It is also found that the chi square value obtained for active-reflective (0.004) and for sequential – global (2.152) is less than the table value (3.841), at 0.05 level, indicating that there is no significant association between locality and the sequential learning style preferences. Hence the null hypothesis stated that **“there is no statistically significant association between locality and learning style preference”** is rejected for visual-verbal and sensing – intuitive learners and accepted for the active-reflective and sequential-global learners.

#### 4.3.11. Association between Learning Style Preference and Type of Family

Chi-square test was done to analyse the association between learning style preferences of students from nuclear and joint family. The results obtained are given in Table 4.22.

**Table 4.22**

**Learning Style Preference and Type of Family**

Learning Style Preference	Type of Family				
	Nuclear (N=848)	%	Joint (N=157)	%	$\chi^2$
Active	597	70	96	61.1	5.30*
Reflective	251	30	61	38.9	
Visual	327	38.6	64	40.8	0.27
Verbal	521	61.4	93	59.2	
Sensing	402	47.4	68	43.3	0.89
Intuitive	446	52.6	89	56.7	
Sequential	493	58.1	77	49	4.46*
Global	355	41.9	80	51	

Note: df=1, N=Number of students

\* p< .05

Results from Table 4.22 reveal that there is a significant association between type of family and the Learning style preferences namely active- reflective and sequential-

global whereas the type of family is not associated to the learning style preference namely visual- verbal and sensing- intuitive. Hence the null hypothesis that “**there is no statistically significant association between learning style preference and type of family**” is accepted for visual-verbal and sensing-intuitive learning style preference and rejected for active-reflective and sequential-global learning style preference.

#### 4.3.12. Association between Learning style Preference and Monthly Income of the Family

Table 4.23 represents the Chi square value for the association between different learning style preferences and monthly income of the family.

**Table 4.23**

#### Learning style Preference and Monthly Income of the Family

Learning Style Preference	Monthly Income of the family								$\chi^2$
	(EWS) N=304	%	(LIG) N=406	%	(MIG) N=162	%	(HIG) N=133	%	
Active	205	67.4	287	70.7	114	70.4	87	65.4	1.82
Reflective	99	32.6	119	29.3	48	29.6	46	34.6	
Visual	113	37.2	143	35.2	68	42.0	67	50.4	10.55*
Verbal	191	62.8	263	64.8	94	58.0	66	49.6	
Sensing	136	44.7	183	45.1	83	51.2	68	51.1	3.29
Intuitive	168	55.3	223	54.9	79	48.8	65	48.9	
Sequential	162	53.3	236	58.1	89	54.9	83	62.4	3.75
Global	142	46.7	170	41.9	73	45.1	50	37.6	

Note: df=3, N=Number of students, (EWS)=Economically Weaker Section, (LIG)=Lower Income Group, (MIG)=Middle Income Group, (HIG)=Higher Income Group.

\* p< 0.05,

From Table 4.23 it evident that the chi square value obtained for visual-verbal (10.545) is greater than the table value at 0.05 level (7.815), which shows that there is a

significant association between monthly income of the family and the learning style preferences namely visual and verbal.

It is also seen that the chi square values obtained for active-reflective (1.819), sensing– intuitive (3.286) and for sequential–global (3.746) were less than the table value (7.815), which indicates that there is no significant association between monthly income and these learning style preferences. Hence the null hypothesis stated that **“there is no statistically significant association between monthly income of the family and learning style preferences”** is rejected for visual and verbal learning style and accepted for the active-reflective, sensing–intuitive and sequential–global learning style preferences.

#### 4.3.13. Association between Learning Style Preference and Medium of Instruction

Table 4.24 represents the Chi square value for the association between different learning style preference and medium of instruction.

**Table 4.24**

#### **Learning Style Preference and Medium of Instruction**

Learning Style Preference	Medium of Instruction				$\chi^2$
	Tamil (N=716)	%	English (N=289)	%	
Active	490	68.4	203	70.2	0.24
Reflective	226	31.6	86	29.8	
Visual	246	34.4	145	50.2	21.01**
Verbal	470	65.6	144	49.8	
Sensing	318	44.4	152	52.6	5.22*
Intuitive	398	55.6	137	47.4	
Sequential	384	53.6	186	64.4	9.22**
Global	332	46.4	103	35.6	

Note: df=1, N=Number of students

\* p< .05, \*\*p< .01

From Table 4.24 it is evident that the chi square value obtained for visual-verbal (21.007) and for sequential-global (9.222) is greater than the table value at .01 level

(6.635), which shows that there is a highly significant association between medium of instruction and learning styles namely visual-verbal and sequential-global. The chi-square value obtained for sensing-intuitive (5.213) is greater than the table value (3.841) at .05 level, which indicates that there is significant association between medium of instruction and learning style namely sensing and intuitive.

It is found that the chi square value obtained for active-reflective (0.235) is less than the table value (3.841) which indicates that there is no significant association between medium of instruction and learning style preferences namely active-reflective. Hence the null hypothesis stated that **“there is no statistically significant association between medium of instruction and learning style preference”** is accepted for active-reflective learning style preference and rejected for visual-verbal, sensing-intuitive and sequential-global learning style preferences.

#### 4.3.14. Association between Learning style Preference and Types of School

Table 4.25 represents the Chi square value obtained for the association between different learning style preferences and types of school. Three types of school namely government, corporation and private schools were considered for the study.

**Table 4.25**

#### **Learning Style Preference and Types of School**

Learning Style Preference	Types of school						$\chi^2$
	Government N=400	%	Corporation N=400	%	Private N=205	%	
<b>Active</b>	265	66.3	282	70.5	146	71.2	2.30
<b>Reflective</b>	135	33.8	118	29.5	59	28.8	
<b>Visual</b>	104	26.0	182	45.5	105	51.2	48.43**
<b>Verbal</b>	296	74.0	218	54.5	100	48.8	
<b>Sensing</b>	162	40.5	186	46.5	122	59.5	19.69**
<b>Intuitive</b>	238	59.5	214	53.5	83	40.5	
<b>Sequential</b>	178	44.5	262	65.5	130	63.4	40.64**
<b>Global</b>	222	55.5	138	34.5	75	36.6	

Note: df=2, N=Number of students  
\*\*p< .01

From Table 4.25 it is evident that the chi square value obtained for visual-verbal (48.425), sensing-intuitive (19.698) and sequential-global (40.635) are greater than the table value at 0.01 level (9.210), which shows that there is a highly significant association between types of school and these sequential learning style preferences. But it is seen that the chi square value obtained for active-reflective (2.304) is less than the table value (5.991) at .05 level, which indicates that there is no significant association between types of school and active-reflective learning style preference. Hence the null hypothesis stated that **“there is no statistically significant association between types of school and learning style preference”** is rejected for visual-verbal, sensing-intuitive and sequential-global and accepted for the learning style preference active-reflective.

#### **4.3.15. Association between Learning Style Preference and Groups of Study**

An attempt was made to find out if there is any significant association between learning style preference and different groups of study namely mathematics, science, computer science, commerce, history and vocational. Table 4.26 represents the Chi square value for the association between different learning style preference and groups of study.

**Table 4.26**

**Learning Style Preference and Groups of Study**

Learning Style Preference	Groups of study												$\chi^2$
	Mathematics N=83	%	Science N=103	%	Computer Science N=274	%	Commerce N=346	%	History N=40	%	Vocational N=159	%	
<b>Active</b>	60	72.3	76	73.8	187	68.2	235	67.9	27	67.5	108	67.9	1.91
<b>Reflective</b>	23	27.7	27	26.2	87	31.8	111	32.1	13	32.5	51	32.1	
<b>Visual</b>	35	42.2	40	38.8	120	43.8	139	40.2	10	25.0	47	29.6	12.46*
<b>Verbal</b>	48	57.8	63	61.2	154	56.2	207	59.8	30	75.0	112	70.4	
<b>Sensing</b>	45	54.2	54	52.4	131	47.8	162	46.8	19	47.5	59	37.1	9.27
<b>Intuitive</b>	38	45.8	49	47.6	143	52.2	184	53.2	21	52.5	100	62.9	
<b>Sequential</b>	44	53.0	55	53.4	171	62.4	213	61.6	17	42.5	70	44	21.58**
<b>Global</b>	39	47.0	48	46.6	103	37.6	133	38.4	23	57.5	89	56	

Note: df=5, N=Number of students

\* p< .05, \*\*p< .01

From Table 4.26 it is evident that the chi square value obtained (21.575) for sequential and global learners is greater than the table value at .01 level (15.086), which shows that there is a highly significant association between groups of study and learning style preference namely sequential-global. The chi square value obtained (12.459) for visual-verbal learning style preference is also greater than the table value (11.070) at .05 level, which indicates that there is significant association between groups of study and learning style preference namely visual-verbal. The chi square value obtained for active-reflective (1.910) and for sensing-intuitive (9.265) are less than the table value (11.070) at 0.05 level indicating that there is no significant association between groups of study and these learning style preferences. Hence the null hypothesis stated that “**there is no statistically significant association between groups of study and Learning Style Preference**” is rejected for sequential-global and visual-verbal and accepted for active-reflective and sensing-intuitive style of learning preference.

#### 4.3.16. Association between Learning Style Preference and Availability of Study Room at Home

To investigate the association between learning style preference and availability of separate study room in the home, Chi-square analysis was carried out and the results obtained are given in Table 4.27.

**Table 4.27**

#### Learning Style Preference and Availability of Separate Study Room at Home

Learning Style Preference	Separate Study room at home				$\chi^2$
	Yes (N=228)	%	No (N=777)	%	
Active	156	68.4	537	69.1	0.039
Reflective	72	31.6	240	30.9	
visual	89	39	302	38.9	0.002
Verbal	139	61	475	61.1	
sensing	106	46.5	364	46.8	0.009
Intuitive	122	53.5	430	55.2	
Sequential	146	64	424	54.6	6.434*
Global	82	36	353	45.4	

Note: df=1, N=Number of students

\* p< 0.05

From Table 4.27 The results suggest that; at  $\chi^2 (1, N= 1005) =6.434$ ,  $p<0.05$ , learning style preference namely sequential- global is associated with the availability of separate study room facility at home and it is also noted that there is no statistically significant association between the availability of separate study room facility and other Learning Style Preference namely active- reflective, visual- verbal and sensing- intuitive. Hence the null hypothesis that “**there is no statistically significant association between Learning style preference and the availability of separate study room facility at home**” is rejected for sequential and global learners and accepted for students with other learning style preferences.

#### 4.3.17. Association between Learning Style Preference and Availability of Computer

An effort was made to find out if there is any association between learning style preference of students and availability of computer to work in their home. Table 4.28 display the Chi-square analysis carried out for finding out the association.

**Table 4.28**

#### **Learning Style Preference and Availability of Computer to work at home**

Learning Style Preference	Computer to work at home				$\chi^2$
	Yes (N=208)	%	No (N=797)	%	
Active	145	69.7	548	68.8	0.07
Reflective	63	30.3	249	31.2	
Visual	96	46	295	37	5.79*
Verbal	112	54	502	63	
Sensing	100	49	370	46.4	0.18
Intuitive	108	51	427	53.6	
Sequential	121	58.2	449	56	0.23
Global	87	41.8	348	44	

Note: df=1, N=Number of students

\*  $p < .05$

The chi-square analysis revealed the fact that there is a significant association between visual and verbal learning style preference and the availability of computer to

work at home, which means the students who have computer at home prefer to be more of visual and verbal learners. We could also examine from Table 4.28 there is no significant association between availability of computer at home and the learning style preferences namely active- reflective, sensing- intuitive and sequential- global. Hence the null hypothesis that “**there is no statistically significant association between learning style preference and availability of computer at home** is rejected for visual- verbal learners and accepted for active- reflective, sensing- intuitive and sequential- global learners.

#### 4.3.18. Association between Learning style preference and internet access at home

Chi-square analysis was conducted to investigate the association between students learning style preference and internet access at home. The results obtained are given in Table 4.29.

**Table 4.29**

##### Learning Style Preference and Internet access at Home

Learning Style Preference	Internet access at home				$\chi^2$
	Yes(N=130)	%	No(N=875)	%	
Active	91	70	602	68.8	0.08
Reflective	39	30	273	31.2	
Visual	68	52.3	323	37	1.28**
Verbal	62	47.7	552	63	
Sensing	62	47.7	408	46.6	0.05
Intuitive	68	52.3	467	53.4	
Sequential	77	59.2	493	56.3	0.39
Global	53	40.8	382	43.7	

Note: df=1, N=Number of students

\*\*p< 0.01

From Table 4.29 it is clear that there is a highly significant association between learning style preference namely visual- verbal and availability of internet access in their home to work. It is also seen that there is no statistically significant association between internet access and learning style preference namely Active-Reflective, Sensing-Intuitive

and Sequential- Global. Hence the null hypothesis that “**there is no statistically significant association between learning style preference and internet facilities available at home**” is rejected for visual- verbal learners and accepted for other styles of learning style preference.

#### 4.4.19. Association between Learning Style Preference and News Paper Reading Habit of Higher Secondary Students

Chi square test was administered in order to examine whether there is any significant association between learning style preference and news paper reading habit of the students. The results of the test are presented in Table 4.30.

**Table 4.30**  
**Learning Style Preference and News Paper Reading Habit**

Learning Style Preference	News paper reading habit				$\chi^2$
	Yes (N=576)	%	No (N=429)	%	
Active	404	70	289	67	0.88
Reflective	172	30	140	33	
Visual	217	37.7	174	41	0.86
Verbal	359	62.3	255	59	
Sensing	254	44	216	50.3	3.86*
Intuitive	322	56	213	49.7	
Sequential	322	56	248	57.8	0.36
Global	254	44	181	42.2	

Note: df=1, N=Number of students

\* p< .05

The results  $\chi^2$  (1, N=1005=3.861), P=0.049 on the contingency reveal that there is a significant association between sensing-intuitive learning style preference and news paper reading habit. The  $\chi^2$  values for Active- Reflective, Visual- Verbal and Sequential- Global reveals that there is no statistically significant association between learning style preference and news paper reading habit of the students.

Hence the null hypothesis that, “**There is no statistically significant association between learning style preference and news paper reading habit**” is rejected for sensing-intuitive learning style preference and accepted for other three learning style preferences.

**Section D: Analysis of Metacognitive Awareness of students based on Personal variables, Academic variables and Facilities available at home.**

Analysis was carried out to compare the metacognitive awareness of higher secondary students based on the Personal variables namely, gender, locality, type of family and monthly income of the family, academic variables like medium of instruction, types of school and groups of study and Facilities available at home like separate study room at home, computer and internet access at home and news paper reading. The results obtained are presented in Table 4.31 to Table 4.52.

**4.3.20. Comparison of Metacognitive Awareness based on Gender of the students**

An effort was made to compare the metacognitive awareness of students based on their gender and the results obtained for t-test is given in Table 4.31.

**Table 4.31**

**Metacognitive Awareness and Gender**

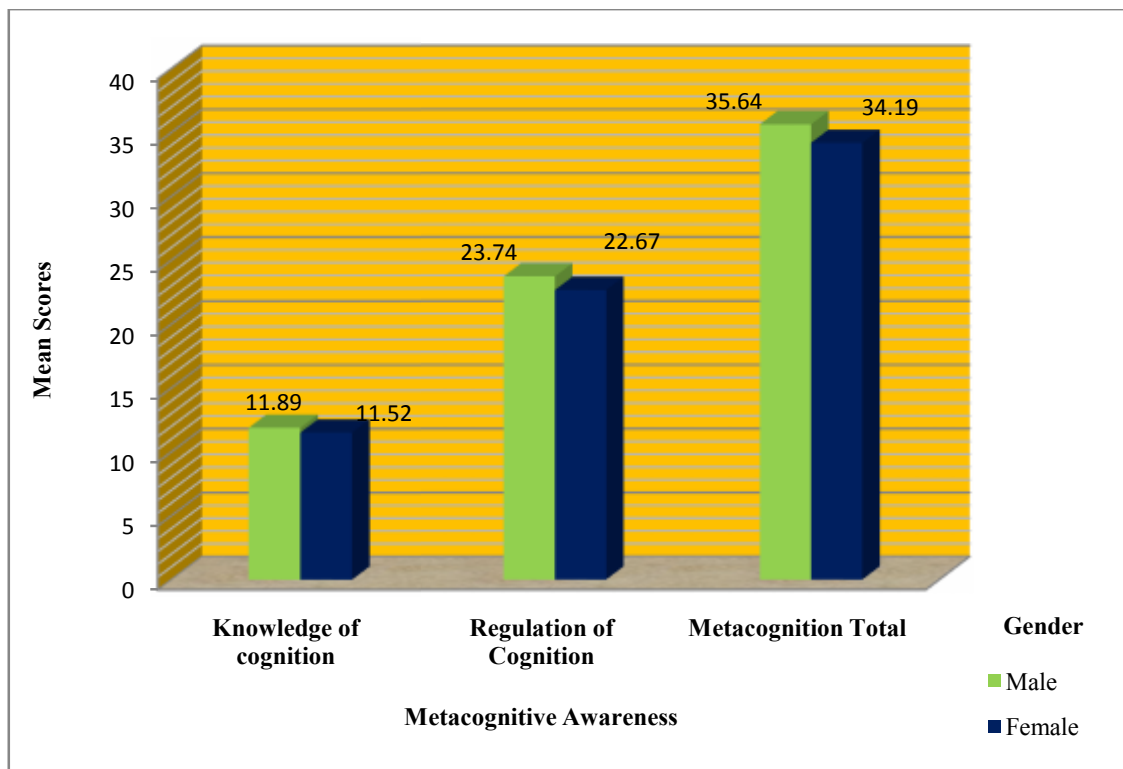
Metacognitive Awareness	Gender				t-value	df
	Male (N=420)		Female (N=585)			
	Mean	SD	Mean	SD		
<b>Knowledge of Cognition</b>	11.89	2.99	11.52	3.11	1.91	1003
<b>Regulation of Cognition</b>	23.74	5.82	22.67	5.96	2.85**	
<b>Metacognition Total</b>	35.64	8.19	34.19	8.23	2.76**	

Note: N=Number of students, SD-standard deviation, df=degrees of freedom  
 \*\* p< .01

From Table 4.31, it is seen that there is a highly significant difference in the total metacognitive awareness and regulation of cognition of male and female students and the

mean value suggests that male students possess better metacognitive awareness and regulation of cognition than the female students. Hence the null hypothesis that “**there is no statistically significant difference in the metacognitive awareness**” of male and female students is accepted for the component knowledge of cognition and is rejected for total metacognition and regulation of cognition. This result is in contradiction to the findings of Zulkipli (2006) and Rani (2013) whose sample showed no significant difference in total metacognitive awareness based on gender.

The mean values obtained for metacognitive awareness, knowledge of cognition and regulation of cognition by male and female students are graphically represented in Figure 4.15



**Figure 4.15. Metacognitive Awareness and Gender**

#### **4.3.21. Comparison of Sub Components of Metacognitive Awareness of male and female students**

A comparison of the sub components of metacognitive awareness of the students based on gender was attempted. t-test was conducted and the results are presented in Table 4.32.

**Table 4.32****Sub Components of Metacognitive Awareness and Gender**

Sub Components	Gender				t-value	df
	Male (N=420)		Female (N=585)			
	Mean	SD	Mean	SD		
<b>Declarative Knowledge</b>	5.92	1.54	5.82	1.67	1.03	1003
<b>Procedural Knowledge</b>	2.38	1.08	2.32	1.22	0.77	
<b>Conditional Knowledge</b>	3.59	1.39	3.39	1.47	2.29*	
<b>Planning</b>	4.95	1.78	4.71	1.87	1.98*	
<b>Information Management Strategies</b>	6.54	2.23	6.21	2.15	2.44*	
<b>Comprehension Monitoring</b>	4.69	1.59	4.48	1.70	2.11	
<b>Debugging Strategies</b>	3.42	1.43	3.35	1.55	0.67	
<b>Evaluation</b>	4.15	1.36	3.93	1.54	2.29*	

Note: N=Number of students, SD=standard deviation, df=degrees of freedom

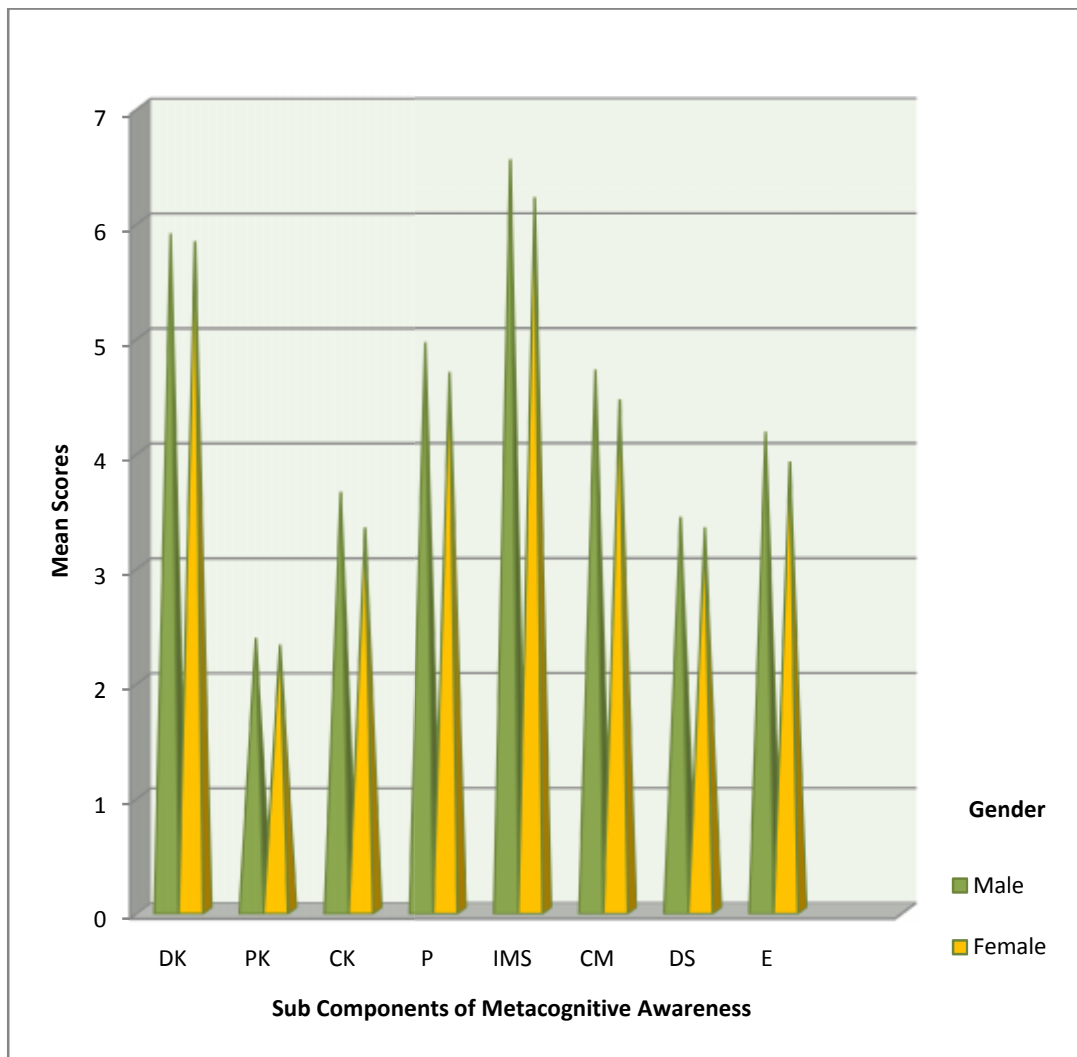
\* p< .05

From Table 4.32 it is seen that there is a significant difference in the subcomponents of metacognitive awareness namely conditional knowledge, planning, information management strategies, comprehension monitoring and evaluation. The mean value shows that male students possess better conditional knowledge, planning, information management strategies, comprehension monitoring and evaluation skills than female students.

Hence the results reveal that male students possess better knowledge of appropriate conditions for better performance and are also better in setting goals, organizing information so that learning becomes more efficient. They also assess their learning to see whether they understand the materials better and judge whether they have attained the set goal after completion of the task.

The t-value for the subcomponents of metacognitive awareness namely declarative knowledge, procedural knowledge and debugging strategies shows that there is no statistically significant difference based on gender.

Hence the null hypothesis stated that “**there is no statistically significant difference between male and female students in the sub components of metacognitive awareness**” is rejected for the subcomponents conditional knowledge, planning, information management strategies, comprehension monitoring and evaluation and accepted for the subcomponents declarative knowledge, procedural knowledge and debugging strategies. The results are graphically represented in Figure 4.16.



**Figure 4.16: Sub Components of Metacognitive Awareness and Gender**

#### **4.3.22. Comparison of Metacognitive Awareness of Rural and Urban students**

An effort was made to compare the metacognitive awareness of students based on their locality. The result obtained is reported in Table 4.33

**Table 4.33****Metacognitive Awareness and Locality**

Metacognitive Awareness	Rural (N=880)		Urban (N=125)		t-value	df
	Mean	SD	Mean	SD		
<b>Knowledge of Cognition</b>	11.65	3.09	11.86	2.93	0.70	1003
<b>Regulation of Cognition</b>	23.19	5.96	22.56	5.70	1.11	
<b>Metacognition Total</b>	34.84	8.30	34.42	8.04	0.54	

*Note:* N=Number of students, SD=standard deviation, df=degrees of freedom

The t-value for the total metacognitive awareness score, knowledge of cognition and regulation of cognition shows that there is no statistically significant difference based on locality. Hence the null hypothesis stated that **“there is no statistically significant difference between rural and urban students in the metacognitive awareness”** is accepted for the total metacognitive awareness score, knowledge of cognition and regulation of cognition. However, unlike the findings of Rani (2013), locale wise difference in metacognitive awareness is not seen in this study.

#### **4.3.23. Comparison of Subcomponents of Metacognitive Awareness of Students Based on their Locality**

The sub components of metacognitive awareness of the students based on their locality was compared using t-test and the results are presented in Table 4.34.

**Table 4.34****Sub Components of Metacognitive Awareness and Locality**

Sub Components	Rural (N=880)		Urban (N=125)		t-value	df
	Mean	SD	Mean	SD		
<b>Declarative Knowledge</b>	5.88	1.61	5.68	1.70	1.32	1003
<b>Procedural Knowledge</b>	2.32	1.19	2.49	0.92	1.54	
<b>Conditional Knowledge</b>	3.44	1.46	3.68	1.27	1.74	
<b>Planning</b>	4.83	1.87	4.62	1.61	1.21	
<b>Information Management Strategies</b>	6.37	2.18	6.16	2.24	1.01	
<b>Comprehension Monitoring</b>	4.55	1.67	4.64	1.59	0.57	
<b>Debugging Strategies</b>	3.38	1.53	3.39	1.32	0.11	
<b>Evaluation</b>	4.06	1.48	3.75	1.39	2.23*	

Note: N=Number of students, SD=standard deviation, df=degrees of freedom,

\* p< .05

Table 4.34 shows that there is a significant difference only in the sub component of metacognitive awareness namely evaluation skills. The mean value shows that evaluation is better for rural students. The result imply that rural students are better in evaluating their performance in relation to their goals.

The t-value for the subcomponents of metacognitive awareness namely declarative knowledge, procedural knowledge, conditional knowledge, planning, information management strategies, comprehension monitoring and debugging strategies shows that there is no statistically significant difference based on locality.

Hence the null hypothesis stated that **“there is no statistically significant difference between rural and urban students in the metacognitive awareness”** is rejected for the subcomponent evaluation and accepted for the subcomponents declarative knowledge, procedural knowledge, conditional knowledge, planning, information management strategies, comprehension monitoring and debugging strategies.

#### 4.3.24. Comparison of Metacognitive Awareness of Students Based on Type of Family

An effort was made to compare the metacognitive awareness of students from nuclear and joint family. The results of t-test obtained is given in Table 4.35

**Table 4.35**

##### **Metacognitive Awareness based on Type of Family**

Metacognitive Awareness	Type of family				t-value	df
	Nuclear (N=848)		Joint (N=157)			
	Mean	SD	Mean	SD		
<b>Knowledge about cognition</b>	11.75	3.04	11.32	3.20	1.58	1003
<b>Regulation of Cognition</b>	23.17	5.93	22.83	5.88	0.67	
<b>Metacognition Total</b>	34.92	8.23	34.15	8.33	1.07	

*Note:* N=Number of students, SD=Standard Deviation , df=degrees of freedom

The t-value for total metacognitive awareness, knowledge of cognition and regulation of cognition shows that there is no statistically significant difference based on type of family. Hence the null hypothesis stated that **“there is no statistically significant difference in metacognitive awareness of students from nuclear and joint family”** is accepted.

#### 4.3.25. Comparison of Sub Components of Metacognitive Awareness of Students Based on Type of Family

Table 4.36 represents the results of the comparison of the sub components of metacognitive awareness of the students based on their type of family. t-test was conducted and the results are presented in Table 4.36.

**Table 4.36****Sub Components of Metacognitive Awareness and Type of Family**

Sub Components	Type of family				t-value	df
	Nuclear(N=848)		Joint(N=157)			
	Mean	SD	Mean	SD		
<b>Declarative Knowledge</b>	5.86	1.62	5.87	1.59	0.04	1003
<b>Procedural Knowledge</b>	2.36	1.18	2.25	1.08	1.06	
<b>Conditional Knowledge</b>	3.52	1.40	3.20	1.60	2.56*	
<b>Planning</b>	4.77	1.86	4.99	1.65	1.38	
<b>Information Management Strategies</b>	6.39	2.18	6.10	2.21	1.57	
<b>Comprehension Monitoring</b>	4.58	1.65	4.48	1.70	0.70	
<b>Debugging Strategies</b>	3.41	1.52	3.22	1.39	1.42	
<b>Evaluation</b>	4.02	1.49	4.04	1.34	0.17	

Note: N=Number of students, SD=Standard Deviation, df=degrees of freedom

\*p< .05

From Table 4.36 it is clear that there is significant difference in one of the subcomponent of metacognitive awareness namely conditional knowledge. The mean value shows that conditional knowledge is better for students from nuclear family which implies that students from nuclear family have knowledge about the circumstances when a particular process or task should be done.

The t-value for the subcomponents of metacognitive awareness namely declarative knowledge, procedural knowledge, planning, information management strategies, comprehension monitoring and debugging strategies and evaluation shows that there is no statistically significant difference based on type of family.

Hence the null hypothesis stated that **“there is no statistically significant difference in the metacognitive awareness of students from nuclear and joint family”** is rejected for the subcomponent conditional knowledge and accepted for the all other subcomponents.

#### 4.3.26. Comparison of Metacognitive Awareness of Higher Secondary Students Based on Monthly Income of the Family

To study whether the income of the family contributes towards metacognitive awareness of higher secondary students belonging to families with different monthly income, Analysis of variance was conducted. Table 4.37 presents the F-values obtained for total metacognitive awareness, knowledge of cognition and regulation of cognition. The students were classified into different groups based on the income classification by government of Tamil Nadu. The student sample in the present study belong to four income groups. They are Economically Weaker Sections (EWS) with money income up to Rs.12,000, Lower Income Group (LIG) with monthly income from Rs.12,001 to Rs. 18,000, Middle Income Group (MIG) with monthly income from Rs. 18,001 to Rs. 37,000 and Higher Income Group (HIG) in the range Rs.37,001 to Rs.62,000. The results obtained is reported in Table 4.37.

**Table 4.37**

**Metacognitive Awareness and Monthly Income of the Family**

Metacognitive Awareness	Source of variation	Sum of Squares	Mean Square	<i>F</i>
<b>Metacognition Total</b>	<b>BG</b>	1954.33	651.44	5.51**
	<b>WG</b>	118330.371	118.21	
<b>Knowledge of Cognition</b>	<b>BG</b>	118.63	39.54	4.25**
	<b>WG</b>	9322.21	9.31	
<b>Regulation of Cognition</b>	<b>BG</b>	509.73	169.91	4.90**
	<b>WG</b>	34704.41	34.67	

Note: BG=Between Group, WG=Within Group, df=degrees of freedom, df=3(BG), df=1001(WG),

\*\* p< .01

ANOVA results of Table 4.37 reveals that a highly significant difference exists among students from families with different monthly income in total metacognitive awareness, knowledge of cognition and regulation of cognition.

Post hoc analysis using Tukey test was used to determine significance between groups and to find out which group of students are better in metacognitive awareness and its components and the results obtained are given in Table 4.37.1 to 4.37.3.

#### **Tukey test results for Metacognitive Awareness**

Post hoc analysis was done using Tukey test to find out which income group of students possess better metacognitive awareness. The results are given in Table 4.37 .1

**Table 4.37.1**

#### **Tukey test results for Metacognitive Awareness based on Monthly Income**

Monthly Income of the Family	No. of students	Mean value	
		1	2
<b>(HIG) – Rs.37,001 to Rs.62,000</b>	133	45.49	45.49
<b>(EWS) – upto Rs.12,000/-</b>	304	45.33	
<b>(MIG) - Rs. 18,001 to Rs.37,000</b>	162	45.19	
<b>(LIG) - Rs.12,001 to Rs.18,000</b>	406		48.17
<b>Significant</b>		0.99	0.06

Results of Table 4.37.1 indicates that students from family with monthly income Rs.12,001 to Rs.18,000 possess better metacognitive awareness than their counterparts.

#### **Tukey test results for Knowledge of Cognition**

Tukey test was done to find out which group of students possess better knowledge of cognition. The results are given in Table 4.37.2

**Table 4.37.2****Tukey test results for Knowledge of Cognition**

Income of The Family	No. of students	Mean value
		1
<b>(HIG) – Rs.37,001 to 62,000</b>	133	11.50
<b>(EWS) – upto Rs.12,000/-</b>	304	11.37
<b>(MIG) - Rs.18,001 to Rs.37,000</b>	162	11.37
<b>(LIG) - Rs.12,001 to Rs.18,000</b>	406	12.09
<b>Significant</b>		0.08

From Table 4.37.2 it is seen that students from family with monthly income Rs.12,001 to Rs.18,000 have more knowledge of cognition than their counterparts.

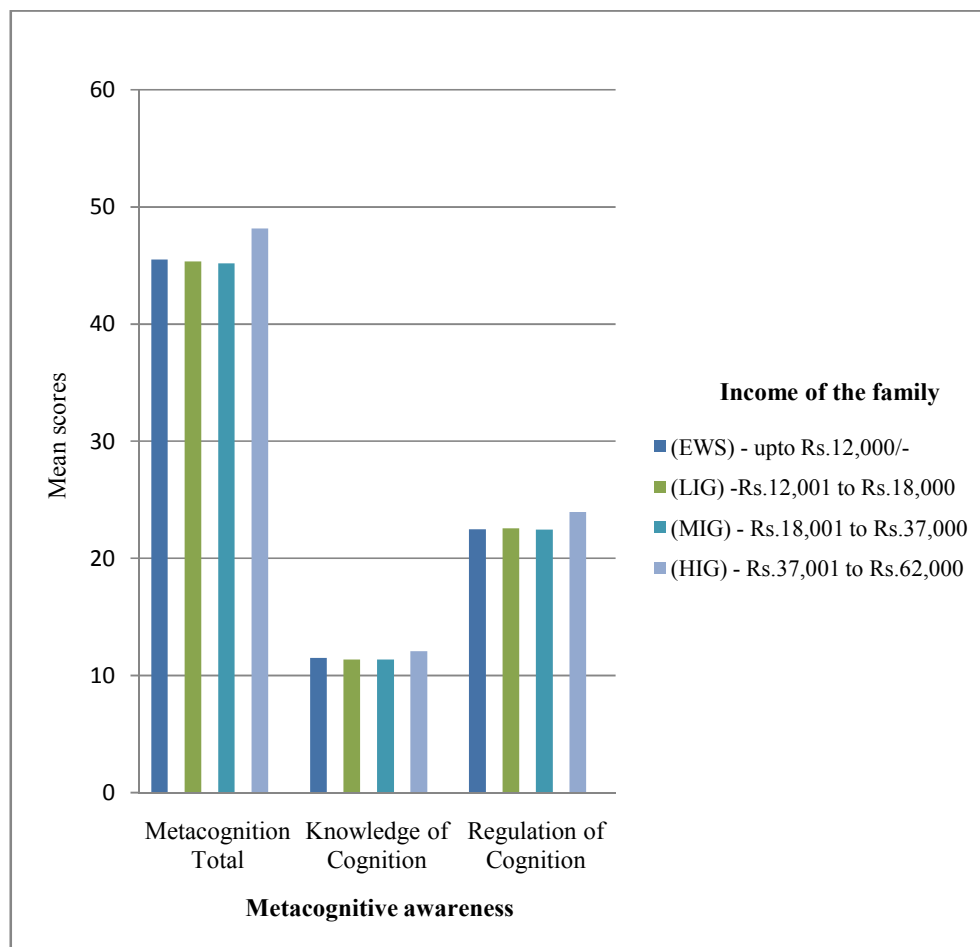
**Tukey test results for Regulation of Cognition**

To find out which group of students possess better regulation of cognition Tukey test was done and the results are given in Table 4.37 .3

**Table 4.37.3****Tukey test results for Regulation of Cognition**

Income of the Family	No. of students	Mean value	
		1	2
<b>(HIG) - Rs.37,001 to Rs.62,000</b>	133	22.48	
<b>(EWS) – upto Rs.12,000/-</b>	304	22.59	22.59
<b>(MIG) - Rs.18,001 to Rs.37,000</b>	162	22.45	
<b>(LIG) - Rs.12,001 to Rs.18,000</b>	406		23.98
<b>Significant</b>		0.99	0.05

The mean value suggests that students from family with monthly income of Rs.12,001 to Rs.18,000 have more regulation of cognition than their counterparts.



**Figure 4.17: .Metacognitive Awareness and Monthly Income of the Family**

#### **4.3.27. Comparison of Sub Components of Metacognitive Awareness of Higher Secondary Students Based on Monthly Income of the family**

To study whether the income of the family contributes towards Sub Components of metacognitive awareness of higher secondary students belonging to families with monthly income in the ranges <Rs.12,000, Rs.12,001 to Rs.18,000, Rs.18,001 to Rs.37,000 and Rs.37,001 to Rs.62,000. Analysis of variance was conducted. Table 4.38 presents the F values obtained for all the eight sub components of metacognitive awareness based on the monthly income of the family.

**Table 4.38****Sub Components of Metacognitive Awareness and Monthly Income of the Family**

Sub Components	Source of variation	Sum of Squares	Mean Square	<i>F</i>
<b>Declarative Knowledge</b>	BG	16.407	5.469	2.108
	WG	2596.811	2.594	
<b>Procedural Knowledge</b>	BG	1.958	0.653	0.482
	WG	1355.232	1.354	
<b>Conditional Knowledge</b>	BG	39.410	13.137	4.849**
	WG	2711.828	2.709	
<b>Planning</b>	BG	68.896	22.299	4.706**
	WG	4742.909	4.738	
<b>Information Management Strategies</b>	BG	0.262	8.723	0.018
	WG	4809.237	4.804	
<b>Comprehension Monitoring</b>	BG	0.710	0.237	0.086
	WG	2748.653	2.746	
<b>Debugging Strategies</b>	BG	17.052	5.684	4.246*
	WG	1340.138	1.339	
<b>Evaluation</b>	BG	31.458	10.486	4.058*
	WG	2586.317	2.584	

Note: BG- Between Group, WG-With in Group, df-degrees of freedom, df=3(BG), df=1001(WG)  
 \*p<.05, \*\*p< .01

**Tukey test results for Conditional Knowledge**

To find out which group of students possess better conditional knowledge, planning, debugging strategies and evaluation Tukey HSD test was carried out and the results are given in Table 4.38.1 to Table 4.38.4

**Table 4.38.1****Tukey test results for Conditional Knowledge**

Income of the Family	No. of students	Mean value	
		1	2
<b>(HIG) - Rs.37,001 to Rs.62,000</b>	133	4.35	
<b>(EWS) – upto Rs.12,000/-</b>	304	4.37	
<b>(MIG) - Rs. 18,001 to Rs.37,000</b>	162	4.53	4.53
<b>(LIG) - Rs.12,001 to Rs.18,000</b>	406		4.79
<b>Significant</b>		0.31	0.11

It is evident from Table 4.38.1 that students coming from family with monthly income in the range Rs. 12,001 to Rs.18,000 have more conditional knowledge than their counterparts. They are better in analyzing the conditions under which they can learn better and they know when and why to use certain learning procedures.

**Tukey test results for Planning**

Post hoc analysis using Tukey test was conducted and the results for planning are given in Table 4.38.2

**Table 4.38.2****Tukey test results for Planning**

Income of the Family	No. of students	Mean value	
		1	2
<b>(HIG) - Rs.37,001 to Rs.62,000</b>	133	6.02	
<b>(EWS) – upto Rs.12,000/-</b>	304	6.17	
<b>(MIG) - Rs.18,001 to Rs.37,000</b>	162	6.18	
<b>(LIG) - Rs.12,001 to Rs.18,000</b>	406		6.66
<b>Significant</b>		0.50	1.00

From Table 4.38.2 it is seen that students from family with a monthly income of Rs.12,001 to Rs.18,000 have more planning than their counterparts.

### **Tukey test results for Debugging Strategies**

The post hoc analysis results for debugging strategies are given in Table 4.38.3

**Table 4.38.3**

### **Tukey test results for Debugging Strategies**

Income of The Family	No. of students	Mean value	
		1	2
<b>(MIG)- Rs.18,001 to Rs.37,000</b>	162	2.21	
<b>(EWS)– uptoRs.12,000/-</b>	304	2.24	
<b>(HIG) - Rs.37,001 to Rs.62,000</b>	133	2.26	
<b>(LIG) - Rs.12,001 to Rs.18,000</b>	406		2.50
<b>Significant</b>		0.66	1.00

From Table 4.38.3 it indicates that students with family income of Rs. 12,001 to Rs.18,000 plan better and set goals and allocate resources prior to learning than the students from other income range.

### **Tukey test results for Evaluation**

Post hoc analysis was carried out using Tukey test to find out which group of students are better in evaluating their success and the results obtained are given in Table 4.38.4

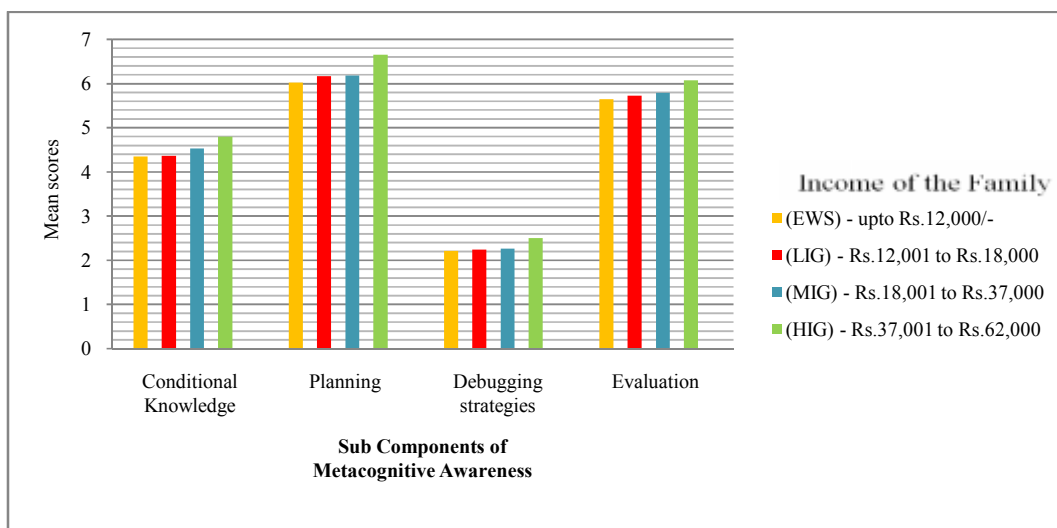
**Table 4.38.4**

**Tukey test results for Evaluation**

Income of The Family	No. of students	Mean value	
		1	2
(MIG) - Rs. 18,001 to Rs.37,000	162	5.65	
(EWS) – upto Rs.12,000/-	304	5.73	
(HIG) - Rs.37,001 to Rs.62,000	133	5.79	5.79
(LIG) - Rs.12,001 to Rs.18,000	406		6.07
<b>Significant</b>		0.41	0.08

From Table 4.38.4 the results indicates that students with family income of Rs.12,001 to Rs.18,000 evaluate their success in goal accomplishment better than the students from other families.

It is seen that of the different ranges of family income, students from family with monthly income Rs. 12,001 to 18,000 are found to be better in metacognitive awareness.



**Figure 4.18 Sub components of Metacognitive Awareness and Monthly Income of the Family**

#### 4.3.28. Comparison of Metacognitive Awareness of students based on their Medium of Instruction

An effort was made to compare the metacognitive awareness of students based on their medium of instruction. The result obtained is given in Table 4.39.

**Table 4.39**

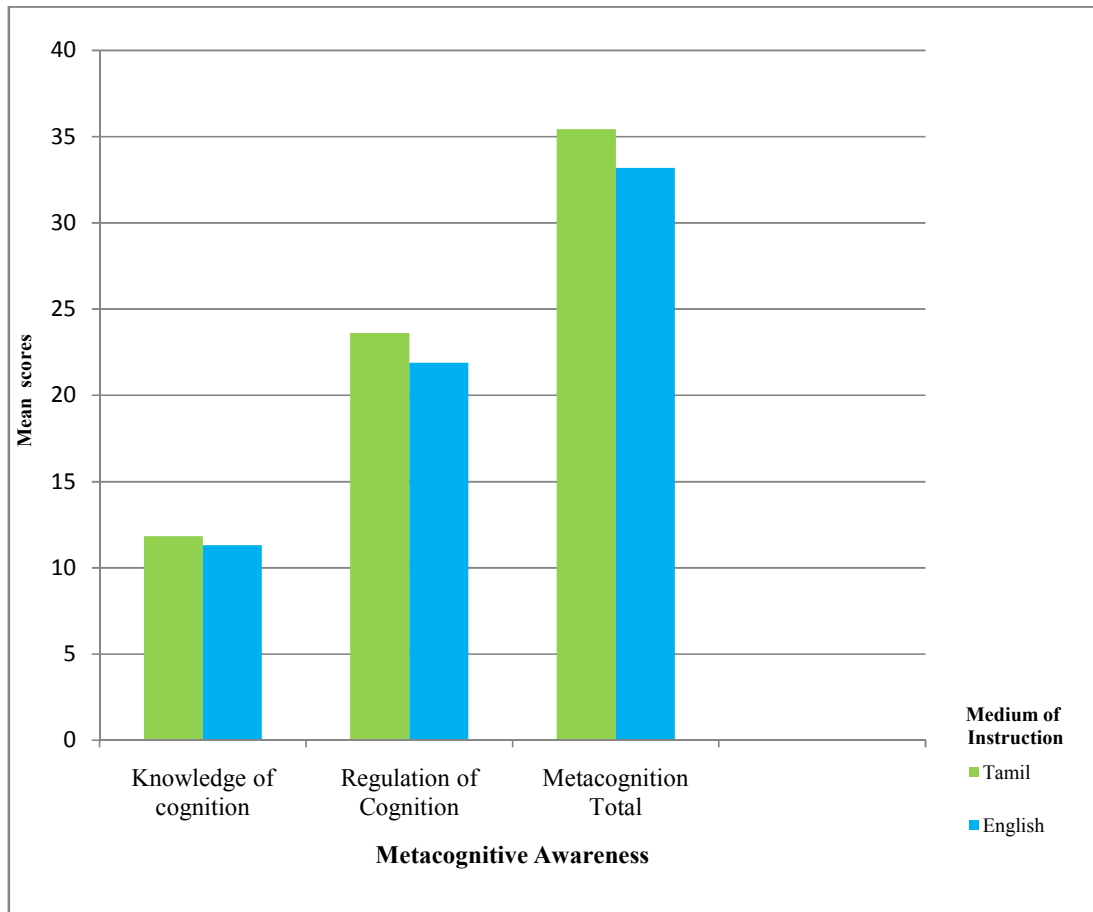
#### **Metacognitive Awareness and Medium of Instruction**

Metacognitive Awareness	Medium of instruction				t-value	df
	Tamil (N=716)		English (N=289)			
	Mean	SD	Mean	SD		
<b>Knowledge of cognition</b>	11.83	3.07	11.31	3.04	2.45*	1003
<b>Regulation of Cognition</b>	23.61	5.78	21.89	6.09	4.19**	
<b>Metacognition Total</b>	35.44	8.07	33.20	8.46	3.93**	

Note: N=Number of students, SD=standard deviation, df=degrees of freedom

\* p< .05, \*\*p< .01

From Table 4.39 it is evident that there is a highly significant difference in the total metacognitive awareness and regulation of cognition of Tamil and English medium students and the mean value suggest that Tamil medium students possess better metacognitive awareness and regulation of cognition than the English medium students. It is also seen that there is a significant difference at 0.05 level in the component of metacognitive awareness namely knowledge of cognition of Tamil and English medium students and the Tamil medium students are found to have more knowledge about their cognition than the English medium students. Hence the null hypothesis that **“there is no statistically significant difference in the metacognitive awareness and its components of Tamil and English medium students”** is rejected for total metacognitive awareness, knowledge of cognition and regulation of cognition.



**Figure 4.19. Metacognitive Awareness and Medium of Instruction**

**4.3.28. Comparison of Sub Components of Metacognitive Awareness of Tamil and English Medium Students**

Table 4.40 presents the comparison of sub components of metacognitive awareness of the students based on their medium of instruction namely English and Tamil. The results obtained are presented in Table 4.40.

**Table 4.40****Sub Components of Metacognitive Awareness and Medium of Instruction**

Sub Components	Medium of Instruction				t-value	df
	Tamil (N=716)		English (N=289)			
	Mean	SD	Mean	SD		
<b>Declarative Knowledge</b>	5.92	1.59	5.71	1.64	1.95	1003
<b>Procedural Knowledge</b>	2.41	1.17	2.19	1.12	2.69**	
<b>Conditional Knowledge</b>	3.49	1.43	3.41	1.46	0.85	
<b>Planning</b>	4.94	1.81	4.47	1.86	3.73**	
<b>Information Management Strategies</b>	6.45	2.11	6.09	2.36	2.37*	
<b>Comprehension Monitoring</b>	4.63	1.67	4.39	1.62	2.06*	
<b>Debugging Strategies</b>	3.45	1.49	3.20	1.51	2.35*	
<b>Evaluation</b>	4.14	1.43	3.73	1.54	3.95**	

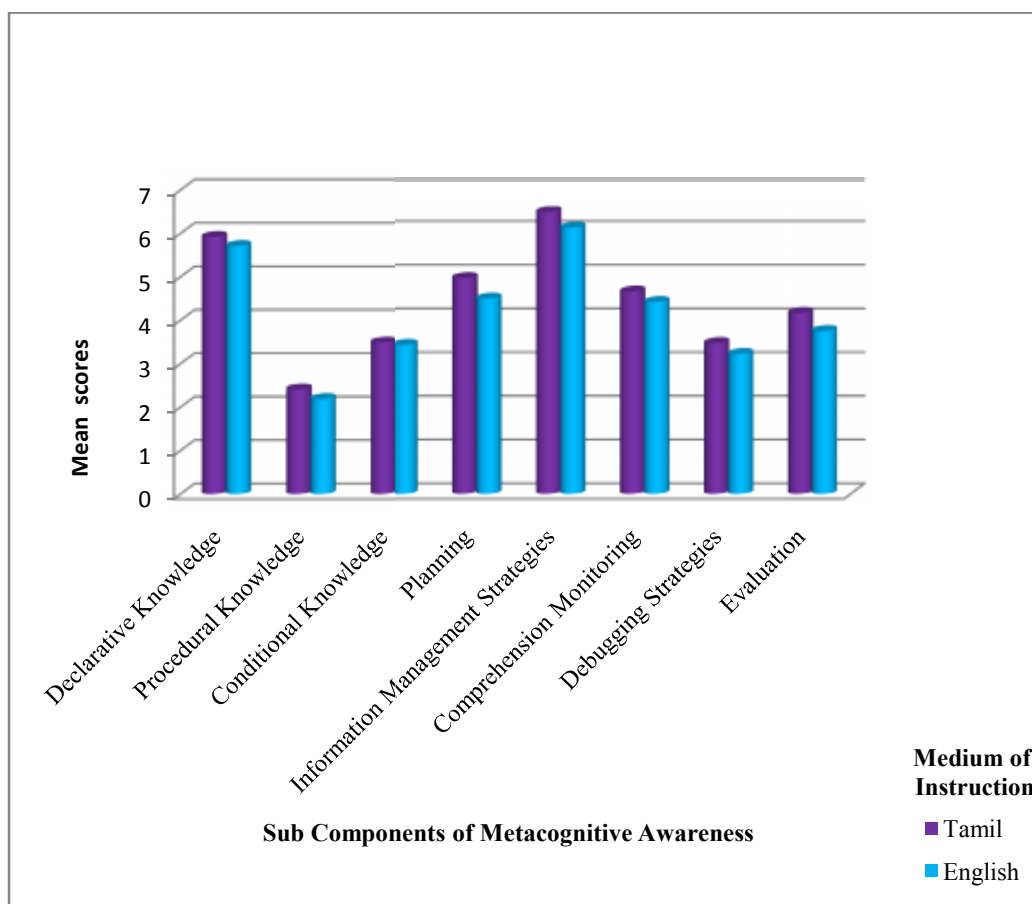
Note: N=Number of students, SD=standard deviation, df=degrees of freedom

\* p< .05, \*\*p< .01

From Table 4.40 it is evident that there is a highly significant difference in the sub components of metacognitive awareness of Tamil and English medium students namely procedural knowledge, planning and evaluation. The mean value shows that Tamil medium students possess better procedural knowledge, planning and evaluation than English medium students, which implies that they know the correct strategies to accomplish their tasks and they plan and have better goal setting attitude.

It is also found that there is a significant difference at 0.05 level in the metacognitive awareness of Tamil and English medium students in information management strategies, comprehension monitoring and debugging strategies. The mean values indicate that Tamil medium students possess better information management strategies comprehension monitoring and debugging strategies, which means they have better knowledge of organization and elaboration, better assessment of one's own comprehension and correct comprehension and performance errors.

Hence the null hypothesis stated that “**there is no statistically significant difference between Tamil and English medium students in the different metacognitive awareness and its sub components** ” is rejected for the sub components procedural knowledge, planning, information management strategies, comprehension monitoring, debugging strategies and evaluation and is accepted for declarative knowledge and conditional knowledge. The mean scores obtained are represented in Figure 4.20.



**Figure 4.20 Sub Components of Metacognitive Awareness and Medium of Instruction**

#### **4.3.30. Comparison of Metacognitive Awareness of Higher Secondary Students Based on the Types of School**

Metacognitive awareness of the higher secondary school students studying in different types of school, namely government, corporation and private were compared using one way ANOVA and the results obtained are presented in Table 4.41.

**Table 4.41****Metacognitive Awareness and Types of school**

<b>Metacognitive Awareness</b>	<b>Source of variation</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F</b>
<b>Metacognition Total</b>	BG	14453.33	7226.66	68.42**
	WG	105831.38	105.62	
<b>Knowledge of Cognition</b>	BG	4839.27	419.64	48.88**
	WG	8601.56	8.58	
<b>Regulation of Cognition</b>	BG	3919.18	1959.59	62.74**

Note: BG=Between Group, WG=Within Group, degrees of freedom,  $df=2(BG)$ ,  $df=1002(WG)$ ,  
\*\* $p < .01$

ANOVA results reveal that a highly significant difference exists among the students from different types of school namely government, corporation and private in metacognitive awareness which implies that types of school contributes towards the metacognitive awareness of the students. Hence the null hypothesis stated **“there is no statistically significant difference in the metacognitive awareness of the students based on their types of school”** is rejected.

Post hoc analysis was done to find out which types of school contributes towards the development of metacognitive awareness and results obtained are given in Table 4.41.1 to Table 4.41.3 Tukey test was done to find out which means are significantly different from other means.

**Tukey test results for Total Metacognitive Awareness**

Post hoc analysis was done to find out whether the students of government, corporation, private possess better metacognitive awareness. The results are given in Table 4.41.1.

**Table 4.41.1****Tukey test results for Total Metacognitive Awareness**

Types of school	No. of students	Mean value		
		1	2	3
Corporation	400	42.20		
Private	205		46.59	
Government	400			50.70
Significant		1.00	1.00	1.00

From the Table 4.41.1 it is seen that the government school students possess better metacognitive awareness than their counterparts in corporation and private schools.

**Tukey test results for Knowledge of Cognition**

Post hoc analysis was done to find out which types of school students possess better knowledge of cognition. The results are given in Table 4.41.2.

**Table 4.41.2****Tukey test results for Knowledge of Cognition**

Types of school	No. of students	Mean value		
		1	2	3
<b>Corporation</b>	400	10.62		
<b>Private</b>	205		11.84	
<b>Government</b>	400			12.66
<b>Significant</b>		1.00	1.00	1.00

From the Table 4.41.2 it is seen that the government school students have more knowledge of cognition than their counterparts in corporation and private schools. The

result implies that students of government school possess better knowledge before being able to process or use critical thinking related to task or topic.

### Tukey test results for Regulation of Cognition

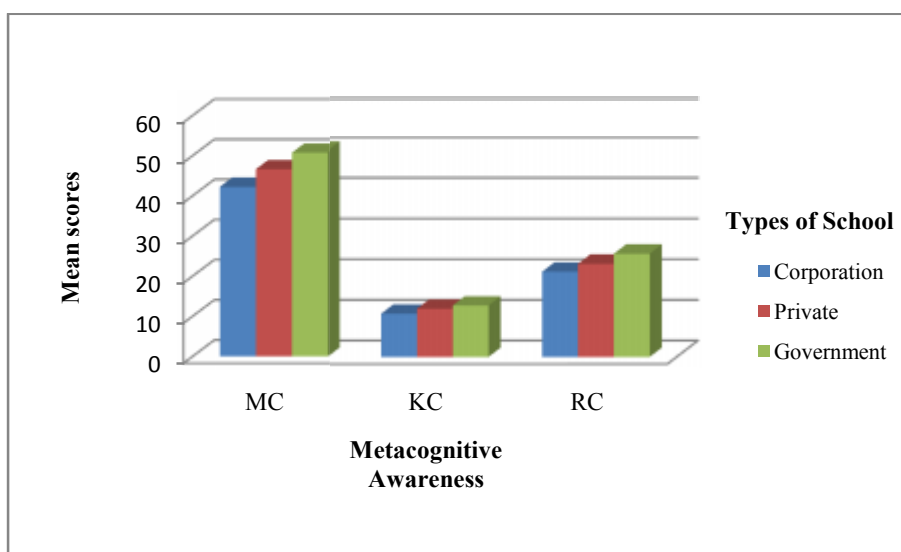
Post hoc analysis was done to find out which types of school students possess better regulation of cognition. The results are given in Table 4.41.3.

**Table 4.41.3**

### Tukey test results for Regulation of Cognition

Types of school	No. of students	Mean value		
		1	2	3
<b>Corporation</b>	400	20.96		
<b>Private</b>	205		22.90	
<b>Government</b>	400			25.38
<b>Significant</b>		1.00	1.00	1.00

From Table 4.41.3, it is seen that the government school students have more regulation of cognition than the students from Corporation school and Private schools. The graphical representation of the comparisons is presented in Figure 4.21



**Figure 4.21. Metacognitive Awareness and Types of school**

#### 4.3.31 Comparison of Sub components of Metacognitive Awareness of Higher Secondary Students Based on the Types of School in which they study

Sub components of Metacognitive awareness of the higher secondary school students studying in different types of school, namely government, corporation and private were compared using one way ANOVA and the results obtained for ANOVA are presented in Table 4.42.

**Table 4.42**

**Sub components of Metacognitive Awareness and Types of school**

Sub components	Source of variation	Sum of Squares	Mean Square	F
<b>Declarative Knowledge</b>	BG	36.961	18.480	7.18**
	WG	2580.815	2.576	
<b>Procedural Knowledge</b>	BG	108.719	54.360	43.63**
	WG	1248.471	1.246	
<b>Conditional Knowledge</b>	BG	179.139	89.569	47.25**
	WG	1899.359	1.896	
<b>Planning</b>	BG	285.170	142.585	46.29**
	WG	3086.766	3.081	
<b>Information Management Strategies</b>	BG	265.66	132.830	29.29**
	WG	4544.145	4.535	
<b>Comprehension Monitoring</b>	BG	103.943	51.970	19.67**
	WG	2647.295	2.642	
<b>Debugging Strategies</b>	BG	85.351	42.676	19.64**
	WG	2177.210	2.173	
<b>Evaluation</b>	BG	102.834	51.417	24.90**
	WG	2068.768	2.065	

Note: BG= Between Group, WG=Within Group, degrees of freedom, df=2(BG), df=1002(WG), \*\*p<0.01

ANOVA results reveal that a highly significant difference exists among the students from different types of school namely government, corporation and private in all the sub components of metacognitive awareness which implies that types of school contributes towards the sub components of metacognitive awareness of the students. Hence the null hypothesis stated “there is no significant difference in the sub components of metacognitive awareness of the students based on their types of school” is rejected.

Post hoc analysis was done to find out which types of school contributes towards the development of different sub components of metacognitive awareness and results obtained are given in Table 4.42.1 to Table 4.42.8 Tukey post hoc analysis was used to find out which means are significantly different from other means.

#### **Tukey test results for Declarative Knowledge**

The Post hoc analysis results for declarative knowledge are given in Table 4.42.1

**Table 4.42.1**

#### **Tukey test results for Declarative Knowledge**

Types of school	No. of students	Mean value	
		1	2
<b>Corporation</b>	400	5.70	
<b>Private</b>	205	5.71	
<b>Government</b>	400		6.10
<b>Significant</b>		0.94	1.00

From the Table 4.42.1 it is seen that the government school students possess better declarative knowledge (DK) than their counterparts in corporation and private schools.

#### **Tukey test results for Procedural Knowledge**

Post hoc analysis results using Tukey test for procedural knowledge is given in Table 4.42.1

**Table 4.42.2****Comparison of Procedural Knowledge of students of different types of school**

Types of school	No. of students	Mean value		
		1	2	3
<b>Corporation</b>	400	1.95		
<b>Private</b>	205		2.46	
<b>Government</b>	400			2.68
<b>Significant</b>		1.00	1.00	1.00

From Table 4.42.2, it is seen that the government school students have more procedural knowledge (PK) than the students from corporation school and private schools which implies that students from government schools are better in applying the knowledge they have for completing a task or process.

**Tukey test results for Conditional Knowledge**

The Post hoc analysis was done to find out which group of students possess better conditional knowledge and the results are given in Table 4.42.3.

**Table 4.42.3****Tukey test results for Conditional Knowledge**

Types of school	No. of students	Mean value	
		1	2
<b>Corporation</b>	400	2.96	
<b>Private</b>	205		3.67
<b>Government</b>	400		3.88
<b>Significant</b>		1.00	0.06

From Table 4.42.3, it is indicated that the government school students possess better conditional knowledge (CK) than the students from corporation school and private schools. The post hoc result reveals the fact that government school students are better in

knowing when to use a particular procedure. Next to government school students, the private school students are found to possess better Conditional Knowledge.

#### **Tukey test results for the sub component Planning**

Post hoc analysis results for planning is given in Table 4.42.4. The Post hoc analysis was done using Tukey method.

**Table 4.42.4**

#### **Tukey test results for Planning**

Types of school	No. of students	Mean value		
		1	2	3
<b>Corporation</b>	400	4.24		
<b>Private</b>	205		4.70	
<b>Government</b>	400			5.43
<b>Significant</b>		1.00	1.00	1.00

The results presented in Table 4.42.4 proved that the government school students have more planning (P) skill than their counterparts in corporation and private schools. Government school students are found to be better in selecting, predicting, planning, scheduling, goal setting and allocating resources needed for the accomplishment of their goal.

#### **Tukey test results for Information Management Strategies**

The Post hoc analysis was done to find out which group of students possess better information management strategies. The results are given in Table 4.42.5.

**Table 4.42.5****Tukey test results for Information Management Strategies**

Types of school	No. of students	Mean value		
		1	2	3
<b>Corporation</b>	400	5.77		
<b>Private</b>	205		6.34	
<b>Government</b>	400			6.93
<b>Significant</b>		1.00	1.00	1.00

The Tukey HSD results indicates that the government school students have better information management strategies (IMS) than their counterparts in corporation and private schools. The results indicate that students studying in government schools organize, elaborate and summarise the informations better than the students from private and corporation schools.

**Tukey test results for Comprehension Monitoring**

To find out which group of students possess better comprehension monitoring (CM) Tukey test was conducted and results are given in Table 4.42.6.

**Table 4.42.6****Tukey test results for Comprehension Monitoring**

Types of school	No. of students	Mean value		
		1	2	3
<b>Corporation</b>	400	4.92		
<b>Private</b>	205		4.60	
<b>Government</b>	400			4.92
<b>Significant</b>		1.00	1.00	1.00

The values presented in Table 4.42.6 depicts that the government school students have more comprehension monitoring (CM) than the students in corporation and private schools.

#### **Tukey test results for Debugging Strategies**

Post hoc analysis was done to find out which group of students possess better debugging strategies. The results are given in Table 4.42.7

**Table 4.42.7**

#### **Tukey test results for Debugging Strategies**

Types of school	No. of students	Mean value		
		1	2	3
Corporation	400	3.06		
Private	205		3.35	
Government	400			3.71
Significant		1.00	1.00	1.00

From Table 4.42.7 it is seen that the government school students use better debugging strategies (DS) than their counterparts in corporation and private schools.

#### **Tukey test results for Evaluation**

Post hoc analysis was done to find out which group of students evaluate things better. The results are given in Table 4.42.8

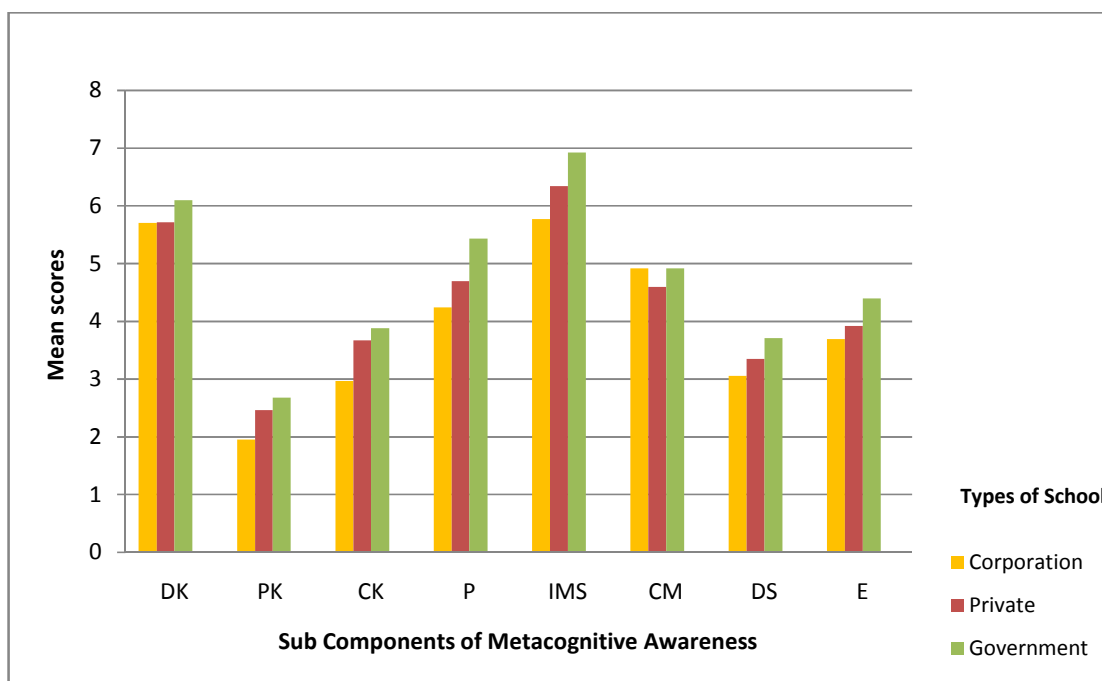
**Table 4.42.8**

#### **Tukey test results for Evaluation**

Types of school	No. of students	Mean value	
		1	2
<b>Corporation</b>	400	3.69	
<b>Private</b>	205	3.91	
<b>Government</b>	400		4.40
<b>Significant</b>		0.05	1.00

From Table 4.42.8 it is seen that the government school students possess better evaluation skills, which means they assess, appraise and verify their knowledge related to the performance or skills after the completion of the task they have taken, than the students of corporation and private schools.

All the post hoc results bring out the fact that students studying in government schools are better aware of their metacognitive skills than the students studying in corporation and private schools. The results obtained in post hoc analysis for the subcomponents of metacognitive awareness is presented in Figure 4.22.



**Figure 4.22 Sub Components of Metacognitive Awareness and Types of school**

#### **4.3.32. Comparison of Metacognitive Awareness of Higher Secondary Students Based on their Groups of study**

An effort was made to compare the metacognitive awareness of the higher secondary school students based on their groups of study namely Mathematics, Science, Computer Science, Commerce, History and Vocational stream. The results obtained for ANOVA are presented in Table 4.43.

**Table 4.43****Metacognitive Awareness and Groups of study**

<b>Metacognitive Awareness</b>	<b>Source of variation</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F</b>
<b>Metacognition Total</b>	BG	6366.53	1273.31	11.17**
	WG	113918.17	114.03	
<b>Knowledge About Cognition</b>	BG	344.49	68.89	7.57**
	WG	9096.34	9.11	
<b>Regulation of Cognition</b>	BG	1900.32	380.063	11.40**
	WG	33313.83	33.35	

Note: BG= Between Group, WG=Within Group, df=degrees of freedom, df=5(BG), df=999(WG),

\*\*< 0.01

ANOVA results reveal that a highly significant difference exists among the students from different groups of study namely Mathematics, Science, Computer Science, Commerce, History and Vocational in total metacognitive awareness, components and all the sub components of metacognitive awareness which implies that groups of study contributes towards the metacognitive awareness of the students. Hence the null hypothesis stated “there is no significant difference in the metacognitive awareness of the students based on their groups of study” is rejected.

Post hoc analysis was done using Tukey test to find out which groups of study contributes towards the development of different components of metacognitive awareness and results obtained are given in Table 4.43.1 to 4.43.3. The graphical representation of the comparison is given in Figure 4.31 and Figure 4.23.

**Tukey test results for Total Metacognitive Awareness**

Post hoc analysis results are given in Table 4.43.1.

**Table 4.43.1**

**Tukey HSD comparison test on Total Metacognitive Awareness for different groups of study**

Groups of study	No. of students	Mean value		
		1	2	3
Computer Science	274	33.35		
Commerce	346	33.65	33.65	
Science	103	34.52	34.52	
History	40		36.05	36.05
Mathematics	83		36.71	36.71
Vocational	159			38.67
Significant		0.163	0.08	0.19

From the Table 4.43.1 it is seen that the mean value obtained by the vocational group students is greater than the other groups of study, which brings out the fact that they possess better metacognitive awareness.

#### **Tukey test results for Knowledge of Cognition**

Tukey test was done to find out which group of students possess better knowledge of cognition. The results are given in Table 4.43.2.

**Table 4.43.2**

**Tukey comparison test on Knowledge of Cognition**

Groups of study	Group of students	Mean value		
		1	2	3
Commerce	346	11.28		
Computer Science	274	11.32		
Science	103	11.46	11.46	
History	40	12.15	12.15	12.15
Mathematics	83		12.58	12.58
Vocational	159			12.72
Significant		0.32	0.09	0.76

Results of Table 4.43.2 reveals that the mean value obtained in knowledge of cognition is more for vocational group students and hence they have more knowledge of cognition than students specializing in commerce, computer science, science, history and mathematics.

### **Tukey test results for Regulation of Cognition**

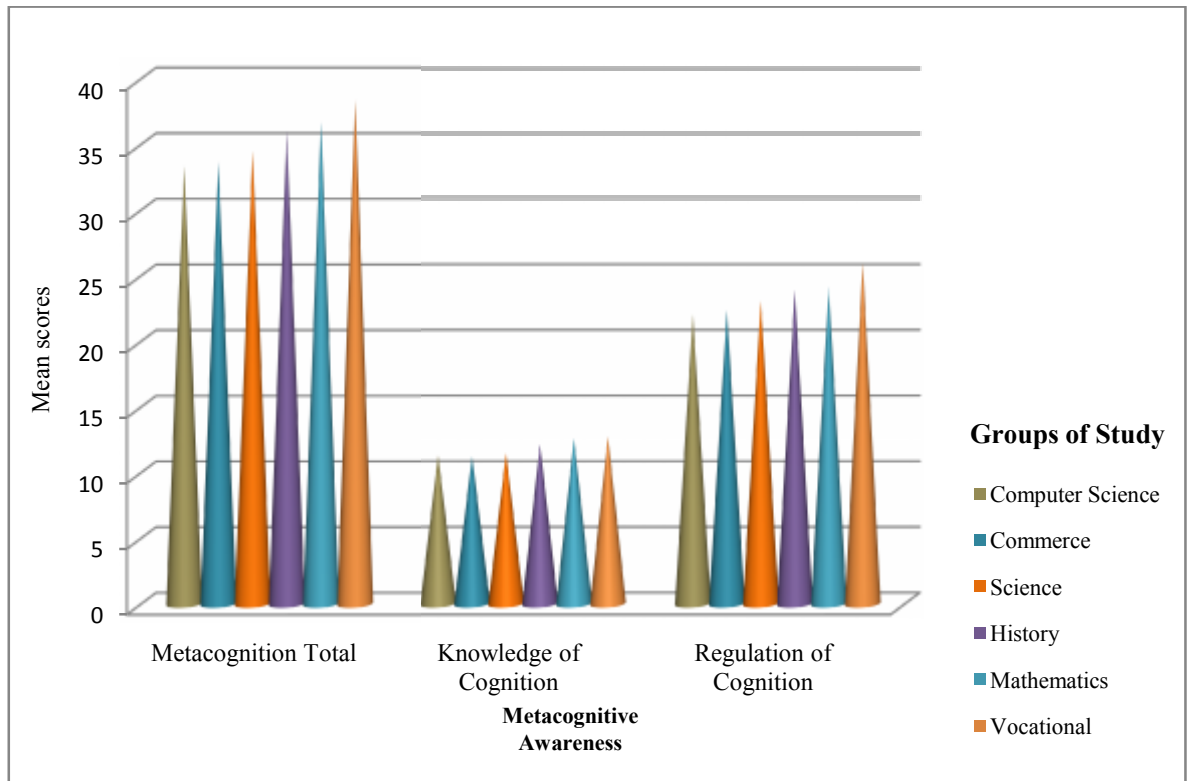
Post hoc analysis was done to find out which group of students possess better regulation of cognition. The results are given in Table 4.43.3.

**Table 4.43.3**

### **Tukey test results for Regulation of Cognition**

Groups of study	Group of students	Mean value	
		1	2
<b>Computer Science</b>	274	22.03	
<b>Commerce</b>	346	22.36	
<b>Science</b>	103	23.06	
<b>History</b>	40	23.90	23.00
<b>Mathematics</b>	83	24.14	24.13
<b>Vocational</b>	159		25.94
<b>Significant</b>		0.10	0.12

From the Table 4.43.3 it is seen that the vocational group students have more regulation of cognition than students specializing in commerce, computer science, science, history and mathematics.



*Figure 4.23. Metacognitive Awareness and Groups of study*

#### **4.3.33. Comparison Sub components of Metacognitive Awareness of Higher Secondary Students Based on the Groups of study**

An effort was made to compare the Sub components of metacognitive awareness of the higher secondary school students based on their groups of study namely Mathematics, Science, Computer Science, Commerce, History and Vocational. The results obtained for ANOVA are presented in Table 4.44.

**Table 4.44**

**Sub components of Metacognitive Awareness and Groups of Study**

<b>Sub components</b>	<b>Source of variation</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F</b>
<b>Declarative Knowledge</b>	BG	53.909	10.782	4.21**
	WG	2559.309	2.562	
<b>Procedural Knowledge</b>	BG	99.220	19.844	15.76**
	WG	1257.970	1.259	
<b>Conditional Knowledge</b>	BG	104.829	20.966	10.62**
	WG	1971.556	1.974	
<b>Planning</b>	BG	134.872	26.974	8.32**
	WG	3240.119	3.243	
<b>Information Management Strategies</b>	BG	174.524	34.905	7.52**
	WG	4634.975	4.640	
<b>Comprehension Monitoring</b>	BG	83.701	16.740	6.27**
	WG	2665.663	2.668	
<b>Debugging Strategies</b>	BG	71.902	14.380	6.57**
	WG	2188.416	2.191	
<b>Evaluation</b>	BG	90.778	18.156	8.73**
	WG	2077.863	2.080	

*Note:* SD=Standard Deviation, BG= Between Group, WG=Within Group, df=degrees of freedom, df= 5(BG), df=999(WG), \*\*p<0.01, \* p< .05

ANOVA results reveal that a highly significant difference exists among the students from different groups of study namely Mathematics, Science, Computer Science, Commerce, History and Vocational on all the sub components of metacognitive awareness which implies that groups of study contributes towards the Sub components of metacognitive awareness of the students. Hence the null hypothesis stated “**there is no**

**statistically significant difference in the Sub components of metacognitive awareness of the students based on their groups of study” is rejected.**

Post hoc analysis (Tukey HSD) was done to find out which groups of study contributes towards the development of different sub components of metacognitive awareness and results obtained are given in Table 4.44.1 to 4.44.8. The graphical representation of the comparison is given in Figure 4.24.

#### **Tukey test results for Declarative Knowledge**

The Post hoc analysis results for declarative knowledge obtained by Tukey HSD are given in Table 4.44.1

**Table 4.44.1**

#### **Tukey test results for Declarative Knowledge**

Groups of study	Group of students	Mean value	
		1	2
History	40	5.58	
Commerce	346	5.67	5.67
Computer Science	274	5.77	5.76
Science	103	6.10	6.01
Vocational	159	6.20	6.20
Mathematics	83		6.28
Significant		0.06	0.08

From the results in Table 4.44.1 it is seen that students who have opted the group namely, mathematics is found to possess better mean scores in declarative knowledge which means mathematics students know their strengths and weakness than the students specializing in other subjects.

#### **Tukey test results for Procedural Knowledge**

Post hoc analysis results for procedural knowledge are given in Table 4.44.2. The post hoc analysis was done using Tukey method.

**Table 4.44.2****Tukey test results for Procedural Knowledge**

Groups of study	Group of students	Mean value		
		1	2	3
Commerce	346	2.12		
Computer Science	274	2.14		
Science	103	2.36	2.36	
Vocational	159		2.65	2.65
Mathematics	83			3.00
History	40			3.05
Significant		0.67	0.43	0.12

In the case of procedural knowledge, students specializing in history were found to be better than the other groups. Students of history group is followed by mathematics group in possessing better procedural knowledge.

**Tukey test results for Conditional Knowledge**

The Post hoc analysis was done to find out which group of students possess better conditional knowledge and results are presented in Table 4.44.3.

**Table 4.44.3****Tukey test results for Conditional Knowledge**

Groups of study	Group of students	Mean value		
		1	2	3
Commerce	346	3.24		
Computer Science	274	3.28		
Science	103	3.38	3.38	
History	40	3.80	3.80	3.80
Vocational	159		3.94	3.94
Mathematics	83			4.13
Significant		0.05	0.06	0.55

When the results obtained in the metacognitive subcomponent conditional knowledge is analysed using Tukey test, it is seen that mathematics group is better, followed by vocational group.

#### **Tukey test results for Planning**

Post hoc analysis result for the sub component planning is given in Table 4.44.4.

**Table 4.44.4**

#### **Tukey test results for Planning**

<b>Groups of study</b>	<b>Group of students</b>	<b>Mean value</b>	
		<b>1</b>	<b>2</b>
<b>Computer Science</b>	274	4.50	
<b>Commerce</b>	346	4.56	
<b>History</b>	40	5.03	5.03
<b>Science</b>	103	5.03	5.03
<b>Mathematics</b>	83	5.12	5.12
<b>Vocational</b>	159		5.48
<b>Significant</b>		0.14	0.46

Tukey test results indicate that vocational group students plan better than the other groups. The students of mathematics group are also found to be better in planning next to vocational group students.

#### **Tukey test results for Information Management Strategies**

Post hoc analysis was done to find out which group of students possesses better information management strategies. The results are given in Table 4.44.5.

**Table 4.44.5****Tukey test results for Information Management Strategies**

Groups of study	Group of students	Mean value		
		1	2	3
Commerce	346	5.95		
Computer Science	274	6.18	6.18	
History	40	6.38	6.38	6.38
Science	103	6.54	6.54	6.54
Mathematics	83		6.84	6.84
Vocational	159			7.09
Significant		0.38	0.24	0.17

From Table 4.44.5, the Post hoc results reveal that vocational group students use better information management strategies than other groups. This means vocational group students possess the ability to break down information into chunks and they are good at organizing, elaborating and summarising information.

**Tukey test results for Comprehension Monitoring**

To find out which group of students possess better comprehension monitoring (CM) Tukey post hoc test analysis was done and the results are given in Table 4.44.6.

**Table 4.44.6****Tukey test results for Comprehension Monitoring**

Groups of study	Group of Students	Mean value		
		1	2	3
Commerce	346	4.29		
History	40	4.40	4.40	
Computer Science	274	4.50	4.50	4.50
Science	103	4.54	4.54	4.54
Mathematics	83		4.99	4.99
Vocational	159			5.08
Significant		0.89	0.11	0.13

When Tukey test was used to find out which group is better in comprehension monitoring, it is seen that mean scores is greater for vocational group, which implies that they are more aware of their comprehension of content.

### **Tukey test results for Debugging Strategies**

The Post hoc analysis was done to find out which group of students possess better debugging strategies. The results are given in Table 4.44.7.

**Table 4.44.7**

#### **Subject wise Post Hoc Analysis for Debugging Strategies**

Groups of study	Group of students	Mean value		
		1	2	3
<b>Computer Science</b>	274	3.09		
<b>Science</b>	103	3.27	3.27	
<b>Commerce</b>	346	3.32	3.32	
<b>Vocational</b>	159	3.68	3.68	3.68
<b>Mathematics</b>	83		3.83	3.83
<b>History</b>	40			4.00
<b>Significant</b>		0.055	0.08	0.64

The results in Table 4.44.7 brings out the fact that history group students use more debugging strategies than the other groups. It is understood that they get help or rethink and try to understand everything than the students opting other Groups of study.

### **Tukey test results for Evaluation**

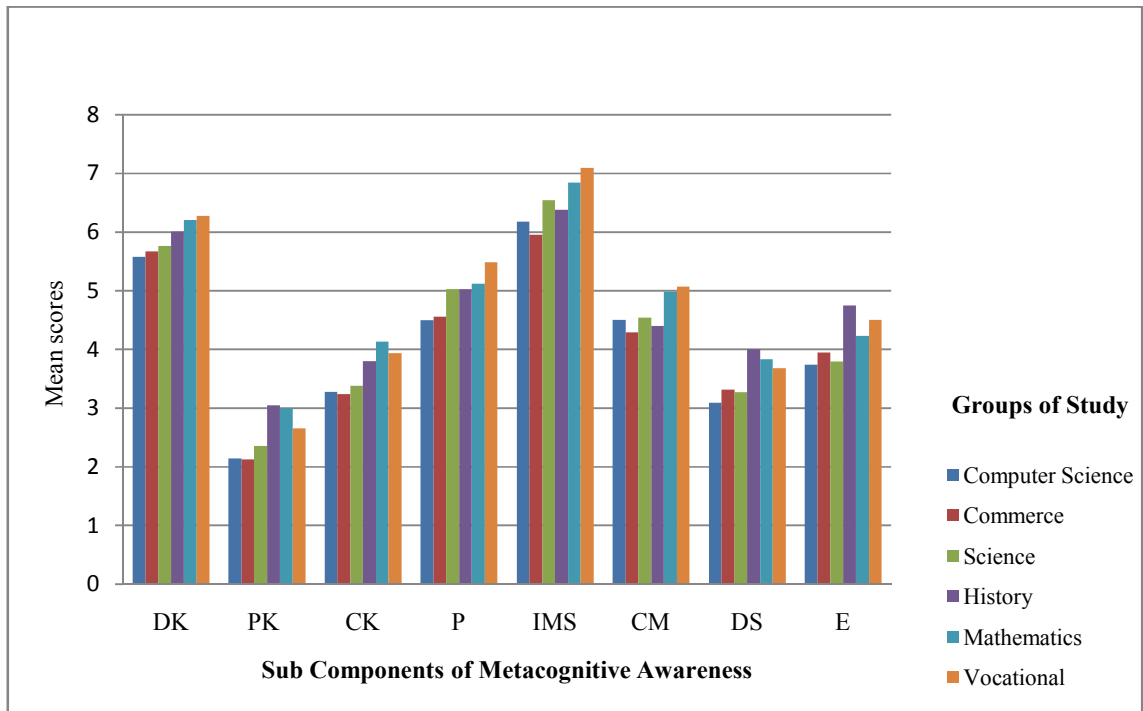
The Post hoc analysis was done to find out which group of students possess better Evaluation skill. The Post hoc test, Tukey method was used and the results are presented in Table 4.44.8

**Table 4.44.8****Tukey test results for Evaluation**

Groups of study	Group of students	Mean value		
		1	2	3
<b>Computer Science</b>	274	3.74		
<b>Science</b>	103	3.80		
<b>Commerce</b>	346	3.95	3.95	
<b>Mathematics</b>	83	4.23	4.23	4.23
<b>Vocational</b>	159		4.50	4.50
<b>History</b>	40			4.75
<b>Significant</b>		0.15	0.07	0.10

The results in Table 4.44.8 brings out the fact that history group students have more evaluation skills than the other groups. They are better in checking whether learning process was successful and whether goals set have been attained.

The post hoc results reveal that students of vocational group are better in metacognitive awareness, Knowledge of Cognition and Regulation of Cognition, Planning, Information Management Strategies and Comprehension Monitoring, whereas students of Mathematics Groups of study possess better Declarative Knowledge and Conditional Knowledge. It is also seen that the use of Debugging Strategies and Planning is more for students in the History groups of study. The results are graphically presented in Figure 4.24.



**Figure 4.24. Sub components of Metacognitive Awareness and Groups of study**

**4.3.34. Comparison of Metacognitive Awareness of students based on the facilities available at home**

An attempt was made to compare the metacognitive awareness of students based on the facilities available at home like separate study room, computer to work, internet access and newspaper reading.

**4.3.34.1 Comparison of Metacognitive Awareness of students based on the availability of separate study room.**

The metacognitive awareness of students who have separate study room were compared using student ‘t’ test and the results are given in Table 4.45

**Table 4.45****Metacognitive Awareness and Availability of Study Room at Home**

Metacognitive Awareness	Separate Study room at home				t-value	df
	Yes (N=228)		No (N=777)			
	Mean	SD	Mean	SD		
<b>Metacognition Total</b>	34.45	8.44	34.91	8.19	0.79	1003
<b>Knowledge of Cognition</b>	11.69	3.14	11.67	3.047	0.10	
<b>Regulation of Cognition</b>	22.72	5.90	23.23	5.93	1.16	

Note: N=Number of students , SD=Standard Deviation , df=degrees of freedom

From Table 4.45 it is seen that there is no significant difference in the metacognitive awareness of students who have separate study room and who do not have separate study room at home. Hence the null hypothesis stated that **“there is no statistically significant difference in the metacognitive awareness and the components of metacognitive awareness with respect to availability of separate study room at home”** is accepted.

#### **4.3.35. Comparison of Sub Components of Metacognitive Awareness of Students Based on the availability of separate Study Room at Home**

Even though there is no significant difference in the total metacognitive awareness score and Knowledge of Cognition and Regulation of Cognition, an attempt was made to see if there is any significant difference in the Sub Components of Metacognitive Awareness of Students who have and who do not have separate study room at home and the results obtained for t-test is reported in Table 4.46

**Table 4.46****Sub Components of Metacognitive Awareness and Availability of Study Room at Home**

Sub Components	Separate Study room at home				t-value	df
	Yes (N=228)		No (N=777)			
	Mean	SD	Mean	SD		
<b>Declarative Knowledge</b>	5.82	1.75	5.87	1.57	0.44	1003
<b>Procedural Knowledge</b>	2.41	1.12	2.33	1.18	0.93	
<b>Conditional Knowledge</b>	3.47	1.37	3.47	1.45	0.04	
<b>Planning</b>	4.65	1.90	4.85	1.81	1.45	
<b>Information Management Strategies</b>	6.41	2.18	6.33	2.19	0.48	
<b>Comprehension Monitoring</b>	4.47	1.72	4.59	1.63	0.93	
<b>Debugging Strategies</b>	3.25	1.52	3.42	1.49	1.53	
<b>Evaluation</b>	3.94	1.53	4.04	1.45	0.95	

*Note:* N=Number of students , SD=Standard Deviation, df=degrees of freedom

From Table 4.46 it is seen that there is no significant difference in the sub components of metacognitive awareness of students who have separate study room and who do not have separate study room at home. Hence the null hypothesis stated that **“there is no statistically significant difference in the sub components of metacognitive awareness of students based on the availability of separate study room”** is accepted.

#### 4.3.36. Comparison of Metacognitive Awareness of students based on the Availability of Computer to work at Home

An attempt was made to see if there is any statistically significant difference in the metacognitive awareness of students who have a computer to work at home and who do not have a computer to work at home. Student t-test was conducted and the results are given in Table 4.47.

**Table 4.47**

#### Metacognitive Awareness and Availability of Computer to work at home

Metacognitive Awareness	Computer to work at home				t-value	df
	Yes (N=208)		No (N=797)			
	Mean	SD	Mean	SD		
Knowledge of Cognition	11.63	3.22	11.69	3.03	0.24	1003
Regulation of Cognition	23.25	5.92	23.08	5.93	0.36	
Metacognition Total	34.88	8.52	34.77	8.18	0.17	

*Note:* N=Number of students, SD=Standard Deviation, df=degrees of freedom

The t-value for the total metacognitive awareness and its components knowledge of cognition and regulation of cognition shows that there is no statistically significant difference between students who have a computer to work in their home and who do not have a computer. Hence the null hypothesis stated that **“there is no statistically significant difference in metacognitive awareness of students who have computer to work and who do not have computer to work at home”** is accepted.

#### 4.3.37. Comparison of Sub Components of Metacognitive Awareness of Students Based on the Availability of Computer at Home

Table 4.48 represents the results of the comparison of the sub components of metacognitive awareness of the students based on their availability of computer to work at home. t-test was conducted and the results are presented in Table 4.48.

**Table 4.48****Sub Components of Metacognitive Awareness and Availability of Computer to work at home**

Sub Components	Computer to work at home				t-value	df
	Yes (N=208)		No (N=797)			
	Mean	SD	Mean	SD		
<b>Declarative Knowledge</b>	5.72	1.68	5.90	1.60	1.46	1003
<b>Procedural Knowledge</b>	2.44	1.10	2.32	1.18	1.35	
<b>Conditional Knowledge</b>	3.48	1.35	3.47	1.46	0.04	
<b>Planning</b>	4.98	1.70	4.76	1.87	1.49	
<b>Information Management Strategies</b>	6.31	2.23	6.36	2.18	0.26	
<b>Comprehension Monitoring</b>	4.54	1.61	4.57	1.67	0.24	
<b>Debugging Strategies</b>	3.42	1.44	3.37	1.52	0.42	
<b>Evaluation</b>	4.00	1.34	4.02	1.50	0.17	

*Note:* N=Number of students , SD=Standard Deviation,, df=degrees of freedom

The t-value for all the subcomponents of metacognitive awareness shows that there is no statistically significant difference between students who have computer at home and who do not have computer to work at home. Hence the null hypothesis stated that **“there is no significant difference in sub components of metacognitive awareness of students who have computer and who do not have computer at home to work”** is accepted.

#### **4.3.38. Comparison of Metacognitive Awareness of students based on Internet access at home**

An attempt was made to compare the metacognitive awareness of students based on the internet access at home. The results obtained is given in Table 4.49

**Table 4.49****Metacognitive Awareness and Internet access at Home**

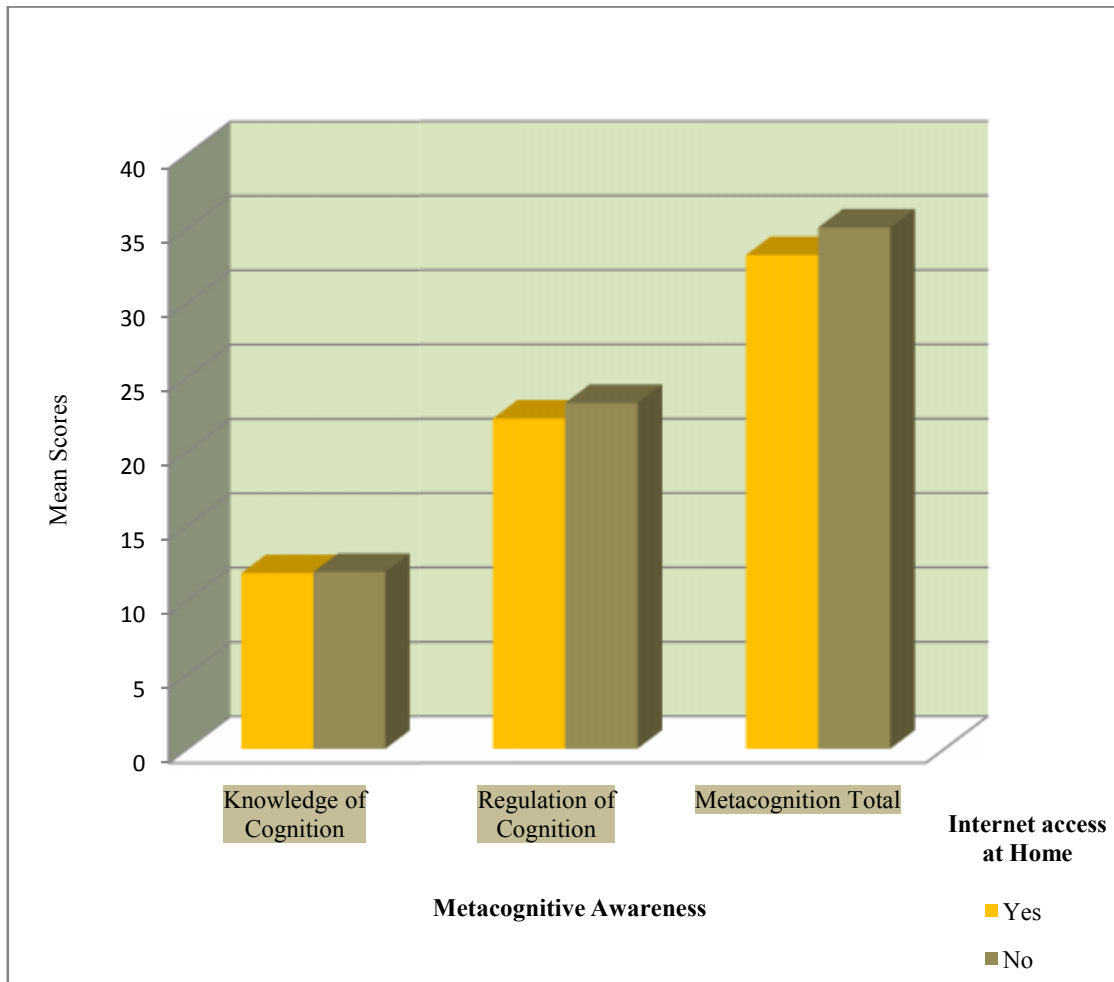
Metacognitive Awareness	Use of Internet access at home				t-value	df
	Yes (N=130)		No (N=875)			
	Mean	SD	Mean	SD		
<b>Knowledge of Cognition</b>	10.98	3.45	11.78	2.99	2.81 *	1003
<b>Regulation of Cognition</b>	22.20	5.58	23.25	5.96	1.90	
<b>Metacognition Total</b>	33.18	8.35	35.03	8.21	2.41*	

Note: N=Number of students, SD=Standard Deviation, df=degrees of freedom

\*  $p < .05$

The t-value for the total metacognitive awareness and the component of metacognitive awareness namely knowledge of cognition shows that there is a statistically significant difference between students who have internet access at home and who do not have internet access at home. The mean value brings out the fact that students who do not have internet access at home possess better metacognitive awareness and knowledge of cognition than the students who have internet access at home. But there is no significant difference in the regulation of cognition of students who have internet and who do not have internet access at home.

Hence the null hypothesis stated that **“there is no statistically significant difference in metacognitive awareness of students who have internet access and those who do not have internet access at home”** is accepted for regulation of cognition and rejected for total metacognitive awareness and knowledge of cognition.



**Figure 4.25. Metacognitive Awareness and Internet Access at Home**

**4.3.39. Comparison of Sub Components of Metacognitive Awareness of Students Based on the Internet Access at Home**

An attempt was made to compare the sub components of metacognitive awareness of the students based on the internet access at home. t-test was conducted and the results are presented in Table 4.50.

**Table 4.50****Sub Components of Metacognitive Awareness and Internet Access at Home**

Sub Components	Use of Internet at home				t-value	df
	Yes ( N=130)		No (N=875)			
	Mean	SD	Mean	SD		
<b>Declarative Knowledge</b>	5.32	1.89	5.94	1.56	4.11 **	1003
<b>Procedural Knowledge</b>	2.35	1.08	2.34	1.18	0.09	
<b>Conditional Knowledge</b>	3.30	1.47	3.50	1.43	1.47	
<b>Planning</b>	4.52	1.79	4.85	1.84	1.95	
<b>Information Management Strategies</b>	6.22	2.07	6.37	2.21	0.74	
<b>Comprehension Monitoring</b>	4.40	1.60	4.59	1.66	1.21	
<b>Debugging Strategies</b>	3.22	1.55	3.40	1.49	1.33	
<b>Evaluation</b>	3.85	1.37	4.04	1.48	1.38	

Note: N=Number of students , SD=Standard Deviation, df=degrees of freedom

\*\*p< 0.01

The t-value indicates that there is no statistically significant difference in the metacognition subcomponents of students who have internet access at home and who do not have internet facility, except for declarative knowledge. The mean values indicate that students who do not have internet access at home have better declarative knowledge than the students who have internet access at home. This implies that students who do not use internet are better aware of their strengths and weakness in carrying out a task. Hence the null hypothesis that **“there is no statistically significant difference between the students in sub components of metacognitive awareness who have Internet access and those who do not have Internet access at home”** is accepted for all subcomponents of metacognitive awareness except declarative knowledge.

#### 4.3.40. Comparison of Metacognitive Awareness of students based on their News Paper Reading Habit

An attempt was made to find out if there is any statistically significant difference in the total metacognitive awareness and the two components of metacognition namely knowledge of cognition and regulation of cognition between students who read newspaper and who do not read newspaper daily. The t-test was conducted and the results obtained are given in Table 4.51.

**Table 4.51**

#### **Metacognitive Awareness and News Paper Reading Habit**

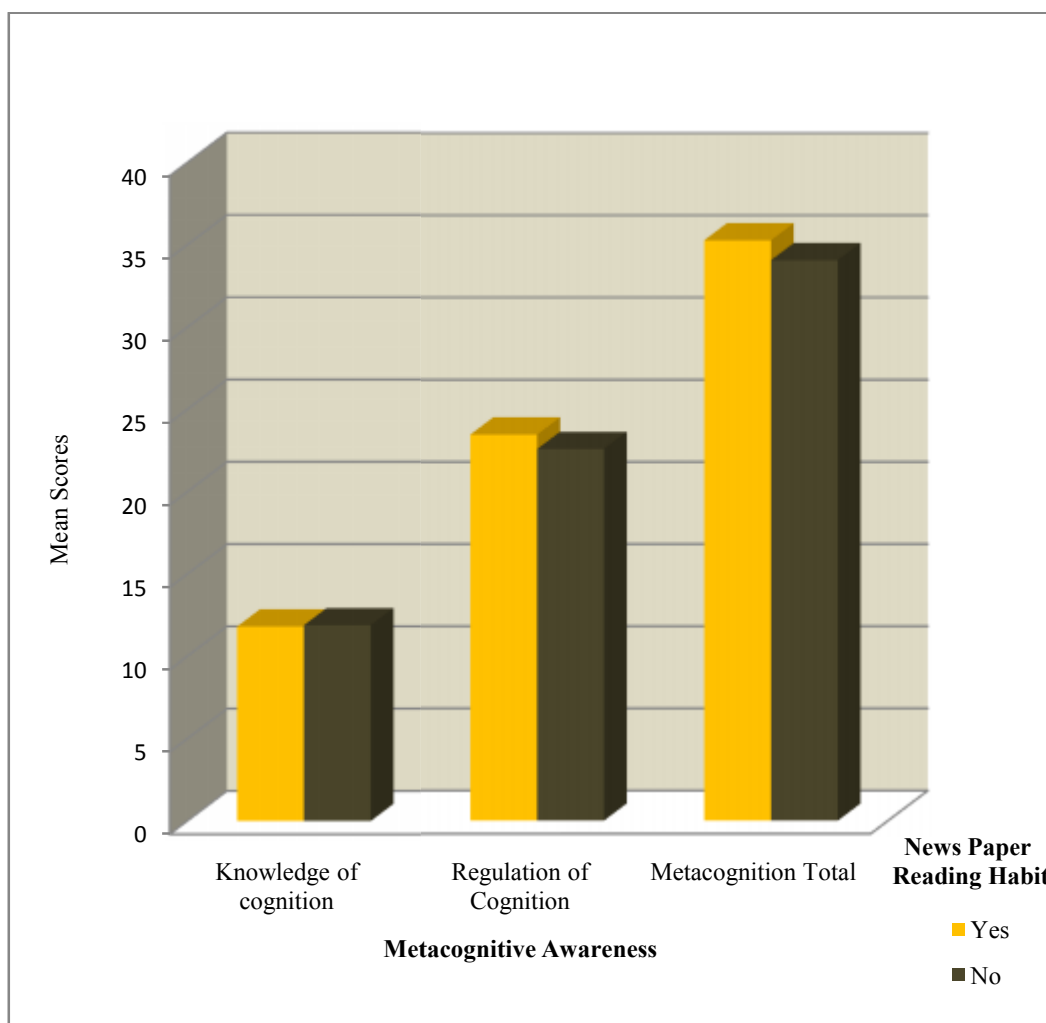
Metacognitive Awareness	News paper reading habits				t-value	df
	Yes (N=576)		No (N=429)			
	Mean	SD	Mean	SD		
Knowledge of cognition	11.82	2.98	11.9	3.17	1.64	1003
Regulation of Cognition	23.49	5.83	22.61	6.02	2.36*	
Metacognition Total	35.31	8.08	34.10	8.42	2.30*	

Note: N=Number of students, SD=Standard Deviation, df=degrees of freedom

\* p< .05

From Table 4.51 it is seen that there is a significant difference in the metacognitive awareness of students who read newspaper and who do not read newspaper daily in the total metacognitive awareness and the component namely regulation of cognition. The mean values indicate that students who read newspaper possess better metacognitive awareness and regulate their cognition than the students who do not read newspaper daily.

The result also shows that students who read newspaper daily and who do not read newspaper daily do not differ statistically in the component knowledge of cognition. Hence the null hypothesis stated “**there is no statistically significant difference in the metacognitive awareness and the components of metacognition namely knowledge of cognition and regulation of cognition with respect to newspaper reading**” is accepted for the component knowledge of cognition and rejected for total metacognitive awareness and the component regulation of cognition.



**Figure 4.26. Metacognitive Awareness and News Paper Reading Habit**

**4.3.41. Comparison of Sub Components of Metacognitive Awareness of Students Based on the News Paper Reading Habit**

An independent samples t-test was conducted for each of the eight subcomponents of metacognitive awareness to find out whether their metacognitive awareness differ based on their newspaper reading habit and the results are given in Table 4.52.

**Table4.52****Sub Components of Metacognitive Awareness and News Paper Reading Habit**

Sub Components	News paper reading habit				t-value	df
	Yes (N=576)		No (N=429)			
	Mean	SD	Mean	SD		
<b>Declarative Knowledge</b>	5.86	1.63	5.83	1.60	0.54	1003
<b>Procedural Knowledge</b>	2.41	1.09	2.25	1.25	2.21*	
<b>Conditional Knowledge</b>	3.52	1.43	3.41	1.46	1.10	
<b>Planning</b>	4.91	1.79	4.67	1.87	2.11*	
<b>Information Management Strategies</b>	6.5	2.08	6.09	2.31	3.19**	
<b>Comprehension Monitoring</b>	4.54	1.66	4.59	1.65	0.48	
<b>Debugging Strategies</b>	3.43	1.48	3.31	1.52	1.26	
<b>Evaluation</b>	4.07	1.46	3.94	1.48	1.37	

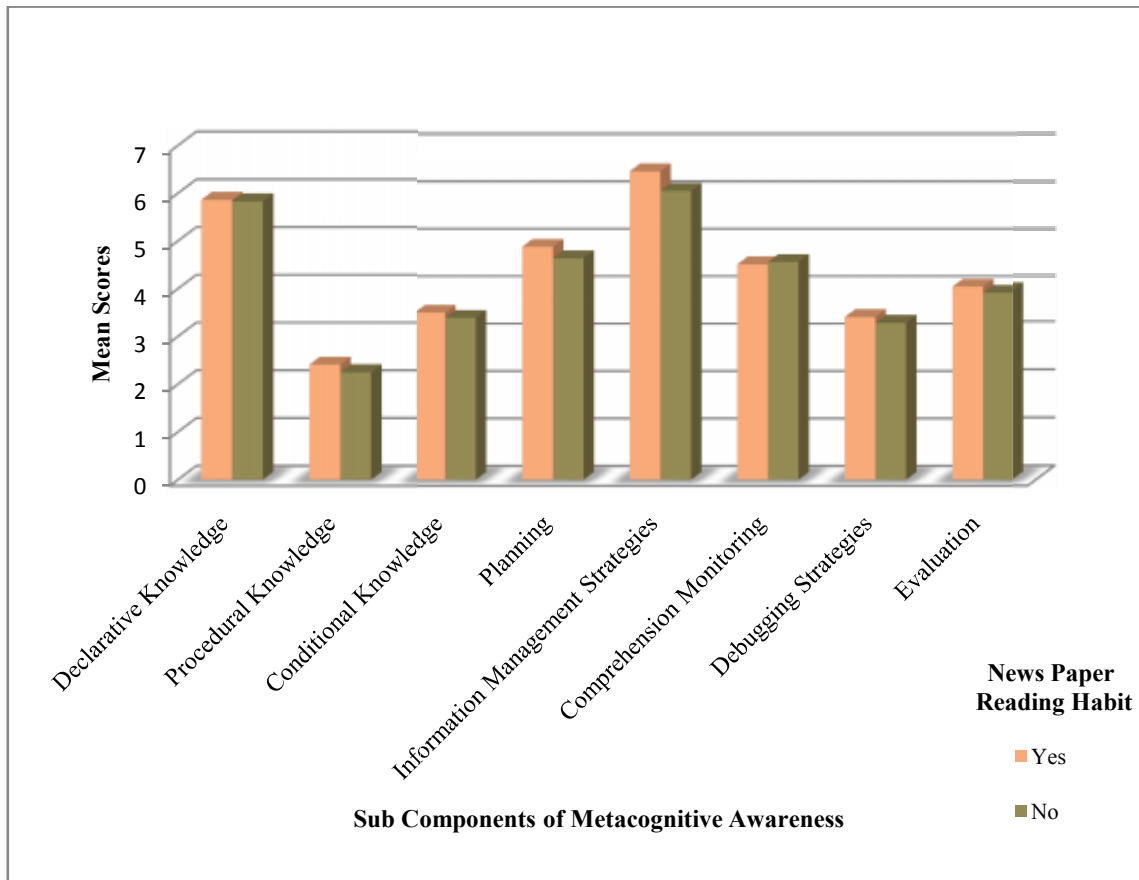
Note: N=Number of students , SD=Standard Deviation, df=degrees of freedom

\*\*p< 0.01, \* p< 0.05

From Table 4.52 it seen that there is a highly significant difference in the subcomponent of metacognitive awareness namely information management strategies and a significant difference in procedural knowledge and planning. The mean value shows that procedural knowledge, planning and information management strategies is better for students who read newspaper daily than who do not read newspaper.

The t-value for the subcomponents of metacognitive awareness namely declarative knowledge, conditional knowledge, comprehension monitoring and debugging strategies and evaluation shows that there is no statistically significant difference based on news paper reading habit.

Hence the null hypothesis stated that **“there is no statistically significant difference in the sub components of metacognitive awareness with respect to newspaper reading”** is rejected for procedural knowledge, planning and information management strategies and accepted for declarative knowledge, conditional knowledge, comprehension monitoring, debugging strategies and evaluation.



**Figure 4.27 Sub Components of Metacognitive Awareness and News Paper Reading Habit**

**Conclusion**

This chapter outlines the statistical analysis of data, descriptive analysis of data and hypothesis wise analysis. Data collected were analysed using appropriate statistics and the results were interpreted.

Results, findings and recommendations are in the next chapter.