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PARENTS' SOCIOECONOMIC STATUS AND PUPILS' MATHEMATICS ACHIEVEMENT: STEPWISE MULTIPLE REGRESSION ANALYSIS APPROACH.

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Abstract*— *The purpose of the present study is to examine the impact of parental socioeconomic status on pupils' achievement in secondary school Mathematics. The population of the study consists of class nine students studying in different secondary and higher secondary schools of Karbi Anglong district of Assam state in India. 900 students of 30 different schools and their parents participated in the survey and responded to the questionnaires. Stepwise Multiple Regression Analysis technique is adopted to analyze collected data. The main objective of the study is to determine the relationship between parents' socioeconomic status and its impact on the scholastic attainment of secondary school students in mathematics. The result of the analysis reveals that parents' socioeconomic status has significant relationship with school learners' academic achievement in mathematics.

Keywords*— *Socioeconomic Status, Mathematics Achievement, Stepwise Multiple Regression, Secondary School.

I. INTRODUCTION

The study on relationship between parents' socioeconomic status and students' academic achievement has been carried out by different researchers in different parts of the world. Socioeconomic status is the blending of social and economic position of an individual or a family in relation to other individuals or families in the society which is measured on the basis of income, educational level, cast and community, occupation status. When a relationship between social background and educational achievement is present, then it follows that students from disadvantaged backgrounds face disadvantages at school and later in adult life.

The socioeconomic status has been at the centre of a very active field of educational research. Coleman's (1966) study on Equality of Educational Opportunity is viewed as a historic point in mathematics education investigate where socioeconomic status has been viewed as a solid indicator of students' scholastic accomplishment.

Bidwell and Friedkin (1988) recognized three noteworthy roads that prompt a connection between parents' social foundation and educational achievement. There exists a strong correlation between parents' socioeconomic status (SES), and children's highest educational degree **(**Blau & Duncan, 1967; Featherman & Hauser, 1978; Mare, 1981; Ganzeboom, Treiman, & Ultee, 1991; Erikson & Goldthorpe, 1993; M¨uller & Karle, 1993; Shavit & Blossfeld, 1993; Kerckhoff, 1995; Erikson & Jonsson, 1996; Jeynes, 2002; Eamon, 2005; Ahmed & Bora, 2011). Some studies suggest that Socio Economic Status (SES) is the strongest indicator of school students' achievement (Coleman et al., 1966; Jencks et al., 1972; Jencks et al., 1979; Gamoran, 1987; Bryk, Lee and Smith, 1993). Israel et al (2001) conclude that both parents' socioeconomic status and social capital available in the family promote child's educational achievement. Boloz, S.A., & Varrati, R. (1983) showed that socioeconomic status was the most consistent variable, showing a strong relation to academic achievement. Recent studies revealed that parents' socioeconomic status were significant correlated with students' overall academic achievement (Igobo, et al, 2014; Yelkpieri, 2016; Ayibatonye & Okere, 2018) as well as achievement in the subjects of Mathematics (McConney & Perry, 2010; Farooq, et al, 2011; Alghazo, 2015; Haiying & Pang, 2016)

Contrasts in the level of capacity and nature of education accessible, area or network to which the students has a place, diverse access to instructive facilities as indicated by his social class status, religion, race add to the accomplishment of a youngster (Naik, S. P., 1998). Indian educationists affirmed that intelligence and socio-financial foundation are significant supporters of mathematics accomplishment (Devi, 1976; Kabu, 1980; Jabbal, 1981; Nilima Kumari, 1984; Singh, 1986; Trivedi, 1988; Ganguly, 1989; Borbora, 1997; Pradhan, D.,1997).

In Indian context, recently many researchers found that students' socioeconomic condition was positively and significantly correlated to their scholastic performances (Prabha & Gupta, 2000; Choudhury, M., 2005; Bhuyan & Choudhury, 2008; Saikia & Kalita, 2008; Gohain, 2009; Sharma, M., 2009; Bora, A., 2010; Chandra & Shaikh, 2013; Choudhury & Das, 2016) There is positive correlation between SES and academic achievement of students.

Socioeconomic status of a family associates with scholastics accomplishments of their youngsters at school level. That Socioeconomic status depends on family income, Parents' highest level of education, Parents' occupation and societal position.

II. METHODOLOGY:

Selection of sample:

In the present paper, investigators chose the mixing or blending of descriptive and experimental research strategies. Survey strategy is received from descriptive research to gather data from focused area of the populace. Concerning strategy, diverse measurable devices and systems are connected to perform control and controlled tastings on various factors. For this purpose a sample of 30 unique schools was chosen. Members in this study were 900 secondary school pupils considering in class nine in both urban and rural territories in Karbi Anglong district of Assam and their parents. There were 460 male pupils and 440 female pupils, 449 fathers and 551 mothers in the investigation. Regarding cast and community, 576 learners were from Schedule Tribe, 54 from Schedule Cast and 270 from general class. Out of 900 student members, 400 concentrated in country region and 500 in urban regions. 443 understudies were from Government/Govt. aided schools and 457 were from non-public schools.

Research Instruments:

Two research instruments were developed for the study. The first questionnaire was developed to access Parents' Socioeconomic Status (PSS). There were two parts in PSS scale. Part-A for demographic information of the respondents and the part B-relates to their Socioeconomic conditions. The second questionnaire consists of 20 objective questions of school Mathematics to access Mathematical Achievement (MA) of students. A board of specialists painstakingly looked into both the instruments and made necessary changes.

i. **Reliability Test:** A pilot survey was carried out on an sample of 122 pupils and for reliability test Cronbach's Alfa was performed. The reliability test for PSS instrument was found as 0.807 and that of MA instrument was 0.753.
ii. **Factor Analysis:** For validity of research instruments, factor analysis test were done. For PSS instrument Kaiser-Meyer-Olkin (KMO) value was 0.783 and for MA instrument KMO value was 0.736.
iii. **Analysis of data:** The collected data were analyzed with the Statistical Package for the Social Sciences (SPSS) version 22.

III. OBJECTIVES OF THE STUDY:

The objectives of the present study are

a) To determine the relationship between parents' socioeconomic status and its impact on the scholastic attainment of secondary school students in mathematics.
b) To determine the relationship between parents' highest educational attainment and its impact on the scholastic attainment of secondary school students in mathematics.
c) To determine the relationship between parents' occupation and its impact on the scholastic attainment of secondary school students in mathematics.
d) To determine the relationship between parents' income and its impact on the scholastic attainment of secondary school students in mathematics.
e) To determine impact of parents' societal position on the scholastic attainment of secondary school students in mathematics.

IV. ANALYSIS OF DATA:

Collected data was inserted in SPSS data table. The researchers define one dependent variable and four independent or predictor variables.

TABLE: 01 VARIABLES OF THE STUDY

Independent Variables (IV)	Dependent Variable (DV)
SEF1: Parents' occupation	**MA**: Mathematics Achievement
SEF2: Parents' Highest Educational Level	
SEF3: Parents' Income	
SEF4: Parents' Societal position	

Stepwise Linear Regression Analysis (SLRA) is performed to determine the best model that has highest influences on scholastic accomplishment of secondary school students in mathematics. Analyses were done by using SPSS version 22.

V. ASSUMPTIONS FOR STEPWISE MULTIPLE REGRESSION ANALYSIS:

Linear relationship between DV and IVs:

Multiple linear regressions require linear relationship between the independent and dependent variables. A simple way to check this is by producing scatter plots of the relationship between each of IVs and DV.

No multi-colinearity:

This is essentially the assumption that predictor varriables are not too highly correlated with one another. To test this assumption, Co linearity diagnostics option can be chosen during analysis.

Independent residual values:

This is essentially the same as saying that individual observations to be autonomous from each other. This can be tested by utilizing the Durbin-Watson measurement.

Constant variance of the residuals:

This is called homoscedasticity. This implies, the spreadness of the residuals ought to be genuinely steady at each spot of the independent factors which can be tried by create an uncommon scatter-plot that incorporates the entire model.

Normally distributed residual values:

This assumption can be tested by looking at the distribution of residuals. It can be done by using the normal probability plot option.

VI. RESULTS:

The table 1 reflects the demographic pattern of the respondents of the present study.

TABLE: 02: SAMPLE DEMOGRAPHIC DATA. N=900

Parameter	n	%
Gender (Students)		
Male	460	51.1
Female	440	48.9
Gender (Parents)		
Male	449	49.9
Female	551	50.1
Cast & Community		
ST	576	64.0
SC	54	06.0
General	270	30.0
Domicile		
Rural	400	44.4
Urban	500	55.6
School Authority		
Government	443	49.2
Private	457	50.8

Stepwise linear Multiple Regression Analysis was used to determine whether there were any statistically significant differences exist between the two or more variables. SPSS (Version 22) is applied on the collected data.

Stepwise Multiple Regression Analysis:

Parents' Socioeconomic Status Scale was associated with four factors. **SEF1**: Parents' occupation, **SEF2**: Parents' Highest Educational Level, **SEF3**: Parents' Income and **SEF4**: Parents' Societal position. The following Table shows the descriptive statistics of the present study.

TABLE: 03: DESCRIPTIVE STATISTICS

	Mean	Std. Deviation	N
Achievement	19.2767	4.66260	900
SEF1	1.50	.500	900
SEF2	1.66	.908	900
SEF3	1.56	.497	900
SEF4	1.51	.500	900

The model summary contains three models. Model 1 represents the first stage in the hierarchy when SEF2 is used as the only predictor. Model 3 represent the final model in the analysis. The column heading R gives the multiple correlation coefficients between dependent variable and the independent variable. The model summery table shows the correlation between Model 3 and academic achievement in mathematics is .570. The R^2 column gives the measure in variability in the achievement with predictors. Model 1 i.e SEF2 accounts for 25.4% of variation in mathematics achievement. Model 3 is 32.4% accountable for the variation in mathematics achievement. The adjusted R^2 gives some idea how the model generalizes. The values of adjusted R^2 should be same as or very close to the corresponding values of R^2. In the present study the difference in the final model 3 is (0.324-0.322) = 0.002 or .2% only. This means that if data were collected from population instead of a sample the variance will change by 0.2% only. Durbin-Watson value gives the idea about the measure of autocorrelation or serial correlation in residuals. Durbin-Watson test statistic is 1.987 which is lying in the range of 1.5 to 2.5 and so it is relatively normal. Values outside of this range could be cause for concern. According to Field (2009) the values under 1 or more than 3 are a definite cause for concern.

TABLE: 04: MODEL SUMMARY

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.504[a]	.254	.253	4.03047	.254	305.106	1	898	.000	
2	.548[b]	.300	.298	3.90519	.046	59.541	1	897	.000	
3	.570[c]	.324	.322	3.83879	.024	32.301	1	896	.000	1.987

a. Predictors: (Constant), SEF2, **b**. Predictors: (Constant), SEF2, SEF3, **c**. Predictors: (Constant), SEF2, SEF3, SEF4,
d. Dependent Variable: Achievement

In a multiple regression analysis ANOVA comprises of estimations that give information about levels of variability inside a regression model and shape a foundation for test of significance.. From the table-05, it is clear that all three models of the study are statistically significant for achievement in mathematics. Model 1 comprises of one predictor variable SEF2 i.e. Parents' Highest Educational Level. Model 2 comprises of SEF2, SEF3. This indicates that the combine effect of Parents' Highest Educational Level and Parents' Income is better than only Parents' Highest Educational Level on students' mathematics achievement. The best fitted model 3 comprises of three independent variables SEF2, SEF3 & SEF4. The impact of combination of Parents' education, income and societal position is the best for their youngsters' scholastic achievement in school mathematics. Surprisingly, the independent variable SEF1, i. e. Patents' occupation find any place in any one of the models.

TABLE: 05: ANOVA TEST

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4956.359	1	4956.359	305.106	.000[b]
	Residual	14587.751	898	16.245		
	Total	19544.110	899			
2	Regression	5864.390	2	2932.195	192.268	.000[c]
	Residual	13679.720	897	15.251		
	Total	19544.110	899			
3	Regression	6340.384	3	2113.461	143.419	.000[d]
	Residual	13203.726	896	14.736		
	Total	19544.110	899			
a. Dependent Variable: Achievement,			**b**. Predictors: (Constant), SEF2			
c. Predictors: (Constant), SEF2, SEF3,			**d**. Predictors: (Constant), SEF2, SEF3, SEF4			

In coefficients table-06, let take a look at the last model-3. B-coefficients are for the most part significant and in positive ways. Since all indicators have indistinguishable scales, it is desirable over translate the B-coefficients as opposed to the beta coefficients. Our last model-3 expresses that

MA= 9.995+2.549×SEF2+1.824 ×SEF3+1.468 ×SEF4

The strongest predictor variable in the best model is SEF2 with B value 2.549. One percent increase in SEF2 leads to 2.549% increase in the DV. Beta values are standardized coefficients. Beta values give the Standard Deviations of DV changes. Beta values indicate that SEF2 is more effective variables than the other IVs. Co-linearity of data is measured with tolerance values and Variance Indicator Factor (VIF). Tolerances of all the factors are greater than 0.1 and VIFs are less than 10. Therefore co-linearity assumption is satisfied by the collected data.

TABLE: 06: COEFFICIENTS OF VARIABLES.

Coefficients[a]													
		Un-standardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations			Co-linearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	14.986	.280		53.529	.000	14.437	15.536					
	SEF2	2.585	.148	.504	17.467	.000	2.294	2.875	.504	.504	.504	1.000	1.000
2	(Constant)	11.908	.482		24.681	.000	10.961	12.854					
	SEF2	2.544	.143	.496	17.730	.000	2.262	2.825	.504	.509	.495	.999	1.001
	SEF3	2.023	.262	.216	7.716	.000	1.508	2.537	.234	.249	.216	.999	1.001
3	(Constant)	9.995	.581		17.189	.000	8.854	11.137					
	SEF2	2.549	.141	.497	18.074	.000	2.272	2.826	.504	.517	.496	.999	1.001
	SEF3	1.824	.260	.194	7.012	.000	1.313	2.334	.234	.228	.193	.980	1.020
	SEF4	1.468	.258	.157	5.683	.000	.961	1.975	.183	.187	.156	.982	1.019
a. Dependent Variable: Achievement													

TABLE: 07: EXCLUDED INDEPENDENT VARIABLES.

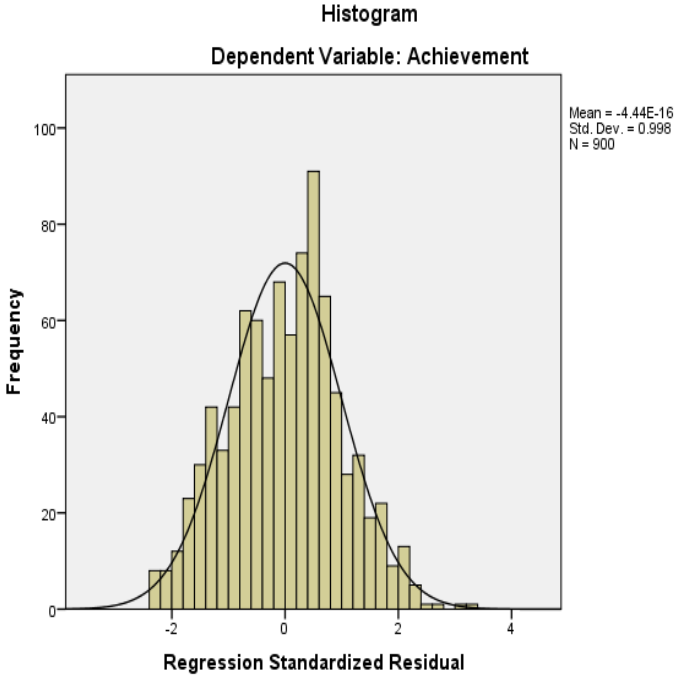
Model		Beta In	t	Sig.	Partial Correlation	Co-linearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	SEF1	.030[b]	1.051	.294	.035	1.000	1.000	1.000
	SEF3	.216[b]	7.716	.000	.249	.999	1.001	.999
	SEF4	.184[b]	6.517	.000	.213	1.000	1.000	1.000
2	SEF1	.030[c]	1.068	.286	.036	1.000	1.000	.999
	SEF4	.157[c]	5.683	.000	.187	.982	1.019	.980
3	SEF1	.041[d]	1.501	.134	.050	.995	1.005	.977

a. Dependent Variable: Achievement, b. Predictors in the Model: (Constant), SEF2
c. Predictors in the Model: (Constant), SEF2, SEF3, SEF4 d. Predictors in the Model: (Constant), SEF2, SEF3, SEF4

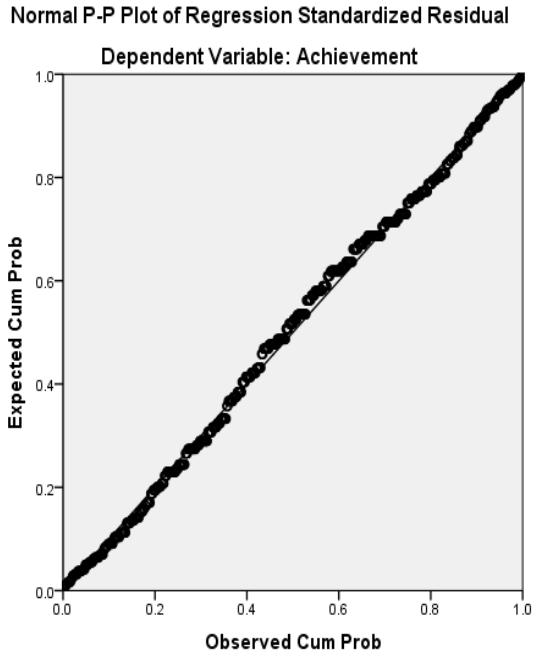
Table-07 shows the characteristics of the IV which is excluded from different models. It is observed that SEF1 has no significant effect in all the three models as sig. values are greater than 0.05 in all cases. So, SEF1 is excluded from all the models.

The following Picture-01 and Picture-02 show the graphical representation of standardized residuals. Picture-01 clears reflects the fact that the normalcy assumption for Stepwise Multiple Regression Analysis is satisfied. Moreover, linearity assumption is satisfied as the Picture-02 shows a pretty linear line.

PICTURE: 01: RESIDUAL HISTOGRAM



PICTURE: 02: P-P PLOTTING



VII. DISCUSSIONS AND CONCLUSIONS:

From the above results we have seen that all the required assumptions of Stepwise Multiple regression Analysis are satisfied by the collected data. The analysis gives us there models. Model 1 contains SEF2 i.e Parents' Highest Educational Level. Parents' Highest Educational Level (SEF2) and Parents' Income (SEF3) are IVs associated with Model 2. Model 3 comprises of three IVs, namely, Parents' Highest Educational Level (SEF2), Parents' Income (SEF3) and Parents' Societal position (SEF4). Table -04 and Table-05 reflect that all three models have significant effects on students academic achievement in school mathematics as sig. values of each model is 0.000 < 0.001. The R and, consequently R^2 and Adjusted R^2 values in the table-04 indicate that the Model 3 is the Ideal Model for this study (R values:: $.570^c > .548^b > .504^a$).

Table-07 indicates that the independent variable SEF1 related to parents' occupation has no significant effect on students' scholastic attainment in mathematics. Significance level of SEF1 for Model 1, Model 2 and Model 3 are respectively 0.294, 0.286 and 0.134. And so, SEF1 is excluded from all the models.

From the above discussion the researchers conclude that socioeconomic status of parents has significant effect on their youngsters' academic achievement in mathematics. Parental highest educational level is the most influential factor on mathematics achievement of school learners and parents' occupation has no effect on Mathematics achievement.

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