

## Extracurricular Activities and Learning Outcomes of School Students: A Regression Analysis

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**Abstract:** This study sought to find out how being involved in extracurricular activities (ECAs) can influence development of personality, academics, and social skills of 8<sup>th</sup> and 9<sup>th</sup> class school children in Delhi. The findings are that the ECAs impact the personality development of the students significantly whereas their impact on academic level of students is not significant. This can be true as the ECAs listed down by the students do not seem to have much effect on academic performance. Also, the ECAs do reduce the time spent by the students on academics at home, given that homework is given for them.

**Keywords:** Extracurricular activities, Academic level, Personality development, Regressions

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### CONTEXT, LITERATURE AND PURPOSE

Stephen Covey was a great educator. In a seminal contribution (Covey, 2008), he had pointed out that educating oneself for success in the 21st century requires not just competency in “core subjects traditionally taught such as math, science, reading, writing, history, geography, health, arts and language in conjunction with themes like financial management, global awareness, economics, entrepreneurship and civic awareness”. What are more importantly required are “(a) Life and Career Skills (leadership, ethics, accountability, adaptability, self-direction, personal responsibility and productivity, social sensitivity and responsibility, people skills, initiative, and cross-cultural communication and other skills); (b) Learning and Innovation Skills (critical thinking, problem solving, communication, creativity, collaboration); and (c) Technology Skills (computer literacy, media awareness and information management)”. In other words, children and the youth require not just left brain based education but more of right brain based education (Bose, 2024) that meets four of their basic needs : “(a) physical (safety, good health, food, exercise, shelter and hygiene); (b) social-emotional (acceptance, kindness, friendship, the desire to love and to be

loved); (c) mental (intellectual growth, creativity, and stimulating challenges); and (d) spiritual (contribution, meaning and uniqueness)."

In light of this, we can appreciate very much a vast variety of extracurricular activities (ECAs) offered in schools and colleges like, for example, dance, drama, music, sports, students' council, various clubs, debates, essay writing, painting, etc. in order to stimulate right brain development. However, in relation to the impact of ECAs, there is or can be a divided opinion: that they help students out in their growth and development or, alternatively, that they lead to poor performance in academics, tiredness and frustration. Given this hypothetical perplexity, we examined some literature—13 studies—and found that much of it is in support of the former opinion, i.e. the first one.

In a study by Holland and Andre (1991), we find that participation in extra curriculums is positively correlated with certain desirable academic and personal/social characteristics in adolescents. There is a "positive relationship between the extent of participation in activities and higher career aspirations and their subsequent attainment". Activity participation is also associated with improved racial relations in schools as extra-curriculums are the main source of interracial contact for students in secondary schools. These results suggest that extra-curriculums and academics are partners, not antagonists, in the quest to help students develop personally, socially and academically.

O'Dea (1994) found that "students involved in ECAs have a significantly higher grade point average (GPA) than students not involved in them. The mean GPA of students involved was 3.201, and 2.556 for students not involved. A t-test was used to determine if a significant difference existed between the two means. The probability of the t-test was less than 0.000499. A significance level of 0.01 was established. The sample size was comprised of 421 seniors and statistical analysis was done using the SPSS data management system".

Eccles and Barber (1999) observed students in 6th grade from 10 schools in Michigan (1259 respondents) and they considered 5 different ECAs i.e. prosocial, team sports, school involvement, performing arts and academic clubs. They concluded that involvement in team sports increases involvement in risky behaviours, while involvement in these ECAs resulted in students liking school better at 10th and 12th grade, and students liking to be attending college full time and in getting higher than expected 12th grade GPA.

Consider the study by Watson (2004). He had tested two null hypotheses separately for male and female students that there was "no statistically significant difference in the mean GPA of high school males/females who

were grouped by their participation" in ECAs. Students who were enrolled during 1997-2000 (3274) in Dade County High School, Georgia were categorized by gender and by membership in five different ECA groups: interscholastic athletics only, co-curricular activities only, interscholastic athletics and co-curricular activities and no ECAs. Data was analyzed using ANOVA, and it showed a highly statistically significant effect of participation on mean GPA and both null hypotheses were rejected. Thus, the conclusion emerged that expanding rather than contracting ECAs in terms of "co-curricular activities may be the least expensive means of improving academic performance".

Fujita (2005) was an interesting study with the conclusion that participation in extracurricular activities has a positive effect on academic performance. "Participation in athletics, television viewing and community service improved academic performance, while participation in musical performance did not. One cannot expect excessive amounts of academic abilities from a child solely because he or she is actively involved in too many" ECAs.

"Participants in out-of-school activities can learn skills such as teamwork, leadership skills", with decreased likelihood of showing up behavioral problems. However if "overscheduled, children may be tired, irritable and show little interest" in participation. Participation in ECAs leads to better grades, "a decrease in absenteeism and increased connectedness to school", with higher standardized test scores, higher educational attainment, and higher realization of self-concepts. These findings are owed to the study of Nikki (2009).

A study by Craft (2012) focused on the impact of participation in sports, music programmes, and school clubs on student achievement: GPA, SAT scores, success on the Georgia High School Graduation Writing Test, and absentee rates. It concluded that through participation in ECAs, students can learn "teamwork, dedication, time management, and the ability to build positive relationships with other students, teachers, coaches, parents, and community members".

Cariaga and Molina (2013) found that there was a positive impact of ECAs in the "personality development of the members of the performing groups", in which the "social aspect got the highest ranking, followed by the emotional aspect, mental aspect, physical and lastly the spiritual aspect". In this study there were 42 respondents. Majority of them were aged 18-19 years.

The study by Singh and Mishra (2013) found that ECAs have positive effects on students' behavior, school performance and social aspects. They had used a sample of 60 students of age group between 13 and 15 years

from 2 private schools of Lucknow, and the t-test showed a significant difference in the performance of children involved in ECAs.

A positive relationship between time management skills as the dependent variable and involvement in individual sports and martial arts as the explanatory variable was found by Ivaniushina and Zapletina (2015). Students involved in individual sports and martial arts developed significantly better goal setting skills than those not involved. Any activity, which adolescents perceive as important, is perceived as a way to form their own identity, according to this study.

A cross-sectional study at the Armed Forces Medical College was conducted by Ahmed et al. (2015). It was found that students, numbering a total of 475 and selected randomly, did benefit from participation in ECAs. Data was analysed in terms of percentage and Pearson Chi-Square test. The class attendance of participating students was more than non-participating ones. In professional MBBS examinations participants in ECAs passed in one attempt while percentage of pass was less among non-participating students. Tanner (2017) had studied “direct effects—both positive and negative—of participation in ECAs on the academic performance of students of all grade levels”. His results showed that ECAs did more benefit than harm. He took into account the confounding variables namely, age, intensity, and type of physical activity.

Four hypotheses were formed by Freeman (2017) to study the relationship between ECAs and academic achievement. Correlation coefficient of 0.33 was found between GPA and involvement in ECA. Correlation coefficient of 0.60 was found between ACT scores and ECA.

In light of this, we were curious to take on the objective of finding out the impact of ECAs—the activities that “fall outside the realm of the normal curriculum of school”, college or university education—on academic as well as personality development of school students by an experimental small-scale statistical study in Delhi, the capital of India.

## **DATA AND METHODOLOGY**

We had collected relevant data from a sample of 154 students of 8<sup>th</sup> and 9<sup>th</sup> standards from three schools in Delhi. Most of the respondents were girls with quite a few being boys. Students were asked to fill up a questionnaire divided into three parts, related to general questions, personality test questions and academic test questions respectively. Personality test marks, and judgement of various personality traits—leadership skills, communication skills, emotional intelligence and problem solving skills of students—were calculated according to the scaling given to various responses, and the performance of the students in the 2<sup>nd</sup> part of the

questionnaire. Data regarding academic test marks was obtained through the marks scored by students in the 3rd part of the questionnaire, which contains general as well as subject related questions to test the academic competency of students. The number of ECAs attended by students was calculated as per the number of ECAs listed by them in the 1st part of the questionnaire. Various ECAs listed by the students included sports, music, debate, dance and happiness classes with some time given for meditation too. For the remaining variables data was obtained through the responses of students in relation to the 1st part of the questionnaire.

Our study uniquely contributed to our research objective in two ways, by taking a more diverse sample and by constructing a standardized questionnaire. By contrast, all the earlier research we had scanned as pointed out above, either evaluated students of a single institution only or the academic level was judged using GPA or scores in various tests which in turn were calculated by different institutions by different parameters.

After collecting the data, descriptive statistics of the variables were obtained as follows:

Variable	Obs	Mean	Std. Dev.	Min	Max
pmi	154	53.77922	5.291807	36	71
aci	154	6.571429	2.525315	0	11
hrsi	154	2.409091	1.195655	.5	7
ecai	154	2.253247	1.135072	0	5
rci	154	.8116883	.3922364	0	1
cli	154	.7012987	.4591819	0	1
resi	154	.6363636	.4826152	0	1
hwi	154	.7142857	.4532279	0	1
timei	154	.5381851	.36122	.04	1.667
ecaihwi	154	1.688312	1.434949	0	5
sno	154	77.5	44.60007	1	154

It was evident that students had not attended many ECAs which ranged from 0 to 5, with average number of activities being around 2. Further, on an average, students scored 6.57 (out of 12) marks in the academics test while 53.78 marks in the personality test. By looking at the minimum, maximum and the average values of all the variables, we could reject the possibility of presence of any outliers in our data.

Various dependent (DE), explanatory (EX) and dummy (DU) variables taken into account for running regression equations were as follows: Personality Test Marks (DE) of a student were considered to be impacted by the number of ECAs (EX) attended by the student in school, whether or

not the marks of ECAs were added in report cards (DU), whether or not the classes of ECAs happened regularly (DU) and whether the students participated well in ECAs (DU) or not. Academics Test Marks (DE) were considered to be impacted by the hours spent on academics at home (EX) and the other variables being the same as those impacting personality test marks. Hours spent on academics at home (DE) were considered to be impacted by whether or not homework was given in ECAs (DU) and further by the number of ECAs attended (EX), thus the cross product of these two variables was taken in the regression equation. It might also be impacted by the time (in hours) spent in commuting to school (EX).

We had selected the method of Ordinary Least Squares (OLS) for estimating our regression equations because in all the literature review that we had done, the researchers had used it obtained satisfactory results as expected. Also, for the various following considerations:

We expected a positive linear relationship between the number of ECAs attended by a student (main explanatory variable) and his/her marks scored in personality and academic tests. We believed that as the number of ECAs increase, there would be an improvement on the personality and academic front on a linear scale and each new ECA would lead to almost equal improvement in the above two parameters irrespective of number of ECAs already present. The rationale behind this assumption was that each ECA was unique in its own way and was focused on improving a particular personality trait or academic knowledge. For example, Yoga targets to improve the mental health of students whereas MUNs (Model United Nations) target to improve their communication skills wherein both the aspects come under the plethora of personality traits of the student. On the academic front, Yoga can help by teaching students to remain calm while giving an exam so that chances of silly mistakes are reduced, while MUNs help by enhancing their general knowledge. Similarly every ECA impacts the academics and personality of a student in its own way so that every additional activity leads to approximately same incremental change in these aspects.

For the regression considering the impact of ECA on the hours available for academics at home, we had assumed that all ECAs in which homework was given, lead to an almost equal amount of reduction in the study hours available for academics at home. For the control variable as well, which is time spent on commuting to school, we can say that as time in commuting increases, time available at home for academic studies decreases linearly. This is a logical statement.

Our objective, thus, was to estimate the following three regressions (ANCOVA models) using the primary data collected from students:

- $PM_i = b_0 + b_1ECA_i + b_2RC_i + b_3CL_i + b_4RES_i + r_{1i}$  (+) (+) (+) (+)  
(+)
- $AC_i = a_0 + a_1ECA_i + a_2HRS_i + a_3RC_i + a_4CL_i + a_5RES_i + r_{2i}$  (+)  
(+) (+) (+) (+) (+)
- $HRS_i = q_0 + q_1ECA_i*HW_i + q_2TIME_i + r_{3i}$  (+) (-) (-)

Where,

**PM<sub>i</sub>** = Personality test marks

**AC<sub>i</sub>** = Academics test marks

**HRS<sub>i</sub>** = Hours spent on academic studies at home

**ECA<sub>i</sub>** = Number of extracurricular activities attended

**RC<sub>i</sub>** = 1 : Marks in extra-curriculars added in report cards

0 : Marks in extra-curriculars not added in report cards

**CL<sub>i</sub>** = 1 : Classes of extra-curriculars happen regularly

0 : Classes of extra-curriculars do not happen regularly

**RES<sub>i</sub>** = 1 : Students participate well in extra-curricular activities

0 : Students do not participate well in extra-curricular activities

**HW<sub>i</sub>** = 1 : Homework in given in extra-curriculars

0 : Homework not given in extra-curriculars

**TIME<sub>i</sub>** = Time (in hours) spent on commuting to school

The a-priori expected signs of the coefficients are indicated below the respective coefficients in brackets. The coefficient of RC<sub>i</sub> variable in the first two regressions was expected to be positive because if the marks or grades obtained in ECAs would have been counted in the final report card of the students, they would have a greater incentive to be attentive in the ECA classes and thus more positive impact was likely to be there on their personality and academics. Also, the coefficient of variables CL<sub>i</sub> and RES<sub>i</sub> were expected to be positive for the first two regressions as if the classes of ECAs were held regularly and the response of students was good in these classes, and then it was expected to increase the impact on personality and academics. Further, it was expected that the more the number of hours spent on studying at home, the higher would be the positive impact on academic level, thus the coefficient of HRS<sub>i</sub> in the second regression was expected to be positive. In the last regression, as time spent on commuting to school increases i.e. TIME<sub>i</sub> increases, the number of hours spent on academics at home are likely to fall hence the negative expected sign of the coefficient.

After obtaining the regression output for the above three equations using **STATA**, Our analytical procedure involved the following steps:

Interpretation of the regression coefficients and seeing if they are individually statistically significant through t-tests at 5% LoS (level of significance) and also whether they are jointly significant through F-test. In case of any deviation of the result from our a-priori expectations, we have explained the differences.

Testing of the various OLS estimation assumptions. The assumption of 'Expectation of the error term given the values of explanatory variables should be zero' is required to show that the OLS estimators are unbiased estimators of the true parameters. To test this assumption we have used the command of **summarize** on the residuals of all the three regression equations and have seen whether their means are close to zero or not. The assumption of 'Homoscedasticity of the error term' is required to show that the OLS estimators are most efficient in the class of linear unbiased estimators. To test this assumption, we have used the command of **hettest**, which makes use of the B-P test to test for the presence of heteroscedasticity in the error term, for all the three regression equations. The assumption of 'No auto-correlation of the error terms' is required to show that the OLS estimators are most efficient in the class of linear unbiased estimators. Since we have a cross-sectional data, we have not used the Durbin-Watson test for checking this assumption. We have simply plotted a scatter diagram of the residuals of each regression equation with respect to the serial number of the observation in the sample to which it corresponds using the command of **scatter**. The assumption of 'Normality of the error term' is required to carry out the procedure of hypothesis testing and building of confidence intervals for the estimators of the parameters. To test this assumption, we have used the commands of **kdensity**, **pnorm** and **qnorm** and have studied the output graphs for all the three regression equations and found that all the residuals almost follow a normal distribution with slight deviations. If the assumption of 'No high multicollinearity among the regressors is violated then the model would not give correct predictions of the dependent variable and it is likely that the OLS estimators turn out to be statistically insignificant individually as their standard errors increase and t-ratio falls. To test this assumption, we have used the commands of **vif** and **correlate** for all the three regression equations. The assumption that 'Model is correctly specified' is tested by using the command of **ovtest** which makes use of the Ramsey RESET test to check if the model has any omitted variables.

## RESULTS AND INTERPRETATION

Consider the first regression equation and its details as follows:

$$1. \quad PM_i = b_0 + b_1ECA_i + b_2RC_i + b_3CLI_i + b_4RES_i + r_{1i}$$

. \*1st regression - Impact of ECA on Personality  
 . reg pmi ecai rci cli resi

Source	SS	df	MS			
Model	1662.15569	4	415.538924	Number of obs =	154	
Residual	2622.33781	149	17.5995826	F( 4, 149) =	23.61	
Total	4284.49351	153	28.0032255	Prob > F =	0.0000	
				R-squared =	0.3879	
				Adj R-squared =	0.3715	
				Root MSE =	4.1952	

pmi	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
ecai	1.533989	.3078941	4.98	0.000	.925586 2.142392
rci	2.595167	.8884107	2.92	0.004	.8396556 4.350678
cli	3.264407	.7872986	4.15	0.000	1.708694 4.820119
resi	2.128648	.7356595	2.89	0.004	.674975 3.582321
_cons	44.57238	1.046155	42.61	0.000	42.50517 46.6396

. summarize r1

Variable	obs	Mean	Std. Dev.	Min	Max
r1	154	7.40e-09	4.139983	-11.16755	11.16982

. \*Checking Homoscedasticity of r1  
 . estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity  
 Ho: Constant variance  
 Variables: fitted values of pmi  
 chi2(1) = 0.76  
 Prob > chi2 = 0.3839

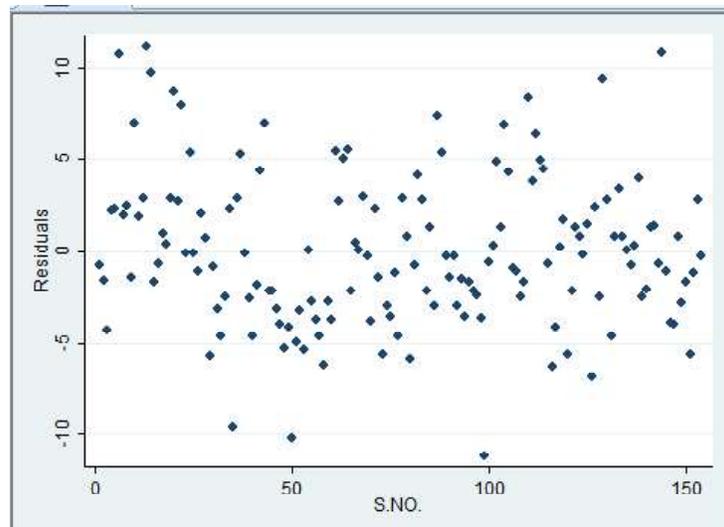


Figure 1: Checking for Autocorrelation

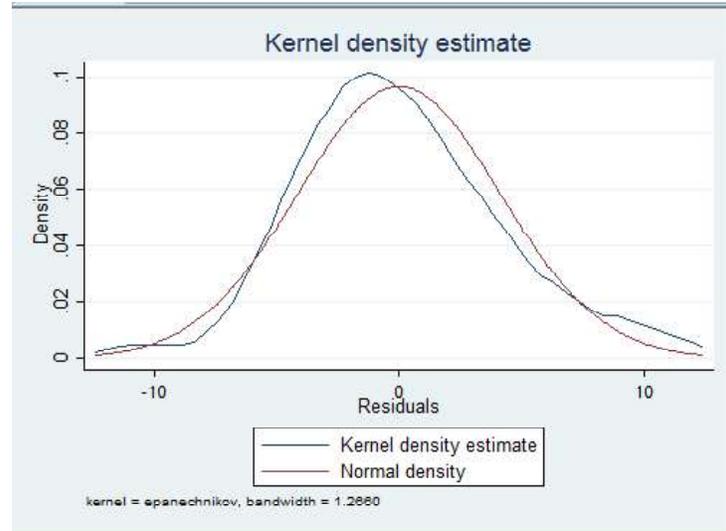


Figure 2 : Checking for normality of the error term r1

```
. *Checking Model Specifcator
. ovtest
```

```
Ramsey RESET test using powers of the fitted values of pmi
Ho: model has no omitted variables
      F(3, 146) =      1.05
      Prob > F =      0.3726
```

As the number of ECAs attended by a student increase by 1, the mean PMi improves by 1.53 marks keeping RCi, CLi, and RESi constant. The mean PM is higher by 2.5951 marks for the students whose ECA marks are added in report card (RCi= 1) as compared to the ones whose marks are not added, ceteris paribus. The mean PMi is higher by 3.2644 marks for the students whose ECA classes happen regularly (CLi = 1) from those whose ECA classes do not happen regularly, ceteris paribus. The mean PMi is higher by 2.1286 marks for the students who believe that the class participates well in ECA (RESi = 1) as compared to those who believe that the response is not good, ceteris paribus. The signs of all the coefficients are as per a -priori expectations.

The t-statistic is significant at 5% LoS for all the above estimators and the model is also jointly significant as confirmed by the F-test at 5% LoS. The mean of the residuals r1 is a very small positive number i.e. 0.0000000074 hence the assumption of “expected value of error term” being “equal to zero given the values of explanatory variables” has been satisfied so the OLS estimators would be unbiased as the explanatory variables are non-stochastic as well. Under the B-P test for testing the heteroscedasticity

assumption, we do not reject the null hypothesis as the P-value of 0.3839 is greater than the value of level of significance i.e. 5% or 0.05 and hence the computed test statistic value lies in the non-rejection region. As we do not reject the null hypothesis which states that there is homoscedasticity in the model, so our OLS estimators would be efficient (as assumption of no auto-correlation is also being satisfied).

By looking at the scatter plot of the residuals against the serial number of the observation in the sample, we don't find any particular pattern among the scatter points and they appear to be randomly spread. So, we can conclude that there is no auto correlation among the error terms, and so our OLS estimators would be efficient (as assumption of no heteroscedasticity is also being satisfied).

By looking at the Kernel Density graph of the residuals, we can clearly see that the Kernel Density Estimate curve of the residuals almost coincides with normal curve hence we can say that the assumption of the error terms being normally distributed is also satisfied and hence the hypothesis testing procedures for the individual estimators of the regression would be valid and so would be the estimation of their confidence intervals. We find that the VIF (Variance Inflation Factor) for coefficients of all explanatory variables is close to 1 which means that there is not much distortion in their standard errors and hence their computed t-ratios are also not distorted. Also the mean VIF comes to be 1.09 which is very close to 1. Also, the correlation between the explanatory variables is not very large, with the largest being 0.2735 between RES<sub>i</sub> and CL<sub>i</sub> which itself is quite small. Hence, we can conclude by considering both the analyses that there is no presence of high degree of multicollinearity among the explanatory variables. Under the Ramsey RESET test for testing the no model specification error assumption, we do not reject the null hypothesis as the P-value of 0.3726 is greater than the value of level of significance i.e. 5% or 0.05 and hence the computed test statistic value lies in the non-rejection region. As we do not reject 'the null hypothesis which states that there is no omitted variables in the model, so we conclude that we do not have a model specification error'.

Now consider the second regression equation and its details:

$$2. \quad AC_i = a_0 + a_1ECA_i + a_2HRS_i + a_3RC_i + a_4CL_i + a_5RES_i + r_{2i}$$

```
. *2nd regression - Impact of ECA on Academics
. reg aci ecai hrsi rci cli resi
```

Source	SS	df	MS	
Model	361.272909	5	72.2545818	
Residual	144.441777	148	0.9759579	
Total	505.714686	153		

```
Number of obs = 154
F( 5, 148) = 17.40
Prob > F = 0.0000
R-squared = 0.7163
```

```
. *Checking Homoscedasticity of r2
. estat hettest
```

```
----- Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
aci Ho: Constant variance
Variables: fitted values of aci
```

	chi2(1)	Prob > chi2				
ecai	1.303201	.260453	3.31	0.066	.010905	2.1490110
hrsi	.8551624	.357308	2.39	0.018	.1490781	1.561247
rci	2.630196	.1070005	4.61	0.000	1.503805	3.756587
cli						
resi						
_cons						

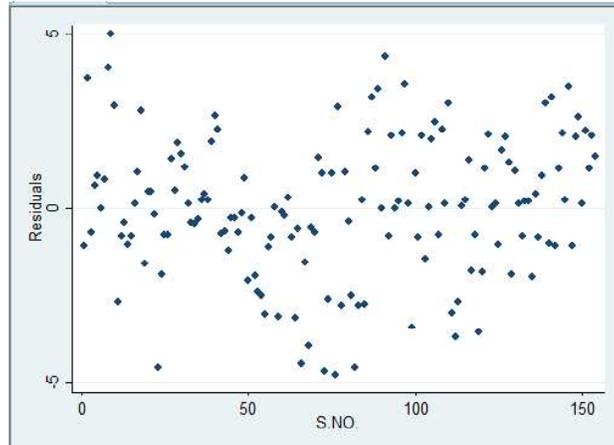


Figure 3: Checking for auto-correlation

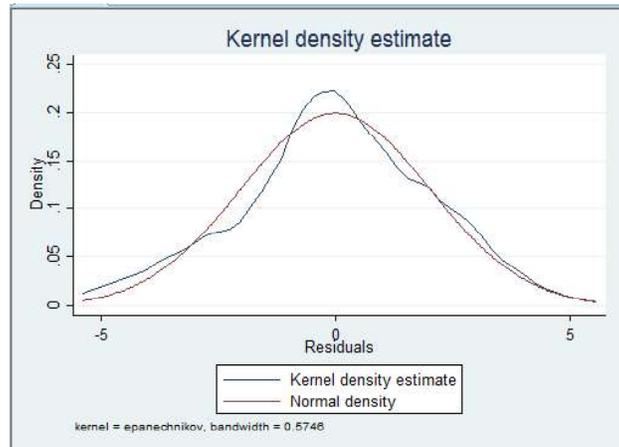


Figure 4 : Checking for normality of the error term r2

. \*Checking Multicollinearity  
 . vif

Variable	VIF	1/VIF
cli	1.16	0.859063
resi	1.10	0.912515
rci	1.07	0.937442
ecai	1.06	0.941778
hrsi	1.05	0.956059
Mean VIF	1.09	

. correlate ecai hrsi rci cli resi  
 (obs=154)

	ecai	hrsi	rci	cli	resi
ecai	1.0000				
hrsi	0.0556	1.0000			
rci	0.1519	0.1305	1.0000		
cli	0.2088	0.1824	0.1574	1.0000	
resi	0.0618	0.0669	0.1538	0.2735	1.0000

. \*Checking Model Specificaton  
 . ovtest

Ramsey RESET test using powers of the fitted values of aci  
 Ho: model has no omitted variables  
 F(3, 145) = 3.58  
 Prob > F = 0.0155

As the number of ECAs attended by a student increases by 1, the mean ACi increases by 0.0976 marks keeping HRSi, RCi, CLi, and RESi constant. As the number of hours available for academics at home (HRSi) increases by 1 hour, the mean ACi increases by 0.9462 marks, ceteris paribus. The mean ACi is lower by 0.0895 marks for the students whose ECA marks are added in report card (RCi = 1) as compared to the ones whose marks are not added, ceteris paribus. The mean ACi is higher by 1.3832 marks for the students whose ECA classes happen regularly (CLi = 1) from those whose ECA classes do not happen regularly, ceteris paribus. The mean ACi is higher by 0.8551 marks for the students who believe that the class participates well in ECA (RESi = 1) as compared to those who believe that the response is not good, ceteris paribus. The signs of all the coefficients are as per a -priori expectations except for the coefficient of RCi but that does not matter because the coefficient is insignificant. The t-statistic is significant for HRSi, CLi and RESi at 5% LoS and the model is also jointly significant as confirmed by the F-test at 5% LoS. Coefficients of ECAi and RCi are insignificant. This can be because many ECAs in which students have taken part do not impact their academic performance much. For e.g. music, dance, etc as mentioned by students don't really have a major impact on their academic performance.

As the number of ECAs themselves don't have a significant impact on academic performance, hence the fact that whether their marks are added in the report card or not would also not have any significant impact because of which the coefficient of  $RC_i$  is also insignificant. Whereas, other factors of  $CL_i$  and  $RES_i$  would impact the academics even if number of ECAs do not because it can be assumed that if the classes of ECAs happen regularly then the classes of other core subjects also happen regularly in schools thus positively impacting academics level of students. Moreover, if the response of students is good in ECAs then it is assumed to be good in academics also.

The mean of the residuals  $r_2$  is a very small negative number i.e. -0.0000000109 hence the assumption of "expected value of error term being equal to zero given the values of explanatory variables" has been satisfied so the OLS estimators would be unbiased as the explanatory variables are non-stochastic as well. Under the B-P test for testing the heteroscedasticity assumption, we do not reject the null hypothesis as the P-value of 0.7396 is greater than the value of level of significance i.e. 5% or 0.05 and hence the computed test statistic value lies in the non-rejection region. As we do not reject the null hypothesis which states that there is homoscedasticity in the model, so our OLS estimators would be efficient (as assumption of no auto-correlation is also being satisfied).

By looking at the scatter plot of the residuals against the serial number of the observation in the sample, we don't find any particular pattern among the scatter points and they appear to be randomly spread. So, we can conclude that there is no auto correlation among the error terms, so our OLS estimators would be efficient (as assumption of no heteroscedasticity is also being satisfied). By looking at the Kernel Density graph of the residuals, we can clearly see that the Kernel Density Estimate curve of the residuals almost coincides with normal curve hence we can say that the assumption of the error terms being normally distributed is also satisfied and hence the hypothesis testing procedures for the individual estimators of the regression would be valid and so would be the estimation of their confidence intervals.

We find that the VIF for coefficients of all explanatory variables is close to 1 which means that there is not much distortion in their standard errors and hence their computed t-ratios are also not distorted. Also the mean VIF comes to be 1.09 which is very close to 1. Also, the correlation between the explanatory variables is not very large, with the largest being 0.2735 between  $RES_i$  and  $CL_i$  which itself is quite small. Hence, we can conclude by considering both the analyses that there is no presence of high degree of multicollinearity among the explanatory variables. Under the Ramsey RESET test for testing the no model specification error assumption, we do

not reject the null hypothesis as the P-value of 0.0155 is greater than the value of level of significance i.e. 1% or 0.01 and hence the computed test statistic value lies in the non-rejection region (though the null hypothesis would get rejected at a 5% level of significance). As we do not “reject the null hypothesis which states that there is no omitted variables” in the model, so we conclude that we do not have a model specification error.

Finally, consider the third regression equation and its details.

$$3. \text{ HRS}_i = q_0 + q_1 \text{ECA}_i + q_2 \text{TIME}_i + r_3i$$

```
. *3rd regression - Impact of ECA on hours spent on academics at home
. reg hrsi ecai hwi timei
```

Source	SS	df	MS	Number of obs	=	154
Model	43.1416818	2	21.5708409	F(2, 151)	=	18.55
Residual	175.585591	151	1.16281848	Prob > F	=	0.0000
				R-squared	=	0.1972
				Adj R-squared	=	0.1866

```
. summarize r3
```

Variable	Obs	Mean	Std. Dev.	Min	Max	
r3	154	-2.81e-09	1.071269	-2.812464	3.741746	
ecaihwi	-.1656465	.0610446	-2.71	0.007	-.2862583	-.0450347
timei	-1.251964	.2425	-5.16	0.000	-1.731096	-.7728332
_cons	3.362542	.1805078	18.63	0.000	3.005895	3.71919

```
. *Checking Homoscedasticity of r3
. estat hettest
```

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance  
 Variables: fitted values of hrsi

chi2(1) = 5.75  
 Prob > chi2 = 0.0164

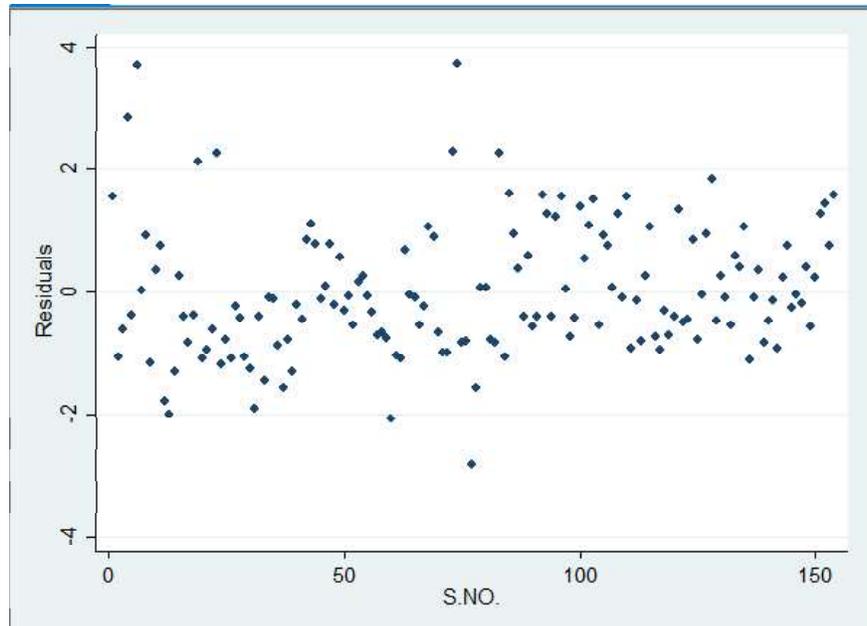


Figure 5 : Checking for auto-correlation

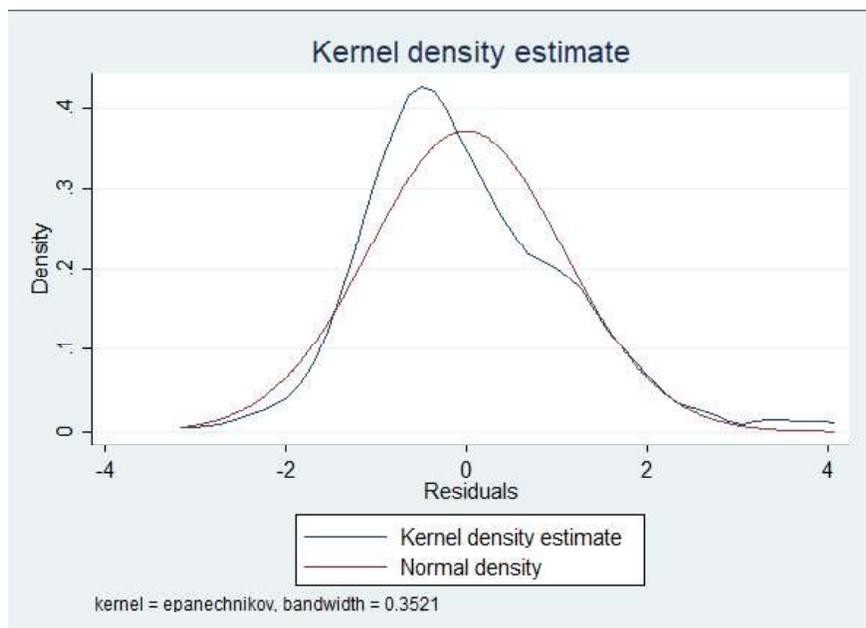


Figure 6 : Checking for normality of the error term r3

. \*Checking Multicollinearity

. vif

Variable	VIF	1/VIF
ecaihwi	1.01	0.990498
timei	1.01	0.990498
Mean VIF	1.01	

. correlate ecaihwi timei

(obs=154)

	ecaihwi	timei
ecaihwi	1.0000	
timei	0.0975	1.0000

. \*Checking Model Specificaton

. ovtest

Ramsey RESET test using powers of the fitted values of hrsi

Ho: model has no omitted variables

F(3, 148) = 0.61

Prob > F = 0.6102

If a student gets homework in ECAs ( $HW_i = 1$ ), an increase in ECA by 1 leads to a decrease of 0.1656 hours spent on academics studies at home on an average, commuting time being constant.. Whereas if a student doesn't get homework in ECAs ( $HW_i = 0$ ), then the number of ECAs attended by the student is irrelevant in impacting the hours spent on academics at home. As the time spent on commuting to school ( $TIME_i$ ) increases by 1 hour, the mean hours spent on academics at home fall by 1.2519 hours, other things constant. The signs of all the coefficients are as per a-priori expectation. The t-statistic is significant at 5% LoS for all the above estimators and the model is also jointly significant as confirmed by the F-test at 5% LoS. The mean of the residuals  $r_3$  is a very small negative number i.e. -0.00000000281 hence the assumption of expected value of error term being equal to zero given the values of explanatory variables has been satisfied so the OLS estimators would be unbiased as the explanatory variables are non-stochastic as well. Under the B-P test for testing the heteroscedasticity assumption, we do not reject the null hypothesis as the P-value of 0.0164 is greater than the value

of level of significance i.e. 1% or 0.01 and hence the computed test statistic value lies in the non-rejection region (though the null hypothesis would get rejected at a 5% level of significance). As we do not reject the null hypothesis which states that there is homoscedasticity in the model, so our OLS estimators would be efficient (as assumption of no auto-correlation is also being satisfied).

By looking at the scatter plot of the residuals against the serial number of the observation in the sample, we don't find any particular pattern among the scatter points and they appear to be randomly spread. So, we can conclude that there is no auto correlation among the error terms, so our OLS estimators would be efficient (as assumption of no heteroscedasticity is also being satisfied). By looking at the Kernel Density graph of the residuals, we can clearly see that the Kernel Density Estimate curve of the residuals almost coincides with normal curve hence we can say that the assumption of the error terms being normally distributed is also satisfied and hence the hypothesis testing procedures for the individual estimators of the regression would be valid and so would be the estimation of their confidence intervals.

We find that the VIF for coefficients of all explanatory variables is close to 1 which means that there is not much distortion in their standard errors and hence their computed t-ratios are also not distorted. Also the mean VIF comes to be 1.01 which is very close to 1. Also, the correlation between the explanatory variables  $ECA_i \cdot HW_i$  and  $TIME_i$  is not very large i.e. 0.0975. Hence, we can conclude by considering both the analyses that there is no presence of high degree of multicollinearity among the explanatory variables. Under the Ramsey RESET test for testing the no model specification error assumption, we do not reject the null hypothesis as the P-value of 0.6102 is greater than the value of level of significance i.e. 5% or 0.05 and hence the computed test statistic value lies in the non-rejection region. As we do not reject the null hypothesis which states that there is no omitted variables in the model, so we conclude that we do not have a model specification error.

## **CONCLUSION AND LIMITATIONS**

This study was conducted under the broad understanding that "today's young people (students) are expected to have not just technical and intellectual skills but personal competence (self-awareness, self-assessment, self-confidence, self-control, transparency, adaptability, achievement, initiative, optimism) and social competence (empathy, organizational awareness, service, inspirational leadership, developing others, creating change, conflict management, building bonds, team work, synergy and

collaboration)" (Bose, 2024). In other words, ECAs are expected to contribute to academic and personality development of students.

And through this study, we have found that the number of ECAs attended by the students has a significant impact on their personality development and hours spent on academics at home but not on their academic levels at 5% LoS using t-test. ECAs have a significant positive impact on the personality development while having a significant negative impact on the hours spent on academics at home given that homework is given for ECAs. But the ECAs do not significantly impact the academic performance and that maybe because the nature of many ECAs which the students listed was not academics oriented and whether an ECA would have an impact on academics performance or not depends on the nature of ECA as stated in Fujita (2005). So we can conclude that though ECAs do reduce the number of hours available for academics at home given homework is given for ECAs, this loss is offset by the improvement in personality that they bring about. Also, ECAs have an insignificant impact on academics in our study contrary to what our literature survey conveys.

Having said that, we must admit that our sample size was small and so we can say that the results from this study cannot be generalized to the entire population. During collection of data, we also faced problems of communication barrier as students could not understand some questions, and so some responses might have gone wrong because of misunderstanding of the questions.

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### *References*

- Ahmad, R.M. et al (2015). Effects of Extra Curricular Activities on Student's Academic Performance. *Journal of Armed Forces Medical College*, 11(2).
- Bose, Annavajhula J C (2024). Right Brain Attributes and Skills for a Good Society. Personal Development. [www.ecosocsrcc.com](http://www.ecosocsrcc.com), July 20.
- Covey, Stephen R. (2008). *The Leader in Me*. Free Press. New York.
- Craft, S.W. (2012). The Impact of Extracurricular Activities on Student Achievement at the High School Level. University of Southern Mississippi. Retrieved from: <https://pdfs.semanticscholar.org/acb5/38af275c7cdc28a89c960262b2ad21b58c8e.pdf>
- Cariaga, J.N. and Molina, J. (2013). The Impact of Extra-Curricular Activities in the Personal Development of the Members of Performing Groups of Philippine Normal University-North Luzon. Philippine Normal University.
- Eccles, J.S. and Barber, B.L. (1999). Student Council, Volunteering, Basketball, or Marching Band: What Kind of Extracurricular Involvement Matters?, *Journal of Adolescent*

*Research*. Retrieved from: <https://pdfs.semanticscholar.org/6a24/82d21a9526c1a3e5d325dc901d9aecce8d62.pdf>

Freeman, R. (Aug, 2017). The Relationship Between Extracurricular Activities And Academic Achievement, National Louis University.

Fujita, K. (2005). The Effects of Extracurricular Activities on the Academic Performance of Junior High Students, Undergraduate Research Journal for the Human Sciences. Retrieved from: <https://www.kon.org/urc/v5/fujita.html>

Holland, A., and Andre, T. (1991). Is the Extracurriculum an Extra Curriculum? *American Secondary Education*, 19(2), 6-12.

Ivaniushina, V.A. and Zapletina, O.O. (2015). Participation in Extracurricular Activities and Development of Personal and Interpersonal Skills in Adolescents. Journal of Siberian Federal University. *Humanities& Social Sciences*. 11.

Nikki, W. (May 2009). Impact of Extracurricular Activities on Students, The Graduate School University of Wisconsin-Stout. Retrieved from: <https://www2.uwstout.edu/content/lib/thesis/2009/2009wilsonn.pdf>

O'Dea, J.W. (1994). The Effect of Extracurricular Activities on Academic Achievement. School of Education Drake University. Retrieved from: <https://core.ac.uk/download/pdf/46924406.pdf>

Singh, A. and Mishra, S. (2013). Impact of Extracurricular Activities on Students in Private School of Lucknow District. *International Journal of Humanities and Social Science Invention*. Retrieved from: [https://www.researchgate.net/publication/257536354\\_Impact\\_of\\_extracurricular\\_activities\\_on\\_students\\_in\\_private\\_school\\_of\\_Lucknow\\_District](https://www.researchgate.net/publication/257536354_Impact_of_extracurricular_activities_on_students_in_private_school_of_Lucknow_District)

Tanner, B. (2017). Effects of Extracurricular Activities and Physical Activity on Academic, Intuition: The BYU Undergraduate Journal in Psychology: Vol 12(2), 159-165.

Watkins, A.B. (2004). The Effects of Participation in Extracurricular Activities on the Mean Grade Point Average of High School Students in a Rural Setting. University of Tennessee, Knoxville. Retrieved from: [https://trace.tennessee.edu/cgi/viewcontent.cgi?article=6303&context=utk\\_graddiss](https://trace.tennessee.edu/cgi/viewcontent.cgi?article=6303&context=utk_graddiss)

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