IV. RESULTS AND DISCUSSION

The findings of the study titled **"Predictive Models of Multiple Intelligence, Learning Style and Teaching Pedagogy for the Academic Achievement of School Children"** were explicated based on the objectives of the study as below-mentioned headings and sub-headings:

A. Personal profile of the respondents

a. General profile of the student respondents
b. Personal profile of the teacher respondents

B. Academic Achievement (AA)

a. Categorisation of the student respondents based on their subject-wise AA
b. Association between socio-demographic variables and AA of the student respondents

C. Multiple Intelligence(MI)

a. Categorisation of the student respondents based on their level of MI
b. Association between socio-demographic variables and MI of the student respondents

D. Learning Style (LS)

a. Categorisation of student respondents based on their LS
b. Association between socio-demographic variables and LS of the student respondents

E. Teaching Pedagogy (TP)

a. Categorisation of the teacher respondents based on their TP
b. Association between personal profile variables and TP adopted by the teacher respondents

F. Predictive Models Integrating MI, LS and TP

a. Predictors of Academic Achievement in Language
b. Predictors of Academic Achievement in English
c. Predictors of Academic Achievement in Mathematics
d. Predictors of Academic Achievement in Science
e. Predictors of Academic Achievement in Social Science

G. Suggestive Academic Achievement (AA) Framework for Samacheer Kalvi

A. PERSONAL PROFILE OF THE RESPONDENTS

The respondents of the study were both the student respondents and their teachers. Accordingly, the personal profile of the selected school children included class, gender, type of family, birth order, type of school, area of residence and educational status of their parents. Moreover, the personal profile of selected teacher respondents had certain personal factors namely age, gender, experience, subjects handled and the type of school in which they were employed. In total, the general profile of the selected respondents was briefly presented under the following heads:

a. General profile of the student respondents
b. Personal profile of the teacher respondents

a. General profile of the student respondents

The personal information on class, gender, type of family, birth order, type of school and area of residence of the selected student respondents was presented in Table I.

The class-wise distribution shows that 34.4% of the student respondents were in the 8^{th} class, closely followed by 7^{th} standard students (33.2%) whereas, 32.4% belonged to class 6. The gender-wise distribution reveals that, out of the total 3026 student respondents, girls had a higher representation of almost 52% when compared to their counterparts, who were only 48%. Tracing the type of family, the children hailed from, a good percentage of them were from nuclear families (64.4%), whereas 27.8% were from joint families. Only 7.7% hailed from extended families. The observation was by the reality that the extended family system has faded out.

The study demanded a comparison of intelligence and academic achievement among student respondents enrolled in various types of schools. So, three major categories of schools based on administration, namely government schools, aided schools, and private schools, were identified, and the data were collected from student respondents of all three types of schools. The enrollment rate in aided schools was higher (45.5%), followed by private schools (39.4%). On the other hand, just 15% were from government schools. This finding confirms that government school has lost their importance. Moreover, the findings point out that, parents in the present scenario, strive for expensive education for their children.

Taking a look at the birth order, it was evident that more than half of the student respondents (51.9%) under study were first born followed by 39.9% who were middle born. Only 8.2% of them were lastborn. When it comes to the area of residence, the table states that 45% of the student respondents hailed from semi-urban areas followed by 34.8% from urban areas. The percentage of students residing in rural areas was comparatively lower.

TABLE – VII

DEMOGRAPHIC CHARACTERISTICS OF THE SELECTED STUDENT RESPONDENTS **N=3026**

Variables		**N**	**%**
Class	6th std	980	32.4
	7th std	**1006**	**33.2**
	8th std	**1040**	**34.4**
Gender	Boys	1457	48.1
	Girls	**1569**	**51.9**
Type of family	Nuclear	1950	**64.4**
	Joint	842	27.8
	Extended	**234**	7.7
Type of school	Government	457	15.1
	Aided	**1378**	**45.5**
	Private	1191	39.4
Birth order	1st born	**1570**	**51.9**
	Middle born	1208	39.9
	Last born	248	8.2
Area of residence	Rural	623	20.6
	Semi-urban	**1351**	**44.6**
	Urban	1052	34.8
Father's education	10th	**1016**	**33.6**
	12th	652	21.5
	UG	948	31.3
	PG	410	13.5
Mother's education	10th	**1099**	**36.3**
	12th	757	25.0
	UG	851	28.1
	PG	319	10.5

The last part of the table depicts the details of the educational status of the parents, 34% of the fathers of the selected student respondents had completed their secondary level of

education. 31% were graduates. 21.5% have had completed a higher secondary level of education and only 13.5% of the fathers were post-graduates. As far as the mother's education is concerned, 36.3% of the mothers have completed their secondary level of education. However, 28% were degree holders, while one-tenth of them were postgraduates. 25% of them had a higher secondary level of education.

b. Personal profile of the teacher respondents

Table III depicts the personal profiles of the selected school teacher respondents.

TABLE VIII

PERSONAL PROFILE OF THE SELECTED TEACHER RESPONDENTS

N_1=215

Variables		N	%
Age	25-35 years	70	33
	36-45 years	100	46
	46-55 years	45	21
Gender	Male	39	18
	Female	176	82
Educational Qualification	UG	16	7
	PG	51	24
	UG with B.Ed.	30	14
	PG with B.Ed.	96	45
	PG with M.Ed.	22	10
Subjects Handled	Tamil	32	15
	English	67	31
	Mathematics	42	19
	Science	47	22
	Social Science	27	13
Professional Experience	<1 year	4	2
	1- 5 years	69	32
	6 -10 years	49	23
	>10 years	93	43
Type of school	Government	28	13
	Aided	110	51
	Private	77	36

It was evident from the above table that out of a total of 215 school teacher respondents selected for the present study 46% of them were in the 36 to 45 years age group, followed by

33% of them in the 25 to 35 age band and 21% within the age ambit of 46 to 55 years age. As expected, a high percentage of them (82%) of them were female school teacher respondents. Concerning their educational qualification, the table states that a good percentage (45%) of them had done their PG with a B.Ed. as their educational qualification. Almost one-fourth of the selected teacher respondents were post-graduates and 14% of them were graduates with B.Ed. followed by 10% who were postgraduates with M.Ed. A mere 7% of them were just graduates.

Whilst categorising the teacher respondents based on the subjects that they handle; it was revealed that the English teachers were more in number accounting for 31% of the whole lot. Moreover, the number of teachers handling Mathematics and Science was the next highest, whereas, the number of teachers handling Social Science was the least. The data on the teaching experience portrayed a ratio of 1.5:1:2 of three categories of experience namely 1-6 years, 6-10 years and more than 10 years. This ratio can be considered as a welcoming feature as a wide range of experience of teacher respondents would help in integrated teaching pedagogy. However, very few teachers were freshers (2%). A little more than half of the teacher respondents (51%) were working in aided schools, 36% of them in private schools and just 13% in government schools. This data is evidence of the reality that the government schools were vanishing gradually.

B. ACADEMIC ACHIEVEMENT (AA)

Academic Achievement (AA) portrays the academic outcomes that indicate the extent to which student respondents have attained their educational goals. Beyond the level of school achievement, AA was also important for their successful development in society in the coming years. Student respondents performing well in school were better equipped to make the transition into adulthood and to achieve occupational as well as economic success (Organisation for Economic Co-operation and Development, 2022). Keeping in line with the objectives of the present study, this part of the study explored the AA of the selected school children under the following two heads.

a. Categorisation of the student respondents based on their Subject-wise AA

b. Association between socio-demographic variables and AA of the student respondents

a. Categorisation of the selected student respondents based on their subject-wise AA

To appraise the Academic Achievement (AA) of the selected student respondents, their report cards/mark cards were obtained. The subject-wise average marks scored in five major exams of an academic year was computed. Based on the average marks, the subject-wise AA of the selected student respondents were categorised into seven grades on a Likert Scale as outstanding (91% - 100%), excellent (81% - 90%), very good (71% - 80%), good (61% - 70%), average (51% - 60%), below-average (41% -50%), and low (35% - 40%). Table IX and Figure 13 depict the level of AA of selected student respondents.

A glance at the above figure reveals that the highest percentage of student respondents were under the below-average category concerning their AA in three out of the five subjects (English, Mathematics and Science) and overall, very few of them come under the excellent and outstanding category. On further perusal, the above table illustrates that 35% of the target respondent's AA in the Language was very good. However, 24% of them displayed below-average AA and 18.2% in the average category closely followed by 15.3% exhibiting good performance. A meagre percentage (4%) of them was in the excellent and outstanding categories. A heartening thing to note was that a negligible percentage of them (3.2%) showed low AA in Language.

Concerning English, it was evident from the table that 31.1% of the respondents were in the below-average category, and nearly one-fourth of the respondents (23%) exhibited average AA closely followed by children in the good category (20.5%). Like in the case of Language, in English too, only a meagre percentage (6.5%) of them showed low AA. However, an equal percentage of them exhibited excellent plus outstanding achievement.

TABLE IX

CATEGORISATION OF THE SELECTED STUDENT RESPONDENTS BASED ON THEIR SUBJECT-WISE AA

N=3026

Subject-wise AA	Level													
	Outstanding (91% - 100%)		Excellent (81% -90%)		Very Good (71% -80%)		Good (61% -70%)		Average (51% -60%)		Below-average (41% -50%)		Low (35% -40%)	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Language	63	2.1	51	1.7	**1061**	**35.1**	464	15.3	551	18.2	739	24.4	97	3.2
English	39	1.3	136	4.5	396	13.1	620	20.5	698	23.1	**941**	**31.1**	196	6.5
Mathematics	4	.1	73	2.4	171	5.7	522	17.3	761	25.1	**909**	**30.0**	586	19.4
Science	11	.4	5	.2	22	.7	506	16.7	885	29.2	**982**	**32.5**	615	20.3
Social Science	00	00	147	4.9	398	13.2	**776**	**25.6**	735	24.3	693	22.9	276	9.1

Percent-wise distribution of the selected student respondents based on subject-wise AA

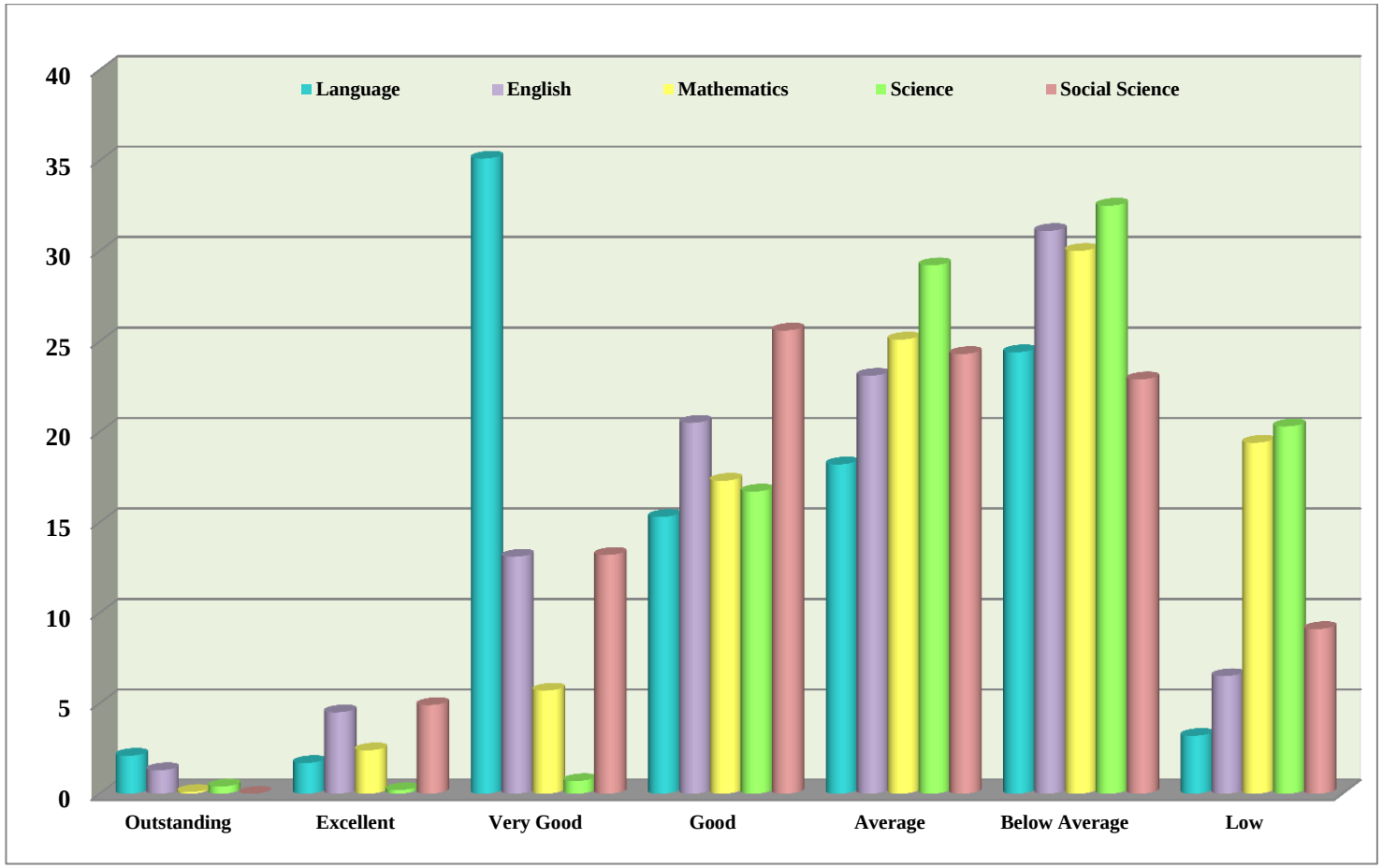


Figure 13

Similar to English, in Mathematics more children were classified under the below-average academic band (30%) followed by average achievement (25.1%). However, unlike in the case of Language and English, a greater number of student respondents' AA was in the low category (19.4%). Having said this, it was noteworthy that 17.3% were categorised under the good category. Only 5.7% come under the very good band and a mere number of respondents (2.5%) come under the excellent and outstanding categories put together. Keeping in line with Mathematics, in Science, a considerable percentage (32.5%) of them were categorised in the below-average band of academic achievement followed by the average band (29.2%). However, the Science subject recorded a low category of 20.3% compared to all other four subjects. Another point to be noted was that very few of them were in the very good, excellent and outstanding categories in all.

In Social Science, more respondents come under the good category (25.6%) by means of their AA closely followed by the average level (24.3%). 23% come under the below-average band. As in English, 13.2% of them performed well and were categorised under the very good category. Only 9.1% of them exhibited low performance followed by approximately 5% in the 'excellent' category. These overall results caution the academicians, school administrators and teachers to get deep into the facts and analyse the factors that contribute to the poor achievement scores and thereby devise certain methodologies/strategies to foster the school respondent's learning in these subjects.

b. Association between socio-demographic variables and AA of the student respondents

There were several studies investigating the role of academic factors, teacher quality and school-related factors in the AA of student respondents. However, one major lacuna was research that sought to determine the role of non-academic factors. Even the research examining the influence of the non-academic factors, in other words, the socio-demographic factors, focused on the overall performance in the school but not on the subject-wise achievement. Owing to this reason of minimal research in the specified domain, the current study aimed to investigate the association between the socio-demographic factors (independent variables) and the subject-wise AA (dependent variables) of the selected student respondents.

As the data set of the present study followed a normal distribution, parametric tests were computed. Based on the number of subgroups two types of parametric tests were computed a) t-test, an inferential statistic to determine whether a significant difference exists between the means of two subgroups and how they are related (gender). b). One-way ANOVA to investigate the association between a single factor that has more than two subgroups (class, father's education, mother's education, type of school, type of family, birth order, and area of residence). The dependent variable was subject-wise AA (Language, English, Mathematics, Science and Social Science). The subsection below summarises the above-mentioned tests showing the influence of socio-demographic factors on the subject-wise AA within the following subheads.

i. Influence of Gender on subject-wise AA
ii. Influence of Class-of-study on subject-wise AA
iii. Influence of Father's education on subject-wise AA
iv. Influence of Mother's education on subject-wise AA
v. Influence of Type of family on subject-wise AA
vi. Influence of Type of school on subject-wise AA
vii. Influence of Birth order on subject-wise AA
viii. Influence of Area of residence on subject-wise AA

i. Influence of Gender on Subject-wise AA

Table X represents the influence of gender on the subject-wise AA.

TABLE X
INFLUENCE OF GENDER ON SUBJECT-WISE AA OF SELECTED STUDENT RESPONDENTS N=3026

Predictors	Boys N=1457		Girls N=1569		*t* (2955)	*p*	Cohen's d
	M	SD	M	SD			
Language	63.13	14.293	62.66	13.218	0.930	.352	.03
English	58.35	14.149	56.99	12.702	**2.775**	**.006**	**.10**
Mathematics	52.05	11.595	52.73	12.251	-1.566	.118	.05
Science	50.02	9.832	50.97	10.733	**-2.549**	**.011**	**.09**
Social Science	57.93	13.480	58.51	13.232	-1.203	.229	.04

The above table depicting the influence of the independent variable (gender) on the AA of the selected student respondents vividly stated that two among the five subjects (English and Science) showed significant differences concerning gender. A significant mean difference in English with *t* (2955) =2.775 and *p*=.006 based on the mean accuracy showed that boys exhibited higher scores and were significantly different from girls. On the other hand, a significant mean difference in Science with *t* (2995) = -2.549 and *p*=.011 based on the mean score, displayed that girls exhibited a higher score (M=50.97, SD=10.733) and were significantly different from boys. All the more, the other three subjects namely Language, Mathematics and Social Science didn't show any significant gender difference. A study done by Parajuli and Thapa (2017) points out that gender plays a significant role in influencing AA. It further states that girls exhibited better AA compared to boys. This finding was in partial support of the present finding concerning Science and contradicts the results of English AA.

The value of Cohen's d measure of effect size (*d*) was .09 for Science and .10 for English indicating no effect size as the mean difference between boys and girls was 0.2 the size of SD. In other words, the mean difference was small compared to the variability in the data and the significant result might be due to the large sample size.

ii. Influence of Class-of-study on subject-wise AA

Table XI portrays the results of one-way ANOVA showing the nature of dependency of the subject-wise AA vis-a-vis the independent variable namely the class-of-study.

TABLE XI
INFLUENCE OF CLASS OF STUDY ON SUBJECT-WISE AA OF THE SELECTED STUDENT RESPONDENTS N=3026

Predictors	6th std (N= 980)		7th std (N= 1006)		8th std (N= 1040)		*F* (2, 3023)	*p*	η^2
	M	***SD***	***M***	***SD***	***M***	***SD***			
Language	62.27	15.371	62.52	13.252	63.82	12.500	**3.744**	**.024**	**.02**
English	56.25	16.133	56.77	12.220	57.64	11.331	**21.286**	**.000**	**.14**
Mathematics	49.48	10.951	53.01	12.983	54.58	11.227	**49.454**	**.000**	**.09**
Science	47.99	9.135	50.71	11.241	52.70	9.915	**54.540**	**.000**	**.03**
Social Science	57.71	15.236	58.55	12.783	58.23	11.915	1.152	.316	.07

The above table states that the class-of-study does have a significant impact on four out of five academic subjects namely Language with $F(2,3023)=3.744, p=.024$, and $\eta^2=0.02$; English with $F(2,3023)=21.286$, $p=.001$ and $\eta^2=0.14$; Mathematics with $F(2,3023)=9.454$, $p=.001$and$\eta^2=0.09$ Science with $F(2,3023)=54.540$, $p=.001$ and $\eta^2=0.03$. Though the F statistics revealed a significant association between the independent and the dependent variable, the effect size computed as eta square (η^2) conveys the strength of the relationship between variables. Accordingly, the present data showed a small effect size over the dependent variables namely AA in Language ($\eta^2=0.02$) and Science ($\eta^2=0.03$). The effect size was medium in Mathematics ($\eta^2=0.09$) and large in English ($\eta^2=0.14$). However, concerning Social Science, the table displayed an insignificant mean difference between the class-of-study and AA. A graph was plotted (Figure 2) with the mean scores procured by the respondents belonging to each subgroup in subjects having significant variations (Language, English, Mathematics and Science).

The figure vividly depicted that the 8thstandard students exhibited higher mean scores compared to their counterparts in all of the dependent variables (Language-63.82, English-57.64, Mathematics-54.58 and Science-52.70). Further, an interesting thing that has been observed from the above result was that the class-of-study was directly proportional to their AA in all the subjects. In other words, the higher the class, the higher the level of their AA. This may be attributed to the fact that as the students climbs up higher, they tend to get more serious and responsible towards academic performance and also understand the academic concepts better than their other counterparts (6th and 7th std).

iii. Influence of Father's education on subject-wise AA

Table XII shows the result of one-way ANOVA, depicting the association between the independent variable-father's education and the subject-wise AA (Language, English, Mathematics, Science and Social Science) of the selected student respondents.

Pair-wise plot of subject-wise AA based on the Class-of-study with significant variations

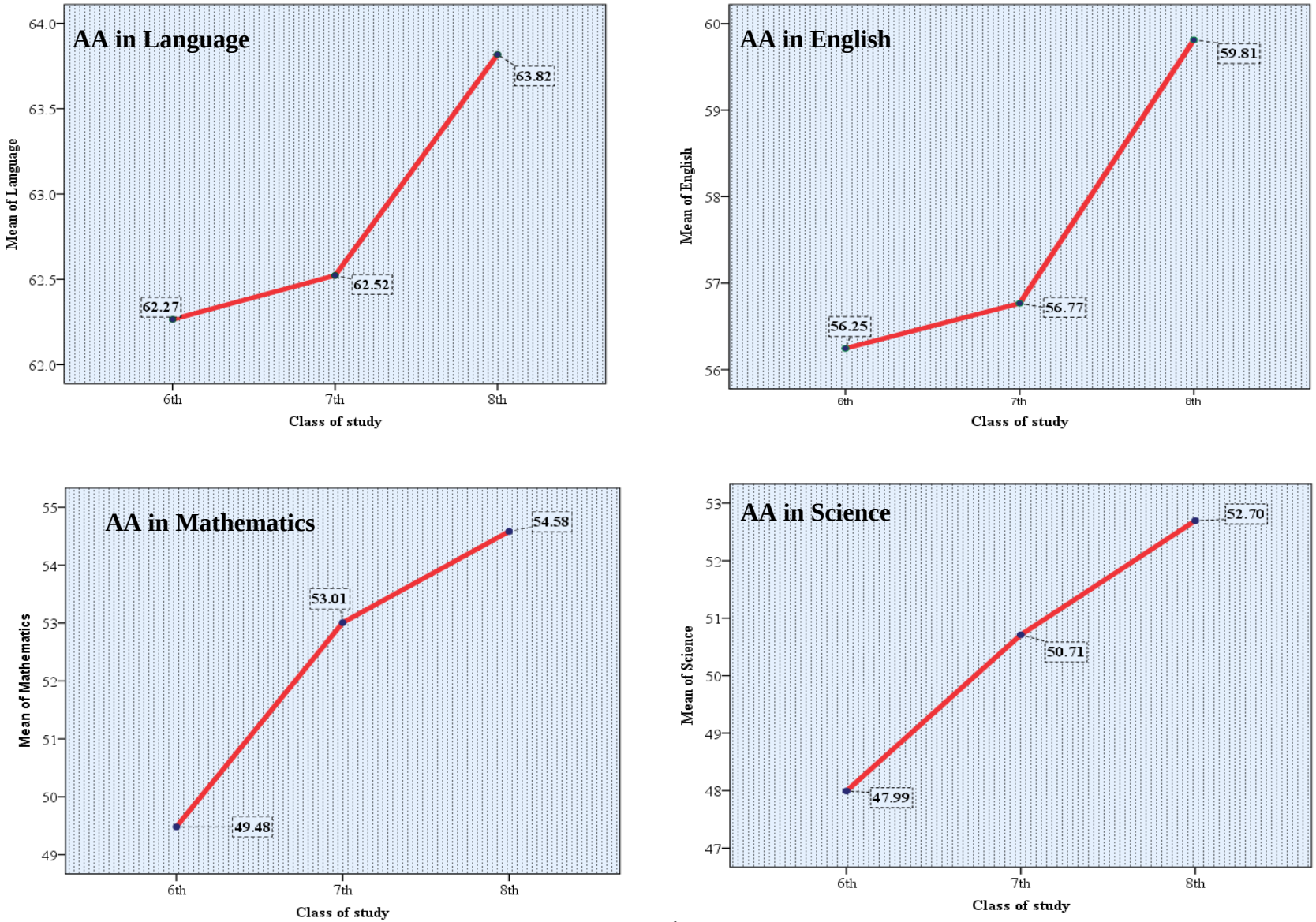


Figure 14

TABLE XII

INFLUENCE OF FATHER'S EDUCATION ON SUBJECT-WISE AA OF THE SELECTED STUDENT RESPONDENTS

N=3026

Predictors	10th std (N=1016)		12th std (N=652)		UG (N=948)		PG (N=410)		*F* (3,3023)	*p*	η^2
	M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**			
Language	63.39	13.338	62.57	13.581	62.90	13.856	62.08	14.708	1.053	.368	0.01
English	57.38	13.164	57.00	13.266	58.12	13.165	58.20	14.884	1.264	.285	0.01
Mathematics	52.10	11.878	51.12	11.738	53.76	12.275	52.09	11.372	**6.929**	**.000**	**0.06**
Science	50.72	10.548	50.01	10.083	50.43	9.866	50.99	11.107	.953	.414	0.09
Social Science	58.58	12.875	58.05	12.882	57.65	13.200	59.00	15.431	1.325	.264	0.01

Table XII indicated a significant mean difference across the father's education status on the AA in Mathematics alone with F (3, 3023)=6.929, p=.001and η^2=0.06; the effect size computed as eta square (η^2) showed a medium effect. In other words, the subgroups of the father's education qualification produce a moderate effect on the AA in Mathematics of the selected student respondents. Apart from Mathematics, the father's education does not seem to have a statistically significant association with the AA of the other four subjects namely (Language, English, Science and Social Science). A graph was plotted with the mean scores procured by the respondents belonging to each subgroup concerning Mathematics and illustrated in Figure 15.

Pair-wise plot of AA in Mathematics based on the Father's educational qualification

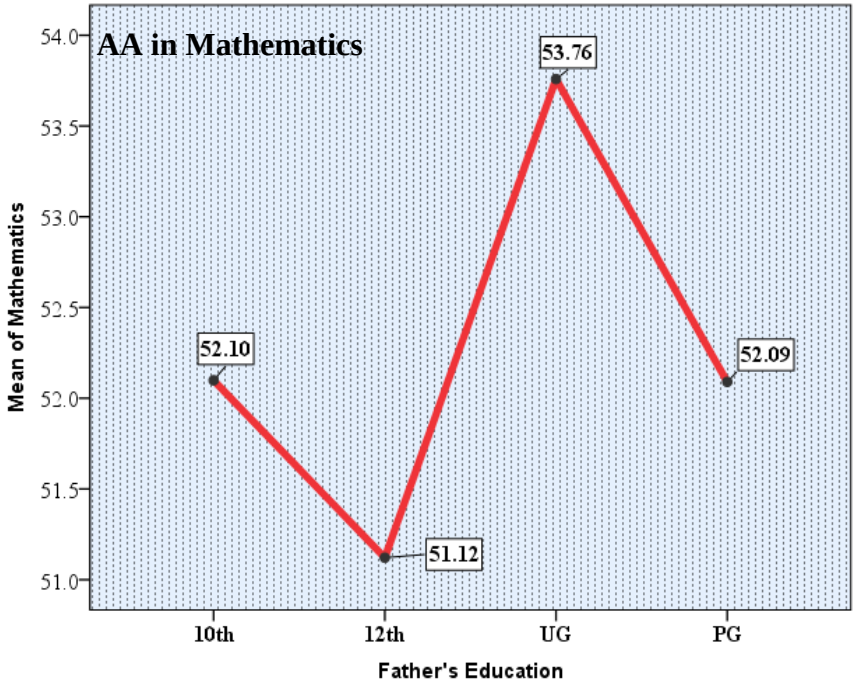


Figure 15

The above figure depicted that the student respondents of graduate fathers exhibited a higher mean score of 53.76 compared to their other counterparts in Mathematics. Interestingly, this result was also supported by a study done by Masud et al. (2019). The study stated that the higher the level of a father's education higher the level of AA of students in

general. Having said this, it has to be noted the mean score procured by the student respondents of postgraduate fathers was less in comparison to the graduate fathers. This observation necessitates further exploration.

iv. Influence of Mother's education on subject-wise AA

The results of one-way ANOVA computed to determine the associations between the independent variable (mother's educational qualification) over the dependent variable (subject-wise AA of student respondents) were displayed in Table XIII. The table stated that the mother's education does have a significant impact on the student's AA in two subjects namely Language with $F(3,3023)=4.451 p=.004$ and $\eta^2 = 0.04$ and Science with $F(3,3023)=7.953$, $p=.001$ and $\eta^2=0.07$; Owing to the huge sample size the effect size in terms of eta square (η^2) was computed, which showed a small effect over the AA in Language ($\eta^2=0.04$) and moderate effect on AA in Science ($\eta^2=0.07$); However, concerning English, Mathematics and Social Science, the table displayed insignificant mean difference between the mother's education and AA of selected student respondents.

A graph was also plotted with the mean scores procured by the respondents belonging to each subgroup concerning subjects having significant variation (Language and Science) and illustrated in Figure 16.

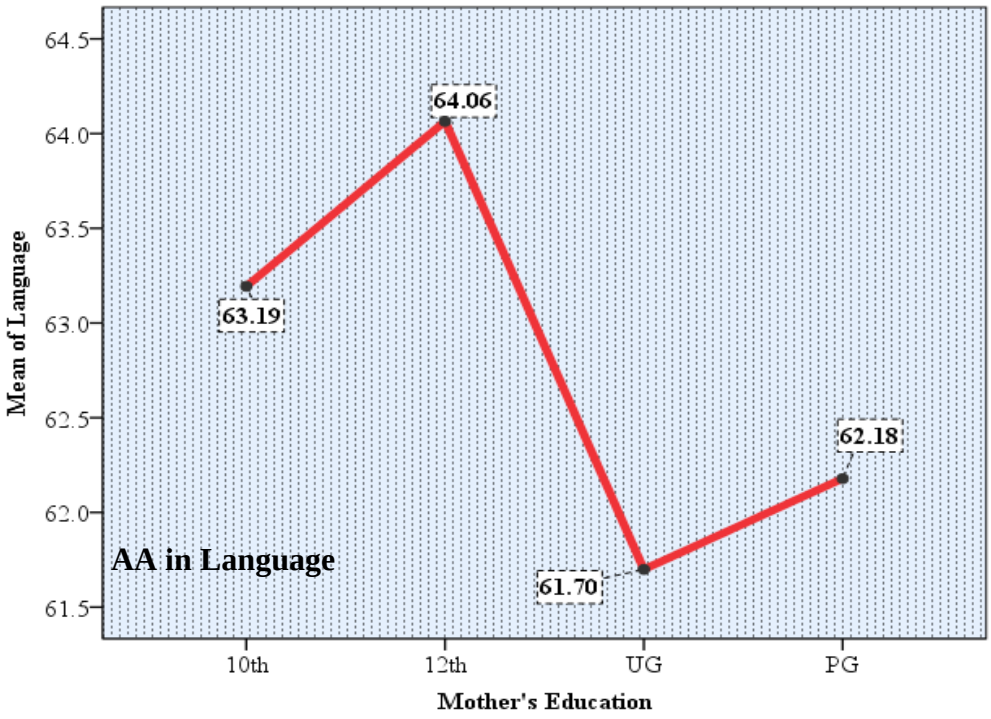
TABLE XIII

INFLUENCE OF MOTHER'S EDUCATION ON SUBJECT-WISE AA OF THE SELECTED STUDENT RESPONDENTS

N=3026

Predictors	10th std (N=1099)		12th std (N=757)		UG (N=851)		PG (N=319)		*F*(3,3023)	*p*	η^2
	M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**			
Language	63.19	13.021	64.06	13.515	61.70	14.707	62.18	13.840	**4.451**	**.004**	**0.04**
English	57.71	12.718	57.67	13.167	58.01	14.664	56.41	13.012	1.116	.341	0.01
Mathematics	52.62	11.831	51.93	11.419	52.59	12.064	52.33	13.177	.579	.628	0.05
Science	51.37	10.636	50.99	9.931	49.55	10.252	48.98	9.938	**7.953**	**.000**	**0.07**
Social Science	58.66	13.007	58.48	12.344	57.44	14.417	58.29	13.845	1.452	.226	0.01

Pair-wise plot of subject-wise AA based on the Mother's educational qualification with significant variations



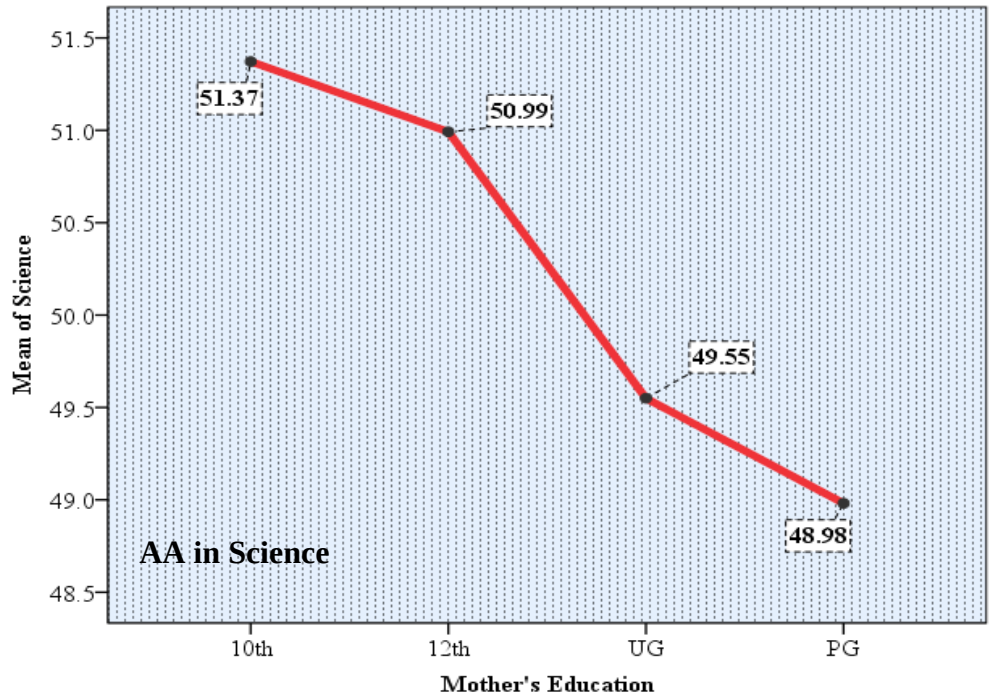


Figure 16

The figure vividly depicted that the student respondents of 12th and 10th standard passed mothers reported a higher mean score compared to their counterparts in Language (64.06 and 63.19 respectively) and Science (50.99 and 51.37 respectively) subjects. A study by Awan and Kauser (2015) stated that mothers' education plays a significant role in the AA of school children, but did not specify the type of influence on the same. However, the result of the present study concludes that the mothers with lower levels of education had student respondents who could score higher in a few subjects. This might be due to the realisation of the value of education by the mothers and hence taking extra care in their student's education.

v. Influence of Type of family on Subject-wise AA

Table XIV portrays the results of one-way ANOVA showing the nature of dependency of the dependent variables (subject-wise AA) over the independent variable, the type of family (nuclear, joint and extended) of the selected student respondents.

TABLE XIV
INFLUENCE OF THE TYPE OF FAMILY ON SUBJECT-WISE AA OF THE SELECTED STUDENT RESPONDENTS N=3026

Predictors	Nuclear (N=1950)		Joint (N=842)		Extended (N=234)		*F* (2,3023)	*p*	η^2
	M	SD	M	SD	M	SD			
Language	63.11	13.811	62.49	13.717	62.41	13.305	.744	.475	.00
English	57.67	13.341	57.74	13.557	57.09	13.796	.223	.800	.00
Mathematics	52.39	11.779	52.50	12.082	52.20	12.809	.063	.939	.00
Science	50.64	10.389	50.10	9.688	50.94	11.816	1.035	.355	.00
Social Science	57.99	13.431	58.34	12.957	59.89	14.026	2.167	.115	.00

The table indicates that the type of family does not have any kind of impact on the AA of the respondents in all five subjects as the F statistics didn't reveal any significant association between the above said dependent and independent variables. Likewise, the eta square (η^2) = 0.00 too indicated no effect of the same. A part of the study carried out by Betancort et al. (2013) among school students indicating that the type of family does not play any significant role in AA support the present findings.

vi. Influence of the Type of school on subject-wise AA

Table XV shows the result of one-way ANOVA, depicting the association between the type of school and the subject-wise AA (Language, English, Mathematics, Science and Social Science) of the selected student respondents

TABLE XV
INFLUENCE OF THE TYPE OF SCHOOL ON SUBJECT-WISE AA OF THE SELECTED STUDENT RESPONDENTS **N=3026**

Predictors	Government (N=457)		Aided (N=1378)		Private (N=1191)		*F* (2,3023)	*p*	η^2
	M	SD	M	SD	M	SD			
Language	64.24	12.159	61.95	13.642	63.44	14.362	**6.379**	**.002**	**.04**
English	57.33	12.290	57.69	13.373	57.72	13.924	.149	.861	.00
Mathematics	55.39	11.983	53.87	13.274	49.57	9.469	**60.604**	**.000**	**.03**
Science	54.69	11.162	50.45	11.109	48.98	8.426	**52.483**	**.000**	**.03**
Social Science	59.43	13.502	58.83	14.293	57.08	12.031	**7.674**	**.000**	**.05**

The above Table XV states that the type of school has a significant impact on the AA of four of the five subjects (i.e.) Language $F(2,3023)=6.379$ and $p.=002$; Mathematics $F(2,3023)=60.604$ and $p=.001$; Science $F(2,3023) = 52.483$ and $p=.001$ and Social Science $F(2,3023)=7.674$ and $p=.001$. Though the F Statistics revealed a significant association between the independent and the dependent variable, the effect size computed as eta square (η^2) showed a small effect over AA in Language ($\eta^2= 0.04$), Mathematics ($\eta^2=0.03$), Science ($\eta^2 =0.03$) and Social Science ($\eta^2=0.05$); Furthermore, concerning English, the table displayed an insignificant mean difference between the type of school that student respondents were enrolled in and AA in English ($F(2,3023) =.149$, $p=.861$).A study done by Yusuf and Adigun (2010) indicated that the type of school had no significant influence on students' academic achievement contradicts the present finding.

A graph was plotted with mean scores procured by the respondents belonging to each subgroup concerning subjects having significant variation (Language, Mathematics, Science and Social Science) and displayed in Figure 17.

Pair-wise plot of subject-wise AA based on the Type of school with significant variations

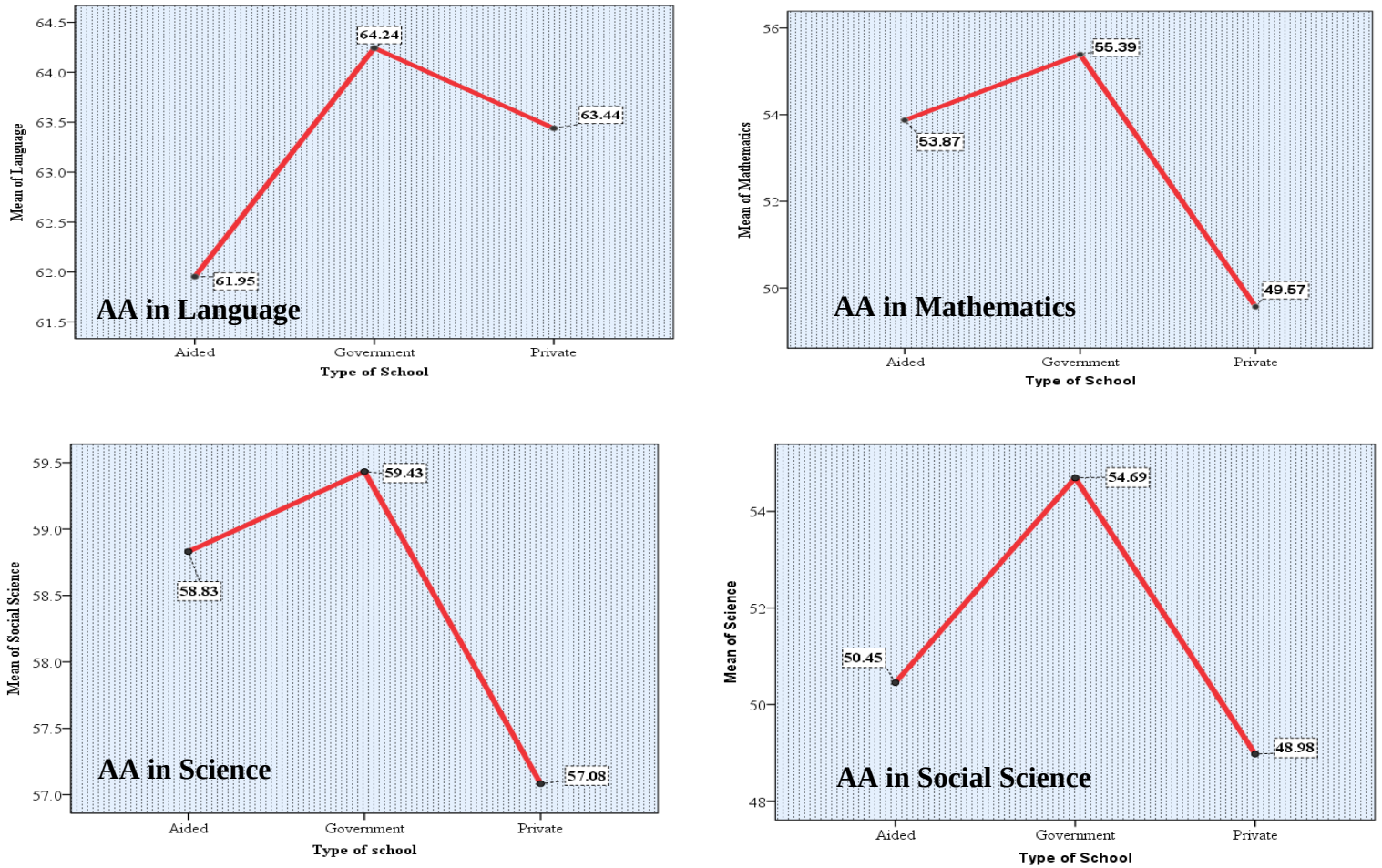


Figure 17

The figure depicted that the children who are studying in government schools exhibited higher mean scores compared to their other counterparts in Language (64.24), Mathematics (49.57) Science (48.98) and Social Science (57.08). As reported by Clement, (2010), the government's effort to frame a continuous and comprehensive evaluation to analyse the skills and values of the students studying in the school may be the reason.

vii. Influence of Birth order on subject-wise AA

Table XVI exhibits the result of one-way ANOVA showing the association between the birth order of the school-going children and the dependent variable (AA namely Language, English, Mathematics, Science and Social Science).

TABLE XVI
INFLUENCE OF BIRTH ORDER ON SUBJECT-WISE AA OF THE SELECTED STUDENT RESPONDENTS **N=3026**

Predictors	Firstborn (N=1570)		Middle born (N=248)		Lastborn (N=1208)		*F* (2,3023)	*p*	η^2
	M	SD	M	SD	M	SD			
Language	63.13	13.887	62.39	12.426	62.67	13.822	.555	.574	.00
English	57.61	13.274	57.84	12.145	57.64	13.893	.031	.969	.00
Mathematics	52.20	11.670	54.41	12.517	52.27	12.143	**3.809**	**.022**	**.02**
Science	50.25	10.161	53.35	10.813	50.27	10.337	**10.315**	**.06**	**.06**
Social Science	58.00	13.094	59.92	13.543	58.19	13.631	2.236	.107	.00

It can be stated from the above result that birth order was found to be less significant when compared to many other socio-demographic factors. The above table states that the birth order does have a significant impact on only two out of five subjects namely Mathematics $F(2,3023)=3.809$, $p=.022$, $\eta^2=0.02$ and Science $F(2,3023)=10.315$, $p=.001$ and $\eta^2=0.06$; With a statistically significant F value, the effect size calculated (η^2) showed a only small effect over the dependent variable namely the AA in Mathematics ($\eta^2=0.02$); moderate effect on AA in Science ($\eta^2=0.06$); Furthermore, concerning Language, English and Social Science, the table displayed insignificant mean difference between the birth order and academic achievement of the target respondents. A graph was plotted with scores procured by the respondents belonging to each subgroup in subjects having significant variations (Mathematics and Science) and illustrated in Figure 18.

Pair-wise plot of subject-wise AA based on the Birth order with significant variations

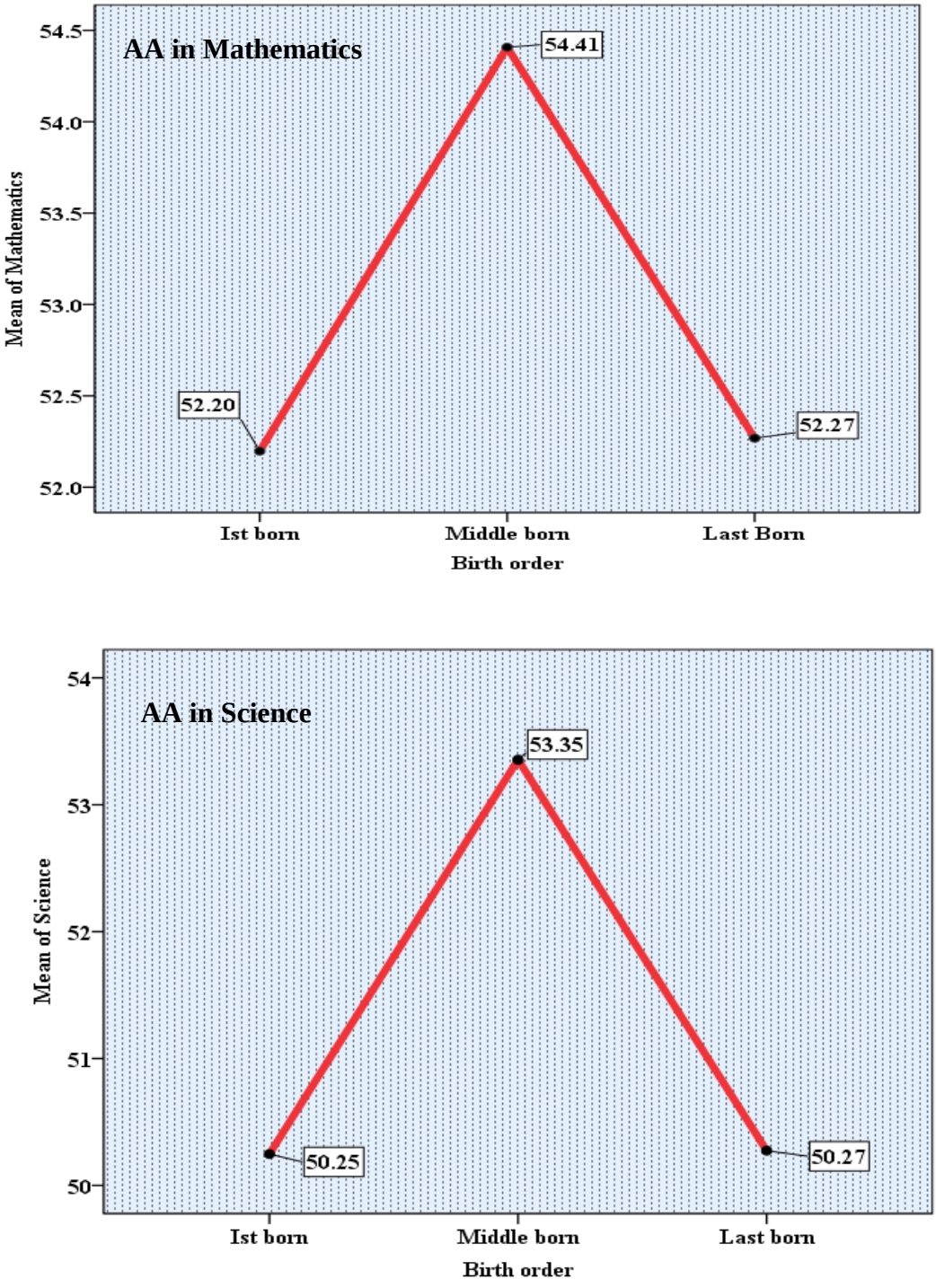


Figure 18

The figure depicted that the middle-born respondents reported higher mean scores compared to their counterparts in the AA in Mathematics (54.41) and Science (53.35). The researcher owes to a conception that middle-born student respondents were good at being a mediator and more independent in handling any situation. They don't think about right or wrong, but they have more freedom and less pressure growing up. The same characteristics that might have been applied in learning the academic subjects might be one significant reason for the middle-born respondents to score high in the core subjects (Science and Mathematics). Moreover, as these subjects need logical understanding and execution at the right time, the middle-born students were able to make it possible when compared to their cohorts.

viii. Influence of Area of residence on subject-wise AA

Table XVII portrays the one-way ANOVA statistical analysis showing the influence of the area of residence on the subject-wise AA of the selected student respondents.

TABLE XVII

INFLUENCE OF AREA OF RESIDENCE ON SUBJECT-WISE AA OF THE SELECTED STUDENT RESPONDENTS N=3026

Predictors	Rural (N=623)		Semi-Urban (N=1351)		Urban (N=1052)		*F* (2,3023)	*p*	η^2
	M	SD	M	SD	M	SD			
Language	64.20	14.279	63.42	12.984	61.41	14.248	**10.004**	**.000**	**.06**
English	58.31	14.515	58.38	12.108	56.31	14.271	**8.005**	**.000**	**.05**
Mathematics	50.70	9.694	52.89	11.132	52.79	13.912	**8.041**	**.000**	**.05**
Science	49.79	8.834	52.18	10.143	48.79	11.010	**34.611**	**.000**	**.03**
Social Science	56.40	10.911	59.55	12.893	57.63	14.989	**13.619**	**.000**	**.08**

The area of residence has a strong impact on all the five domains of AA in Language with $F(2,3023)=10.004$ and $p=.001$; English with $F(2,3023)=8.005$ and $p=.001$; Mathematics with $F(2,3023)=8.041$ and $p=.001$; Science with $F(2,3023)=34.611$, $p=.001$, and Social Science with $F(2,3023)=13.619$ and $p=.001$; With a statistically significant F value, the effect size computed as eta square (η^2)showed a small effect over the AA in English ($\eta^2=0.05$), Mathematics ($\eta^2= 0.05$) and Science ($\eta^2=0.03$); moderate effect on AA in Language ($\eta^2=0.06$); high effect on AA in Social science ($\eta^2= 0.08$); A graph was plotted with sores procured by the respondents belonging to each subgroup about all subjects and displayed in Figure 19.

Pair-wise plot of subject-wise AA based on the Area of residence with significant variations

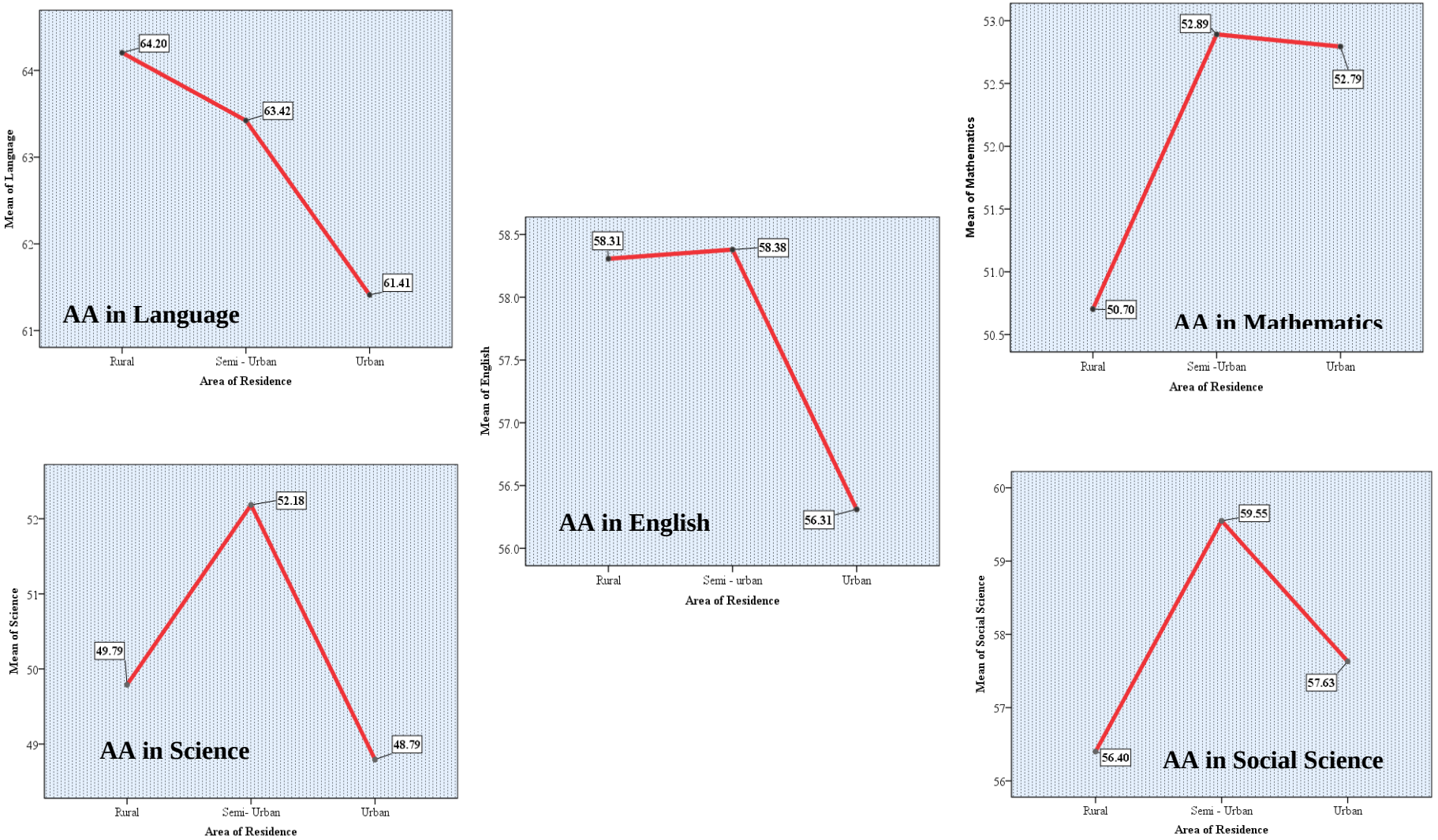


Figure 19

Figure 7 reported that the student respondents residing in semi-urban areas exhibited higher mean scores compared to their counterparts in almost four subjects namely English (58.38), Mathematics (52.89), Science (52.18) and Social Science (59.55). In the AA of language (64.20) alone, the rural respondents had an augmented mean score when compared to their counterparts. On the whole, the result of semi-urban respondents scoring better may be attributed to the fact that respondents in these areas were more focused on studies due to fewer external distractions and peer group involvement and hence could spend more time in their studies and perform better academically.

Overall, based on the subject-wise AA, the selected respondents' score in English alone had a large effect size with the respondents in the higher classes performing better than their counterparts. The variables namely parents' education, type of school and birth order was not associated with the AA in English. Whilst, the AA in Language was found to be associated with every variable understudy except the father's educational status and birth order. However, the effect size was medium only for the area of residence (Rural respondents outperforming their counterparts). The AA of one core subject, Mathematics, was found to have a small to moderate effect in almost all socio-demographic variables except the educational qualification of the fathers of the selected respondents. A medium effect was revealed in the class-of-study (the higher the class, the better the AA), and the father's education (the higher the educational status of the father better the AA). AA of another core subject, Science, like Mathematics, was found to have a small to moderate effect in almost all the socio-demographic variables except the educational qualification of the respondents' fathers, and gender alone did not show any impact on student respondents. The AA in Social Science was less associated with socio-demographic variables than the two core subjects (Mathematics and Science). However, both the type of school and area of residence (respondents from the semi-urban area performed better) had a large effect size with the selected respondents. The type of family doesn't show any impact on the AA of selected student respondents.

C. MULTIPLE INTELLIGENCE

It is a well-known fact that no two students think and learn similarly. Hence, there has always been the need to present the same information in different lights to reach different students. This necessity is predominantly driven by the theory of Multiple Intelligence (MI) that aids in providing a framework and tools to meet the needs of different types of learners. The theory suggests that every individual has nine different types of intelligence that combine to form an individual's specific cognitive potential. These intelligences, although separate, work together in many combinations, in students' learning exercises (Kurt & Sezek, 2021).

Despite constant evolution in educational practices, culturally, many school systems today value Linguistic and Logical-mathematical abilities over others and hence, an important part of learning is geared towards developing these two areas. According to Gardner, this is not a comprehensive approach. Though there have been studies on this topic, it remains an area of interest, not fully fathomed and which could be explored further and further. Prompted by this, the researcher has attempted to understand the MI of the selected student respondents under the following subheads:

a. Categorisation of the student respondents based on their level of MI
b. Association between socio-demographic variables and MI of the student respondents

a. Categorisation of the selected student respondents based on their level of MI

As identifying the level of MI of the selected student respondents would go a long way in rethinking and recouping the teaching and learning styles that would better aid the respondents in enhancing their overall performance, the present study had its focus on 6^{th}, 7^{th} and 8^{th} std. students. These grades are perceived to be crucial as far as laying the foundation for higher studies is concerned. Hence, it becomes all the more important that the level of MI of these selected student respondents was appropriately identified. Based on the scores procured in the MI scale, the level of each MI has been grouped into seven categories namely Extremely high (42 & above), High (36-41), Above average (31-35), Average (23-30), Below average (18-22), Low (12-17), Extremely low (11 and below) and the categorisation was shown below in Table XVIII and Figure 20.

TABLE XVIII

CATEGORISATION OF THE SELECTED STUDENT RESPONDENTS BASED ON THEIR LEVEL OF MI

N=3026

Domains of Intelligences	Level													
	Extremely high (42 & above)		High (36 - 41)		Above average (31 - 35)		Average (23 - 30)		Below average (18 - 22)		Low (12 - 17)		Extremely low (11 & below)	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Linguistic	22	0.7	300	10	1070	35.4	**1436**	**47.5**	180	5.9	18	.6	00	00
Logical	41	1.4	184	6	1131	37.4	**1372**	**45.3**	298	9.8	00	00	00	00
Bodily-kinesthetic	36	1.2	572	19	**1074**	**35.5**	1041	34.4	303	10	00	00	00	00
Spatial	18	0.6	22	0.7	818	27	**1778**	**58.8**	386	12.8	0.4	0.1	00	00
Musical	00	00	533	17.6	593	19.6	**1360**	**44.9**	540	17.8	00	00	00	00
Naturalistic	00	00	466	15.4	753	24.9	**1241**	**41.0**	566	18.7	00	00	00	00
Interpersonal	12	0.4	434	14	549	18.1	**1984**	**65.9**	47	1.6	00	00	00	00
Intrapersonal	25	0.8	659	22	**1085**	**35.9**	742	24.9	505	16.7	00	00	00	00
Existential	6	0.2	427	14	741	24.5	**1360**	**44.9**	491	16.2	1	0.0	00	00

Percentage distribution of the selected student respondents based on their level of MI

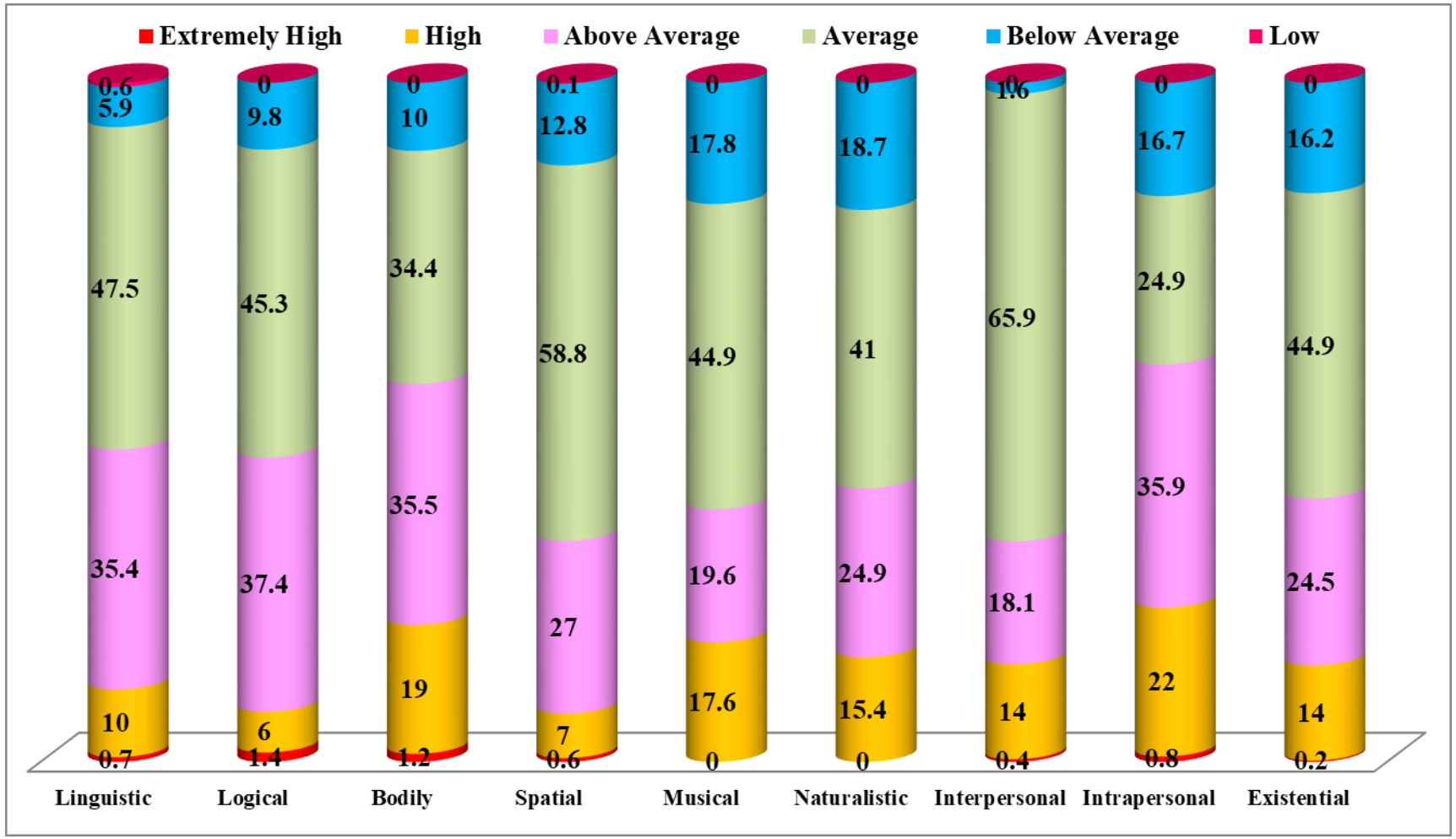


Figure 20

It could be inferred from the above table that out of the nine domains of MI, there were just a few (5.2%) respondents who possessed extremely high levels of Linguistic (0.7%), Logical (1.4%), Bodily-kinesthetic (1.2%), Spatial (0.6%), Intrapersonal (0.4%), Interpersonal (0.8%), and Existential intelligence (0.2%). None of the student respondents had extremely high levels of Musical and Naturalistic intelligence.

Twenty-two percent of the student respondents possessed a high level of Intrapersonal intelligence, followed by 19% of the student respondents categorised under the high category in Bodily-kinesthetic type of intelligence and 17.6% who were good in Musical intelligence. Remaining intelligence like Naturalistic, Interpersonal and Existential was within the 14 to 15% band. However, only 10% of the student respondents possessed a high Linguistic intelligence level and 6% had a high level of Logical intelligence. A mere 1% of them had high Spatial intelligence.

Thirty-seven percent of the student respondents possessing Logical intelligence were categorised under the above-average category closely followed by Intrapersonal (36%), Bodily-kinesthetic (35.5%) and Linguistic (35.4%) intelligence. 27% of them had above-average Spatial intelligence and not very far behind were both Existential (24.5%) and Naturalistic intelligence (24.9%).

Sixty-six percent of the student respondents were found to possess an average level of Interpersonal intelligence followed by Spatial intelligence (58.8%) and Linguistic intelligence (47.5%). The remaining intelligences namely Logical, Musical, and Existential were within the 44% to 45% band. However, 41% of respondents possessed an average level of Naturalistic intelligence, 34.4% had an average level of Bodily-kinesthetic and the remaining 25% with average Intrapersonal intelligence. The above results were in concordance with a study done by Singh et al. (2017) which stated that different students possessed different forms of intelligence and most students had more than one form of intelligence.

A glance at the above table and graph reveals that except for Bodily-kinesthetic and Intrapersonal types of intelligences that were found above average levels, all other intelligences were only at the average level among the selected student respondents. However,

it is noteworthy that none of the nine types of intelligence levels were in the extremely low category among the respondents and only five respondents possessed low levels of Spatial and Existential intelligence compared with other intelligences.

The researcher perceives that this could play a very crucial role in the academic achievement of the selected student respondents as they go up the class ladder. Though, presently they exhibit a range of 'very good' to 'poor' academic achievement, there exists a need to model the learning concepts in such a way that it caters to respondents with all types of MI so that it becomes a good learning tool for students, and hence facilitating the student respondents in performing better academically. Overall, it can be said that the MI concept can go a long way in drawing the respondents back to learning.

b. Association between socio-demographic variables and MI of the student respondents

Apart from the student's ability, other external factors, such as family, neighbourhood, and peer group, play a crucial role in influencing their MI. Few researchers have tried to find the correlation between intelligence and socio-demographic status and found a moderate to significant relationship between the two (Stumm & Plomin 2015). Keeping this in mind, the present study aims to understand the influence of socio-demographic factors on the MI of the selected student respondents, for which the researcher computed two types of parametric tests based on the number of subgroups. a) t-tests an inferential statistic was used to determine whether a significant difference exists between the means of two subgroups and how they are related (gender). b) One-way ANOVA was used to investigate the association between a single factor that has more than two subgroups (socio-demographic factors) and the dependent variable (9 domains of MI). The subsection below summarises the t-test and one-way ANOVA results, displaying the influence of corresponding socio-demographic factors on all the 9 domains of MI of the selected student respondents in the following subheads.

i. Influence of Gender on MI
ii. Influence of Class-of-study on MI
iii. Influence of Father's education on MI
iv. Influence of Mother's education on MI
v. Influence of Type of family on MI

vi. Influence of Type of school on MI

vii. Influence of Birth order on MI

viii. Influence of Area of residence on MI

i. Influence of Gender on MI

Table XIX depicts the influence of gender on the MI of the student respondents.

TABLE XIX

INFLUENCE OF GENDER ON MI OF SELECTED STUDENT RESPONDENTS

N=3026

Predictors	**Boys**		**Girls**				**Cohen's**
	M	**SD**	**M**	**SD**	***t(3024)***	***p***	**d**
Linguistic	30.20	4.762	29.42	4.759	**4.548**	**.000**	**0.1**
Logical	30.06	4.878	29.74	4.786	1.861	.063	0.0
Bodily-Kinesthetic	29.69	4.676	30.01	4.978	-1.833	.067	0.0
Spatial	29.64	4.043	29.67	4.064	.187	.852	0.0
Musical	29.68	5.347	29.74	5.534	.326	.745	0.0
Naturalistic	30.45	5.477	30.28	5.614	.877	.381	0.0
Interpersonal	30.60	4.281	30.74	4.521	.875	.382	0.0
Intrapersonal	30.12	5.484	30.27	5.668	-.703	.482	0.0
Existential	30.06	5.252	30.09	5.414	-.196	.845	0.0

The above table portrays the influence of the independent variable (gender) on the MI of the selected student respondents by stating that only Linguistic intelligence among the nine domains showed a significant difference concerning gender with t (3024) = 4.548 and p=.001. Based on the mean accuracy, boys displayed a higher mean score and were significantly different from girls (M=30.20, SD=4.762). Through a statistically significant variation in Linguistic intelligence was revealed that Cohen's d measure of effect size (d) was computed owing to the large sample size. The d = 0.1 indicated no effect size based on gender on the same. Hence boys and girls do not differ. This result contracted to the study conducted by Hanafiyeh (2013) who confirmed that it was only Linguistic intelligence that was statistically varying based on gender.

Other eight types of intelligence namely Logical, Bodily-kinesthetic, Musical, Spatial, Interpersonal, Naturalistic, Intrapersonal and Existential intelligence did not show any significant gender differences. A study carried out by Kaur and Chkara (2008) was contradictory to the current finding. In their study that assessed MI among young adolescents concerning sex differences, significant differences were observed in the mean scores of boys and girls for Linguistic, Logical, Musical and Bodily-kinesthetic intelligence. This study further found out that in the case of Linguistic and Musical intelligence girls were slightly ahead whereas, boys were ahead of girls in the case of Logical and Bodily-kinesthetic intelligence though not significant.

ii. Influence of Class-of-study on MI

Table XX portrays the results of one-way ANOVA which shows the nature of dependency of the dependent variables (9 domains of MI) vis-a-vis the independent variable (class-of-study) of the selected student respondents.

TABLE XX

INFLUENCE OF CLASS-OF-STUDY ON MI OF THE SELECTED STUDENT RESPONDENTS

N=3026

Predictors	6th std (N=980)		7th std (N=1006)		8th std (N=1040)		*F*(2, 3023)	*p*	η^2
	M	SD	M	SD	M	SD			
Linguistic	29.91	4.454	29.92	5.079	29.58	4.763	1.659	.190	0.0
Logical	29.82	4.785	29.71	4.780	30.14	4.920	2.213	.110	0.0
Bodily	29.64	4.679	29.96	4.887	29.95	4.930	1.503	.223	0.0
Spatial	29.58	4.072	29.83	4.063	29.55	4.024	1.412	.244	0.0
Musical	29.47	5.386	29.89	5.473	29.76	5.468	1.558	.211	0.0
Naturalistic	30.15	5.520	30.32	5.475	30.60	5.641	1.732	1.77	0.0
Interpersonal	30.57	4.260	30.77	4.493	30.67	4.461	.531	.588	0.0
Intrapersonal	29.92	5.553	30.26	5.611	30.40	5.570	1.928	.146	0.0
Existential	29.84	5.291	30.19	5.335	30.20	5.376	1.454	.234	0.0

The above table indicates that the Class-of-study does not have any impact on every domain of MI as the f statistics (p>.05) didn't reveal any significant association between the

above-mentioned dependent and independent variables. Likewise, the eta square (η^2) = 0.00 too indicated no effect.

iii. Influence of Father's education on MI

Table XXI displays the result of one-way ANOVA, illustrating the association between the independent variable (father's education) and the 9 domains of MI of the selected student respondents.

The results indicated a significant mean difference across the father's education on Logical intelligence with $F(3,3023)=3.197$ and $p=.023$, however, the effect size computed as eta square (η^2) showed no effect over the dependent variable the Logical intelligence (η^2= 0.0)**;** Apart from Logical, father's education does not seem to have any statistically significant relationship with the other types of MI (Linguistic, Bodily, Spatial, Musical, Naturalistic, Interpersonal, Intrapersonal and Existential). The statistically significant 'f' value and zero effect size of the independent variable (father's education) over the dependent variables (Logical intelligence of student respondents) could be owed to the huge sample size. However, a deeper analysis of the mean scores on Logical intelligence portrays that the respondents of graduate fathers displayed higher mean scores (30.27) compared to the other counterparts. The lowest score was among the student respondents of fathers with a higher secondary level of education. A supportive study was done by Aydemir and Karali (2014) among 7^{th} std. school students too indicated that the father's education played a mildly significant role in influencing the Logical intelligence of selected student respondents.

TABLE XXI

INFLUENCE OF FATHER'S EDUCATION ON MI OF THE SELECTED STUDENT RESPONDENTS

N=3026

Predictors	**10th std (N=1016)**		**12th std (N=652)**		**UG (N=948)**		**PG (N=410)**		***F*** **(3,3023)**	***p***	**η^2**
	M	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***			
Linguistic	29.59	4.922	29.78	4.534	30.07	4.739	29.70	4.856	1.683	.169	0.0
Logical	29.83	4.887	29.54	4.677	30.27	4.853	29.75	4.851	**3.197**	**023**	**0.0**
Bodily	29.86	5.024	29.99	4.790	29.84	4.682	29.66	4.798	.393	.758	0.0
Spatial	29.65	4.044	29.62	3.949	29.66	4.121	29.72	4.097	.054	.983	0.0
Musical	29.80	5.526	29.73	5.430	29.68	5.342	29.54	5.511	.239	.869	0.0
Naturalistic	30.28	5.557	30.24	5.536	30.57	5.534	30.27	5.585	.666	.573	0.0
Interpersonal	30.75	4.492	30.56	4.318	30.72	4.406	30.56	4.346	363	.780	0.0
Intrapersonal	30.28	5.714	29.98	5.515	30.32	5.464	30.08	5.618	603	.613	0.0
Existential	30.16	5.423	29.88	5.266	30.18	5.256	29.96	5.419	.550	.648	0.0

iv. Influence of Mother's education on MI

The results of one-way ANOVA computed to determine the association between the levels of mother's education (independent variables) over the nine domains of MI of student respondents (dependent variable) was displayed in Table XVII

Table XXII clearly states that seven out of nine types of MI were influenced by the educational status of the mothers which include Linguistic (F(3,2023)=4.917 and p=.002), Bodily-kinesthetic (F(3,3023)=4.533 and p=.004), Musical (F(3,3023)=3.894, and p=.009), Spatial (F(3,3023) =3.199 and p=.022), Interpersonal (F(3,3023)= 4.529 and p=.004), Intrapersonal (F(3,3023)=6.404, p=.004) and Existential (F(3,3023)=5.604, p=.001). However, concerning Logical and Naturalistic intelligence, the table displayed insignificant mean difference between the mother's education and MI of selected student respondents. With a statistically significant F value for seven intelligence, the effect size computed as eta (η^2) showed a small effect in Linguistic (η^2= 0.4), Bodily-kinesthetic (η^2= 0.4), Spatial (η^2= 0.3), Musical (η^2= 0.3), Interpersonal (η^2= 0.4), and Existential (η^2= 0.5) type of intelligence; Medium effect on Intrapersonal intelligence (η^2= 0.6); A graph was also plotted with mean scores procured by the respondent belonging to each subgroup with the intelligence having significant variations and illustrated in Figure 21.

TABLE XXII

INFLUENCE OF MOTHER'S EDUCATION ON MI OF THE SELECTED STUDENT RESPONDENTS

N=3026

Predictors	**10th std (N=1099)**		**12th std (N=757)**		**UG (N=851)**		**PG (N=319)**		***F*** **(3,3023)**	***p***	**η^2**
	M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**			
Linguistic	29.52	4.974	29.73	4.632	29.88	4.575	30.67	4.852	**4.917**	**.002**	**0.4**
Logical	30.04	4.923	29.66	4.777	29.87	4.769	30.00	4.814	1.025	.381	0.0
Bodily-Kinesthetic	30.23	5.073	29.89	4.889	29.50	4.551	29.44	4.525	**4.533**	**.004**	**0.4**
Spatial	29.93	4.141	29.65	3.904	29.42	4.040	29.35	4.089	**3.199**	**.022**	**0.3**
Musical	30.09	5.462	29.74	5.556	29.42	5.380	29.11	5.206	**3.894**	**.009**	**0.3**
Naturalistic	30.66	5.488	30.21	5.609	30.18	5.574	30.19	5.523	1.636	.179	0.0
Interpersonal	31.05	4.657	30.56	4.378	30.41	4.175	30.34	4.107	**4.529**	**.004**	**0.4**
Intrapersonal	30.78	5.631	29.98	5.584	29.80	5.479	29.78	5.516	**6.404**	**.000**	**0.6**
Existential	30.57	5.424	30.00	5.405	29.66	5.247	29.66	4.970	**5.604**	**.001**	**0.5**

Pair-wise plot of MI based on the Mother's educational qualification with significant variations

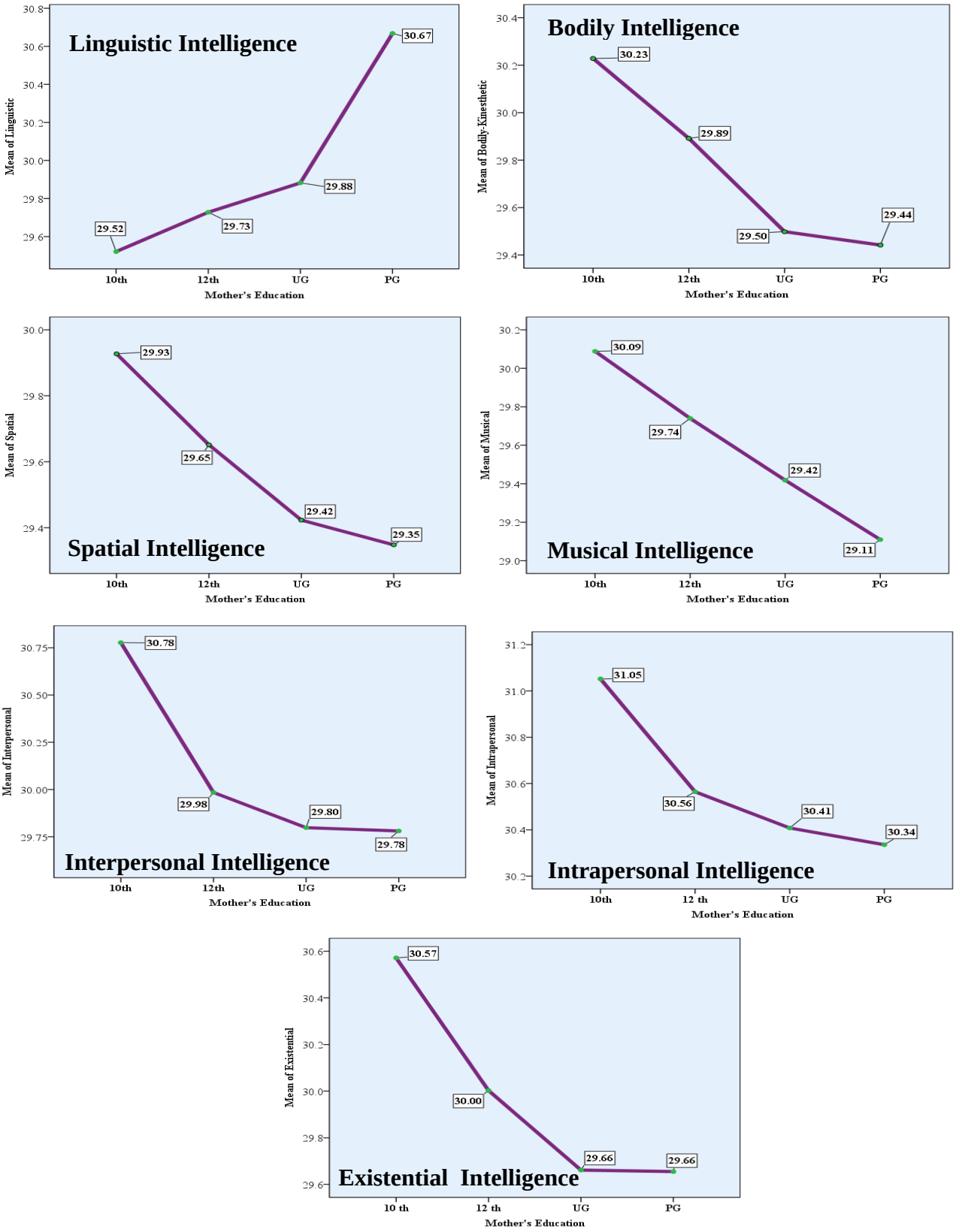


Figure 21

The figure depicted that it was the student respondents of 10th-pass mothers who reported a higher mean score compared to their counterparts in six out of seven MI that they had an impact on. In the case of Linguistic intelligence alone, it has been found that PG mothers had a better mean score (30.67). In other words, Linguistic intelligence alone was found to be in accordance with direct variation – the higher the education level of mothers, the higher the Linguistic intelligence level of the selected student respondents. A noteworthy finding from the above graph was that higher the education level of mothers lowers the MI of the respondents in Bodily-kinesthetic (30.23), Musical (30.09), Spatial (29.93), Interpersonal (31.05), Intrapersonal (30.78) and Existential (30.57) intelligence of the student respondents.

According to Shahzada (2013) and Aydemir and Karali (2014) on Mother's Education and Students' MI, an insignificant correlation was found between mother's education and students' Spatial, Bodily-kinesthetic, Interpersonal, Intrapersonal and Naturalistic intelligence, which was not consistent with the present finding. As per the researcher's perception, one of the reasons for the difference in the above findings may be that the metric pass mothers are fully aware of the hardship that they faced due to a lack of higher education and skills. They do not want their children to undergo the same hardship. Hence, they encourage their respondents to refine their MI from a very early age.

v. Influence of the Type of family on MI

Table XXIII portrays the results of one-way ANOVA showing the nature of dependency of the dependent variables i.e. nine domains of MI vis-a-vis the independent variable, the type of family (nuclear, joint and extended).

The below table indicates that the type of family does not have any impact on the various domains of MI of the selected student respondents. A supportive study done by Kumar (2016) among secondary school students indicated that the type of family does not play any significant role in influencing their MI. Another study done by Geetha and Gupta (2017) among secondary school students also stated that factors like the type of family do not play any significant role in MI and both of the studies were concordant with the present findings.

TABLE XXIII

INFLUENCE OF THE TYPE OF FAMILY ON MI OF THE SELECTED STUDENT RESPONDENTS **N=3026**

Predictors	Nuclear (N=1950)		Joint (N=842)		Extended (N=234)		*F (2,3023)*	*p*	η^2
	M	SD	M	SD	M	SD			
Linguistic	29.80	4.775	29.89	4.677	29.41	5.128	.897	.408	.00
Logical	29.96	4.830	29.88	4.775	29.39	5.111	1.472	.230	.00
Bodily	29.97	4.829	29.69	4.734	29.46	5.230	1.862	.156	.00
Spatial	29.65	4.058	29.72	4.077	29.47	3.940	.355	.701	.00
Musical	29.80	5.406	29.56	5.427	29.52	5.819	.729	.483	.00
Naturalistic	30.44	5.487	30.28	5.602	29.99	5.862	.788	.455	.00
Interpersonal	30.72	4.397	30.64	4.439	30.41	4.382	.574	.563	.00
Intrapersonal	30.29	5.515	30.13	5.634	29.71	5.907	1.216	.297	.00
Existential	30.18	5.300	29.90	5.313	29.82	5.699	1.102	.332	.00

vi. Influence of the Type of school on MI

Table XXIV presents the results of one-way ANOVA, depicting the association between the type of school and the nine domains of MI among the selected student respondents.

TABLE XXIV

INFLUENCE OF THE TYPE OF SCHOOL ON MI OF THE STUDENT RESPONDENTS **N=3026**

Predictors	Government (N=457)		Aided (N=1378)		Private (N=1191)		F(2,3023)	*P*	η^2
	M	*SD*	*M*	*SD*	*M*	*SD*			
Linguistic	28.46	4.903	30.00	4.979	30.07	4.391	**21.360**	**.000**	**.03**
Logical	30.02	5.104	30.04	4.799	29.68	4.759	2.036	.131	.00
Bodily	30.78	5.600	29.89	4.794	29.47	4.514	**12.295**	**.000**	**.03**
Spatial	30.09	3.981	29.62	4.102	29.53	4.016	**3.222**	**.040**	**.03**
Musical	30.23	5.575	29.79	5.459	29.42	5.363	**3.906**	**.020**	**.03**
Naturalistic	30.69	5.709	30.52	5.571	30.05	5.448	**3.259**	**.039**	**.03**
Interpersonal	31.28	5.039	30.71	4.401	30.39	4.124	**6.840**	**.001**	**.04**
Intrapersonal	31.28	5.857	30.34	5.539	29.62	5.450	**15.429**	**.000**	**.03**
Existential	30.89	5.708	30.12	5.327	29.71	5.163	**8.242**	**.000**	**.05**

The above table states that the type of school has a strong impact on the eight out of nine types of MI, Linguistic (F(2,3023) = 21.360 and p=.001), Bodily (F(2,3023) = 12.295 and p=.001), Spatial (F(2,3023) = 3.222 and p=.040), Musical (F(2,3023) = 3.906, and p=.020), Naturalistic (F(2,3023) = 3.259 and p=.039), Interpersonal (F(2,3023) = 6.840 and p=.001), Intrapersonal (F(2,3023) =15.429, p=.001), and Existential(F(2,3023) = 8.242, p=.001). Though the F statistics revealed a significant association between the independent and the dependent variable, the effect size computed as eta square (η^2) showed a small effect over the dependent variable namely Linguistic (η^2 = 0.03), Bodily(η^2 = 0.03), Spatial (η^2 = 0.03), Musical (η^2 = 0.03), Naturalistic (η^2 = 0.03), Interpersonal(η^2 = 0.05), Intrapersonal (η^2 = 0.03) and Existential (η^2 = 0.05); However, concerning Logical intelligence alone, the table displayed insignificant mean difference between the cohorts based on the type of school. In other words, the Logical intelligence of the respondents was almost similar irrespective of the type of school enrolled in.

A graph was plotted with mean scores procured by the respondents belonging to each subgroup with the MI having significant variations and illustrated in Figure 22.

Pair-wise plot of MI based on the Type of school with significant variations

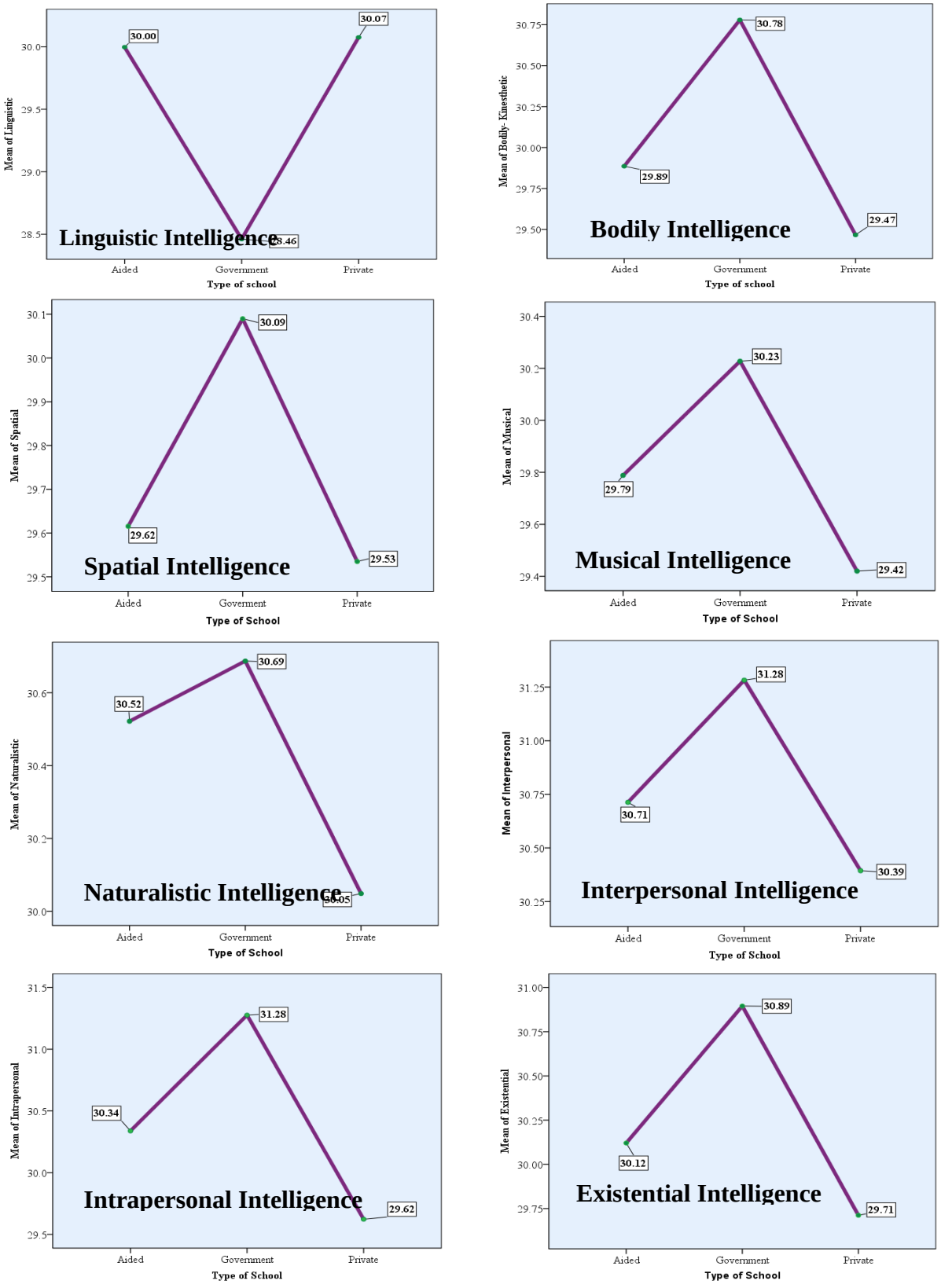


Figure 22

The above figure vividly depicted that the government school students reported higher mean scores compared to their counterparts in seven intelligences namely Bodily-kinesthetic (30.78), Spatial (30.09) Musical (30.23), Naturalistic (30.69), Interpersonal (31.28), Intrapersonal (31.28) and Existential (30.89) but Linguistic intelligence alone indicted just the opposite. Furthermore, from the higher mean score on intelligence it could be inferred that among the three types of schools, government-run schools strongly impacted the above-mentioned domains of intelligence. Whereas, Linguistic intelligence (30.07) was better among student respondents who were studying in private schools.

A supportive study done by Anitha et al. (2013) among secondary school students indicated that the type of school played a significant role concerning MI. It also further stated that government school students had better Logical, Interpersonal and Intrapersonal intelligence when compared to private schools which was concordant with the present study.

vii. Influence of Birth order on MI

Table XXV exhibits the result of one-way ANOVA showing the association between the independent variable (birth order of the selected student respondents) and the dependent variable (9 domains of MI).

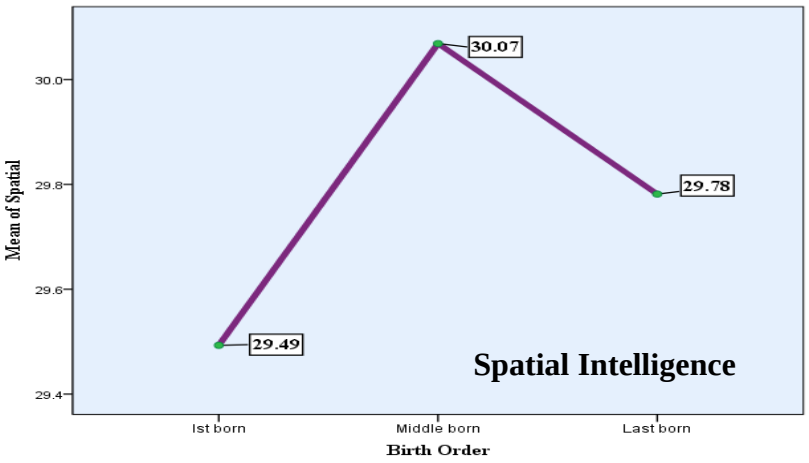
TABLE XXV
INFLUENCE OF BIRTH ORDER ON MI OF THE SELECTED STUDENT RESPONDENTS **N=3026**

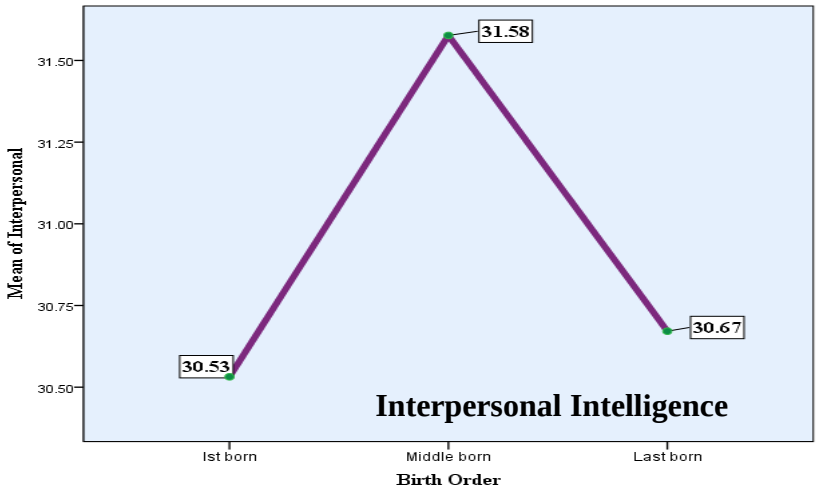
Predictors	**1st born (N=1570)**		**Middle born (N=248)**		**Last born (N=1208)**		**F (2,3023)**	***p***	η^2
	M	***SD***	***M***	***SD***	***M***	***SD***			
Linguistic	29.88	4.673	29.42	5.335	29.76	4.786	1.036	.355	.00
Logical	29.94	4.769	29.93	5.116	29.83	4.858	.176	.839	.00
Bodily	29.79	4.766	30.38	5.428	29.84	4.796	1.616	.199	.00
Spatial	29.49	3.977	30.07	4.336	29.78	4.085	**3.137**	**.044**	**.03**
Musical	29.62	5.393	30.12	5.708	29.75	5.455	.960	.383	.00
Naturalistic	30.25	5.517	30.79	5.656	30.42	5.566	1.146	318	.00
Interpersonal	30.53	4.322	31.58	4.903	30.67	4.391	**6.038**	**.002**	**.04**
Intrapersonal	30.06	5.521	31.00	5.869	30.22	5.585	**3.077**	**.046**	**.03**
Existential	29.98	5.255	30.53	5.526	30.11	5.399	1.186	.306	.00

The table at a glance state that birth order was found to be less significant when compared to certain other socio-demographic factors like type of school and mother's education. Accordingly, the birth order does have a significant impact on only three out of nine domains of intelligence Spatial *(F*(2,3023)=3.137 and *p*=.044), Interpersonal (*F* (2,3023)=6.038, *p*=.002), and Intrapersonal (*F*(2,3023) =3.077 and *p*=.046) of the selected student respondents. With a statistically significant F value, the effect size computed as (η^2) showed only a small effect over the Spatial (η^2= 0.03), Interpersonal (η^2=0.04) and Intrapersonal (η^2= 0.03) intelligence. Moreover, concerning the Linguistic, Logical, Bodily, Musical, Naturalistic and Existential, the table displayed insignificant mean differences between the birth order and MI of the target respondents.

A graph was plotted with mean scores procured by the respondent belonging to each subgroup with the intelligence having significant variations (Spatial, Interpersonal and Intrapersonal intelligence) and illustrated in Figure 23.

Pair-wise plot of MI based on the Birth order with significant variations





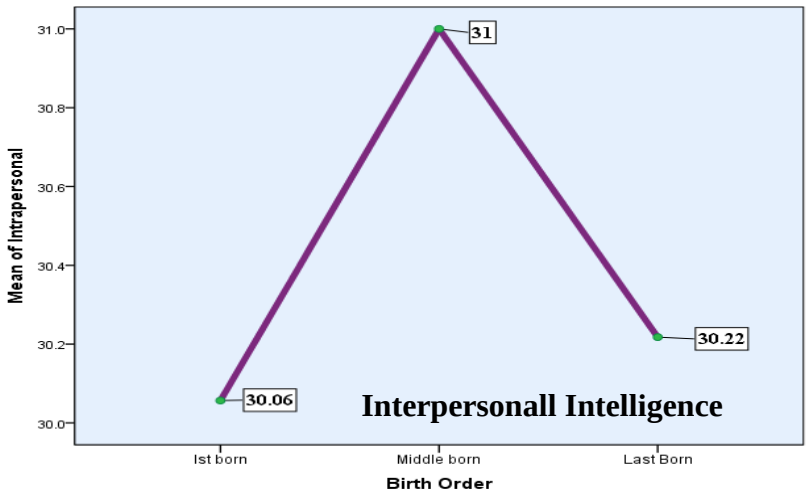


Figure 23

The figure vividly depicted that the middle-born student respondents reported a higher mean score compared to their counterparts on Spatial (30.07), Interpersonal (31.58) and Intrapersonal (31.00) intelligences. Generally, middle-born respondents are good at being a mediator and more independent in handling any situation. It is also hypothesised that they don't think about right or wrong, but they have more freedom and less pressure growing up. They are also found better at understanding others and themselves and also possess the ability to develop their spatial skills through images, charts, pictures, videos and movies. Hence, the present findings confirm the aforementioned discretional characteristic of middle-born children said by Gfroerer et al. (2003).

viii. Influence of Area of residence on MI

Table XXVI portrays the one-way ANOVA statistics showing the influence of the independent variable (area of residence) on the dependent variable (domains of MI) of the selected student respondents.

TABLE XXVI

INFLUENCE OF AREA OF RESIDENCE ON MI OF THE STUDENT RESPONDENTS

N=3026

Predictors	Rural (N=623)		Semi-Urban (N=1351)		Urban (N=1052)		F (2,3023)	*p*	η^2
	M	SD	M	SD	M	SD			
Linguistic	29.96	4.406	29.17	4.777	30.50	4.882	**23.656**	**.000**	**.03**
Logical	29.50	4.812	29.97	4.895	30.03	4.754	2.634	.072	.00
Bodily	29.44	4.715	30.07	5.012	29.83	4.663	**3.679**	**.025**	**.03**
Spatial	29.76	3.955	29.69	4.073	29.55	4.086	.617	.540	.00
Musical	29.40	5.451	29.80	5.467	29.78	5.409	1.261	.284	.00
Naturalistic	29.89	5.504	30.51	5.557	30.45	5.554	2.862	.057	.00
Interpersonal	30.36	4.228	30.88	4.571	30.60	4.285	**3.199**	**.041**	**.03**
Intrapersonal	29.52	5.623	30.45	5.547	30.27	5.568	**6.185**	**.002**	**.04**
Existential	29.74	5.333	30.28	5.379	30.02	5.274	2.263	.104	.00

It can be stated from the above result that the area of residence was found to be significant concerning Linguistic (F (2,3023) = 23.656 and p =.001); Bodily-kinesthetic (F(2,3023)=3.679 and p=.025), Interpersonal (F(2,3023)=3.199,p=.041) and Intrapersonal (F(2,3023)= 6.185 and p=.002) intelligence. With a statistically significant F value, the effect size computed as eta square (η^2) showed a small effect over the Linguistic (η^2=0.03), Bodily-kinesthetic (η^2=0.03) Interpersonal (η^2=0.03) and Intrapersonal (η^2=0.04) intelligence. For the remaining intelligence, namely Logical, Spatial, Musical, Naturalistic, and Existential, the table displayed insignificant mean differences between the area of residence concerning MI of the target respondents. A supportive study done by Sheoran et al. (2018) among young adolescents indicates that the location of residence played a significant role in influencing the MI of selected student respondents.

A graph was plotted with mean scores procured by the respondent belonging to each subgroup about the intelligence having significant variations (Linguistic, Bodily-Kinesthetic, Interpersonal, and Intrapersonal) and illustrated in Figure 24.

The figure below vividly depicts that the student respondents from semi-urban areas reported higher mean scores compared to their counterparts in three out of the four types of MI having significant variations - Bodily-kinesthetic (30.07), Interpersonal (30.88) and Intrapersonal (30.45) intelligence. Also, the Linguistic intelligence's (30.50) mean score alone displayed an opposite result, wherein urban resident school students had better Linguistic mean scores. Understandably, these urban children are more exposed to a robust social life and have easy access to various learning sources, etc.

Pair-wise plot of MI based on the Area of residence with significant variations

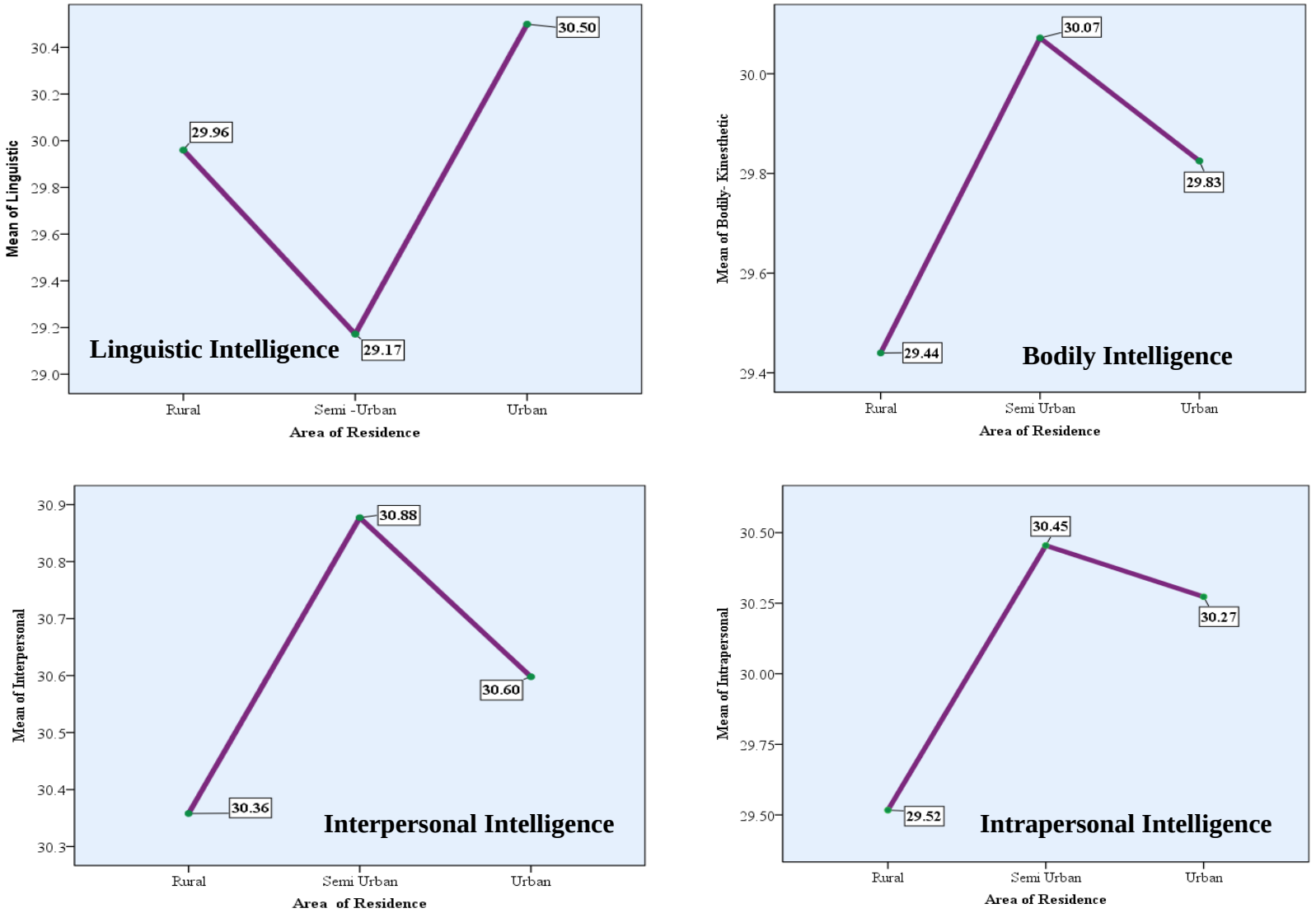


Figure 24

Table XIX to Table XXVI, depicting the influence of socio-demographic factors on MI of school respondents conclusively provides the key results. The Linguistic intelligence of the student respondents was significantly influenced by the socio-demographic variables, namely gender, mother's education, type of school, and area of residence. The variables associated with Intrapersonal intelligence were the mother's education, type of school, birth order, and area of residence. The effect size was medium for the mother's education (respondents of 10th-pass mothers outshined their cohorts). Interpersonal type of intelligence was found to be associated with five out of nine socio-demographic factors with a small effect size namely the mother's education, type of school, birth order, and area of residence. Both Bodily-Kinesthetic and Spatial intelligence had a similar impact on the socio-demographic characteristics and were found to have a small effect on the mother's education, type of school, birth order, and area of residence of the selected respondents. Naturalistic and Existential intelligences were found to have an equal impact on one out of eight socio-demographic factors namely type of school. Musical intelligence was found to have a small effect on the mother's education (respondents of 10th-pass mothers) and the type of school (government school students) of the selected student respondents. Logical intelligence alone displayed the most negligible impact on socio-demographic variables with the father's education. Class of study and type of family did not impact the MI of selected student respondents.

C. LEARNING STYLE (LS)

Learning style (LS) has been known to dominate the educational practice since the period it gained popularity in the 1970s. Various studies have shown that it has been accepted by teachers worldwide. Learning style guides the way students learn. Merrill (2000) opined that the knowledge of the LS facilitates a learner to realise the strengths and weaknesses in learning. In addition, Merrill also stated that matching students' learning preferences with complimentary instructions improves AA and student's attitudes towards learning. Dunn and Griggs (2000) reciprocated the idea by suggesting that matching respondents' LS with educational interventions compatible with those preferences were beneficial to their AA. Hence, in this section of the study the researcher aimed to find out the LS used by the selected target student respondents and it has been presented under the two subheads as given below:

a. Categorisation of student respondents based on their LS
b. Association between socio-demographic variables and LS of the student respondents

a. Categorisation of student respondents based on their LS

Based on the Learning Style Inventory developed by Misra, the level of the six types LS, namely Enactive Reproducing (ER), Enactive Constructive (EC), Verbal Reproducing (VR), Verbal Constructive (VC), Figural Reproducing (FR) and Figural Constructive (FC) among the student respondents were assessed. As each type of LS is essential in one way or another to learn various subjects, the study aimed to assess the level of each LS that had been segregated from extremely high to extremely low. The study aimed to assess the level of each LS adopted by the selected student respondents rather than the preferred learning style. Accordingly, Table XXVII shows the frequency of the levels of various LS adopted by the chosen student respondents.

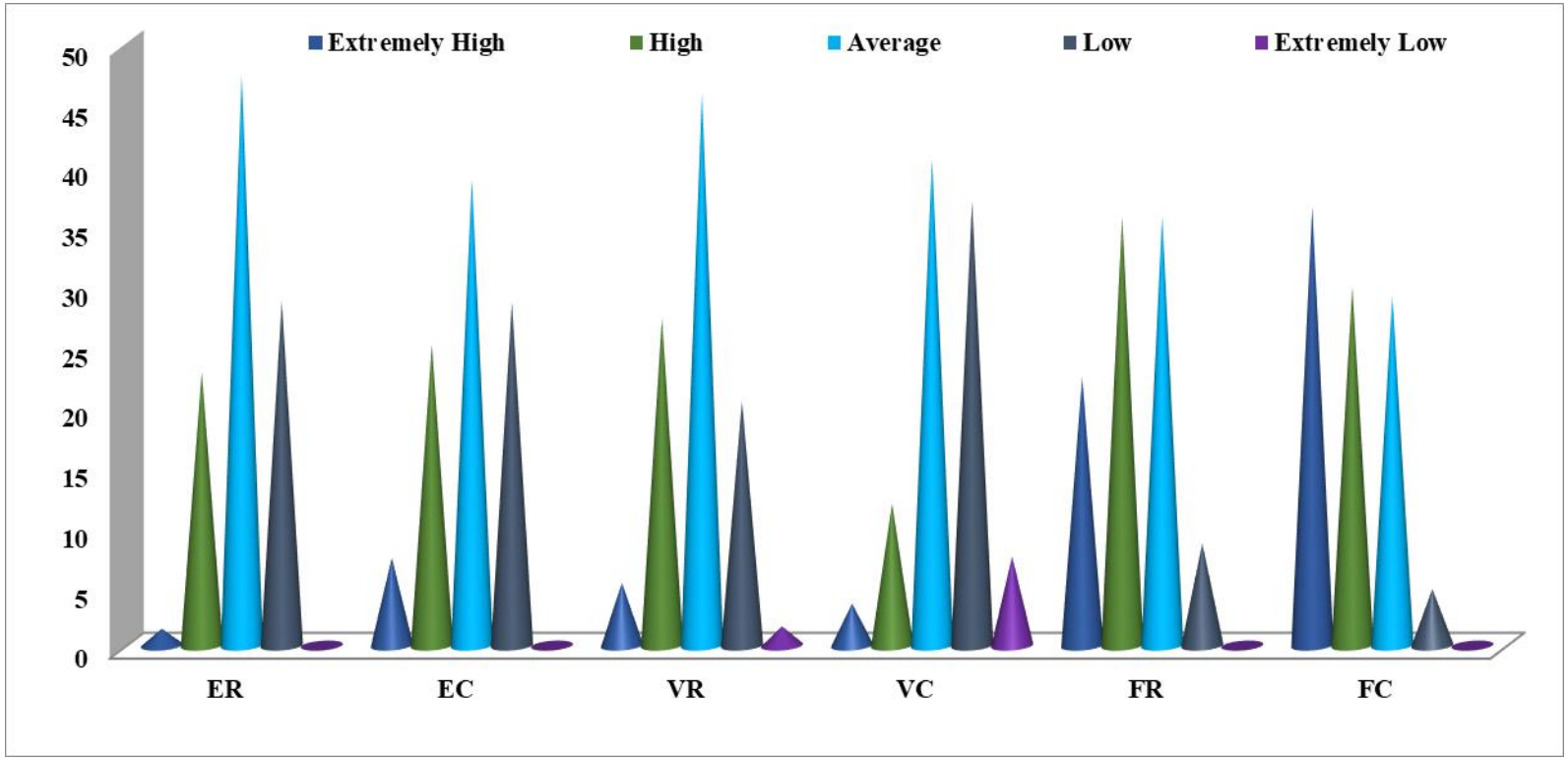
TABLE XXVII

CATEGORISATION OF SELECTED STUDENT RESPONDENTS BASED ON THEIR LEARNING STYLE

N=3026

Type of LS	Level									
	Extremely High		High		Average		Low		Extremely Low	
	N	%	N	%	N	%	N	%	N	%
Enactive Reproducing	**32 & above**		**27-32**		**20-26**		**13-19**		**7-12**	
	41	1.4	686	22.7	1433	47.4	865	28.6	1	00
Enactive Constructive	**33 &above**		**28-32**		**21-27**		**14-20**		**7-13**	
	222	7.3	758	25.0	1171	38.7	863	28.5	00	00
Verbal Reproducing	**33 & above**		**28-32**		**21-27**		**14-20**		**7-13**	
	156	5.2	822	27.2	1387	45.8	614	20.3	47	1.6
Verbal Constructive	**33 & above**		**30-32**		**23-29**		**15-22**		**7-14**	
	106	3.5	358	11.8	1222	40.4	1117	36.9	223	7.4
Figural Reproducing	**26 & above**		**22-26**		**17-21**		**12-16**		**7-11**	
	674	22.3	1078	35.6	1078	35.6	256	8.5	00	00
Figural Constructive	**25 & above**		**16-25**		**12-15**		**10-12**		**7-9**	
	1101	36.4	903	29.8	877	29.0	142	4.7	00	00

Percent-wise distribution of the selected student respondents based on the level of LS



ER- Enactive Reproducing, EC – Enactive Constructive, VR- Verbal Reproducing, VC- Verbal Constructive, FR- Figural Reproducing, FC- Figural Constructive

Figure 25

A quick perusal of the above table and the figure points out that a majority of the target respondents fall under the average level category of possessing various LS. Only a small percentage of them possess extremely high levels of LS, the exception being the figural type of LS where a good percentage of them fall under the extremely high category. Another noteworthy point is that very few fall under the extremely low category.

Having mentioned the top line points of the table, a thorough investigation of each LS independently reveals that in both the enactive styles of learning (reproducing and constructive) most of the target respondents belong to the average category of ER (47.4%) and EC (38.7%). Very few of them possessed extremely high-level Enactive styles. Hence, it could be ascertained that except for a few student respondents, on either side of extremely high and low, a great majority had an average ability to learn through action-based concrete experiences with an emphasis on imitation and practice and learning happened by conceptualising these experiences.

As far as the Verbal style of learning is concerned, similar to the Enactive style, most of them possessed average categories of both VR (45.8 %) and VC (40.4%) type of LS. Similar to the Enactive style, very few of them have extremely high levels of Verbal learning skills. Verbal styles of learning indicate the ability to learn through written or spoken information concerning subject matter communicated with the help of words. All the more the data also portray that the conceptualising ability to reflect, accommodate and think in abstract terms was only on an average level among the student respondents.

The Figural type of learning portrays a different picture when compared to Enactive and Verbal types of learning. Most of them possessed equally high and average levels of FR (35.6% each) and FC (29.8% and 29% respectively). Moreover, 22.3% and 36.4% of the student respondents were found to adopt FR and FC type of LS at an extremely high level. This indicates that these student respondents use their ability to learn through visual experiences like making diagrams, charts, pictures, maps, and photographs. Very few of them possessed extremely low category in figural skills.

To sum up, it can be said that each LS is a crucial contributor to the academic performance of the selected respondents. Hence, all efforts need to be put into increasing the

percentage of extremely high categories concerning LS. Though it can be said that the education system and pattern has evolved with time, even today as far as the Samacheer Kalvi is concerned a good reproduction of subject matter earns better grade academically. Hence, practically children need to be more oriented towards easy methods of reproducing the concepts so that they can perform well academically.

b. Association between socio-demographic variables and LS of the student respondents

Socio-demographic factors are to be measured while dealing with research in educational fields, especially student's LS, which has been proven to be influenced by sociocultural factors. Owing to the reason for minimal research in exploring the association between the socio-demographic factors and LS, the current study aimed to investigate the same. For interpretation, the raw scores of LS were considered for analysis.

The researcher computed two types of parametric tests (based on the number of subgroups). They are t-test and one-way ANOVA with six dependent variables namely Enactive Reproducing (ER), Enactive Constructive (EC), Verbal Reproducing (VR), Verbal Constructive (VC), Figural Reproducing (FR) and Figural Constructive (FC). The subsection below summarises the results, showing the influence of corresponding socio-demographic factors on the LS of the selected student respondents in the following subheads.

i. Influence of Gender on LS
ii. Influence of Class-of-study on LS
iii. Influence of Father's education on LS
iv. Influence of Mother's education on LS
v. Influence of Type of family on LS
vi. Influence of Type of school on LS
vii. Influence of Birth order on LS
viii. Influence of Area of residence on LS

i. Influence of Gender on LS

Table XXVIII represents the influence of gender on all six types of LS

TABLE XXVIII

INFLUENCE OF GENDER ON LS OF THE SELECTED STUDENT RESPONDENTS

N=3026

Dependent variables	Boys N=1457		Girls N=1569		*t* (3024)	*p*	Cohen's d
	M	SD	M	SD			
Enactive Reproducing	22.78	5.334	22.84	5.303	-.538	.593	0.0
Enactive Constructive	24.20	5.367	24.22	5.171	-.647	.520	0.0
Verbal Reproducing	24.88	5.269	24.21	5.073	**2.255**	**.028**	**0.5**
Verbal Constructive	23.40	5.890	23.39	5.864	.423	-.674	0.0
Figural Reproducing	22.53	4.747	22.82	4.600	1.404	.166	0.0
Figural Constructive	24.18	5.357	24.26	5.197	-.698	.488	0.0

The above table portraying the influence of the independent variable (gender) on the LS of the selected student respondents stated that one among the six types of LS, the VR illustrated a significant difference for gender with t (3024) =2.255 and p=.028. The mean accuracy demonstrated that boys exhibited higher VR scores and were significantly different from girls. The value of Cohen's d measure of effect size (d) was 0.5 indicating a medium effect size in Verbal reproducing. The other five LS namely ER, EC, VC, FC and FC didn't show any significant gender difference.

ii. Influence of Class-of-study on LS

Table XXIX portrays the results of one-way ANOVA showing the nature of dependency of the dependent variable i.e., LS vis-a-vis the independent variable, the class-of-study (6^{th}, 7^{th} and 8^{th}) of the selected student respondents. The class-of-study does have a significant impact on three out of six types of LS namely ER - (F(2,3023)=3.235 and p=.040); VR - (F(2,3023)=4.978, p=.009) and VC - (F(2, 3023)=3.272 and p=.038). Though the F Statistics revealed a significant association between the independent and the dependent variable, the effect size computed as eta square (η^2) showed a small effect size over all three LS (ER (η^2=0.03)**,** VR (η^2=0.03) and VC (η^2=0.03).

TABLE XXIX

INFLUENCE OF CLASS-OF-STUDY ON LS OF SELECTED STUDENT RESPONDENTS

N=3026

Predictors	6th std (N= 980)		7th std (N= 1006)		8th std (N= 1040)		*F*(2, 3023)	*P*	η^2
	M	***SD***	***M***	***SD***	***M***	***SD***			
Enactive Reproducing	22.60	5.365	22.67	5.298	23.15	5.279	**3.235**	**.040**	**.03**
Enactive Constructive	24.01	4.954	24.17	5.347	24.44	5.462	1.779	.169	.00
Verbal Reproducing	24.26	5.185	24.67	5.213	24.96	5.102	**4.978**	**.009**	**.03**
Verbal Constructive	23.24	5.914	23.75	5.807	23.10	5.893	**3.272**	**.038**	**.03**
Figural Reproducing	22.83	4.402	22.81	4.763	22.42	4.823	2.557	.078	.00
Figural constructive	24.18	5.011	24.14	5.358	24.34	5.435	.405	.667	.00

However, for EC, FR and FC, the table displayed insignificant mean difference between the class-of-study and LS of the selected student respondents. A contradictory study done by Bayrak (2012) indicated that there was no significant difference between the LS and class level of the selected student respondents. The researcher believed that this contradiction may well be stemming from the fact that a lot of research has happened on this subject since late 1900, and also that the above-quoted study used a different set of LS. Another noteworthy finding that emerged from the table was that among the three classes taken into consideration (6^{th}, 7^{th} and 8^{th}), 8^{th} std students were found to possess reproducing styles (Enactive as well as Verbal) of learning. This might be keeping in trend with the Samacheer kalvi that lays stress on reproducing the subject notes given to the students by their teachers. Seventh-class students independently exerted an influence on the VC type of LS, which needs to be strengthened.

A graph was plotted with the mean scores procured by the respondents belonging to each subgroup of LS having significant variations (ER, VR and VC). The figure displayed that the 8^{th} standard students reported a higher mean score in ER (23.15) and VR (24.96) compared to the students in the 6^{th} and 7^{th} standard. Whereas, the 7^{th} standard students were found to use the VC style of learning (23.75) compared to their counterparts.

Pair-wise plot of LS based on the Class-of-study with significant variations

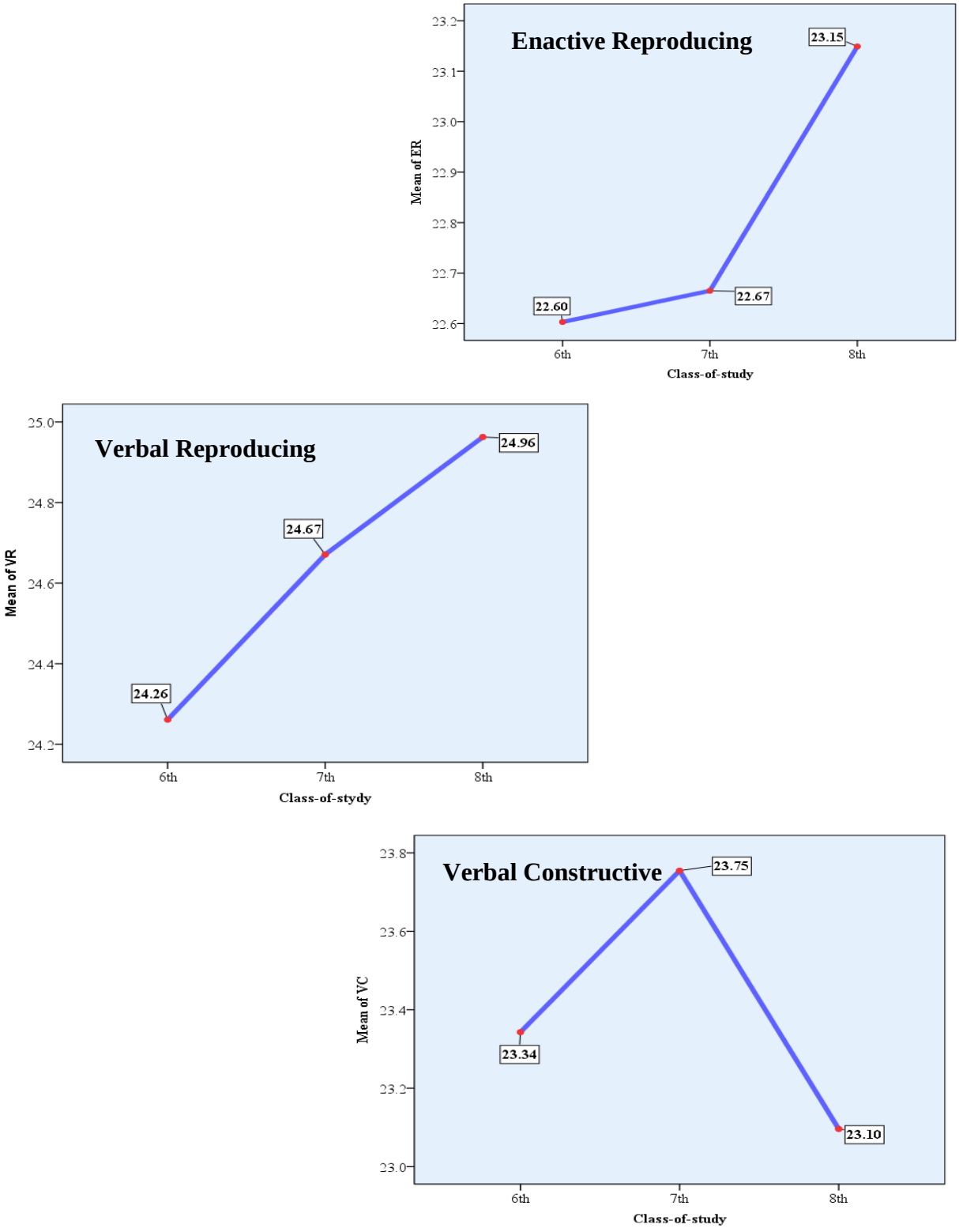


Figure 26

iii. Influence of Father's education on LS

Table XXX shows the result of one-way ANOVA, depicting the association between the independent variable - the father's education and the various types of LS (ER, EC, VR, VC, FR, and FC) of the selected student respondents. The table (on the next page) indicated that the father's education does not have any kind of impact on the LS of their children as the F statistics didn't reveal any significant association. A supportive study done by Singh et al. (2015) among secondary school students indicates that the father's educational status doesn't play any significant role in the LS of students. This indicates the ground reality of typical Indian homes in general where even today the responsibility of student's studies rests with the mothers.

iv. Influence of Mother's education on LS

The results of one-way ANOVA computed to determine the association between the independent variables (the level of mother's education) over the dependent variable (various types of LS) have been displayed in Table XXXI

TABLE XXX

INFLUENCE OF FATHER'S EDUCATION ON LS OF THE SELECTED STUDENT RESPONDENTS

N=3026

Dependent variables	**10th std (N=1016)**		**12th std (N=652)**		**UG (N=948)**		**PG (N=410)**		***F* (3,3023)**	**p**	**η^2**
	M	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***			
Enactive Reproducing	22.86	5.276	22.64	5.382	22.55	5.375	22.55	5.375	.914	.433	0.00
Enactive Constructive	24.29	5.330	24.04	5.259	24.28	5.318	24.11	4.995	.435	.728	0.00
Verbal Reproducing	24.52	5.274	24.86	5.073	24.84	5.208	24.10	4.960	2.512	.057	0.02
Verbal Constructive	23.38	5.837	23.69	5.811	23.38	5.860	23.01	6.102	1.116	.341	0.00
Figural Reproducing	22.74	4.678	22.71	4.551	22.62	4.860	22.63	4.418	.138	.938	0.00
Figural Constructive	24.25	5.323	24.05	5.354	24.30	5.285	24.26	5.004	.318	.813	0.00

TABLE XXXI

INFLUENCE OF MOTHER'S EDUCATION ON LS OF THE SELECTED STUDENT RESPONDENTS

N=3026

Predictors	10th std (N=1099)		12th std (N=757)		UG (N=851)		PG (N=319)		*F* (3,3023)	*p*	η^2
	M	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***			
Enactive Reproducing	23.07	5.208	22.71	5.297	22.53	5.526	22.89	5.149	1.784	.148	**.**00
Enactive Constructive	24.33	5.180	24.13	5.362	24.16	5.370	24.13	5.058	.307	.821	.00
Verbal Reproducing	24.61	5.146	24.73	5.223	24.49	5.288	24.92	4.827	.639	.590	.00
Verbal Constructive	23.41	5.718	23.47	5.827	23.10	6.138	23.98	5.785	1.829	.140	.00
Figural Reproducing	23.12	4.757	22.76	4.607	22.04	4.586	22.71	4.593	**8.847**	**.000**	**.04**
Figural Constructive	24.25	5.151	24.15	5.391	24.22	5.368	24.25	5.184	.057	.982	.00

The above table stated that the level of education of the mothers does have a significant impact on the respondent's FR ($F(3,3023) = 8.847$ and $p=.001$); The effect size computed as eta square (η^2) showed a small effect over the dependent variable, the LS in FR ($\eta^2= 0.04$), concerning the other LS namely ER, EC, VR, VC and FC, the table displayed insignificant mean difference between the mother's education and learning style of selected respondents. A study done by Singh et al. (2015) revealed that there was a significant impact of mother's educational level on the LS of selected student respondents which might be a partially supportive study to the present finding.

A graph plotted with the mean scores procured by the respondents belonging to each subgroup with Figural Reproducing LS has been illustrated in Figure 27.

Pair- wise plot of LS based on the Mother's educational qualification

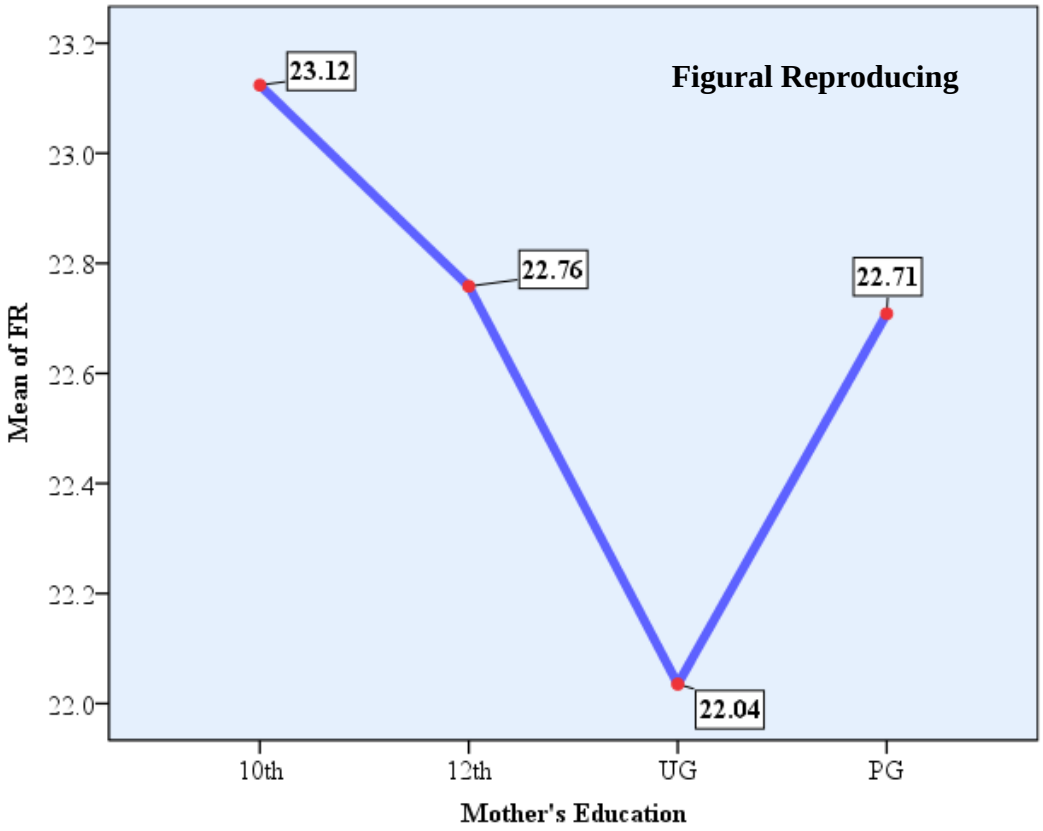


Figure 27

The figure depicted that the student respondents of 10th-pass mothers had procured higher mean scores on Figural Reproducing LS (23.12) when compared to their other counterparts. The researcher perceives that this could be owed to the fact that these mothers with their lower status in education could comprehend pictorial and diagrammatic information easily and hence, may influence their child in using this type of LS more.

v. Influence of the Type of family on LS

Table XXXII portrays the results of one-way ANOVA showing the nature of dependency on various types of LS vis-a-vis the type of family (nuclear, joint and extended) of the selected student respondents.

TABLE XXXII

INFLUENCE OF THE TYPE OF FAMILY ON LS OF THE SELECTED STUDENT RESPONDENTS N=3026

Dependent variables	Nuclear (N=1950)		Joint (N=842)		Extended (N=234)		*F* (2,3023)	*p*	η^2
	M	***SD***	***M***	***SD***	***M***	***SD***			
Enactive Reproducing	22.84	5.303	22.87	5.235	22.39	5.720	.798	.450	.00
Enactive Constructive	24.14	5.275	24.34	5.343	24.32	4.903	.465	.628	.00
Verbal Reproducing	24.54	5.145	24.91	5.124	24.50	5.551	1.582	.206	.00
Verbal Constructive	23.45	5.864	23.40	5.728	22.95	6.476	.749	.473	.00
Figural Reproducing	22.75	4.737	22.52	4.583	22.71	4.454	671	.511	.00
Figural constructive	24.14	5.330	24.39	5.250	24.30	4.884	.715	.489	.00

The type of family does not have an impact on the six types of LS under the study.

vi. Influence of the Type of school on LS

Table XXXIII shows the result of one-way ANOVA, depicting the association between the independent variable -Type of school and various types of LS (ER, EC, VR, VC, FR and FC) of the selected student respondents.

TABLE XXXIII

INFLUENCE OF THE TYPE OF SCHOOL ON LS OF THE SELECTED STUDENT RESPONDENTS **N=3026**

Predictors	Government (N=457)		Aided (N=1378)		Private (N=1191)		F(2, 3023)	*p*	η^2
	M	***SD***	***M***	***SD***	***M***	***SD***			
Enactive Reproducing	23.63	5.419	22.78	5.229	22.53	5.352	**7.158**	**.001**	**.05**
Enactive Constructive	24.88	4.870	24.39	5.170	23.75	5.480	**9.205**	**.000**	**.06**
Verbal Reproducing	23.81	4.701	24.93	5.186	24.62	5.298	**8.046**	**.000**	**.05**
Verbal Constructive	23.60	5.637	23.34	5.937	23.38	5.897	.329	.720	.00
Figural Reproducing	23.56	4.507	22.49	4.587	22.57	4.799	**9.570**	**.000**	**.06**
Figural constructive	24.88	4.868	24.36	5.198	23.80	5.476	**7.900**	**.000**	**.05**

The above table stated that the type of school does have a strong significant impact on five of the six LS namely ER ($F(2,3023) = 7.158$ and $p = .001$); EC $F(2,3023) = 9.205$, and $p = .001$); VR ($F(2,3023) = 8.046$ and $p = .001$); FR ($F(2,3023) = 9.570$, $p = .001$; and FC **(**$F(2,3023) = 7.900$ and $p = .001$). Though the F Statistics revealed a significant association between the independent and the dependent variable, the effect size computed as eta square (η^2) showed a small effect over the ER ($\eta^2 = 0.05$), VR ($\eta^2 = 0.05$) and FC ($\eta^2 = 0.05$); and medium effect size in EC ($\eta^2 = 0.06$) and FR ($\eta^2 = 0.06$); Furthermore, for VC, the table displayed insignificant mean difference between the type of school and LS. A contradictory study carried out by Toppo and Topno (2022) revealed that there was no significant difference between government and private higher secondary school students in their preferred LS, and it may well be due to various factors like varying age groups of the target respondents and different place of study.

For further understanding, graphs were plotted with mean scores procured by the respondents belonging to each subgroup concerning LS having significant variations and illustrated in Figure 28

Pair-wise plot of LS based on the Type of school with significant variations

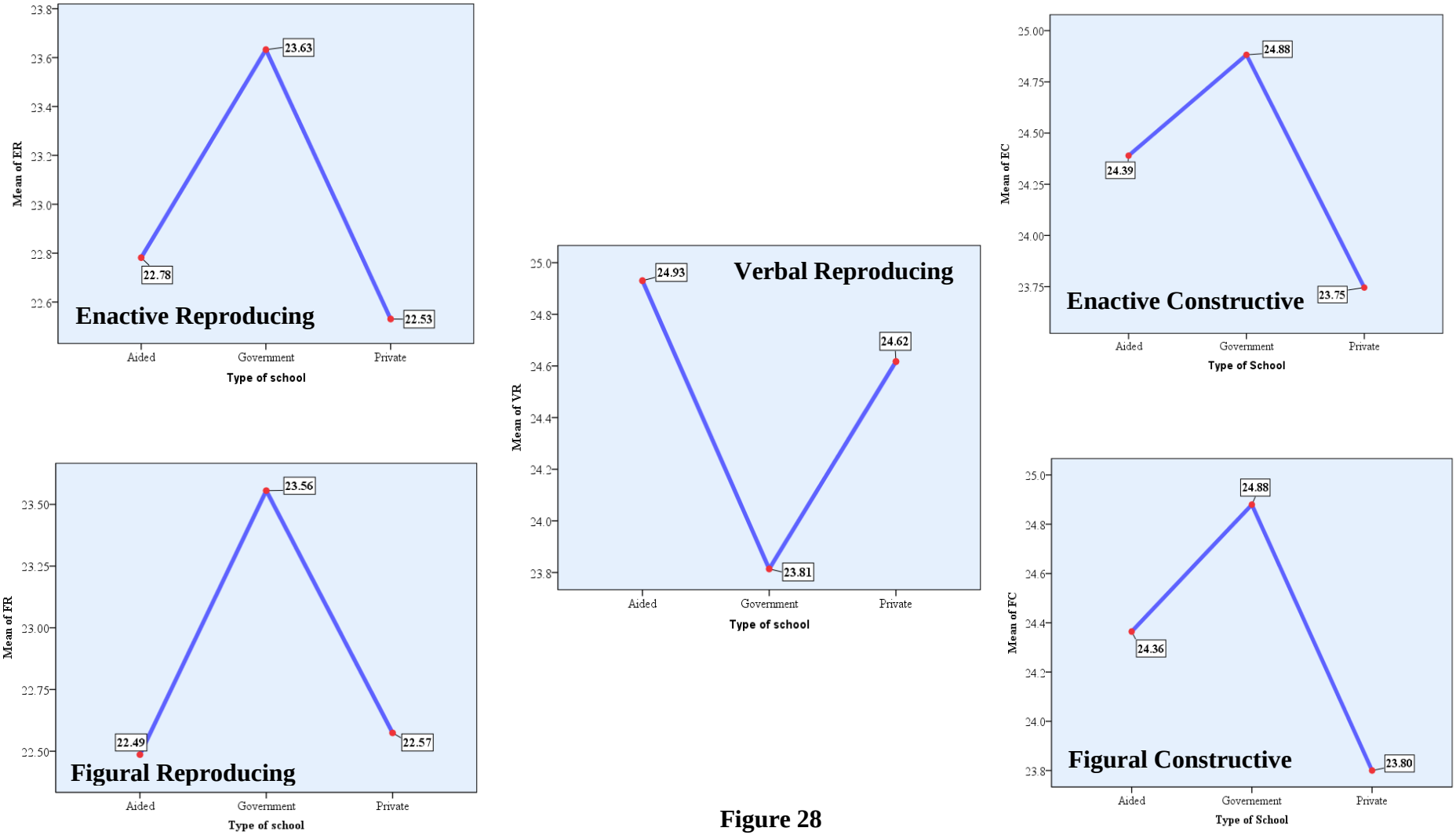


Figure 28

The figure depicted that the respondents studying in Government schools exhibited higher mean scores in ER (23.63), EC (24.88), FR (23.56) and FC (24.88) types of LS. The high mean in VR type of LS (24.93) alone was found among student respondents who were studying in private schools. Reading between the lines from the above result, the researcher perceives that the reason for government school students scoring a high mean in the enactive type of learning style could well be owed to the fact that the government school teachers stick to a typical teaching pattern which lays more emphasis on imitation and practice through old, tried and tested teaching methods. Whereas, a high mean score in the figural type of learning could well be justified that over the recent years, based on the new proactive methods of teaching the government teachers have been trained through compulsory workshops to adopt the figural method of teaching also in their classroom teaching. Private school students reporting high mean score in VR could be due to the reason that private schools lay more stress on written and spoken information mainly communicated through words that suits the verbal style.

vii. Influence of Birth order on LS

Table XXXIV exhibited the result of one-way ANOVA showing the association between the independent variable (birth order of the student respondents) and the dependent variable (various types of LS).

TABLE XXXIV

INFLUENCE OF BIRTH ORDER ON LS OF THE SELECTED STUDENT RESPONDENTS

N=3026

Predictors	1st born (N=1570)		Middle born (N=248)		Last born (N=1208)		F(2, 3023)	p	η^2
	M	*SD*	*M*	*SD*	*M*	*SD*			
Enactive Reproducing	22.71	5.250	23.05	5.450	22.90	5.378	.703	.495	.00
Enactive Constructive	24.16	5.306	24.54	5.033	24.20	5.261	.547	.579	.00
Verbal Reproducing	24.79	5.266	25.14	4.840	24.34	5.104	**3.864**	**.021**	**.02**
Verbal Constructive	23.50	5.909	23.54	5.662	23.22	5.876	.850	.427	.00
Figural Reproducing	22.54	4.678	23.22	4.682	22.76	4.659	2.616	.073	.00
Figural constructive	24.21	5.312	24.34	5.127	24.21	5.259	.069	.934	.00

It can be stated from the above result that birth order was found to be less significant when compared to a few other factors like class-of -study, type of school and area of residence as it had a significant impact only on one LS namely the VR (F (2,3023) =3.864, p=.021); Though the F Statistics revealed a significant association between the independent and the dependent variable, the effect size computed as eta square (η^2) showed only a small effect over the VR style of learning (η^2=0.02); Furthermore, other types of LS displayed insignificant mean difference. Accordingly, a graph was plotted with scores procured by the respondents belonging to each subgroup about VR and illustrated in Figure 29.

Pair-wise plot of LS based on the Birth order with significant variations

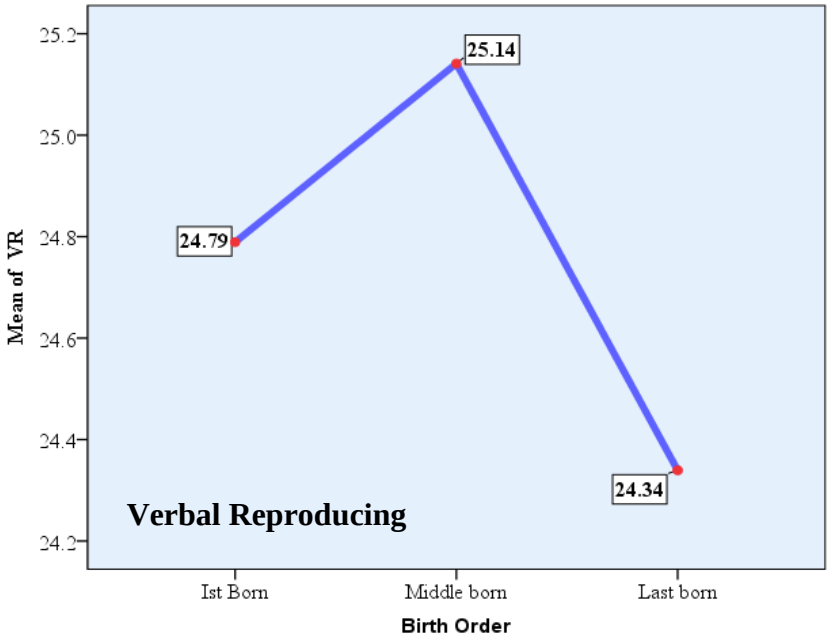


Figure 29

The above figure illustrated revealed that the students who were middle born scored better in verbal reproducing (25.14) when compared to their counterparts. A contradictory study carried out by Sanni and Taiwo (2019) revealed that there was significance between birth order and three learning styles (Visual, Auditory and Kinesthetic) which were in favour of the only child, it may well be due to various factors like varying age group of the target

respondents, different place of study and a different learning style tool used. However, further, studies need to explore the same.

viii. Influence of Area of residence LS

Table XXXV portrays the one-way ANOVA statistical analysis showing the influence of the independent variable (Area of residence) on the dependent variable (various types of LS) of the selected student respondents.

TABLE XXXV

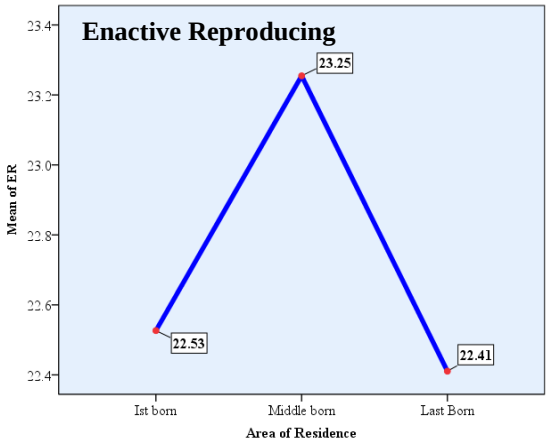
INFLUENCE OF AREA OF RESIDENCE ON LS OF THE SELECTED STUDENT RESPONDENTS N=3026

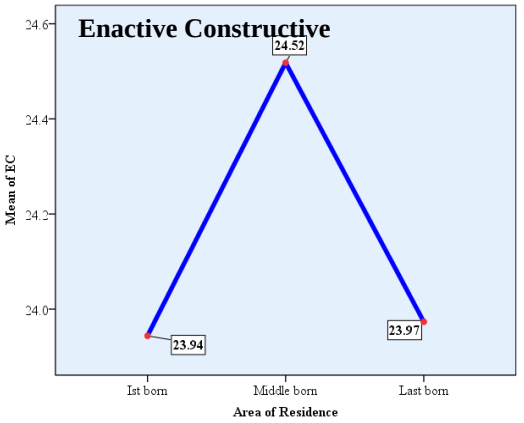
Predictors	Rural (N=623)		Semi-Urban (N=1351)		Urban (N=1052)		F(2,3023)	*p*	η^2
	M	***SD***	***M***	***SD***	***M***	***SD***			
Enactive Reproducing	22.53	5.353	23.25	5.365	22.41	5.196	**8.618**	**.000**	**.05**
Enactive Constructive	23.94	5.496	24.52	5.281	23.97	5.087	**4.180**	**.015**	**.02**
Verbal Reproducing	25.29	5.141	24.61	5.195	24.29	5.131	**7.390**	**.001**	**.04**
Verbal Constructive	23.29	5.856	23.51	5.776	23.39	5.876	.476	.621	.00
Figural Reproducing	22.23	4.877	22.89	4.759	22.68	4.416	**4.293**	**.014**	**.02**
Figural constructive	23.83	5.374	24.53	5.298	24.05	5.166	**4.534**	**.011**	**.02**

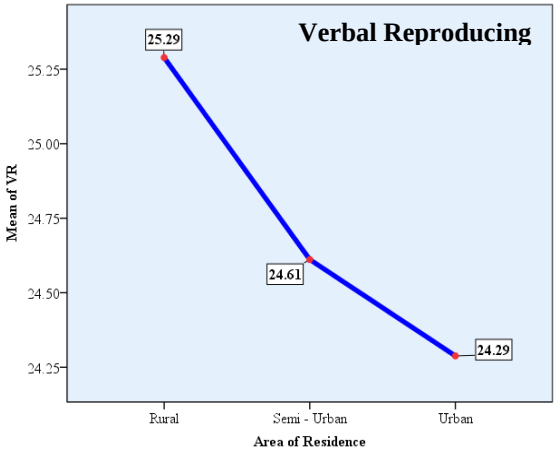
It was evident from the above table that the area of residence has a strong impact on five styles of LS in ER ($F(2,3023) = 8.618$ and $p=.001$); EC ($F(2,3023) = 4.180$ and $p=.001$); VR ($F(2,3023) = 7.390$ and $p = .001$); FR ($F(2,3023) = 4.293$,$p=.001$)and FC **(**$F(2,3023) = 4.534$ and $p = .001$); Though the F Statistics revealed a significant association between the independent and the dependent variable, the effect size computed (η^2) showed only a small effect over five types of LS (ER ($\eta^2=0.05$), EC ($\eta^2=0.02$); VR ($\eta^2=0.04$); FR ($\eta^2 = 0.02$) and FC ($\eta^2= 0.02$); Furthermore, concerning VC, the table displayed insignificant mean difference with the birth order and LS of the target respondents.

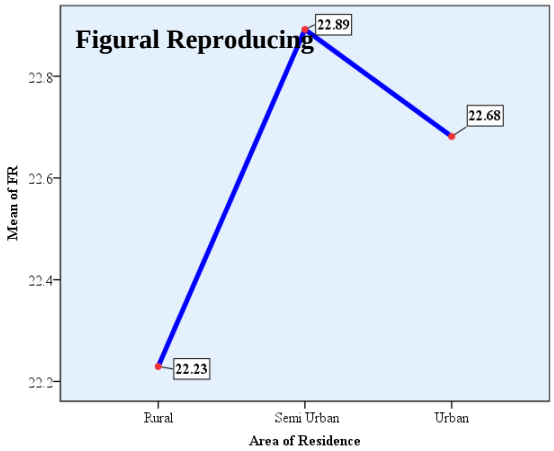
A graph was plotted with scores procured by the respondents belonging to each subgroup concerning learning style having significant variations and portrayed in Figure 30.

Pair-wise plot of subject-wise AA based on the Area of residence with significant









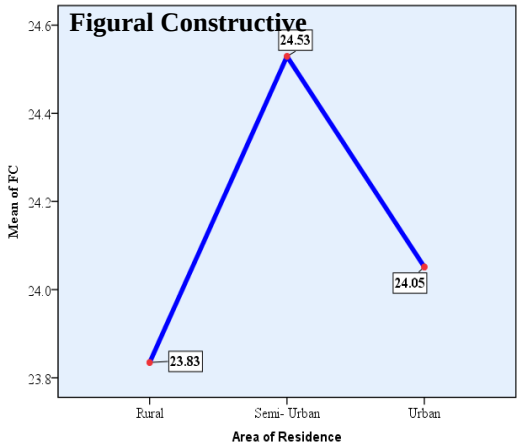


Figure 30

The figure above indicated that the children residing in semi-urban areas reported high mean scores in ER (23.25), EC (24.52), FR (22.89) and FC (24.53). However, it was rural student respondents who scored high on VR (25.29. A very recent study conducted by Sumitha and Prasadh (2022) among higher secondary school students in Raichur stated that the area of residence does play a role in influencing the LS of school students which was concordant with the present study results.

Overall, concerning the impact of LS on socio-demographic factors, the selected respondents' scores in VR alone had a greater influence concerning the socio-demographic characteristics. It was associated with five out of eight socio-demographic predictors, namely gender, class-of-study (respondents from 8^{th} std), type of school (aided school), birth order, and area of residence. However, the effect size was medium only concerning the gender (boys were better than their cohorts), whereas the other factors had a small effect size. EC, FR and FC were found to have an equal impact on two out of eight socio-demographic factors namely the type of school and area of residence. The least influenced LS was verbal constructive, wherein the class-of-study (7^{th} std surpassing their counterparts) had a small effect on the respondents.

E. TEACHING PEDAGOGY (TP)

Pedagogy is a term that refers to the method by which teachers teach both in theory as well as in practice. It is formed by an educator's teaching beliefs and concerns that interplay between culture and different ways to learn. A well-thought-out pedagogy is essential in aiding school students to learn more effectively and develop thinking skills of higher order. It is viewed as a particular pattern of needs, beliefs and behaviour that a teacher displays in the classroom. The theories of Grasha and Grasha (1996) divided the Teaching Pedagogy (TP) into five domains namely Expert, Formal Authority, Demonstrator, Facilitator and Delegator. Based on this, Sharma and Saran (2002) developed a Teaching Style Scale suitable for Indian students after much research and observation. Hence, this was used by the current study to assess the teaching style of selected school teachers. Accordingly, the data was analyzed and presented under two heads namely:

a. Categorisation of the teacher respondents based on their TP
b. Association between personal profile variables and TP adopted by the teacher respondents

a. Categorisation of the teacher respondents based on their TP

At present, the teachers are facilitators of student learning and creators of productive classroom environments, in which students can develop their skills and strengthen their needs at present or in the future. Teachers reflect on their practice to grow and improve. As they do this, their experience informs their intuition for decision-making, and they become better at it (Berliner, 2004). Table XXXVI and Figure 31 display the raw scores scored by the teachers on each of the five TP, namely Expert, Formal Authority, Demonstrator, Facilitator and Delegator, as the teachers were classified within the specified levels of practicing the same (ranging from extremely high to low).

TABLE XXXVI

CATEGORISATION OF THE SELECTED SCHOOL TEACHERS RESPONDENTS BASED ON THE LEVEL OF TP PRACTISED

N=215

Domains of TP	Level											
	Extremely high		High		Above average		Average		Below average		Low	
	N	%	N	%	N	%	N	%	N	%	N	%
Expert style	59 & above		54 – 58		49 – 53		42 – 48		37 – 41		32 – 36	
	00	00	23	10.7	66	30.6	103	48	18	8.2	5	2.5
Formal Authority	58 & above		53 – 57		48 – 52		42 – 47		37- 41		32 – 36	
	6	2.8	15	7	66	30.7	80	37.2	34	15.8	14	6.5
Demonstrator	41 & above		37 – 40		33 – 36		27 – 32		23 – 26		19 – 22	
	2	1	29	13.5	65	30.2	75	35	38	17.6	6	3
Facilitator	42 & above		38 – 41		34 – 37		28 – 33		24 – 27		20 -23	
	3	1.4	14	6.5	61	28.4	110	51.1	18	8.4	8	4
Delegator	41 & above		39 – 42		34 – 38		29 – 33		24 – 28		20 – 23	
	7	3.2	38	17.6	72	33.4	64	30	25	11.6	9	4.2

Percentage distribution of the selected teacher respondents based on the level of TP practised

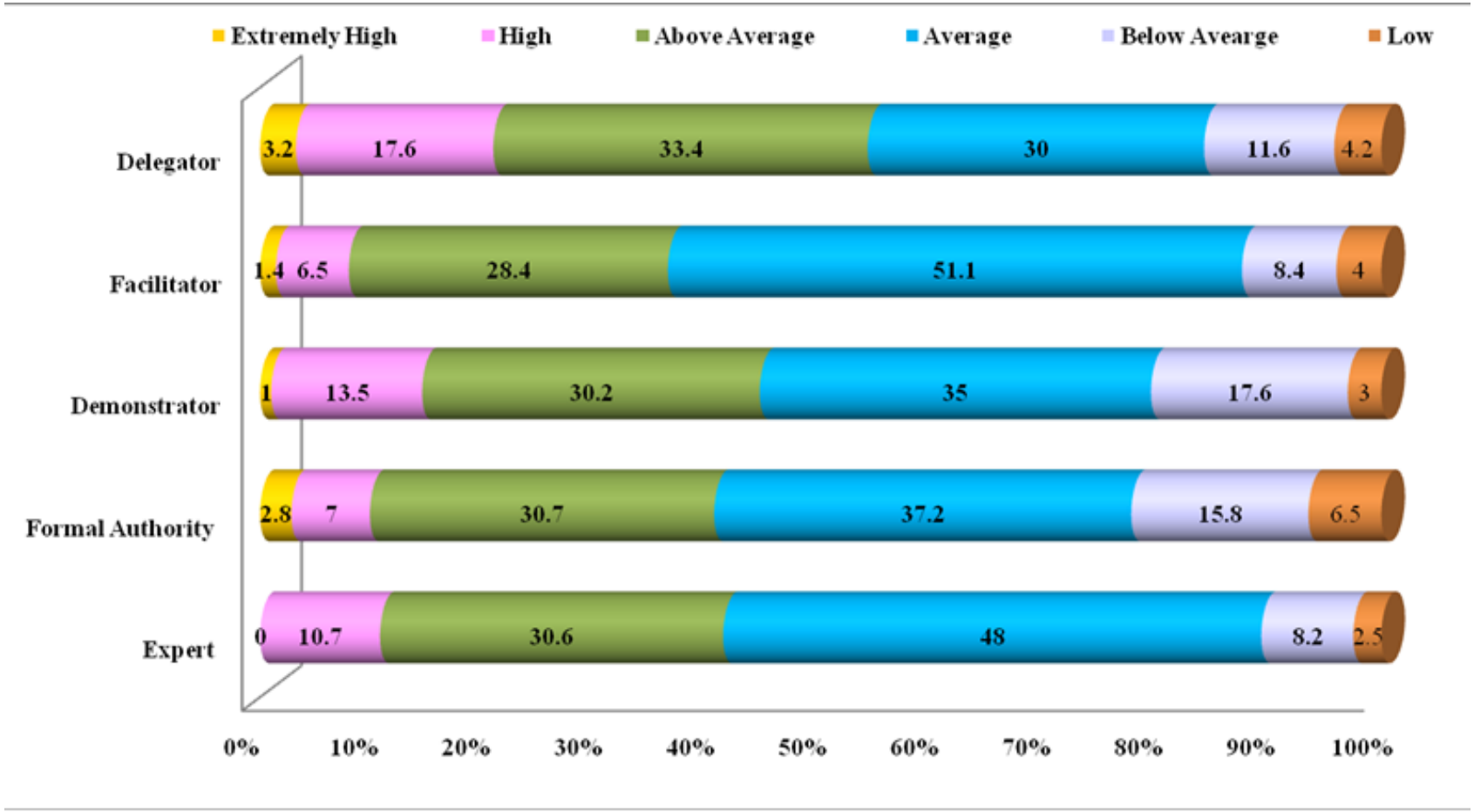


Figure 31

The table above shows the overall level of TP of the selected teacher respondents chosen for the study. One point that stood out from the table was that almost all five types of teaching styles were found at an average level (60.8%) among the selected school teachers. This was followed by above average level (30.8%) which was way behind. All the more, the below-average level was found to be further behind (12.26%) and it was closely followed by the high level (12.16%). However, it was also noteworthy that a negligible percentage of teacher respondents practised the specified style but in the low as well as in the extremely high category.

Looking at each teaching style individually it can be inferred from the figure that 54.2% (above average – 33.4%, high – 17.6% and extremely high – 3.2%) of the teacher respondents were found to practice the delegator style of teaching within the above average to excellent category. Formal Authority style of teaching was found among 49% (above average - 30.7%, high - 7% and extremely high - 2.8%) of the teachers based on the above-said pattern of assessment. The lowest percentage of 36.3% (above average - 28.4%, high - 6.5% and extremely high - 1.4 %) was observed in the Facilitator type of teaching. A study conducted by Sim and Matore (2022) among National-type Chinese primary school teachers partially supports the present finding in accepting that the Facilitator style is the least practised one and contradicts to the observation that the Demonstrator was the prominent style. However, the literature on the Indian educational scenario in general and the Tamil Nadu unified system of education in particular was scarce.

b. Association between personal profile variables and TP adopted by the teacher respondents

Appropriate statistical tools were used to find out the nature of dependency of the dependent variables, i.e. the level of TP practised in terms of raw score vis-a-vis the independent variables, the teacher respondents' age, gender, educational qualification, subject handled, professional experience, and type of school employed in. The subsection below summarizes the t-test and one-way ANOVA results, showing the influence of corresponding personal factors on the TP of the selected teacher respondents.

i. Influence of Age on TP

ii. Influence of Gender on TP

iii. Influence of Education qualification on TP

iv. Influence of Subject handled on TP

v. Influence of Professional experience on TP

vi. Influence of Type of school on TP

i. Influence of Age on TP

Table XXXVII portrays the results of one-way ANOVA showing the nature of dependency of the dependent variables, i.e., the types of TP exhibited by the respondents vis-a-vis the independent variable, the age (25-35yrs, 36-45yrs and 46-55 yrs).

TABLE XXXVII

INFLUENCE OF AGE ON TP SELECTED TEACHER RESPONDENTS

N=215

Predictors	25-35 years (N= 70)		36-45 years (N= 100)		46-55 years (N= 45)		*F* (2, 214)	*p*	η^2
	M	***SD***	***M***	***SD***	***M***	***SD***			
Expert	46.74	4.995	47.31	4.794	48.33	4.400	1.518	.221	.01
Formal Authority	45.90	5.670	45.93	5.965	45.20	4.770	.289	.750	.00
Demonstrator	31.54	4.880	31.13	4.927	31.18	4.846	.410	.664	.00
Facilitator	32.50	4.520	31.70	4.258	32.02	3.775	.729	.484	.00
Delegator	33.86	5.787	33.86	5.160	33.73	4.887	.010	.990	.00

The table indicated that the age of the teachers does not have an impact on all of the five TP's employed by them. Likewise, the eta square (η^2) = 0.00 (p>.05) specified no effect of the same. The researcher too perceives that age is just a number and that is not a criterion to judge the teachers. TP is linked to a professional, ethical value system and stems from their education. The teachers when aware of their teaching style (or styles) can help to increase student engagement and, ultimately, enhance student outcomes is the universal truth.

i. Influence of Gender on TP

Table XXXVIII represents the influence of gender on the five styles of TP displayed by the selected teacher respondents.

TABLE XXXVIII

INFLUENCE OF GENDER ON TP OF SELECTED TEACHER RESPONDENTS

N=215

Predictors	Male N=39		Female N=176		t (213)	p	Cohen's d
	M	SD	M	SD			
Expert	47.15	5.304	47.38	4.689	-0.247	.806	0.45
Formal Authority	45.69	5.583	45.78	5.645	-0.093	.926	0.16
Demonstrator	30.41	4.441	31.35	4.927	-1.167	.248	0.20
Facilitator	31.26	4.592	32.20	4.160	-1.179	.244	0.21
Delegator	32.67	6.322	34.09	5.023	-1.318	.194	0.32

Similar to age as a variable, gender had no significant role in influencing the five TP (Expert, Formal Authority, Demonstrator, Facilitator, and Delegator) practised by the teacher respondents. A study by Karimnia and Mohammdi (2019) claiming that gender plays a significant role in the teaching style of selected teachers contradicts the present finding and the investigator acknowledges the necessity to explore further in this arena.

iii. Influence of Educational qualification on TP

Table XXXIX illustrated the findings of one-way ANOVA, which revealed the nature of the relation between educational qualification on the five domains of TP of the selected school teachers.

The results displayed a significant mean difference concerning the educational qualification of the Demonstrator type of TP; with a statistically significant *F* value (*F* (4, 214) = 2.841 and *p*=.025). The effect size computed as eta square (η^2) showed a small effect over the dependent variable, the Demonstrator (η^2=0.05)**.** Apart from the Demonstrator TP, educational qualification does not seem to have any statistically significant relationship with Expert, Formal Authority, Facilitator and Delegator types of TP.

A graph plotted with mean scores procured by the respondents belonging to each subgroup concerning the Demonstrator TP was illustrated in Figure 32.

TABLE XXXIX

INFLUENCE OF EDUCATIONAL QUALIFICATION ON TP OF SELECTED TEACHER RESPONDENTS

N=215

Predictors	UG (N=16)		PG (N=51)		UG with B.Ed (N=30)		PG with B.Ed (N=96)		PG with M.Ed (N=22)		F (4,214)	*p*	η^2
	M	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***			
Expert	47.38	4.455	48.73	4.152	46.75	4.853	47.38	5.027	46.64	4.655	.949	.437	.01
Formal Authority	43.75	5.422	46.07	7.012	46.39	4.800	45.75	5.784	45.45	4.748	.708	.588	.01
Demonstrator	33.06	4.683	31.45	4.489	32.77	4.804	30.78	4.887	28.95	4.845	**2.841**	**.025**	**.05**
Facilitator	31.00	4099	33.03	4.311	31.14	4.600	32.42	4.067	31.77	3.987	1.449	.219	.02
Delegator	33.31	4.909	32.98	5.784	34.27	6.236	33.94	4.946	35.14	4.507	.759	.533	.01

Pair-wise plot of Demonstrator TP based on the teacher respondents' Educational qualification

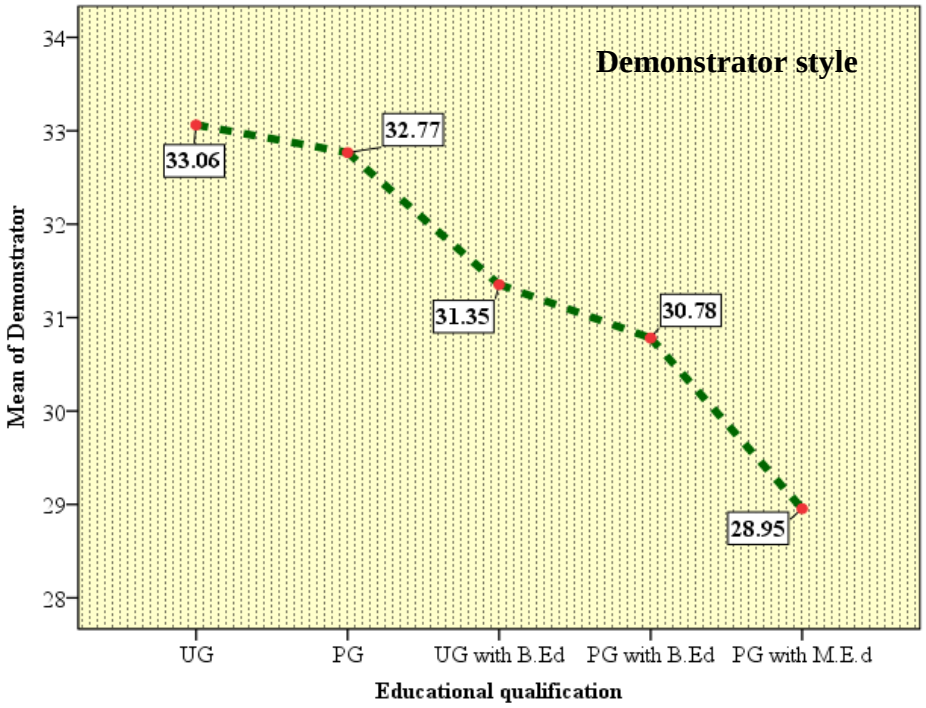


Figure 32

The above-plotted graph portrayed that graduate and post-graduate teachers exhibited higher mean scores than UG with B.Ed and PG with B.Ed. in predicting the Demonstrator teaching style. PG Teachers with M.Ed. exhibited the lowest score. A contradictory study by Mazumder and Kawshik (2014) to understand the factors contributing to the TP indicated that educational qualification did not play a significant role in influencing the TP of the teachers. However, the researcher perceives that graduate and post-graduate teachers exhibit higher scores than their trained counterparts because these untrained teachers need job confirmation, for which they need to perform better than their colleagues. Also, they need to prove their teaching skills and knowledge among the students and authorities.

iv. Influence of Subject handled on TP

Table XL showed the statistical ANOVA test results of the influence of the subject handled by the teacher respondents on the dependent variable - types of TP's.

TABLE XL

INFLUENCE OF SUBJECT HANDLED ON TP OF THE SELECTED TEACHER RESPONDENTS

N=215

Predictors	**Language (N=32)**		**English (N=67)**		**Mathematics (N=42)**		**Science (N=47)**		**Social Science (N=27)**		***F(4,214)***	***p***	***η^2***
	M	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***			
Expert	48.84	5.005	47.64	4.437	46.74	4.607	47.13	5.211	46.11	4.685	1.499	.204	.02
Formal Authority	44.75	5.941	45.37	5.231	45.45	5.433	46.09	5.660	47.89	6.210	1.387	.240	.02
Demonstrator	31.63	5.059	31.82	4.792	31.33	4.586	30.57	5.460	29.85	3.830	1.063	.376	.01
Facilitator	31.91	4.245	32.39	3.900	32.12	3.871	32.04	4.568	31.11	5.147	.442	.778	.00
Delegator	34.25	4.515	33.69	4.903	34.81	5.416	33.32	5.317	33.07	6.799	.665	.617	.01

It was evident from the above table that the subject handled does not impact any of the five types of TP. The *F* statistics didn't expose any significant association between the above-said dependent and independent variables. Likewise, the (η^2) (p>.05) indicated no effect of the same. It is a common assumption that the TP should vary based on the subjects taught. However, the present finding did not support the idea. Gill (2013) stated that the teacher respondents are not handling the same set of students every day because they have different teachers from various subjects each hour. Knowing each student well enough to teach them effectively is incredibly challenging for middle school teachers. Although setting specific TPs for each subject is complex, student-focused differences necessitate instructional techniques that embrace diverse classrooms for students at all learning levels and from various backgrounds without compromising the teacher's strengths. The researcher perceived this may be one of the reasons why teachers do not fix any pattern for a particular subject**.**

iv. Influence of Professional experience on TP

Table XLI exhibits the results of one-way ANOVA, which was conducted to find out the predictive capacity of the personal factors of the selected school teachers vis-a-vis the teaching pedagogy they adopted.

TABLE XLI

INFLUENCE OF PROFESSIONAL EXPERIENCE ON TP OF THE SELECTED TEACHER RESPONDENTS

N=215

Predictors	**< 1 year (N=4)**		**1 -5 years (N=69)**		**6 -10 years (N=49)**		**>10 years (N=93)**		***F (3,214)***	***p***	***η^2***
	M	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***			
Expert	48.75	7.890	46.77	5.012	48.10	5.009	47.30	4.373	.856	.465	**.**01
Formal Authority	33.00	8.718	33.19	5.378	34.69	5.153	33.89	5.172	**2.948**	**.034**	**.04**
Demonstrator	34.50	3.109	31.13	4.835	31.69	4.849	30.80	4.898	1.007	.391	.01
Facilitator	30.75	4.573	31.45	4.578	32.02	4.884	32.52	3.571	.957	.414	.01
Delegator	53.75	4.924	45.51	5.569	45.29	6.090	45.87	5.240	.808	.419	.01

The above table indicated that professional experience does have a significant impact on one out of five types of TP namely Formal Authority (F (3,214) = 2.948, p =.032); Though the F Statistics revealed a significant association between the independent and the dependent variable, the effect size computed as eta square (η^2) showed a small effect size over the dependent variable, the Formal Authority (η^2=0.04)**.** However, concerning Expert, Demonstrator, Facilitator and Delegator style of TP, the table displayed insignificant mean difference. For a detailed analysis, a graph was plotted with the mean scores procured by the respondents belonging to each subgroup of professional experience over the Formal Authority style of teaching as illustrated in Figure 33.

Pair-wise plot of Formal Authority TP on the teacher's Professional experience

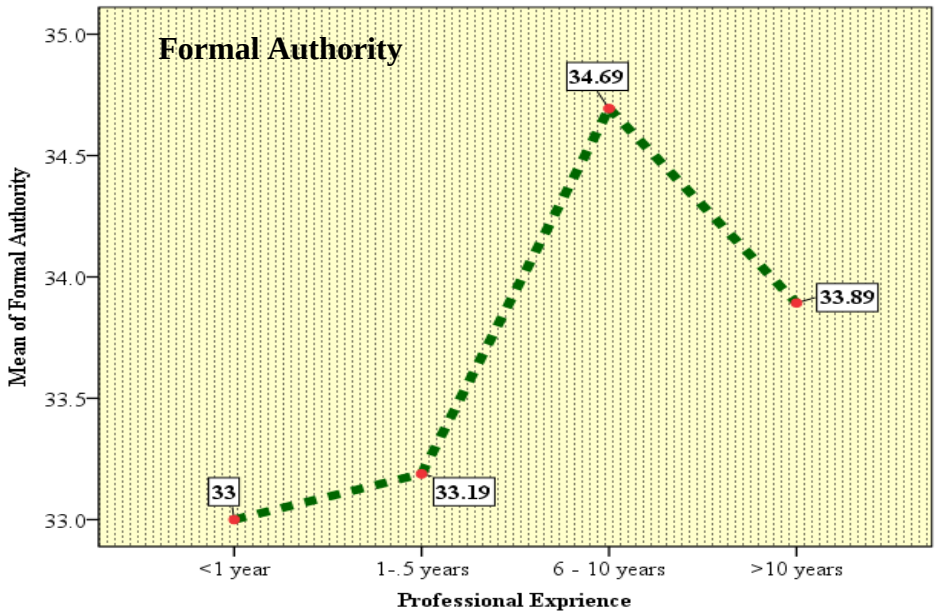


Figure 33

Looking into the mean score of Formal authority, it was evident that teachers with 6 -10 years of experience had a higher mean score (34.69) when compared to others who possessed below six years and more than ten years of teaching experience. A Stanford (2014) study states that a teacher's years of teaching experience play a significant role in the academic achievement of the selected student respondents. The higher the years of experience, the greater the impact of teaching, resulting in better academic achievement. Whereas another study done by Mazumder and Kawshik (2014) to understand the factors contributing to the teaching style showed that age, gender, educational qualification, and years of teaching

experience did not play a significant role in influencing the teachers' teaching styles. The researcher perceives that this contradiction may stem from the above study conducted among university faculty members in two different countries nearly seven years ago. However, this may form an interesting area of investigation for further studies.

iv. Influence of Type of school on TP

Table XLII below depicts the statistical ANOVA results of the influence of the type of school on the dependent variable - the types of TP of selected school teachers.

TABLE XLII

INFLUENCE OF TYPE OF SCHOOL ON TP OF THE SELECTED TEACHER RESPONDENTS

N=215

Predictors	Aided (N=110)		Government (N=28)		Private (N=77)		F(2,214)	*P*	η^2
	M	***SD***	***M***	***SD***	***M***	***SD***			
Expert	47.29	5.153	47.68	4.190	47.29	4.510	.080	.923	.00
Formal Authority	45.78	5.538	45.07	6.140	46.00	5.598	.279	.757	.00
Demonstrator	31.07	4.585	29.82	4.714	31.82	5.193	1.809	.166	.00
Facilitator	31.81	4.609	33.11	3.119	31.95	4.042	1.065	.347	.00
Delegator	33.92	5.187	33.75	5.168	33.74	5.552	.029	.971	.00

It can be inferred from the above table that the type of school does not have any kind of impact on the five types of TP under the present study. The F statistics didn't expose any significant association between the above said dependent and independent variables. Likewise, the eta square (η^2) (p>.05) too indicated no effect of the same.

Overall, based on the types of TP, the selected school teachers' scores in Demonstrator teaching style had a small effect size, and it stated that lower the qualification (graduated teachers) better the performance when compared to their counterparts. The variables, namely Gender, Age, Subjects-Handled, Professional Experience, and Type of School of the teachers, were not associated with the Demonstrator's teaching style. The Formal authority style of teaching has been found to have a small effect on professional experience of the teachers, and it was shown that teachers with 6 to 10 years of an experience performed better in their Formal Authority TP with their students.

F. PREDICTIVE MODELS INTEGRATING MI, LS AND TP

For the primary objective of formulating predictive models for subject-wise Academic Achievement (AA) of school children enrolled in Samacheer Kalvi (Tami Nadu Unified System of Education) integrating Multiple Intelligence (MI) and Learning Style (LS) possessed by the students and Teaching Pedagogy (TP) practised by the teachers, three research questions were to be verified, namely:

1. What is the effect of Multiple Intelligence (MI) on Subject-wise AA?
2. What is the effect of Learning Style (LS) on Subject-wise AA after controlling MI?
3. What is the effect of Teaching Pedagogy (TP) on Subject-wise AA after controlling MI and LS?

To answer these research questions, hierarchical regression analysis with three blocks of variables was considered. One with MI, the second with LS, and the third block encompassing TP. The variables were entered in the order of MI, then LS, and finally, the TP as it seemed chronologically plausible given that MI describes the way the students learn and acquire the information, LS as the way that the students choose to learn and TP being the strategy adopted by the teachers to engage the students in the learning process. As it is the teacher's responsibility to select an appropriate style to address the needs of diverse students at different learning levels, TP was considered in the final model of hierarchical regression. Before conducting hierarchical multiple regression, its relevant assumptions were tested.

1. Firstly, a sample size of 400 was deemed adequate given 20 independent variables (9 domains of MI + 6 types of LS +5 types of TP). Hence, with a sample size of 3026, the results could be generalised to the typical population.
2. The assumption of singularity was also met, as only the subscale scores were included in the model. The total score of the latent variables namely MI, LS and TP was not computed.
3. An examination of correlations (shown in every reporting section of hierarchical regression) revealed that no independent variables were strongly correlated with a coefficient value of more than 0.8.

4. The Collinearity statistics (i.e. Tolerance and VIF attached as Appendix VIII) were all within the accepted limits. Hence, the assumption of multicollinearity was deemed to have been met.
5. Extreme univariate outliers were identified for the subjects (namely English, Science, and Mathematics) during the initial data screening and were modified. An examination of the Cook's distance scores (minimum to maximum) indicated no multivariate outliers (Language - .000 to .005, English - .000 to 005, Mathematics - .000 to .007, Science - .000 to .008 and Social Science 000 to .005).
6. Residual and scatter plots attached as Appendix XI indicated the assumptions of normality, linearity, and homoscedasticity and were found to be satisfactory.

Accordingly, the hierarchical regression models pertinent to the five core subjects AA were carried out and the results were provided within the following subheads:

a. Predictors of Academic Achievement in Language
b. Predictors of Academic Achievement in English
c. Predictors of Academic Achievement in Mathematics
d. Predictors of Academic Achievement in Science
e. Predictors of Academic Achievement in Social Science

a. Predictors of Academic Achievement in Language

To test the predictors – nine domains of MI, six types of LS and five types of TP - over the AA in the Language subject (regional language, Tamil), three blocks of predictors were used. The first block (Model - 1) included the nine domains of MI namely Linguistic, Logical, Bodily-Kinesthetic, Musical, Spatial, Naturalistic, Interpersonal, Intrapersonal, and Existential intelligence as the predictors). The second block (Model - 2) included the six types of Learning Styles namely Enactive Reproducing, Enactive Constructive, Verbal Reproducing, Verbal Constructive, Figural Reproducing, and Figural Constructive as the predictor variables. In block three (Model - 3), the five types of Teaching Pedagogy namely Expert, Formal Authority, Demonstrator, Facilitator, and Delegator were included as the predictor variable. Academic Achievement in the subject - Language was the dependent variable or outcome variable in all three blocks.

The output of Hierarchical regression of independent variables over the dependent variable was discussed in three parts namely correlation statistics, model summary with ANOVA statistics and the hierarchical regression model quantifying the predictive capacity of each independent variable over the dependent variable.

i. Correlation Statistics

The correlation statistics in Table XLIII conclude that though many of the 20 independent variables were correlated with the dependent variable and within itself, the correlation coefficient was not greater than 0.8, meeting the assumption of multicollinearity to proceed further with the planned regression model. Moreover, the correlation between the dependent and the independent variables needs to be understood. Except for the Interpersonal and Existential intelligence in the domain of MI, there existed a statistically significant correlation between the other seven domains of AA in Language. However, the magnitude of the correlation was weak. None of the LS was observed to have a significant association with the dependent variable. Looking into the types of TP, a statistically significant correlation erupts with Expert, Demonstrator, and Facilitator types of TP. All the more, the Expert style had a weak positive correlation. Whereas, the other two styles had a weak negative correlation.

ii. Model summary with ANOVA

Table XLIV a and XLIV b detail the model summary and the ANOVA statistics of the Hierarchical Regression pertinent to the AA in Language as a subject of study.

TABLE XLIII

DESCRIPTIVE STATISTICS AND CORRELATIONS BETWEEN PREDICTOR VARIABLES AND AA IN LANGUAGE

Variables	L	MI1	MI2	MI3	MI4	MI5	MI6	MI7	MI8	MI9	LS1	LS2	LS3	LS4	LS5	LS6	TS1	TS2	TS3	TS4	TS5
AA – Language L	1																				
Linguistic MI1	.056**	1																			
Logical MI2	.044*	.554**	1																		
Bodily MI3	.057**	.558**	.565**	1																	
Spatial MI4	.035*	.523**	.431**	.569**	1																
Musical MI5	.046**	.532**	.547**	.695**	.539**	1															
Naturalistic MI6	.064**	.634**	.669**	.741**	.556**	.735**	1														
Interpersonal MI7	.024	.505**	.550**	.572**	.633**	.663**	.624**	1													
Intrapersonal MI8	.054**	.610**	.631**	.786**	.629**	.770**	.771**	.697**	1												
Existential MI9	.028	.504**	.649**	.666**	.650**	.811**	.791**	.709**	.765 **	1											
Enactive Reproduce LS1	.021	-.036*	.224**	.199**	.062**	.077**	.095**	.033*	.094**	.169**	1										
Enactive Construct LS2	.012	-.090**	-.074**	-.072**	-.022	-.181**	-.155**	-.164**	-.131**	-.155**	.348 **	1									
Verbal Reproduce LS3	-.013	.032*	.069**	.061**	-.009	.010	.028	.001	.016	.032*	.189**	.131**	1								
Verbal Construct LS4	.016	.050**	.139**	.126**	.033*	.026	.017	-.013	.018	.046**	.444**	.273**	.142**	1							
Figural Reproduce LS5	-.009	-.125**	.024	.058**	-.078**	-.065**	-.051**	-.053**	-.011	-.053**	.321**	.401**	.120**	.310**	1						
Figural Construct LS6	.010	-.091**	-.066**	-.057**	-.026	-.160**	-.137**	-.150**	-.114**	-.134**	.313**	.901**	.129**	.242**	.377 **	1					
Expert TS1	.048**	-.094**	-.006	.009	.009	.001	.013	.024	.000	.030*	.042**	-.010	.040*	-.031*	.020	-.029	1				
Formal Authority TS2	-.008	-.039*	.020	.059**	.041*	.036*	.030*	.058**	.056**	.064**	.026	.103**	-.087**	.020	.080**	.087**	.090**	1			
Demonstrator TS3	-.052**	.006	-.050**	-.044**	-.021	-.026	-.040*	-.043**	-.048**	-.051**	-.065**	-.068**	-.069**	-.001	-.038*	-082**	.060**	-.272**	1		
Facilitator TS4	-.027	.030	.043**	-.011	-.010	-.001**	.029	.008	-.009	.025	-.001	-.099**	.075**	.012	-.033*	-132**	.318**	-.421**	.368**	1	
Delegator TS5	-.033*	.052**	-.014	-.024	.014	-.008	-.003	.007	-.032*	.010	-.063**	-.016	.065**	.036*	.002	-.030*	.178**	.135**	-.110**	.210**	1
Mean	62.88	29.80	29.89	29.86	29.66	29.71	30.36	30.67	30.20	30.08	22.81	24.21	24.64	23.39	22.68	24.22	50.21	44.43	30.83	32.57	34.16
SD	13.745	4.776	4.832	4.836	4.053	5.444	**5.548**	4.407	5.580	**5.336**	5.317	5.265	5.173	5.876	4.673	5.274	**4.149**	**5.944**	**5.183**	3.541	4.134
Total	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026

Note. Statistical Significance:* p<.05; ** p<.01;

TABLE XLIV a

MODEL SUMMARY OF HIERARCHICAL REGRESSION

Model	R	R^2	Adjusted R Square	Std.Error of the Estimate	Change statistics				
					ΔR^2	F change	df1	df2	Sig. F change
1	.084	.007	.004	13.718	.007	2.370	9	3016	.011
2	.091	.008	.003	13.722	.001	.651	6	3010	.689
3	.134	.018	.011	13.667	.010	5.923	5	3005	.000

TABLE XLIV b

ANOVA STATISTICS

Model		Sum of square	Df	Mean square	F	Sig.
1	Regression	4013.600	9	445.956	**2.370**	**.011**
	Residual	567521.917	3016	188.170		
	Total	571535.518	3025			
2	Regression	4749.184	15	316.612	**1.681**	**.048**
	Residual	566786.333	3010	188.301		
	Total	571535.518	3025			
3	Regression	10280.741	20	514.037	**2.752**	**.000**
	Residual	561254.777	3005	186.774		
	Total	571535.518	3025			

Model 1: (Constant) Linguistic, Logical, Bodily, Spatial, Musical, Naturalistic, Interpersonal, Intrapersonal and Existential

Model 2: (Constant), Linguistic, Logical, Bodily, Spatial, Musical, Naturalistic, Interpersonal, Intrapersonal, Existential, Enactive reproducing, Enactive constructive, Verbal reproducing, Verbal constructive, Figural reproducing, and Figural constructive

Model 3: (Constant), Linguistic, Logical, Bodily, Spatial, Musical, Naturalistic, Interpersonal, Intrapersonal, Existential, Enactive reproducing, Enactive constructive, Verbal reproducing, Verbal constructive, Figural reproducing, Figural constructive, Expert, Formal Authority, Demonstrator, Facilitator, and Delegator

Dependent Variable: Language

iii. Hierarchical regression model

Table XLV and Figure 34 portray the hierarchical regression model quantifying the predictive capacity of each independent variable over the AA in Language.

TABLE XLV

VARIABLE-WISE HIERARCHICAL REGRESSION MODEL ON AA IN LANGUAGE

Predictors	**R**	**R^2**	**ΔR^2**	**B**	**SE**	**B**	**T**	**Sig.**
Model 1								
Constant				57.604	2.235		25.777	.000
Linguistic	.			.036	.074	.013	.489	.625
Logical				.041	.076	.014	.542	.588
Bodily-Kinesthetic				.036	.091	.013	.395	.693
Spatial				.069	.092	.020	.749	.494
Musical	084	.007*		.087	.089	.035	.979	.328
Naturalistic				**.190**	**.091**	**.077**	**2.077***	**.038**
Interpersonal				-.091	.090	-.029	-1.019	.308
Intrapersonal				.046	.095	.019	.491	.623
Existential				**-.236**	**.106**	**-.092**	**-2.229***	**.026**
Model 2								
Constant				57.632	2.915		19.771	.000
Linguistic				.041	.077	.014	.530	.596
Logical				.024	.078	.009	.310	.757
Bodily-Kines.				.022	.094	.008	.237	.813
Spatial				.048	.093	.014	.516	.606
Musical				.092	.090	.036	1.028	.304
Naturalistic				**.203**	**.092**	**.082**	**2.198***	**.028**
Interpersonal	.091	.008*	.001	-.072	.091	-.023	-.790	.429
Intrapersonal				.059	.095	.024	.613	.540
Existential				**-.250**	**.108**	**-.097**	**-2.322***	**.020**
Enactive Reproducing				.058	.059	.022	.975	.330

Cont….

Predictors	**R**	**R^2**	**ΔR^2**	**B**	**SE**	**B**	**T**	**Sig.**
Enactive Constructive				.040	.113	.015	.354	.723
Verbal Reproducing				-.053	.050	-.020	-1.061	.289
Verbal Constructive				.018	.049	.008	.370	.711
Figural Reproducing				-.062	.062	-.021	-.998	.319
Figural Constructive				.011	.109	.004	.098	.922
Model 3								
Constant				62.760	5.373		11.681	.000
Linguistic	.134	.018**	.010	.093	.078	.032	1.198	.231
Logical				.020	.078	.007	.251	.802
Bodily-Kinesthetic				.016	.094	.006	.170	.865
Spatial				.041	.093	.012	.444	.657
Musical				.093	.089	.037	1.037	.300
Naturalistic				**.186**	**.092**	**.075**	**2.023***	**.043**
Interpersonal				-.083	.090	-.026	-.914	.361
Intrapersonal				.043	.095	.018	.453	.651
Existential				**-.232**	**.108**	**-.090**	**-2.158***	**.031**
Enactive Reproducing				.032	.059	.012	.535	.592
Enactive Constructive				.056	.114	.021	.491	.623
Verbal Reproducing				-.067	.050	-.025	-1.330	.183
Verbal Constructive				.041	.049	.018	.834	.405
Figural Reproducing				-.055	.062	-.019	-.885	.376
Figural Constructive				-.015	.110	-.006	-.133	.894
Expert				**.269**	**.066**	**.081**	**4.054****	**.000**
Formal Authority				**-.099**	**.050**	**-.043**	**-1.971***	**.049**
Demonstrator				**-.157**	**.054**	**-.059**	**-2.937****	**.003**
Facilitator				-.151	.093	-.039	-1.629	.103
Delegator				-.125	.066	-.038	-1.905	.057

Predictors predicting AA in Language

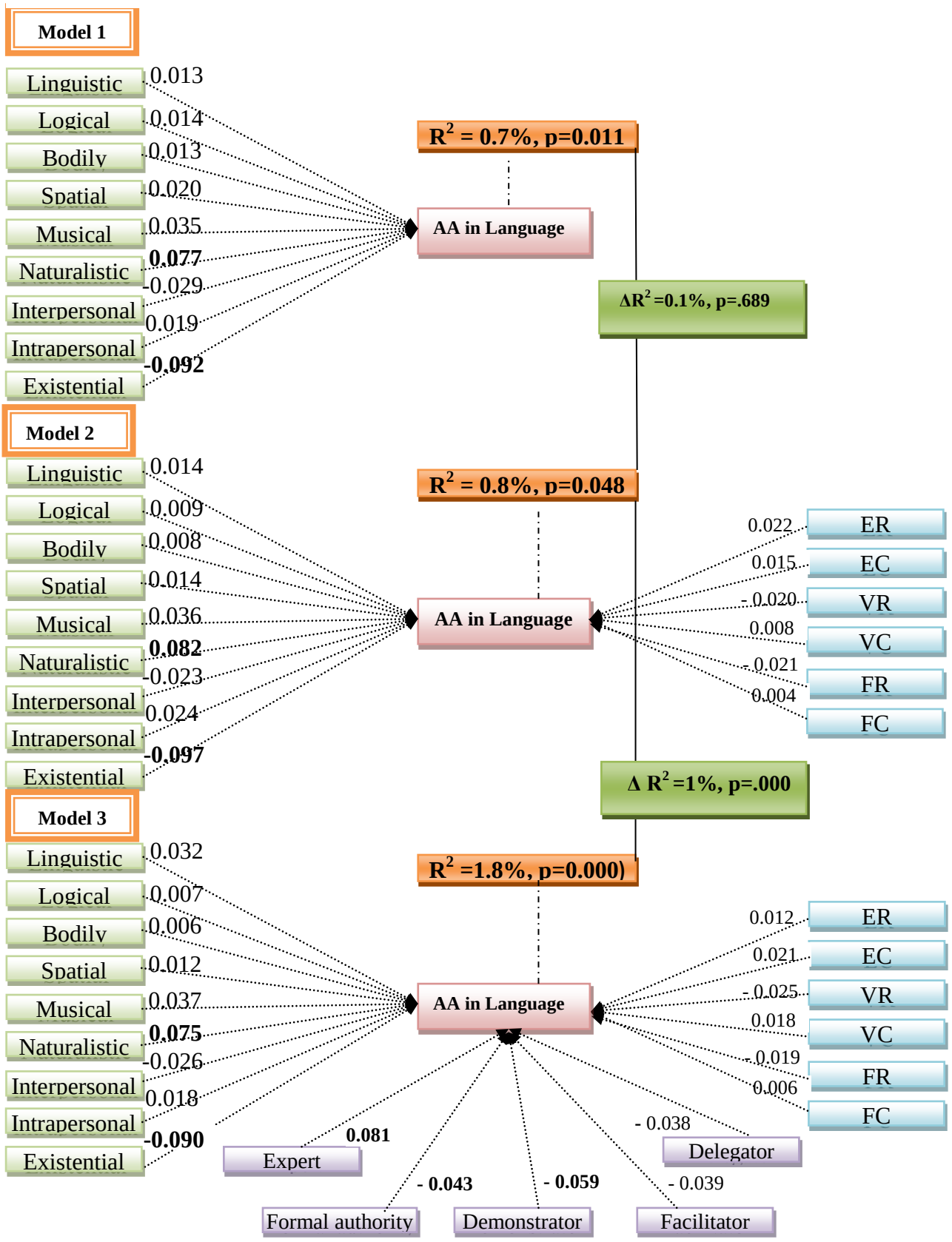


Figure 34

Overall, the model summary depicted in Table XLIVa showed that the first model was significant with F (9, 3016) = 2.370, p =.05, R^2=.007. Hence, the nine domains of MI were significantly associated with AA in Language. However, Table XLV, which shows the domain-wise effect on the AA in Language projects a significant association of Naturalistic intelligence with β = 0.082, t =2.198, p=.05 and Existential intelligence with β= -0.092, t=-2.229, p =.05 over the dependent variable.

The second model with six styles of LS produced an F (15, 3010) =1.681, p <.05, R^2 =.008 showing a significant improvement from the first model. However, the change in F value, [Δ F (6, 3010) = 0.651, p = .689, R^2 = .001] was not significant. With MI held constant, the variable-wise effect shows a strong association of the same two domains of MI as in the first model (Naturalistic β = 0.077, t=2.077, p=.05 and Existential β = -0.092, t =-2.229, p<.05 respectively). All the more, none of the learning styles had a significant relationship with the outcome variable – AA in Language.

The third model after adding five types of TP gave an F (20, 3005) = 2.752, p<.01, R^2 =.018] showing a significant improvement from the other two models indicated by a statistically significant change in F value [ΔF (5, 3005) = 5.923, p<.01, R^2 =.010]. The final adjusted model shows five out of twenty independent variables having significant association with the AA in Language and recorded a higher positive β value in the Expert style of teaching (β = 0.081, p<.01,) followed by the respondent possessing the dominant Naturalistic type of intelligence (β =0.075, p<.05). The table also portrays the negative regression weight of certain variables. The order of negative β value was with the Demonstrator style of teaching (β =- 0.059, p <.01) followed by possessing dominant Existential intelligence (β =- 0.090, p<.01) and then the Formal authority style of teaching (β =- 0.043, p<.05).

An increase in one unit of Expert style (SD=4.15) of teaching, and one unit of Naturalistic intelligence (SD=5.55) increases the Language score of the student respondents by 0.081 marks and 0.075 marks in Language respectively. Moreover, the negative regression weight to Existential intelligence, Demonstrator style, and Formal authority style of teaching signifies that there was an indirect relationship between these predictors and Language score. The higher the score in these predictors not so higher the AA in Language and vice versa.

Hence, an increase in one unit of Existential intelligence (SD =5.33), Demonstrator (SD =5.18), and Formal Authority (SD=5.94) will decrease the Language score of student respondents by 0.090, 0.059, and 0.043 marks.

Overall, Figure 28 demonstrates that when the nine domains of MI were included in the model, the variables explained 0.7% of the variance; the second model (after adding six types of LS) explained 0.8% of the variance; the final model (after adding five types of TP) explained an overall 1.8% of the variance in the dependent variable – AA in Language - with the third model representing a small effect size.

As mentioned earlier in the methodology, to have homogeneity in the data set, the respondents' Language marks were the marks procured in Tamil (the regional language of the respondents). Accordingly, the reason owed for a higher and significant β value in the Naturalistic intelligence in predicting enhanced AA in Language was that the literature components of Tamil deal with Epics that necessitate the child's inclination toward the natural world, as well as towards what human beings have created. Moreover, Tamil though a commonly used Language, the standard of Tamil books followed in the Samacheer pattern of syllabus is high with a clear differentiation between spoken and written Tamil. Students find it tough to learn the lengthy poetry, prose and grammar portions as well as performing academically well. This calls for an Expert teaching style where the teacher can impart their knowledge and Language skills which would benefit the students in learning the Language concepts well and thereby improve the AA of the students.

b. Predictors of Academic Achievement in English

A three-stage hierarchical regression was conducted with AA in the English subject as a dependent or outcome variable. Nine domains of MI were entered at stage 1 of the regression and controlled for further stages. The six types of LS were entered at stage 2 and the five types of TP at stage 3. Inter correlation between the variables used in the multiple regression model was reported in Table XLVI, the summary of the model with ANOVA statistics in Table XLVIIa and XLVIIb and the variable-wise regression statistics in Table XLVIII.

i. Correlation Statistics

As displayed in the correlation Table XLVI, though many of the independent variables were significantly related to each other, the correlation coefficient had a small or moderate effect size and hence the assumption concerning Multicollinearity was met.

Consequently, the correlation coefficient of the independent variables over the dependent variables needs to be understood. Logical, Bodily, Interpersonal and Existential intelligences were not significantly related to the AA in English. Other domains of MI, though statistically related, had a weak correlation. As with Language, English also did not find a significant correlation with learning styles. The Demonstrator and Facilitator style of teaching adopted by the teachers did not affect the respondents' AA in English. The other TP though correlated, the Formal authority has a positive weak correlation, the Delegator and Expert style of teaching bore a negative weak correlation.

ii Model summary with ANOVA

Tables XLVIIa and XLVIIb detail the model summary and the ANOVA statistics of the hierarchical regression related to the AA in English.

TABLE XLVI

DESCRIPTIVE STATISTICS AND CORRELATION BETWEEN PREDICTOR VARIABLES AND AA IN ENGLISH

Variables	E	MI1	MI2	MI3	MI4	MI5	MI6	MI7	MI8	MI9	LS1	LS2	LS3	LS4	LS5	LS6	TS1	TS2	TS3	TS4	TS5
AA – English	1																				
Linguistic (MI1)	.059**	1																			
Logical (MI2)	.023	.554**	1																		
Bodily (MI3)	.025	.558**	.565**	1																	
Spatial (MI4)	.034*	.523**	.431**	.569**	1																
Musical (MI5)	.036*	.532**	.547**	.695**	.539**	1															
Naturali.. MI6)	.042*	.634**	.669**	.741**	.556**	.735**	1														
InterperMI7)	.028	.505**	.550**	.572**	.633**	.663**	.624**	1													
Intraper.. MI8)	.032*	.610**	.631**	.786**	.629**	.770**	.771**	.697**	1												
Existenti..(MI9)	.020	.504**	.649**	.666**	.650**	.811**	.791**	.709**	.765**	1											
ER(LS1)	.015	-.036*	.224**	.199**	.062**	.077**	.095**	.033	.094*	.169**	1										
EC(LS2)	.019	-090**	-074**	-072**	-.022	-181**	-155**	-164**	-.131**	-.155**	.348**	1									
VR(LS3)	.016	.032*	.069**	.061	-.009	.010	.028	.001	.016	.032*	.189**	.131**	1								
VC(LS4)	.012	.050**	.139**	.126**	.033*	.026	.017	-.013	.018	.046**	.444**	.273**	.142**	1							
FR (LS5)	-.050**	-125**	.024	.058**	-.078**	-.065**	-.051**	-.053**	-.011	-.053**	.321**	.401**	.120**	.310**	1						
FR (LS6)	.018	-.091**	-066**	-057**	-.026	-.160**	-.137**	-.150**	-.114**	-.134**	.313**	.901**	.129**	.242**	.377**	1					
Expert (TS1)	-.075**	-.059**	-.017	.037*	.054**	.016	.000	.045*	.027	.042*	.050**	.089**	-.069**	.081**	.080**	.098**	1				
FA(TS2)	.035*	-.016	.036*	.020	-.019	.011	.021	-.003	.031*	.015	.028	.017	-.019	.026	.010	.000	.119**	1			
Demon(TS3)	-.020	-.057**	-.024	.023	.027	.006	-.003	.018	.008	.029	-.025	-.022	-.040*	.033*	.028	-.024	.279**	.034*	1		
Faci(TS4)	-.008	-.014	.011	.040*	.031*	.028	.024	.031*	.050**	.044**	.015	-.001	.030	-.020	.042*	-.008	.083**	.190**	.180**	1	
Dele(TS5)	-.113**	.015	.037*	.040*	.066**	.038*	.044**	.069**	.042*	.086**	.016	-.034*	.100**	.031*	.073**	-.040*	.149**	.086**	.278**	.412**	1
Mean	57.64	29.80	29.89	29.86	29.66	29.71	30.36	30.67	30.20	30.08	22.81	24.21	24.64	23.89	22.68	24.22	48.39	46.75	32.30	32.34	34.43
SD	13.433	4.776	4.832	4.836	4.053	5.444	5.548	4.407	5.580	5.336	5.317	5.265	5.172	5.876	**4.673**	5.274	**4.096**	**5.293**	4.768	**3.314**	**4.768**
Total	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026

Note. Statistical Significance: * p<.05; ** p<.01

TABLE XLVII *a*

MODEL SUMMARY OF HIERARCHICAL REGRESSION

Model	R	R^2	Adjusted R Square	Std.Error of the Estimate	Change statistics				
					ΔR^2	F change	df1	df2	Sig. F change
1	.070	.005	.002	13.338	.005	1.647	9	2986	.096
2	.101	.010	.005	13.317	.005	2.624	6	2980	.015
3	.177	.031	.025	13.184	.021	13.018	5	2975	.000

TABLE XLVII *b*

ANOVA STATISTICS

Model		Sum of square	Df	Mean square	F	Sig.
1	Regression	2637.023	9	293.003	**1.647**	**.096**
	Residual	531236.534	2986	177.909		
	Total	533873.558	2995			
2	Regression	5429.010	15	361.934	**2.041**	**.010**
	Residual	528444.548	2980	177.330		
	Total	533873.558	2995			
3	Regression	16743.238	20	837.162	**4.816**	**.000**
	Residual	517130.319	2975	173.825		
	Total	533873.558	2995			

Model 1: (Constant) Linguistic, Logical, Bodily, Spatial, Musical, Naturalistic, Interpersonal, Intrapersonal and Existential

Model 2: (Constant), Linguistic, Logical, Bodily, Spatial, Musical, Naturalistic, Interpersonal, Intrapersonal, Existential, Enactive reproducing, Enactive constructive, Verbal reproducing, Verbal constructive, Figural reproducing, and Figural constructive

Model 3: (Constant), Linguistic, Logical, Bodily, Spatial, Musical, Naturalistic, Interpersonal, Intrapersonal, Existential, Enactive reproducing, Enactive constructive, Verbal reproducing, Verbal constructive, Figural reproducing, Figural constructive, Expert, Formal Authority, Demonstrator, Facilitator, and Delegator

Dependent Variable: English

iii. Hierarchical regression model

Table XLVIII and Figure 35 depict the hierarchical regression model quantifying the predictive capacity of each independent variable over the AA in English.

TABLE XLVIII

VARIABLE-WISE HIERARCHICAL REGRESSION MODEL ON AA IN ENGLISH

Predictors	R	R^2	ΔR^2	B	SE	β	T	Sig.
Model 1								
Constant				53.205	2.184		24.361	.000
Linguistic	.170[a]	.005		.135	.072	.048	1.865	.062
Logical				-.035	.074	-.013	-.474	.636
Bodily-Kinesthetic				-.098	.089	-.036	-1.109	.267
Spatial				.083	.090	.025	.927	.354
Musical				.099	.087	.041	1.142	.253
Naturalistic				.132	.089	.055	1.479	.139
Interpersonal				-.001	.087	.000	-.011	.991
Intrapersonal				-.003	.092	-.001	-.037	.970
Existential				-.164	.103	-.066	-1.590	.112
Model 2								
Constant				52.160	2.847		18.323	.000
Linguistic	.101[b]	.010*	.005	.116	.074	.041	1.552	.121
Logical				-.058	.076	-.021	-.760	.447
Bodily-Kines.				-.111	.092	-.040	-1.210	.226
Spatial				.044	.091	.013	.487	.626
Musical				.107	.087	.044	1.223	.222
Naturalistic				.152	.090	.063	1.700	.089
Interpersonal				.037	.088	.012	.424	.672
Intrapersonal				.029	.093	.012	.314	.754
Existential				-.194	.105	-.077	-1.851	.064
Enactive Repro…				.074	.057	.030	1.294	.196

Cont….

Predictors	R	R^2	ΔR^2	B	SE	β	T	Sig.
Enactive Constru..				.081	.110	.032	.737	.461
Verbal Repro				.041	.048	.016	.843	.399
Verbal Constru..				.032	.048	.014	.670	.503
Figural Repro..				**-.198**	**.061**	**-.069**	**-3.278****	**.001**
Figural Constru..				.033	.106	.013	.313	.754
Model 3								
Constant				60.386	4.760		12.686	.000
Linguistic	.177[c]	.018**	.031	.110	.074	.040	1.490	.136
Logical				-.078	.076	-.028	-1.027	.305
Bodily-Kinesthetic				-.114	.091	-.041	-1.248	212
Spatial				.077	.090	.023	.854	.393
Musical				.082	.087	.034	.951	.342
Naturalistic				.144	.089	.060	1.622	.105
Interpersonal				.069	.087	.023	.789	.430
Intrapersonal				.003	.092	.001	.035	.972
Existential				-.136	.104	-.055	-1.313	.189
Enactive Repro…				.065	.057	.026	1.145	.252
Enactive Constru..				.059	.109	.023	.541	.589
Verbal Repro				.064	.048	.025	1.328	.184
Verbal Constru..				.047	.048	.021	.987	.324
Figural Repro..				**-.159**	**.060**	**-.056**	**-2.641****	**.008**
Figural Constru..				.044	.105	.017	.416	.677
Expert				**-.227**	**.063**	**-.070**	**-3.619****	**.000**
Formal Authority				**.106**	**.047**	**.042**	**2.272***	**.023**
Demonstrator				.086	.055	.031	1.573	.116
Facilitator				**.181**	**.081**	**.045**	**2.223***	**.026**
Delegator				**-.385**	**.058**	**-.138**	**-6.648****	**.000**

Predictors predicting AA in English

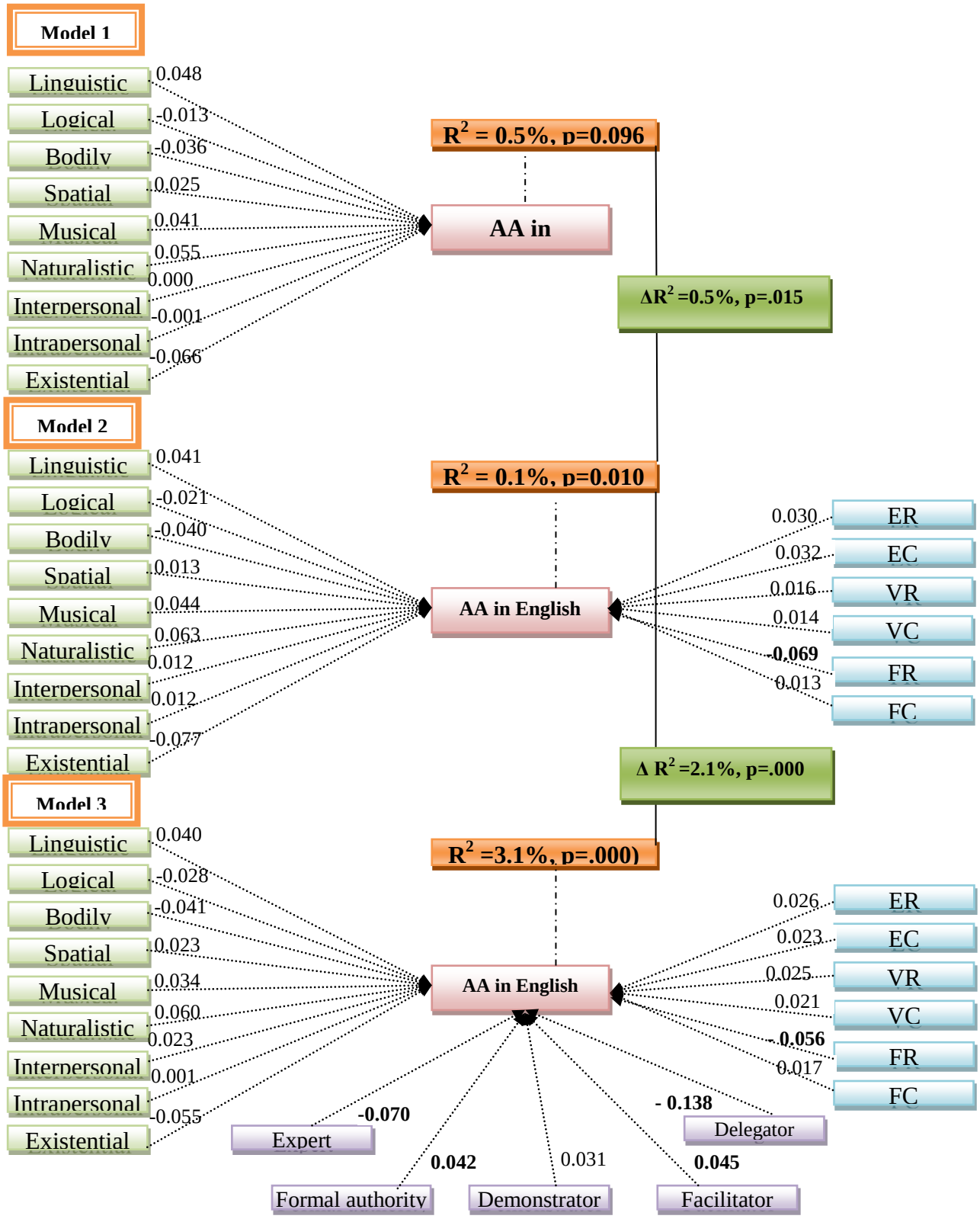


Figure 35

The hierarchical multiple regression revealed that in model 1, the first block of predictors, the 9 domains of MI did not contribute significantly to the regression model (F (9, 2986) =1.647, p>.05) and accounted for an insignificant variation of 0.5 percent (R^2 = .005) in the marks procured in English as a subject of study. Introducing the six types of LS in the second block explained an additional variation of (R^2 = .005) 0.5 percent and this change in ΔR^2 was significant and the overall R^2 was .01 projecting a small effect size.

Adding TP to the regression model explained an additional variance of 2.1% in the English score and this R^2 change was also significant (ΔR^2 =.021, F (5, 2975) = 13.018, p <.000). Altogether, when all the 20 independent variables were included in stage three the significant R^2=.031 explains 3.1% variance in the English score being explained by the nine domains of MI - Linguistic, Logical, Bodily-Kinesthetic, Musical, Spatial, Naturalistic, Interpersonal, Intrapersonal and Existential intelligence, 6 types of LS - Enactive Reproducing, Enactive Constructive, Verbal Reproducing, Verbal Constructive, Figural Reproducing and Figural Constructive and five types of TP - Expert, Formal Authority, Demonstrator, Facilitator and Delegator with F (20,2975)=4816 and p< .000.

Looking into the final model none of the 9 domains of MI predicts the score in English. The most predominant positive predictors are the Formal Authority style of teaching (β = .042, p<.05) followed by the Facilitator type of teaching (β =.045, p<.05). However, there were quite some significant negative predictors in the final model indicating an inverse relationship between Delegator style of teaching (β = -.138, p<.01), Expert style of teaching (β = -.070, p<.01) and Figural reproducing style of learning (β =-.056, p <.01).

An increase in one unit of Facilitator style (SD=3.31) and Formal Authority (SD= 5.29) style of teaching increases the English score of the students by 0.045 marks and 0.042 marks. Moreover, the negative regression weight concerning Figural Reproducing, Expert style, and Delegator style of teaching signifies that the higher the score in these predictors not so higher the AA in English and vice versa. Hence, an increase in one unit of Figural reproducing (SD = 4.67), Expert (SD = 4.09), and Delegator (SD=4.76) would decrease the English score of student respondents by 0.056, 0.070, and 0.138 marks respectively.

Unlike Tamil, English being a special as well as a foreign language, calls for knowledge imparting as well as keeping the modern-day students in check. To make the students understand the prose, poetry as well as grammar concept of the Language, a Formal Authority style of teaching was called for where the teacher not only imparts Language-related knowledge but also provide the student respondents with proper learning goals and structure. This would aid the students in learning the Language correctly and thereby also lay a strong Language foundation for their higher studies and future. Once having imparted the necessary knowledge, it is also the responsibility of the teacher to act as a facilitator by guiding and encouraging the students to expand the knowledge that they have gained. As already indicated and as the model represents, learning English, a foreign language, was not facilitated by the teachers taking a consultative role by placing control and responsibility on the students to learn, a feature of the delegator style of teaching, All the more, Expert style of teaching also was observed to be inefficient in making the student respondents learn English. As understood, the Figural Reproducing style of learning adopted by the student might have an influence on other core subjects but did not gain momentum in learning English.

c. Predictors of Academic Achievement in Mathematics

A Hierarchical multiple regression model was used to examine the relationship between nine domains of MI; six types of LS adopted by student respondents, and five types of TP practiced by the teachers of these students with that of the AA in Mathematics to isolate the predictor that has significant influence in the scores procured in Mathematics. The statistical output of the hierarchical multiple regression is explained in three sections namely correlation analysis between the independent variables as well as the dependent and independent variables, model summary and ANOVA statistics of the hierarchical regression model and the variables-wise coefficient model.

i. Correlation Statistics

Table XLIX on descriptive statistics and correlation for all independent variables shows that none of these variables (9 domains of MI, 6 types of LS, 5 types of TP) were associated strongly with each other (p>.5). Hence the assumption of multicollinearity was met and henceforth the hierarchical regression was carried out for further interpretation. The correlation

statistic of all the independent variables over the dependent variable (AA in Mathematics) reveals that the 8 domains of MI except Existential intelligence were significantly related to the Mathematics score but with a weak correlation. The direction of the relationship was inverse with Linguistic intelligence. Concerning the LS, except for the Figural reproducing, none of the other LS had a significant correlation. Demonstrator and Facilitator type of TP did not find a place in influencing the Mathematics score. However, the Expert and Delegator had a weak positive correlation and the Formal Authority style had a weak negative correlation.

ii Model summary with ANOVA

Tables L a and L b specify the model summary and the ANOVA statistics of the hierarchical regression related to the AA in Mathematics.

TABLE XLIX

DESCRIPTIVE STATISTICS AND CORRELATIONS BETWEEN PREDICTOR VARIABLES AND AA IN MATHEMATICS

Variables	M	MI1	MI2	MI3	MI4	MI5	MI6	MI7	MI8	MI9	LS1	LS2	LS3	LS4	LS5	LS6	TS1	TS2	TS3	TS4	TS5
AA - Maths	1																				
Linguistic MI1	-.031**	1																			
Logical MI2	.054	.554**	1																		
Bodily MI3	.027	.558**	.565**	1																	
Spatial MI4	.043*	.523**	.431**	.569**	1																
Musical MI5	.027*	.532**	.547**	.695**	.539**	1															
Naturalistic MI6	.039*	.634**	.669**	.741**	.556**	.735**	1														
Interpersonal MI7	.037	.505**	.550**	.572**	.633**	.663**	.624**	1													
Intrapersonal MI8	.053*	.610**	.631**	.786**	.629**	.770**	.771**	.697**	1												
Existential MI9	.041	.504**	.649**	.666**	.650**	.811**	.791**	.709**	.765**	1											
Enactive Reproduce LS1	.076	-.036*	.224**	.199**	.062**	.077**	.095**	.033*	.094**	.169**	1										
Enactive Construct LS2	.037	-.090**	-.074**	-.072**	-.022	-.181**	-.155**	-.164**	-.131**	-.155**	.348**	1									
Verbal Reproduce LS3	.008	.032*	.069**	.061**	-.009	.010	.028	.001	.016	.032*	.189**	.131**	1								
Verbal Construct LS4	.014	.050**	.139**	.126**	.033*	.026	.017	-.013	.018	.046**	.444**	.273**	.142**	1							
Figural Reproduce LS5	.002 **	-.125**	.024	.058**	-.078**	-.065**	-.051**	-.053**	-.011	-.053**	.321**	.401**	.120**	.310**	1						
Figural Construct LS6	.040	-.091**	-.066**	-.057**	-.026	-.160**	-.137**	-.150**	-.114**	-.134**	.313**	.901**	.129**	.242**	.377**	1					
Expert TS1	.114**	.093**	-.040	-.072*	-.076**	-.043	-.059	-.105**	-.061	-.109*	-.101**	-.061**	-.053**	-.022**	-.124**	-.049**	1				
Formal Authority TS2	-.082*	.038	-.012*	.003	-.010	-.013	-.018	-.014	-.009*	.003	-.022	-.029	.033	.018	-.049	-.021	.130**	1			
Demonstrator TS3	-.064	.031**	.007	-.040	-.013	-.013	-.007	-.022	-.032	-.023	-.013	-.026	-.012 *	.014*	-.010	-.018	.274**	-.347*	1		
Facilitator TS4	-.179	.113	-.051	-.069 *	-.024 *	-.038	-.051	-.053*	-.078**	-.072**	-.100	.023	-.033	-.031	-.030*	.023	.020**	-.027**	-.063**	1	
Delegator TS5)	.028**	.069	-.047*	-.023 *	.024**	-.006*	-.025**	.005**	-.028*	-.015**	-.049	.050*	.037**	-.050*	-.035**	.041*	-.311**	.189**	-.296**	407**	1
Mean	52.41	29.80	29.86	29.86	29.66	29.71	30.36	30.67	30.20	30.08	22.81	24.21	24.64	23.39	22.68	24.22	46.80	45.69	31.52	31.30	33.84
SD	11.98	**4.776**	**4.832**	4.836	**4.053**	5.444	**5.548**	4.407	**5.580**	**5.336**	**5.317**	5.265	5.173	5.876	4.673	**5.274**	5.037	**4.694**	**4.227**	**3.277**	**4.908**
Total	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026

Note. Statistical Significance: * $p<.05$; ** $p<.01$;

TABLE L a

MODEL SUMMARY OF HIERARCHICAL REGRESSION

Model	R	R^2	Adjusted R Square	Std.Error of the Estimate	Change statistics				
					ΔR	F change	df1	df2	Sig. F change
1	.218	.048	.045	10.544	.048	16.091	9	2897	.000
2	.240	.058	.053	10.499	.010	5.118	6	2891	.000
3	.342	.117	.111	10.170	.060	39.005	5	2886	.000

TABLE L b

ANOVA STATISTICS

Model		Sum of square	Df	Mean square	F	Sig.
1	Regression	16099.753	9	1788.861	**16.091**	**.000**
	Residual	322072.748	2897	111.175		
	Total	338172.502	2906			
2	Regression	19484.546	15	1298.970	**11.784**	**.000**
	Residual	318687.955	2891	110.235		
	Total	338172.502	2906			
3	Regression	39656.888	20	1982.844	**19.170**	**.000**
	Residual	298515.614	2886	103.436		
	Total	338172.502	2906			

Model 1: (Constant) Linguistic, Logical, Bodily, Spatial, Musical, Naturalistic, Interpersonal, Intrapersonal and Existential
Model 2: (Constant), Linguistic, Logical, Bodily, Spatial, Musical, Naturalistic, Interpersonal, Intrapersonal, Existential, Enactive reproducing, Enactive constructive, Verbal reproducing, Verbal constructive, Figural reproducing, and Figural constructive
Model 3: (Constant), Linguistic, Logical, Bodily, Spatial, Musical, Naturalistic, Interpersonal, Intrapersonal, Existential, Enactive reproducing, Enactive constructive, Verbal reproducing, Verbal constructive, Figural reproducing, Figural constructive, Expert, Formal Authority, Demonstrator, Facilitator, and Delegator
Dependent Variable: Mathematics

iii. Hierarchical regression model

Table LI and Figure 36 show the hierarchical regression model quantifying the predictive capacity of each independent variable over the AA in Mathematics.

TABLE LI
VARIABLE- WISE HIERARCHICAL REGRESSION MODEL ON AA IN MATHEMATICS

Predictors	**R**	**R^2**	**ΔR^2**	**B**	**SE**	**B**	**T**	**Sig.**
Model 1								
Constant				51.119	1.756		29.105	.000
Linguistic	.218[a]	.048**		**-.679**	**.061**	**-.291**	**-11.060****	**.000**
Logical				**.255**	**.060**	**.114**	**4.247****	**.000**
Bodily-Kinesthetic				-.035	.071	-.016	-.490	.624
Spatial				**.243**	**.072**	**.091**	**3.393****	**.001**
Musical				-.075	.070	-.038	-1.071	.284
Naturalistic				**.190**	**.072**	**.098**	**2.655****	**.008**
Interpersonal				.024	.070	.010	.351	.726
Intrapersonal				**.277**	**.074**	**.143**	**3.742****	**.008**
Existential				**-.193**	**.083**	**-.095**	**-2.322***	**.020**
Model 2								
Constant				49.427	2.280		21.676	.000
Linguistic	.240[b]	.058**	.010**	**-.655**	**.063**	**-.281**	**-10.399****	**.000**
Logical				**.214**	**.062**	**.096**	**3.465****	**.001**
Bodily-Kines.				-.069	.073	-.031	-.945	.345
Spatial				**.207**	**.073**	**.078**	**2.844****	**.004**
Musical				-.053	.070	-.027	-.753	.451
Naturalistic				**.214**	**.072**	**.110**	**2.979****	**.003**
Interpersonal				.069	.070	.028	.991	.322
Intrapersonal				**.299**	**.074**	**.155**	**4.028****	**.000**
Existential				**-.236**	**.084**	**-.117**	**-2.815****	**.005**
Enactive Reproduce.				**.177**	**.046**	**.087**	**3.836****	**.000**
Enactive Construct.				.102	.090	.050	1.126	**Cont….**

Predictors	**R**	**R^2**	**ΔR^2**	**B**	**SE**	**B**	**T**	**Sig.**
Verbal Reproduce.				-.029	.039	-.014	-.746	.456
Verbal Construct.				-.049	.039	-.026	-1.260	.208
Figural Reproduce.				**-.131**	**.048**	**-.057**	**-2.716****	**.007**
Figural Construct.				.021	.087	.010	.242	.809
Model 3								
Constant				85.881	4.533		18.946	.000
Linguistic	.342[c]	.117**	.060**	**-.473**	**.064**	**-.203**	**-7.433****	**.000**
Logical				**.207**	**.060**	**.093**	**3.446****	**.001**
Bodily-Kinesthetic				-.099	.071	-.045	-1.398	.162
Spatial				**.184**	**.070**	**.069**	**2.608****	**.009**
Musical				-.023	.068	-.012	-.341	.733
Naturalistic				**.176**	**.070**	**.091**	**2.521***	**.012**
Interpersonal				.020	.068	.008	.295	.768
Intrapersonal				**.229**	**.072**	**.119**	**3.171****	**.002**
Existential				**-.230**	**.082**	**-.114**	**-2.814****	**.005**
Enactive Repro…				**.144**	**.045**	**.071**	**3.222****	**.001**
Enactive Constru..				.057	.088	.028	.646	.519
Verbal Repro				-.052	.038	-.025	-1.379	.168
Verbal Constru..				-.034	.038	-.018	-.906	.365
Figural Repro..				**-.126**	**.047**	**-.055**	**-2.690****	**.007**
Figural Constru..				.063	.085	.031	.739	.460
Expert				-.055	.044	-.026	-1.255	.210
Formal Authority				**-.215**	**.046**	**-.094**	**-4.695****	**.000**
Demonstrator				**-.171**	**.051**	**-.068**	**-3.332****	**.001**
Facilitator				**-.824**	**.066**	**-.251**	**-12.552****	**.000**
Delegator				**.242**	**.047**	**.112**	**5.118****	**.000**

The three-stage hierarchical multiple regression statistics projected in Table LI examine the relationship between the 5 types of TP adopted by the teachers of the respondents (Model- 3) against the dependent variable – AA in Mathematics – after controlling the effect of 9 MI domains (Model 1) and 6 types of LS (Model 2) possessed by the respondents.

The R-value of the 1st model (with 9 domains of MI as predictors of Mathematics score) was 0.218, thus a positive relationship existed between the predictor variables and outcome variables. The R^2 (0.048 or 4.8%) was significant with F (9, 2897) =16.091, p< .000, and hence MI of the selected respondents accounted for 4.8% of their marks procured in Mathematics.

Model 2, with a total of 15 predictor variables (9 domains of MI and 6 types of LS), had a significant improvement over the previous model with an R of 0.240 and R^2 of .058, thus 5.8% of the variance had been accounted for the score in mathematics. The change in F accounted for a significant 1% variance (Δ in F (6, 2891) = 5.118, p<.000). Hence, the second set of predictors (LS) could also predict the improvement in Mathematics.

The final model (Model - 3) with a total of 20 predictor variables (9 types of MI - Linguistic, Logical, Bodily-Kinesthetic, Musical, Spatial, Naturalistic, Interpersonal, Intrapersonal and Existential intelligence, 6 types of LS - Enactive Reproducing, Enactive Constructive, Verbal Reproducing, Verbal Constructive, Figural Reproducing and Figural Constructive and five types of TP - Expert, Formal Authority, Demonstrator, Facilitator and Delegator) gave an escalated R value of 0.342 and with an R^2 of 0.117, thus 11.7% of variance. Also, the change in R^2 was significant F (5, 2886) = 39.005, p< .000, and thus the TP adopted by the teachers could predict the Mathematics score of the respondents.

The ANOVA results provided in Table L*b* portray the significance of each of the three models (9 predictors, 15 predictors and 20 predictors respectively). It could be seen that all models were significant with p<.000 and the F value for the third model is the largest [F (20, 2886) =19.170]. The F values denote the overall predictive effects and are different from the F for the amount of change experienced when adding variables, The ANOVA table also shows a least F value (F (6, 2891) =11.784, p<.000) in the second model when compared to the other

two models, thus explaining the least predictive effects of the learning style adopted by the respondents.

Table XLIX shows the β coefficients for the constant and the 20 predictors of the AA in Mathematics. The best fitting model to predict the AA in Mathematics could be derived from the significant β and the t value greater than 2. However, certain predictors were bearing a negative regression weight. In other words, the predictors with negative β have an inverse relationship with the outcome variables (higher the value lower the AA in Mathematics).

The positively related significant predictors in the final model are Logical Intelligence, Spatial intelligence, Naturalistic intelligence, Intrapersonal intelligence, Enactive reproducing, and Delegator style. The negatively related significant predictors are Linguistic Intelligence, Existential, Figural Reproducing, Formal Authority, Demonstrator and Facilitator. Hence the model derived was given below:

Y (AA in Mathematics) *= β_0 + .093 (Logical intelligence) + .069 (Spatial intelligence) +.091(Naturalistic intelligence) + .119(Intrapersonal intelligence) +.071(Enactive Reproducing) +.112 (Delegator) – .203 (Linguistic Intelligence) – .114(Existential intelligence) – .055 (Figural reproducing) –.094 (Formal authority) –.068(Demonstrator) – .251(Facilitator).*

A study carried out by Aswin et al. (2021) found that Intrapersonal Intelligence contributes to students' Mathematics learning achievement. As Intrapersonal intelligence is the ability to understand one's self and utilise this understanding to make decisions and communicate, students with high Intrapersonal intelligence take up the responsibility for the task provided to them. Hence, a student with high Intrapersonal intelligence has had high achievement in learning Mathematics.

A supportive study done by Callman (2014) states that the Logical intelligence of senior secondary school students and their AA in Mathematics showed a significant relationship. Another study done by Liu et al. (2021) stated that there existed a significant correlation between Spatial intelligence and AA in Mathematics. All of the above indicate very strongly that a student who has high Intrapersonal, Logical and Spatial intelligence does

exhibit high AA in Mathematics. Hence, the study strongly recommends that an improvement in a student's Intrapersonal, Logical and Spatial intelligence is essential to improve their score in Mathematics.

However, Linguistic and Existential intelligence with their negative regression weight indicate that they are inversely proportional to the dependent variable (Mathematics). In other words, students who possess high levels of Linguistic and Existential intelligence do not score highly in Mathematics.

Concerning the learning style adopted by the selected respondents, Enactive reproducing had a β value of .071 with a positive regression weight. Enactive reproducing refers to action-based concrete experiences. The emphasis is on imitation and practice. The key characteristic is reproducing which prompts the students to practice the concepts over and over again and reproduce them during their Mathematics exam. Figural reproducing refers to visual experience related to making diagrams, charts, pictures, maps and photographs. The negative regression weight indicates that the higher use of Figural reproducing learning lowers the AA in Mathematics.

As per the final regression model, the Formal authority, Facilitator and Demonstrator styles of teaching with their negative regression weight are found to be inversely proportional to the dependent variable (Mathematics score). With the changing needs of the students, modern-day classrooms have also changed drastically; students no longer like to be kept in control with the old school of thinking techniques like the Formal authority, Demonstrator and Facilitator. The students responded positively to the Delegator style of teaching as it was not only perceived as the modern style of teaching but also created a friendly rapport between the teacher and the students thereby totally discarding the traditional authority. Accordingly, a concordant study by Canto-Herrera and Salazar-Carballo (2010) pointed out that, the Delegator type of teaching style was found to have an impact on the student’s academic achievement in Mathematics. The figure demonstrates the overall predictive capacity of the predictor variable over the outcome variables – AA in Mathematics.

\Predictors Predicting AA in Mathematics

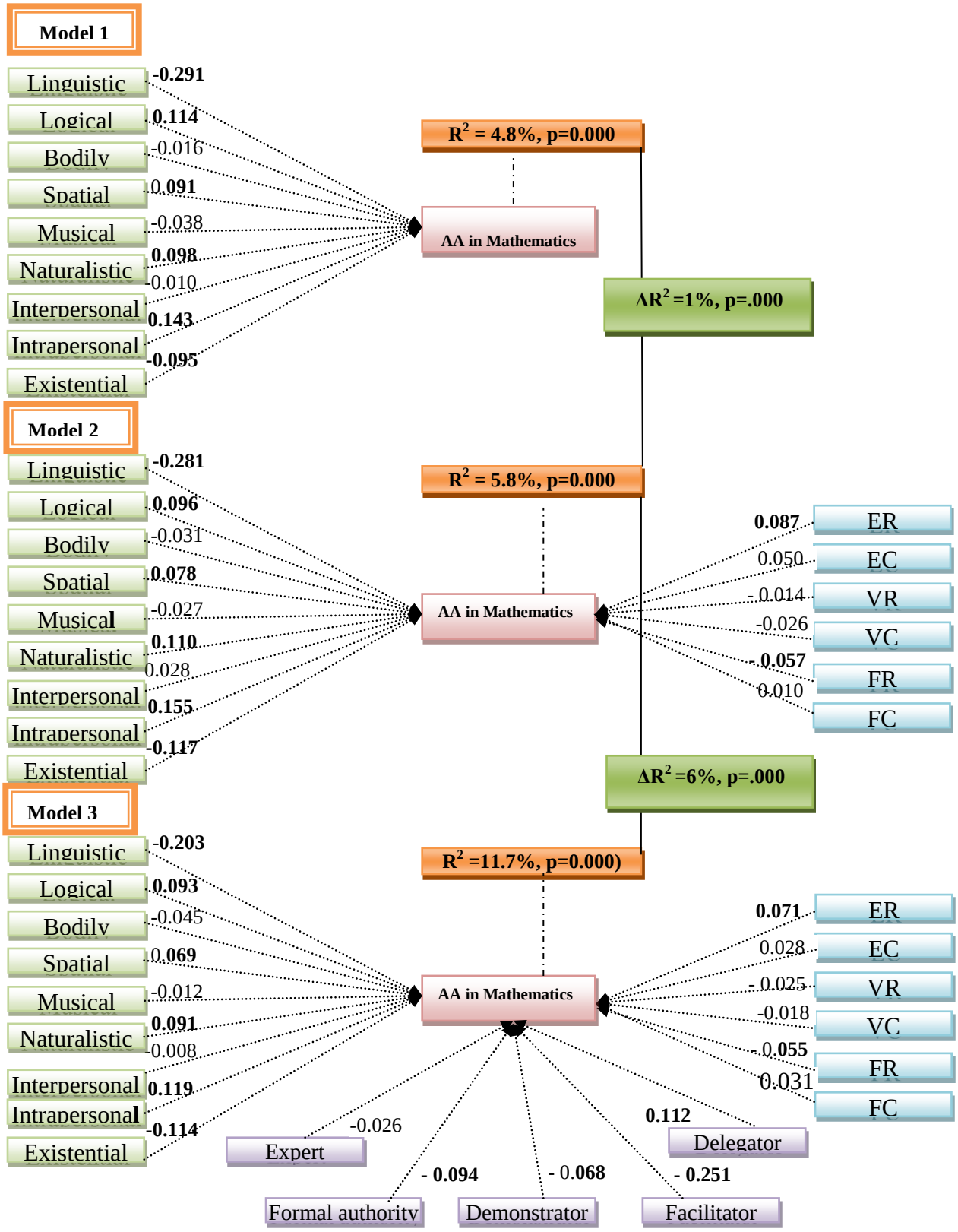


Figure 36

d. Predictors of Academic Achievement in Science

A hierarchical multiple regression model was used to observe the relationship between 9 domains of MI and 6 types of LS adopted by student respondents; 5 types of TP practiced by the teachers of these respondents with that of the AA in Science to isolate the predictors having significant influence in the scores obtained in Science. The statistical output of the hierarchical multiple regressions is explained in three sections namely correlation statistics, model summary and ANOVA, and hierarchical regression model.

ii. Correlation Statistics

Table LII on descriptive statics and correlations for all the independent variables shows that none of these variables (9 domains of MI, 6 types of LS, and 5 types of TP) correlated strongly with each other. Hence, the assumption of multicollinearity is met and the hierarchical regression can be carried out for further interpretation.

The correlation coefficient of the dependent variable shows significant positive correlating independent variables namely, Logical (.554), Bodily-kinesthetic (-.565), Spatial (-569), Musical (-.539), Naturalistic (-.735), Interpersonal (.624), Intrapersonal (-.697) and Existential (-.765) in MI; Enactive Reproducing (-.169), Enactive Constructive (-.348), Verbal Reproducing (-.131), Verbal Constructive (-.142), Figural Reproducing (-.310), and Figural Constructive (-.377) in LS; Expert (- .034), and Delegator (-.544) in TP. Meanwhile, the negative independent variables are Linguistic (-.089) in MI; Formal Authority (-.085) and Facilitator (-.232) in TP.

ii Model summary with ANOVA

Tables LIII *a* and LIII *b* detail the model summary and the ANOVA statistics of the hierarchical regression related to the AA in Science.

TABLE LII

DESCRIPTIVE STATISTICS AND CORRELATIONS BETWEEN PREDICTOR VARIABLES AND AA IN SCIENCE

Variables	M	MI1	MI2	MI3	MI4	MI5	MI6	MI7	MI8	MI9	LS1	LS2	LS3	LS4	LS5	LS6	TS1	TS2	TS3	TS4	TS5
AA – Science	1																				
Linguistic MI1	-.089**	1																			
Logical MI2	.053**	.554**	1																		
Bodily MI3	.060 **	.558**	.565**	1																	
Spatial MI4	.055**	.523**	.431**	.569**	1																
Musical MI5	.034*	.532**	.547**	.695**	.539**	1															
Naturalistic MI6	.041*	.634**	.669**	.741**	.556**	.735**	1														
Interpersonal MI7	.044 **	.505**	.550**	.572**	.633**	.663**	.624**	1													
Intrapersonal MI8	.062*	.610**	.631**	.786**	.629**	.770**	.771**	.697**	1												
Existential MI9	.054**	.504**	.649**	.666**	.650**	.811**	.791**	.709**	.765**	1											
Enactive Reproduce LS1	.082**	-.036*	.224**	.199**	.062**	.077**	.095**	.033*	.094**	.169**	1										
Enactive Construct LS2	.044 **	-.090**	-.074**	-.072**	-.022**	-.181**	-.155**	-.164**	-.131**	-.155**	.348**	1									
Verbal Reproduce LS3	.010	.032*	.069**	.061**	-.009	.010	.028	.001	.016	.032*	.189**	.131**	1								
Verbal Construct LS4	.009	.050**	.139**	.126**	.033	.026	.017	-.013	.018	.046**	.444**	.273**	.142**	1							
Figural Reproduce LS5	.033*	-.125**	.024	.058**	-.078*	-.065**	-.051**	-.053**	-.011	-.053**	.321**	.401**	.120**	.310**	1						
Figural Construct LS6	.045**	-.091**	-.066**	-.057**	-.026**	-.160**	-.137**	-.150	-.114**	-.134**	.313**	.901**	.129**	.242**	.377**	1					
Expert TS1	.104**	-.074**	-.005	-.035**	-.012	.021	.013	-.015**	-.032*	.024	.053**	-.034*	-.112**	.006	.036*	.034*	1				
Formal Authority TS2	-.248**	.114 **	-.062**	.089 *	-.059	-.051**	-.068**	-.098*	-.092**	-.108**	-.129**	-.076**	-.029	-.057**	-.064**	-068**	-.085**	1			
Demonstrator TS3	-.054**	-.135**	-.007	-.043**	.010**	.017	.017	.032	.041 *	.035 *	.058 **	-.014	.006	.020	.128 **	-.010	.192**	-.027	1		
Facilitator TS4	.140**	-.052**	.027	-.045**	.045**	.027	.033 *	.055*	-.043**	.056**	.091 **	.049 **	.052 **	.032 *	.055*	.048 **	.250**	-.117**	-.232**	1	
Delegator TS5)	.066**	-.076 **	-.015	-.036 *	.023	.020	.003	.017**	-.041	.011	.049 **	.066**	.055**	.061**	.055**	.076*	.132**	.058**	-.446**	544**	1
Mean	50.51	29.80	29.89	29.86	29.66	29.71	30.36	30.67	30.20	30.08	22.81	24.21	24.64	23.39	22.68	24.22	46.21	45.68	30.79	32.28	33.96
SD	10.32	**4.776**	**4.832**	4.836	**4.053**	5.444	**5.548**	4.407	**5.580**	**5.336**	5.317	5.265	5.173	**5.876**	**4.673**	5.274	**5.231**	**4.875**	5.374	**4.792**	5.341
Total	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026

Note. Statistical Significance* p<.05; ** p<.01;

TABLE LIII a

MODEL SUMMARY OF HIERARCHICAL REGRESSION

Model	R	R^2	Adjusted R Square	Std. Error of the Estimate	Change statistics				
					ΔR	F change	df1	df2	Sig. F change
1	.278	.077	.074	9.219	.077	26.533	9	2861	.000
2	.293	.086	.081	9.185	.009	4.600	6	2855	.000
3	.393	.155	.149	8.841	.069	46.327	5	2850	.000

TABLE LIII b

ANOVA STATISTICS

Model		Sum of square	Df	Mean square	F	Sig.
1	Regression	20297.300	9	2255.256	**26.533**	**.000**
	Residual	243179.622	2861	84.998		
	Total	263476.922	2870			
2	Regression	22625.551	15	1508.370	**17.880**	**.000**
	Residual	240851.371	2855	84.361		
	Total	263476.922	2870			
3	Regression	40729.297	20	2036.465	**26.056**	**.000**
	Residual	222747.624	2850	78.157		
	Total	263476.922	2870			

Model 1: (Constant) Linguistic, Logical, Bodily, Spatial, Musical, Naturalistic, Interpersonal, Intrapersonal and Existential

Model 2: (Constant), Linguistic, Logical, Bodily, Spatial, Musical, Naturalistic, Interpersonal, Intrapersonal, Existential, Enactive reproducing, Enactive constructive, Verbal reproducing, Verbal constructive, Figural reproducing, and Figural constructive

Model 3: (Constant), Linguistic, Logical, Bodily, Spatial, Musical, Naturalistic, Interpersonal, Intrapersonal, Existential, Enactive reproducing, Enactive constructive, Verbal reproducing, Verbal constructive, Figural reproducing, Figural constructive, Expert, Formal Authority, Demonstrator, Facilitator, and Delegator

Dependent Variable: Science

iii. Hierarchical regression model

Table LIV and Figure 37 portray the hierarchical regression model quantifying the predictive capacity of each independent variable over the AA in Science.

TABLE LIV

VARIABLE-WISE HIERARCHICAL REGRESSION MODEL OF AA IN SCIENCE

Predictors	R	R^2	ΔR^2	B	SE	B	T	Sig.
Model 1								
Constant				50.065	1.549		32.323	.000
Linguistic	.278	077**		**-.765**	**.053**	**-.376**	**-14.403****	**.000**
Logical				**.235**	**.054**	**.118**	**4.326****	**.000**
Bodily-Kinesthetic				.123	.064	.062	1.918	.055
Spatial				**.227**	**.065**	**.096**	**3.503****	**.000**
Musical				-.065	.064	-.037	-1.025	.306
Naturalistic				**.156**	**.064**	**.091**	**2.455***	**.014**
Interpersonal				.020	.063	.009	.312	.755
Intrapersonal				**.274**	**.067**	**.159**	**4.092****	**.000**
Existential				**-.198**	**.075**	**-.111**	**-2.625****	**.009**
Model 2								
Constant				47.919	2.015		23.786	.000
Linguistic	.293	086**	.009**	**-.747**	**.054**	**-.367**	**-13.721****	**.000**
Logical				**.209**	**.055**	**.105**	**3.774****	**.000**
Bodily-Kines.				.104	.066	.052	1.562	.118
Spatial				**.193**	**.066**	**.082**	**2.947****	**.003**
Musical				-.045	.064	-.026	-.708	.479
Naturalistic				**.172**	**.064**	**.100**	**2.681****	**.007**
Interpersonal				.058	.063	.026	.910	.363
Intrapersonal				**.283**	**.067**	**.164**	**4.210****	**.000**
Existential				**-.224**	**.076**	**-.126**	**-2.949****	**.003**

Cont….

Predictors	R	R^2	ΔR^2	B	SE	B	T	Sig.
Enactive Reproduce.				**.128**	**.041**	**.071**	**3.158****	**.002**
Enactive Construct.				.099	.077	.055	1.295	.195
Verbal Reproduce.				-.004	.034	-.002	-.108	.914
Verbal Construct.				-.061	.034	-.037	-1.774	.076
Figural Reproduce.				**-.100**	**.043**	**-.048**	**-2.326***	**.020**
Figural Construct.				.028	.074	.015	.375	.707
Model 3								
Constant				59.897	3.298		18.162	.000
Linguistic	.393	155**	.069**	**-.559**	**.055**	**-.275**	**-10.245****	**.000**
Logical				**.206**	**.053**	**.104**	**3.863****	**.000**
Bodily-Kinesthetic				.064	.064	.032	.996	.319
Spatial				**.183**	**.063**	**.077**	**2.903****	**.004**
Musical				.007	.061	.004	.121	.904
Naturalistic				**.131**	**.062**	**.076**	**2.122***	**.034**
Interpersonal				-.010	.061	-.004	-.160	.873
Intrapersonal				**.238**	**.065**	**.138**	**3.657****	**.000**
Existential				**-.269**	**.073**	**-.151**	**-3.667****	**.000**
Enactive Repro…				**.097**	**.039**	**.054**	**2.471***	**.014**
Enactive Constru..				.050	.074	.028	.679	.497
Verbal Repro				.013	.033	.007	.407	.684
Verbal Constru..				**-.069**	**.033**	**-.042**	**-2.077***	**.038**
Figural Repro..				**-.096**	**.042**	**-.046**	**-2.298***	**.022**
Figural Constru..				.039	.071	.021	.540	.589
Expert				**.088**	**.033**	**.048**	**2.646****	**.008**
Formal Authority				**-.447**	**.036**	**-.228**	**-12.549****	**.000**
Demonstrator				-.007	.037	-.004	-.182	.855
Facilitator				**.232**	**.042**	**.115**	**5.459****	**.000**
Delegator				-.034	.041	-.019	-.833	.405

Predictors predicting AA in Science

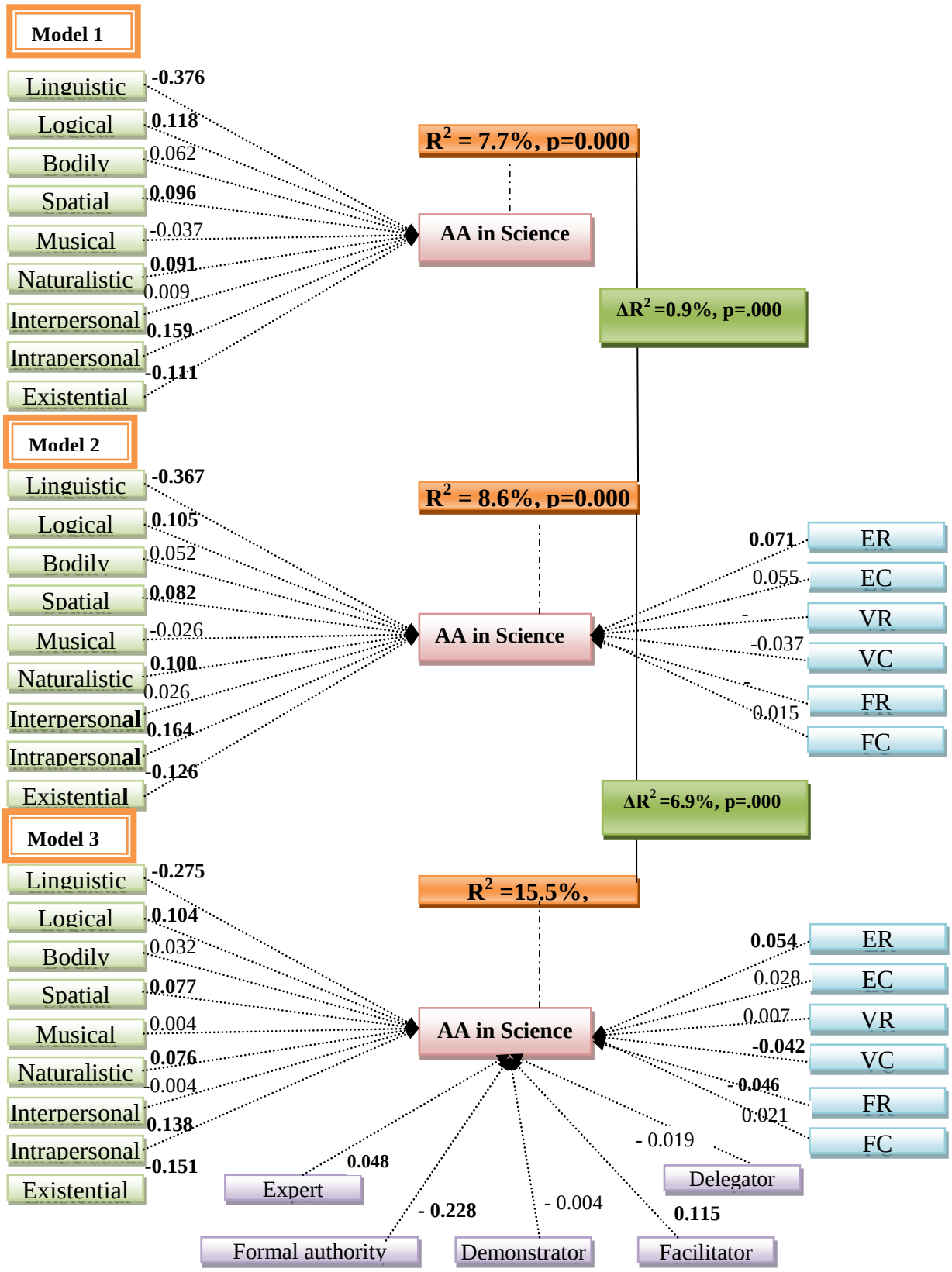


Figure 37

Model 3 of Table LIV assesses the relationship between the 5 types of TP adopted by the teachers of the respondents against the dependent variable – AA in Science – after controlling for the effect of 9 domains of MI and 6 types of LS adopted by the targeted children in the 1st and 2nd model respectively.

The R-value of the 1st model (with 9 domains of MI as predictors of Science score) was 0.278, thus a positive relationship existed between the predictor variables and outcome variables. The R^2 (0.077 or 7.7%) was significant with F (9, 2861) = 26.533, p< .000, and hence MI could account for 7.7% of the variance in the Science marks.

Model – 2, with a total of 15 predictor variables (9 domains of MI and 6 types of LS), reported a significant improvement over the previous model with an R of 0.293 and an R^2 change of .009. Thus 0.9 % of the variance had been accounted for the improvement in the marks scored in Science {Δ in F (6, 2855) =4.600, p < 0.000}. Hence, the second set of predictors (LS) also predicts the improvement in the marks obtained in Science.

The final model (Model - 3) with a total of 20 predictor variables (9 types of MI - Linguistic, Logical, Bodily-Kinesthetic, Musical, Spatial, Naturalistic, Interpersonal, Intrapersonal and Existential intelligences, 6 types of LS - Enactive Reproducing, Enactive Constructive, Verbal Reproducing, Verbal Constructive, Figural Reproducing and Figural Constructive and five types of Teaching Pedagogy - Expert, Formal Authority, Demonstrator, Facilitator and Delegator) gave an escalated R-value of 0.393 with an R^2 of 0.155, thus 15.5% variance. The change in R^2 was also significant with F (5, 2850) = 46.327, p<.000, thus the TP adopted by the teachers predicted the Science marks obtained by the selected student respondents.

The ANOVA result exhibits the significance of each of the three models (9 predictors, 15 predictors and 20 predictors respectively). It could be observed that all the models were significant with p<.000 and the F value for the third model as the largest (F (20, 2850) =26.056). The F values denote the overall predictive effect and are different from the F for the amount of change experienced when adding a variable. The ANOVA table also displays the least F value in the second model when compared to the other two models, thus explaining the least predictive effects of the LS adopted by the students.

Table LIV shows the β coefficients for the constant and the 20 predictors of the AA in Science. The best fitting model to predict the AA in Science could be derived from the significant β and the t value greater than 2. However, certain predictors bore a negative regression weight. In other words, the predictors with negative β have an inverse relationship with the outcome variables (higher the values of the predictor lower the AA in Science).

The positively related significant predictors are Logical intelligence, Spatial intelligence, Naturalistic intelligence, Intrapersonal intelligence, Enactive reproducing, Facilitator style and Expert style. The negatively related significant predictors are Linguistic intelligence, Existential Intelligence, Verbal constructive, Figural reproducing, and Formal authority. Hence the model derived is given below:

Y (AA in Science) = β_0 + .104 (Logical intelligence) + .077 (Spatial intelligence) +.076(Naturalistic intelligence) + .138 (Intrapersonal intelligence) +.054(Enactive reproducing) +.048 (Expert) + .115 (Facilitator) – .275 (Linguistic intelligence) – .151 (Existential intelligence) –.042 (Verbal Constructive) – .046 (Figural reproducing) –.228 (Formal authority).

A supportive study carried out by Williamson and Andrew (2018) stated that there existed a significant positive correlation between Spatial abilities and AA, specifically Science. The study done by Pérez et al. (2014) also stated that it was Logical intelligence that showed significant relationships with academic performance resulting in better AA. Another supportive study done by Ahvan and Pour (2016) revealed that there was a positive significant relationship between Logical, Spatial, Naturalistic and Intrapersonal intelligence and AA of students.

Linguistic with a negative regression weight indicates that it has an inverse relationship with the dependent variable (Science marks). In other words, students with high Linguistic intelligence scores do not score well in Science subject. Science being an important core subject calls for the application of various types of intelligence as it involves facts and figures like Mathematics as well as charts and diagrammatic representations like Social science and also precise verbatim presentation like in the case of Language. Our target segment does not fare very highly in the required set of Multiple Intelligence hence, tend to exhibit below average and average academic performance in this subject. This is an area that needs to be studied closely and separately and come up with improving strategies for both MI as well as AA.

A study was done by Gill (2020) to find out the relationship between the Enactive, Figural and Verbal learning styles and AA of higher secondary students. It revealed that there exists a positive correlation between the various learning styles and the students' AA. However, the value of correlation is very low and not significant whereas, the present study's findings reveal that the Enactive reproducing type of LS alone exhibits high coefficient loadings. This may be due to the reason that the target respondents of the present study are only at the early high school level with their learning styles too being very nascent. Moreover, Science is one of the important subjects they do not want to experiment with learning on their own and hence, adopt the Enactive reproducing style that calls for imitation and practice and reproduce what the teacher teaches in class.

Science by nature is such a subject that involves exploration, experimentation etc. and is also perceived to be one of the important core subjects from the school level onwards. Hence, ideally, it can be associated with a more exploratory method of teaching. However, in the present study, the teachers handling Science subjects are well experienced and they put in their best as experts in teaching Science by following the conservative blackboard method and following it up with Facilitator style.

Similar to Mathematics, the Formal authority style of teaching doesn't go well with the target respondents. The negative regression weight is a clear indicator of the fact that the higher the score of teachers in Formal authority lower the average marks procured in Science by the students. This is per the modern-day teacher-student relationship wherein the teacher has to establish a balance between maintaining a friendly atmosphere in the classroom and at the same time being strict when it comes to concept teaching.

e. Predictors of Academic Achievement in Social Science

A three-stage hierarchical multiple regression was conducted with AA in the Social Science subject (dependent variable). Nine domains of MI were entered at stage 1 of the regression and controlled for further stages. The six types of LS were entered at stage 2 and the five types of TP at stage 3. Inter correlation between the variables used in the multiple regression model was reported in Table LV, the summary of the model, in Table LVI a and the variable-wise regression statistics in Table LVI b. The hierarchical regression model was displayed in Table LVII.

iii. Correlation Statistics

Table LV on descriptive statistics and correlation for all independent variables shows that none of these variables (9 domains of MI, 6 types of LS, 5 types of TP) associated strongly with each other ($p>.05$). Hence the assumption of multicollinearity was met and henceforth the hierarchical regression was carried out for further interpretation. The correlation statistics of all the independent variables over the dependent variable (AA in Social science) revealed that the 8 domains of MI except the Intrapersonal intelligence were significantly related to the Social science score but with a weak correlation. The direction of the relationship was inverse with Linguistic intelligence alone. Four out of six types of LS were correlated. To be specific, Enactive Reproducing had a strong positive correlation; Enactive Constructive, Figural Reproducing and Figural Constructive had a weak correlation with Social science. Delegator type of TP did not find a place in influencing the Social Science score. However, the Facilitator style had a strong positive correlation whereas the Expert and Formal Authority had a weak positive correlation and the Demonstrator style had a weak negative correlation.

ii Model summary with ANOVA

Tables LVI a and LVI b portray the model summary and the ANOVA statistics of the hierarchical regression related to the AA in Social Science.

TABLE LV

DESCRIPTIVE STATISTICS AND CORRELATIONS BETWEEN PREDICTOR VARIABLES AND AA IN SOCIAL SCIENCE

Variables	M	MI1	MI2	MI3	MI4	MI5	MI6	MI7	MI8	MI9	LS1	LS2	LS3	LS4	LS5	LS6	TS1	TS2	TS3	TS4	TS5
AA – Social Science	1																				
Linguistic MI1	-.039*	1																			
Logical MI2	.004	.554**	1																		
Bodily MI3	.021	.558**	.565**	1																	
Spatial MI4	-.004	.523**	.431**	.569**	1																
Musical MI5	.003	.532**	.547**	.695**	.539**	1															
Naturalistic MI6	.010	.634**	.669**	.741**	.556**	.735**	1														
Interpersonal MI7	.017	.505**	.550**	.572**	.633**	.663**	.624**	1													
Intrapersonal MI8	.033*	.610**	.631**	.786**	.629**	.770**	.771**	.697**	1												
Existential MI9	.017	.504**	.649**	.666**	.650**	.811**	.791**	.709**	.765**	1											
Enactive Reproduce LS1	.046**	-.036*	.224**	.199**	.062**	.077**	.095**	.033*	.094**	.169**	1										
Enactive Construct LS2	.035*	-.090**	-.074**	-.072**	-.022	-.181**	-.155**	-.164**	-.131**	-155**	.348**	1									
Verbal Reproduce LS3	.010	.032*	.069**	.061**	-.009	.010	.028	.001	.016	.032*	.189**	.131**	1								
Verbal Construct LS4	-.010	.050**	.139**	.126**	.033*	.026	.017	-.013	.018	.046**	.444**	.273**	.142**	1							
Figural Reproduce LS5	.031*	-.125**	.024	.058**	-.078**	-.065**	-.051**	-.053**	-.011	-.053**	.321	.401**	.120**	.310**	1						
Figural Construct LS6	.033 *	-.091**	-.066**	-.057**	-.026	-.160**	-.137**	-.150**	-.114**	-.134**	.313	.901**	.129**	.242**	.377**	1					
Expert TS1	.032*	.135**	.031 *	-.023	.010	-.004	.007	-.004	-.021	-.003	-.124**	.010**	.005**	-.011**	.002**	.015**	1				
Formal Authority TS2	.032*	-.054**	-.098**	-.005	-.010	-.012	-.064**	-.046**	-.009	-.064**	-.037	.010	.002	-.008	-.014	.041	-.202**	1			
Demonstrator TS3	-.035*	-.005	-.047**	-.064**	-.036*	-.038*	-.038 *	-.060	-.068**	-.061**	-.025	-.031	.059*	-.012*	-.114	-.030	-.162**	.108*	1		
Facilitator TS4	.067**	.028	.010	.008	-.027	.012	.014	.031*	.012	.026	.007	.019	.064	.010	-.008*	.033	.412**	.044**	.290**	1	
Delegator TS5)	.008	.030*	-.061**	-.035*	.019	-.009	-.034*	-.012**	-.040*	-.025	-.030	.011*	-.020**	.034*	-.055**	.025*	.146**	.080**	.329**	575**	1
Mean	52.41	29.80	29.86	29.86	29.66	29.71	30.36	30.67	30.20	30.08	22.81	24.21	24.64	23.39	22.68	24.22	46.80	45.69	31.52	31.30	33.84
SD	11.98	**4.776**	4.832	4.836	4.053	5.444	5.548	4.407	**5.580**	5.336	5.317	5.265	5.173	5.876	4.673	5.274	5.037	4.694	**4.227**	**3.277**	4.908
Total	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026	3026

Note. Statistical Significant* p<.05; ** p<.01;

TABLE LVI *a*
MODEL SUMMARY OF HIERARCHICAL REGRESSION

Model	R	R^2	Adjusted R Square	Std.Error of the Estimate	Change statistics				
					ΔR	F change	df1	df2	Sig. F change
1	.090	.008	.005	13.319	.008	2.725	9	3016	.004
2	.105	.011	.006	13.313	.003	1.479	6	3010	.181
3	.139	.019	.013	13.267	.008	5.159	5	3005	.000

TABLE LVI *b*
ANOVA STATISTICS

Model		Sum of square	Df	Mean square	F	Sig.
1	Regression	4350.801	9	483.422	**2.725**	**.004**
	Residual	535031.014	3016	177.398		
	Total	539381.815	3025			
2	Regression	5923.977	15	394.932	**2.228**	**.004**
	Residual	533457.838	3010	177.229		
	Total	539381.815	3025			
3	Regression	10464.559	20	523.228	**2.973**	**.000**
	Residual	528917.256	3005	176.012		
	Total	539381.815	3025			

Model 1: (Constant) Linguistic, Logical, Bodily, Spatial, Musical, Naturalistic, Interpersonal, Intrapersonal and Existential
Model 2: (Constant), Linguistic, Logical, Bodily, Spatial, Musical, Naturalistic, Interpersonal, Intrapersonal, Existential, Enactive reproducing, Enactive constructive, Verbal reproducing, Verbal constructive, Figural reproducing and Figural constructive
Model 3: (Constant), Linguistic, Logical, Bodily, Spatial, Musical, Naturalistic, Interpersonal, Intrapersonal, Existential, Enactive reproducing, Enactive constructive, Verbal reproducing, Verbal constructive, Figural reproducing, and Figural constructive, Expert, Formal authority, Demonstrator, Facilitator and Delegator
Dependent Variable: Social Science

iii. Hierarchical regression model

Table LVII and Figure 38 illustrate the hierarchical regression model quantifying the predictive capacity of each independent variable over the AA in Social Science.

TABLE LVII

VARIABLE-WISE HIERARCHICAL REGRESSION MODEL ON AA IN SOCIAL SCIENCE

Predictors	**R**	**R^2**	**ΔR^2**	**B**	**SE**	**B**	**T**	**Sig.**
Model 1								
Constant				60.384	2.170		27.826	.000
Linguistic	.090	.008**		**-.242**	**.072**	**-.087**	**-3.346****	**.001**
Logical				-.028	.074	-.010	-.376	.707
Bodily-Kinesthetic				.051	.088	.018	.574	.566
Spatial				-.105	.089	-.032	-1.180	.238
Musical				-.149	.087	-.061	-1.722	.085
Naturalistic				.015	.089	.006	.170	.865
Interpersonal				.063	.087	.021	726	.468
Intrapersonal				**.260**	**.092**	**.109**	**2.832****	**.005**
Existential				.055	.103	.022	.537	.591
Model 2								
Constant				57.283	2.828		20.256	.000
Linguistic	.105	.011**	.003	**-.213**	**.074**	**-.076**	**-2.868****	**.004**
Logical				-.050	.076	-.018	-.653	.514
Bodily-Kines.				-.024	.092	.009	.261	.794
Spatial				-.121	.090	-.037	-1.337	.181
Musical				-.125	.087	-.051	-1.432	.152
Naturalistic				.027	.089	.011	296	.767
Interpersonal				.086	.088	.028	.978	.328
Intrapersonal				**.259**	**.093**	**.108**	**2.796****	**.005**
Existential				.038	.104	.015	.367	.714
Enactive Reproduce.				.096	.057	.038	1.680	.093
Enactive Construct.				.096	.110	.038	.870	.384

Cont….

Predictors	**R**	**R^2**	**ΔR^2**	**B**	**SE**	**B**	**T**	**Sig.**
Verbal Reproduce.				.007	.048	.003	.150	.881
Verbal Construct.				-.074	.048	-.033	-1.545	.122
Figural Reproduce.				.008	.060	.003	.138	.890
Figural Construct.				-.008	.106	-.003	-.079	.937
Model 3								
Constant				51.043	4.815		10.600	.000
Linguistic	.139	.019**	.008**	**-.216**	**.076**	**-.077**	**-2.840****	**.005**
Logical				-.043	.076	-.015	-.562	.574
Bodily-Kinesthetic				.016	.091	.006	-.179	.858
Spatial				-.121	.090	-.037	-1.336	.182
Musical				-.118	.087	-.048	-1.353	.176
Naturalistic				.041	.089	.017	.458	.647
Interpersonal				.076	.088	.025	.862	.389
Intrapersonal				**.247**	**.093**	**.103**	**2.662****	**.008**
Existential				.027	.104	.011	.259	.795
Enactive Repro…				.102	.057	.040	1.777	.076
Enactive Constru..				.116	.110	.046	1.056	.291
Verbal Repro				-.065	.048	.000	-.001	.999
Verbal Constru..				-.071	.048	-.031	-1.476	.140
Figural Repro..				-.006	.060	-.002	-.098	.922
Figural Constru..				-.039	.106	-.015	-.363	.716
Expert				.036	.063	.012	.564	.573
Formal Authority				.075	.040	.036	1.899	.058
Demonstrator				**-.141**	**.060**	**-.048**	**-2.340***	**.019**
Facilitator				**.244**	**.071**	**.087**	**3.424****	**.001**
Delegator				-.048	.051	-.021	-.935	.350

Predictors Predicting AA in Social Science

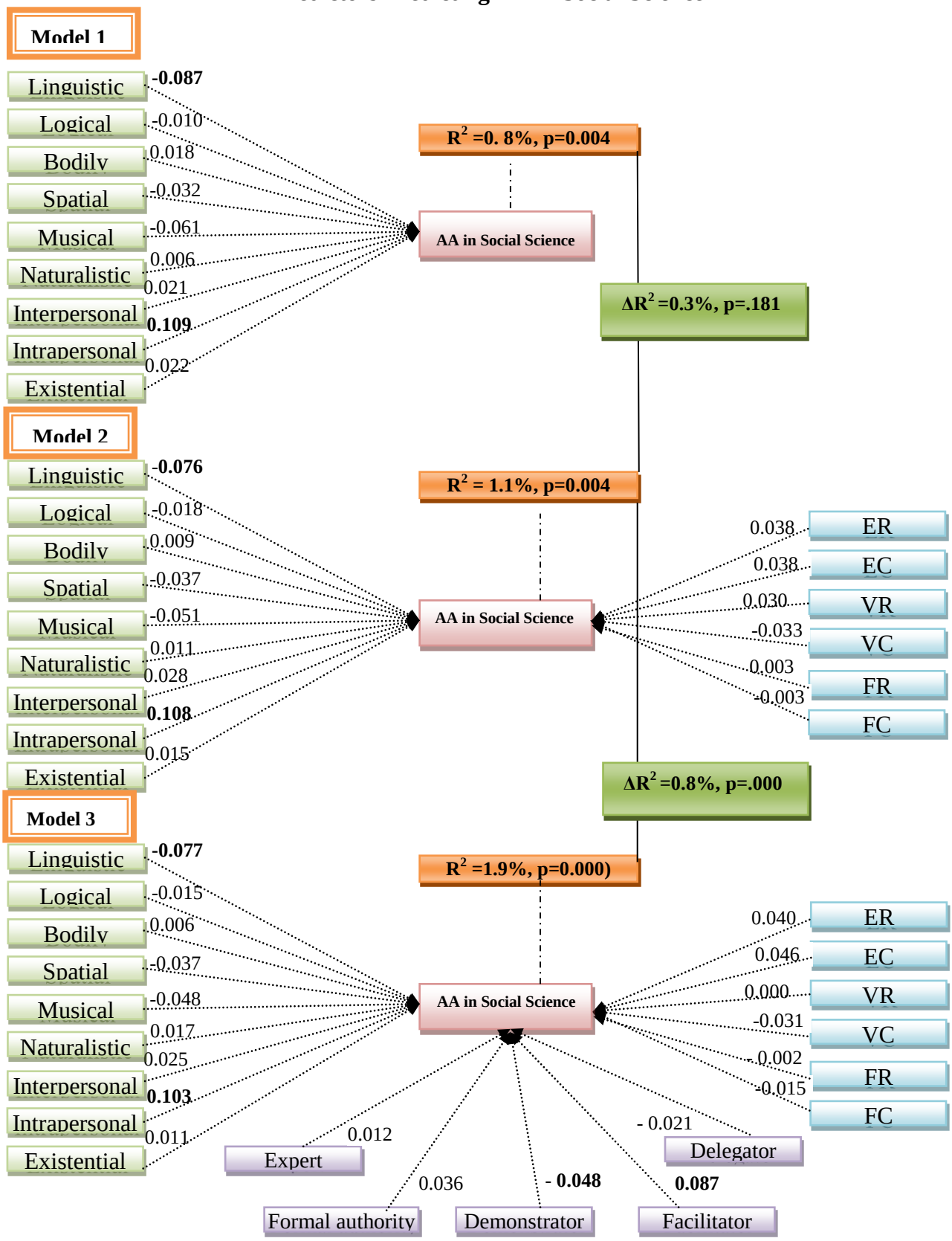


Figure 38

The R-value of the 1st model (with 9 domains of MI as predictors of Social Science score) was 0.090, thus a positive relationship existed between the predictor variables and outcome variables. The R^2 (0.008 or 0.8%) was significant with F (9, 3016) = 2.725, $p < .000$ since MI could account for 0.8 % of the variance in the Social Science marks. The variance was owed to the Intrapersonal MI (β =0.103) positively and Linguistic MI (β =-0.077) negatively

The second model with six styles of LS produced an F (15, 3010) =2.228, $p <.01$, R^2 =0.011] showing improvement from the first model. However, the change in F value, [Δ F (6, 3010) = 1.479, $p < .181$, R^2 = 0.003] was not significant. With MI held constant, the variable-wise effect shows the strong association of the same two domains of MI as in the first model (β = -0.076, t= -2.868, $p <.01$ and β = 0.108, t =2.796, $p<.01$ respectively). All the more, none of the LS had a significant relationship with the outcome variable – Social Science score.

Adding TP to the regression model explained an additional variance of 0.8% in Social Science score and this R^2 change was significant (ΔR^2 =0.008, F (5, 3005) = 5.159, $p<.000$). Altogether, when all the 20 independent variables were included in Model 3 the significant R^2 =0.019 with (F (20,3005) = 2.973, $p<.000$) explained 1.9% variance in the Social Science score being explained by the nine types of MI - Linguistic, Logical, Bodily-kinesthetic, Musical, Spatial, Naturalistic, Interpersonal, Intrapersonal and Existential intelligence, 6 types of LS - Enactive Reproducing, Enactive Constructive, Verbal Reproducing, Verbal Constructive, Figural Reproducing and Figural Constructive and five types of TP - Expert, Formal Authority, Demonstrator, Facilitator and Delegator.

Looking into the final model, it can be stated that the Intrapersonal type of MI (β = .103, $p <.01$) and the Facilitator kind of teaching style (β = .087, $p<.01$) were the positive predictors in Social Science. The Linguistic intelligence (β = -.077, $p <.01$) and Demonstrator type of teaching style (β = -.048, $p <.05$) were the negative predictors.

In other words, an increase in one unit of the Interpersonal type of MI and one unit of Facilitator (SD=4.22) style of teaching increases the Social Science score of the students by 0.103 marks and 0.087 marks in Social Science respectively. Moreover, the negative

regression weight concerning Linguistic intelligence and Demonstrator style of teaching signifies that there is an indirect relationship between these predictors and Social Science scores. The higher the score in these predictors not so higher the AA in Social Science and vice versa. Hence, an increase in one unit of Linguistic intelligence (SD = 4.77) and Demonstrator (SD = 4.22) would decrease the Social Science score of respondents by 0.077 and 0.048 marks respectively.

Social Science too as a subject deals with people of past and present. Accordingly, a study done by Abdi et al. (2013) supports the present findings by stating that a significant relationship was found between Intrapersonal intelligence and learning outcomes of social studies. Like in the case of Mathematics and Science, the selected school students are influenced positively by their Intrapersonal intelligence when it comes to Social Science learning which falls in line with their ability to understand the relationship with others, understanding their strengths and weaknesses.

As far as the teaching style was concerned, the Facilitator style of teaching goes down well with the target respondents as it reflects positively on their AA in Social Science. This is a subject that involves the study of human society, culture, historical events, etc. Though it is one of the essential core subjects, it is perceived to be a dull and dry subject by many students. To counter this and make the subject interesting to learn, the teachers adopt various teaching styles. The one that brings them closer to gaining the student's attention and concentration is the Facilitator kind, one that encourages the students towards self-learning. It motivates students to develop their critical thinking skills and retain knowledge. The present study supports this thinking wherein the Facilitator kind of teaching style aids in improving AA in Social Science. Whereas, the Demonstrator style when followed by the teachers was rejected by the students which is reflected in their academic achievement. The negative regression weight is a clear indicator that the higher the score of teachers in demonstrator lower the academic score of the student respondents.

Overall, based on the above hierarchical multiple regression tables displaying the predictive models for the AA of five subjects, it can be concluded that:

Among the nine types of intelligence, the Intrapersonal and Naturalistic MI top the list by positively influencing the AA of the school children in four major subjects out of five

namely Language, Mathematics, Science and Social Science. Both Spatial and Logical MI occupy the number two place by creating a positive impact on AA concerning two of the core subjects namely Mathematics and Science. An interesting fact from the above tables was that the Linguistic MI alone earns the distinction of consistently affecting the academic outcome of the three major subjects (Mathematics, Science and Social Science) negatively thereby exhibiting an inverse relationship with the mentioned academic subjects. Another interesting point that was evident from the above tables was that Existential MI affects the academic achievement of children in Language (Tamil), Mathematics, and Science negatively. Bodily-kinesthetic, Musical and Interpersonal MI play no role in influencing the AA.

As far as Learning Style is concerned, an interesting takeaway from the hierarchical regression tables was that Enactive Reproducing alone exerts a positive influence over the AA of school children in two subjects (Mathematics and Science). Figural reproducing and Verbal constructive style of learning bore a negative influence. The difference was that Figural reproducing affects the outcome of three subjects (English, Mathematics, and Science) whereas the Verbal constructive type of learning affects the outcome of the Science subject alone. Another noteworthy takeout was that none of the LS showed any influence on Language and Social Science outcomes.

When it comes to TP, the Facilitator style garners more positive responses from the target respondents in terms of their AA (English, Science and Social Science) than the other four styles. The next best was the Expert style positively influencing the outcome of two subjects, Language and Science. Delegator and Formal Authority influenced AA of one subject each (Mathematics and English respectively). The Demonstrator style alone doesn't gather any positive points. However, the target respondents show their dislike towards the Formal Authority style of teaching by scoring low marks in Language, Mathematics and Science followed by the Demonstrator style (negatively affecting Language, Mathematics and Social Science).

G. SUGGESTIVE ACADEMIC ACHIEVEMENT FRAMEWORK FOR SAMACHEER KALVI

The five hierarchical models predicting the level of change that can be brought out in the AA of the target respondents by a unit change in each of the significant predictors in the 9 domains of MI, 6 types of LS and the 5 types of TP were explained in the previous section. Following this, the significant predictors of all 5 subject-wise AA (both negative and positive) were provided in a nutshell as a suggestive framework in Table LIX for an easy understanding and further use of the framework by policymakers and educators. Accordingly, this section elaborates into two heads:

a. Positive predicting factors of subject-wise AA

b. Negative predicting factors of subject-wise AA

a. Positive predicting factors of subject-wise AA

The suggestive framework with positive predictors predicting the subject-wise AA of the respondents enrolled in the Samacheer Syllabus was displayed in Table LVI

The table indicated that only four domains of MI namely Logical, Spatial, Naturalistic, and Intrapersonal intelligence were found to positively predict AA in either of the four subjects namely Language, Mathematics, Science and Social Science. The remaining domains of MI namely Linguistic, Bodily-kinesthetic, Musical, Interpersonal, and Existential intelligence did not exhibit any kind of positive influence on AA. Likewise, in terms of LS, Enactive Reproducing LS was the only positive predictor that influenced AA in two of the five subjects – Mathematics and Science. The remaining 5 LS did not contribute positively to AA. In contrast to MI and LS, the TP showed a strong positive impact on AA. Four out of five types of TP namely Expert, Formal Authority, Delegator, and Facilitator were positively predicting AA of school respondents in all subjects. The Demonstrator style of TP alone did not have any effect on the AA of the target student respondents.

TABLE LIX

SUGGESTIVE SUBJECT-WISE ACADEMIC ACHIEVEMENT FRAMEWORK FOR SAMACHEER KALVI

Subjects	Multiple Intelligence (MI)		Learning Style (LS)		Teaching Pedagogy (TP)	
	Positive	**Negative**	**Positive**	**Negative**	**Positive**	**Negative**
Language	Naturalistic	Existential	-	-	Expert	✓ Formal Authority ✓ Demonstrator
English	-	-	-	Figural Reproducing	✓ Formal Authority ✓ Facilitator	✓ Expert ✓ Delegator
Mathematics	✓ Logical ✓ Spatial ✓ Naturalistic ✓ Intrapersonal	✓ Linguistic ✓ Existential	Enactive Reproducing	Figural Reproducing	Delegator	✓ Formal Authority ✓ Demonstrator ✓ Facilitator
Science	✓ Logical ✓ Spatial ✓ Naturalistic ✓ Intrapersonal	✓ Linguistic ✓ Existential	Enactive Reproducing	✓ Verbal Constructive ✓ Figural Reproducing	✓ Expert ✓ Facilitator	Formal Authority
Social Science	Intrapersonal	Linguistic	-	-	Facilitator	Demonstrator

To further interpret, the subject-wise positive predictors were considered and explained below:

Language: Based on the suggestive framework in Table LIX the one and only MI that could positively predict AA in Language was Naturalistic intelligence. The researcher perceived that living things such as plants and animals and sensitivity to other natural world features (Naturalist intelligence) have a strong relationship with learning Language and its related literature. Accordingly, a supportive study done by Zahedi and Ghabanchi (2014) found that Naturalistic intelligence showed a strong relationship with the literature learning scores of graduates. However, another study by Razmjoo (2008) indicated no significant relationship between native Language, proficiency, and the combination of intelligence of the selected respondents. Nevertheless, the contradictions, the present finding has confirmed that Naturalistic intelligence does have a positive impact towards learning Language as a subject of study. Another predictor towards better Language learning was observed to be the Expert style of TP. As already indicated the subject-wise influence of TP was scarce in the literature. However, the researcher perceives that a teacher practising an Expert style of teaching possesses the knowledge and expertise that students need and strives to challenge students to enhance their competence in learning Language.

English: English, a foreign Language is taught in every school as it is one of the official Languages of diverse India. The suggestive framework has vividly depicted that none of the nine domains of MI or the 6 types of LS – the student-related factors of AA, was found to be related to the scores procured in English by the selected student respondents. However, the teacher-related factor, the TP was found to have a positive influence in terms of the teacher exercising the Facilitator and Formal Authority type of instruction. British Council, the largest online English teaching community, has very well portrayed the role of a teacher as a Facilitator as an essential component in modern English classrooms as it is the key to developing student-centered work, communicative activities and humanistic approaches (British Council, 2023). Further, in a study carried out in Indonesia by Su-Bergil and Ercevik (2019) among 34 EFL (English as a Foreign Language) teachers that assessed teacher beliefs for effective English language teaching and learning, it was found that the belief of being a facilitator has a great impact. Concerning the Formal Authority TP, two studies conducted in

two different countries by Murdani et al. (2020); and Mazloom and Hussain (2020) provide an affirmative statement that the Formal Authority type of TP was the least dominant type of teaching EFL. However, the present finding had a contradictory finding of pointing out that the Formal Authority TP emerged as the second influential predictor in determining the AA in English.

Mathematics: Evidence of the causal link that claims the ability to reason logically aids in mathematical understanding was provided by an Indian study carried out by Sonny and Sivadas (2015). The study revealed a positive significant relationship (.82) between Logical intelligence and AA in Mathematics among 9th-grade students. In addition, Nunes et al. (2010) trained a group of children in logical reasoning and found that they made more progress in Mathematics than a control group who were not given this training. The present suggestive framework showed a concurrent result of Logical MI possessing a positive predictive capacity over the AA in Mathematics of the selected school respondents. The next positive predictor in terms of MI was Spatial Intelligence. "Hawes and Ansari (2020) stated that there is an emerging consensus that spatial thinking plays a fundamental role in how people conceive, express, and perform Mathematics and also specified that the underlying nature of this relationship remains elusive". The underlying nature was explained in a correlation study carried out among junior high school students in Indonesia that confirmed a very strong relationship between Spatial intelligence and Logical intelligence in terms of learning Mathematical concepts (Zaiyar et al. 2020). In other words, the higher the Logical intelligence, the higher the Spatial intelligence and both the MI positively happen to predict AA in Mathematics.

Comenius Twinning Project (2013-2015) aimed to increase student's motivation and interest in the study of Math, pointing out the Mathematical influences in nature, such as symmetry or the various geometrical patterns in natural formations or studying living organisms with a certain shape like pentagon proved the relationship of learning math and Naturalistic intelligence. Furthermore, a recent study by Hardi et al. (2021) observed that a dominant Intrapersonal intelligence predicted better Mathematics learning achievement. The present suggestive framework had also confirmed the same.

Research by Sirmaci (2010) found that there existed a positive significant relationship between 9th-grade students' attitudes to Mathematics and their Learning styles in general. But did not provide any clue about the specific LS. Phan (2012) used latent growth modelling to explore the four sources of information on self-efficacy over the belief in Mathematics over time. The research provided empirical evidence in stating that enactive performance accomplishments were associated closely with the growth of change in Mathematics self-efficacy beliefs. This finding indirectly supports the present suggestive framework that has stated that Enactive Reproducing LS could positively predict the AA in Mathematics.

Looking into the third block of TP as the predictor, the suggestive framework showed that the Delegator style of instruction had resulted in better scores in Mathematics and is further supported by a decade-old study of Canto-Herrera and Salazar-Carballo (2010) with 72 high school Mathematics teachers with that of the academic performance of 1241 students found that the teaching style "Delegator "was associated with better academic performance in Mathematics.

Science: The suggestive framework vividly illustrates a pattern of predictors predicting AA in Science learning as similar to AA in Mathematics in terms of MI and LS. In other words, Logical, Spatial, Naturalistic and Intrapersonal MI and Enactive Reproducing style in LS were observed to positively influence the score procured by the selected student respondents in Science. Way back in 2010, Bishop, a Mathematics enthusiast, had mentioned that Mathematics and Science are similar subjects of study particularly in schools as both the subjects are engaged as ways of understanding that are rooted in rational logic with a greater focus on universal knowledge statements. Also, an exploratory study towards understanding the relationship between Mathematics and Science coursework in secondary schools concluded that Mathematics coursework was essential to promote advanced Science coursework (Ma, 2009). Accordingly, the suggestive framework formulated on positive predictors confirms the idea that Mathematics and Science are two different subjects, but one aids in learning the other and hence the predictors in terms of MI and LS were also similar.

Concerning TS, the suggestive framework showed that the Expert and Facilitator style of instruction alone gave enhanced scores in Science among the selected student respondents. The results of a correlational study carried out by Karamustafaoğlu et al. (2015) were found

to be partially concordant and partially contradictory to the present finding. The study confirmed that Science teachers practice Expert and Delegator TS at a high level, whereas the Formal Authority, Demonstrator and Facilitator TS at a medium level. Mete and Bakir (2016) examined the teaching styles of Science teachers and determined that Science teachers mostly preferred a combination of Facilitator/Demonstrator/Expert style of instruction. Hence, the present suggestive framework for the Samacheer Kalvi was supported by the existing empirical evidence.

***Social Science*:** Nahda and Fathoni (2023) on 'Effect of Intrapersonal Intelligence on Social Science Learning Outcomes; a Correlational Study of Grade V Students at an Elementary School in Indonesia." showed a positive significant influence of Intrapersonal Intelligence on Social Studies of fifth-grade students. Accordingly, the present suggestive framework concerning Social Science and MI showed only Intrapersonal intelligence as a positive predicting factor among all MIs. However, as already indicated none of the LS could positively predict the AA in Social Science of the selected student respondents. Looking into the third block of predictors, the TS, except for the Facilitator type of instruction no other TS were able to determine the marks scored in Social Science. A concordant study of the current framework was from Murtiningsih (2018), who concluded that the Facilitator and Explaining model of instruction was more enjoyable and preferred by the students in the learning of Social Science because the students were involved directly and actively in the learning.

b. Negative predicting factors of subject-wise AA

The suggestive framework displays the sum of various negative predictors affecting the AA of the target student respondents. As the negative predictors were few and the trend of influence on the AA of the five subjects was almost similar the following section on negative predictors of AA was explained based on the constructs.

Multiple Intelligence: The Framework showed that only two domains of MI, namely Linguistic and Existential intelligence, emerged as negative predictors for AA among school children which indicated that the higher Linguistic and Existential intelligence score of the selected respondents lower their AA. The remaining seven factors, namely Linguistic, Bodily-kinesthetic, Musical, Spatial, Naturalistic, Interpersonal, and Intrapersonal intelligence did not display any negative influence on AA.

The suggestive framework states that the Existential MI has a negative effect on three subjects namely Language, Mathematics and Science. While trying to explore the related literature on the same, the researcher was able to realise that almost all studies on MI and AA had only dealt with the first eight MI and the Existential MI was the least explored. However, one study by Jaddou and Abdullah (2018) observed that there were no statistically significant differences in the degree of Existential intelligence due to gender, specialization and years of experience, marital status, and academic performance variables at the significance level of $p \leq 0.05$. Though not completely supportive, Existential MI was found to be not that essential in determining AA. However, Linguistic MI exerting a negative influence on the AA in three subjects namely Mathematics, Science and Social Science has to be further understood. The researcher's observation of the evaluation /assessment system of core papers stands as a reason for the finding. In other words, the assessment of core subjects is based on the keywords and does not require Linguistic elements. Hence the current study strongly recommends that further studies should involve the assessment/evaluation pattern as another crucial construct determining AA.

Learning Style: Concerning LS, two out of six types of LS, namely Verbal Constructive and Figural Reproducing, exhibited a negative impact on AA of Mathematics and Science alone. As of other subjects are concerned none of the LS was found to have a negative influence on its AA.

The more the students practise the Figural Reproducing type of LS, the AA in both Mathematics and Science were observed to have a blow. While analysing the possible reasons only the characteristics of the FR type of LS could answer. Figural reproducing characterises the preferences for visual experiences related to making diagrams, charts, pictures, maps, and photographs with emphasis on imitation and practise. As the respondents were in the 6^{th}-8^{th} Grade, a mere reproduction of figural patterns might not be adequate and they need the constructive type of experience. However, the FC type of LS also did not show a positive effect and it might be because of the transition stage of the student respondents. Similarly, the higher the Verbal Constructive type of LS lower the level of their performance in Science and the finding is supportive of MI's finding in stating that linguistic MI negatively impact the AA in Science.

Teaching Pedagogy: Similarly, three out of five domains of TP (Formal Authority, Demonstrator, and Facilitator) were found to be negatively influencing the AA. The Demonstrator type of TP alone negatively affected the AA of all the subjects except English and Science. The Expert and Delegator type of TP though had a positive influence on specific subjects, did not find a place as a negative predictor of AA except English learning.

AA in Mathematics was observed to be lower when the teachers adopted more of a Facilitator, Demonstrator and Formal Authority type of TP. Sim and Matore (2022) in their study found that the Facilitator and Demonstrator TP positively impacted the AA of primary school students in Mathematics subject, which was not in concordance with the present study. The reason is that the above-quoted study was done among primary teachers handling younger children; where the Delegator TP holds good in the present study that was carried out in teaching secondary school students.

Concerning the AA in Science, the higher the practise of Formal Authority TP, the lower the marks scored in Science by the respondents. The statement of Sim and Matore (2022) based on Grasha-Riechmann Teaching Styles holds good for the present finding, since the use of the Formal Authority TP results in limited, permanent, and inflexible student engagement in the learning process. Hence, a strong attachment to the Formal Authority TP contributes to rigid, standard, and less flexible ways of managing students.

The negative TP pertinent to the AA in Social Science was the Demonstrator type and could be well understood by realising that only a few concepts in Social Science can be taught with model presentations. Hence a moderate use of Demonstrator TP would benefit the students.

On the whole, the suggestive AA framework derived from the predictive models formulated through hierarchical regression integrating the student-related constructs (MI and LS) and teacher-related construct (TP) suggests the following:

- ✓ For Language (Regional Language, Tamil) Naturalistic MI of a student with an Expert style of instruction facilitates better learning in terms of marks obtained. However, Language teachers need to use the Formal Authority and Demonstrator style of instruction to the minimum level possible.

- ✓ AA in English was found to be not influenced by any type of MI. However, the student's Figural Reproducing type of LS and the teacher's Expert and Delegator style of instruction are to be at its minimum. Also, the framework suggests that English teachers adopt a good level of Formal Authority and Facilitator type of TP.
- ✓ AA in Mathematics gets enhanced with an increase in students' Logical, Spatial, Naturalistic and Intrapersonal MI while adopting the Enactive Reproducing type of LS. The framework suggests the teacher be a Delegator while teaching Mathematics and cautions them to use Formal Authority, Demonstrator and Facilitator type of instruction at a minimal use. The Linguistic MI and Figural Reproducing LS do not help in learning Mathematics
- ✓ AA in Science follows a similar trend with that of AA in Mathematics in terms of student-related factors except for an additional LS namely Verbal Constructive type that was found to destruct Science learning. However, the TP to be used was completely different in suggesting that an Expert and a Facilitator type of instruction could enhance the student's ability to learn Science. Moreover, the use of Formal Authority TP was not entertained.
- ✓ AA in Social Science was found to be enhanced when a student has a good Intrapersonal MI and a teacher adopts the Facilitator type of instruction. However, the framework suggests that Linguistic MI and Demonstrator TP will have a negative impact.

Hence, to conclude, the suggestive framework thus provided and explained would be of great help to the teachers, administrators, policymakers and the Education Department of Tamil Nadu in providing insight into what is required for Academic Achievement specific to every subject of study. As the framework offers a deeper understanding of the student-related factors essential for better AA, interventions to activate the specific MI and LS needed can be planned by the teacher and administrator of the schools. At the same time Staff development programme can be carried out to train the teachers in using appropriate TP based on the subjects they handle. At the policy level, the suggestive framework could serve as an initial requisite document to plan the curricular framework and formulate lesson plans of the Samacheer Kalvi.