CHAPTER 4

DATA ANALYSIS AND INTERPRETATION OF RESULTS

4.1 Introduction

The current research was associated with the general purpose of examining the association between students' perceived teacher engagement and their engagement in learning and their influence on the academic achievement of the secondary school students of West Bengal. Further, the gender gap in student engagement and academic achievement of boys and girls was examined. The roles of students' perceived teacher engagement and their engagement in predicting students' academic achievement were also investigated. Besides, it was also examined whether the gender gap in student engagement is explained by the gender gap in perceived teacher engagement and whether the gender gap in students' academic achievement is explained by the gender gap in perceived teacher engagement and by the gender gap in student engagement.

4.2 Objective-wise data analysis

4.2.1 The gender difference in perceived teacher engagement of the students

Objective 1: To compare the mean scores of perceived teacher engagement (viz. perceived cognitive-physical engagement, perceived socio-emotional engagement, and perceived pedagogical engagement) of boys and girls.

$H_0$1: There is no significant difference in the mean scores of perceived teacher engagement (viz. perceived cognitive-physical engagement, perceived socio-emotional engagement, and perceived pedagogical engagement) of boys and girls.

The null hypothesis $H_0$1 deals with two variables: gender and Perceived teacher engagement. However, perceived teacher engagement has three components namely, perceived cognitive-physical engagement (PCPE), perceived socio-emotional engagement (PSEE), and perceived pedagogical engagement (PPE).

In $H_0$1, all the Perceived teacher engagement dimensions (viz. PCPE, PSEE, and PPE) are continuous variables. Whereas, gender is a categorical variable with two independent as well as unrelated levels namely, male and female. During the data collection process, no respondent was measured more than once. The observations for all the respondents were independent of each other. For girls (N= 611), the mean scores of PCPE (M_{PCPE}= 21.160±4.958), PSEE (M_{PSEE}= 24.150±5.783), and of PPE (M_{PPE}= 21.860±5.013) were numerically higher than those of the boys (N= 621) with mean scores (see Table 4.3) of PCPE (M_{PCPE}= 20.280±5.300), PSEE (M_{PSEE}= 23.330±5.988), and of PPE (M_{PPE}= 20.670±5.301). The 'numerical differences' have been depicted in Figure 4.4. Further, to examine the statistical significance of 'the numerical differences' in terms of mean scores of PCPE, PSEE, and PPE of boys and girls, the null hypothesis (i.e. $H_0$1) was tested using independent samples t-test (two-tailed).

Before performing the test, the assumptions associated with this statistical technique were checked. Firstly, there were no significant outliers in the two groups (i.e. male and female) separately in terms of PCPE, PSEE, and PPE, as assessed by inspection of the box plots (see Figure 4.2) of the two categorical independent groups (i.e. male and female).

Secondly, from the descriptive statistics (see Table 4.1) of PCPE, PSEE, and PPE, the value of kurtosis and skewness (i.e., skewness< $\left|2.0\right|$ and kurtosis< $\left|9.0\right|$) indicated that each of the groups (i.e. male and female) were approximately normally distributed, separately (Schmider, Ziegler, Danay, Beyer, & Buhner, 2010). The normality of those criterion variables across gender was further supported by the corresponding Q-Q plots (see Figure 4.3) and the histograms (see Figure 4.1) associated with those variables and also from the statistically insignificant results of Shapiro-Wilk test (1965) and Kolmogorov-Smirnov test (see Table 4.2). Thirdly, the results of Levene's Test (1960) (F= 2.381, p= 0.123 for PCPE, F= .373, p= 0.541 for PSEE, and F= 1.286, p= 0.257 for PPE) ensured the homogeneity of variances of the criterion variables across gender (see Table 4.3). Thus, the data satisfied all the assumptions of the independent samples t-test and thereby qualified for applying the test.

Figure 4. 1

Histograms for Perceived Teacher Engagement dimensions separately for Males and Females

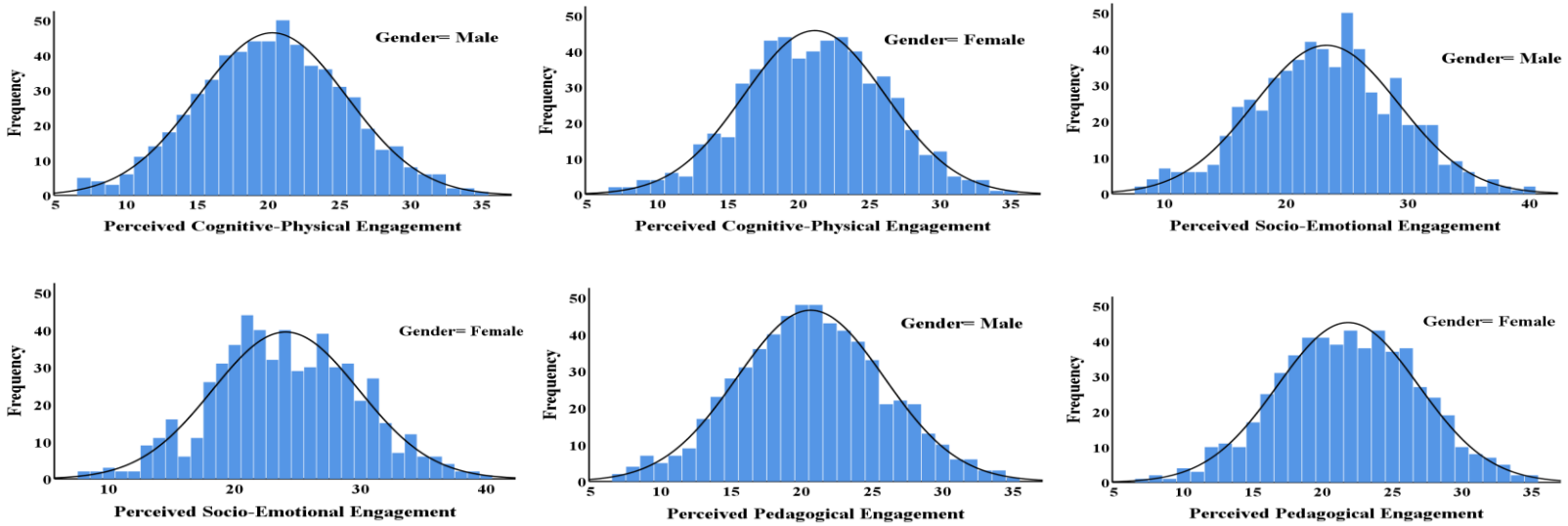
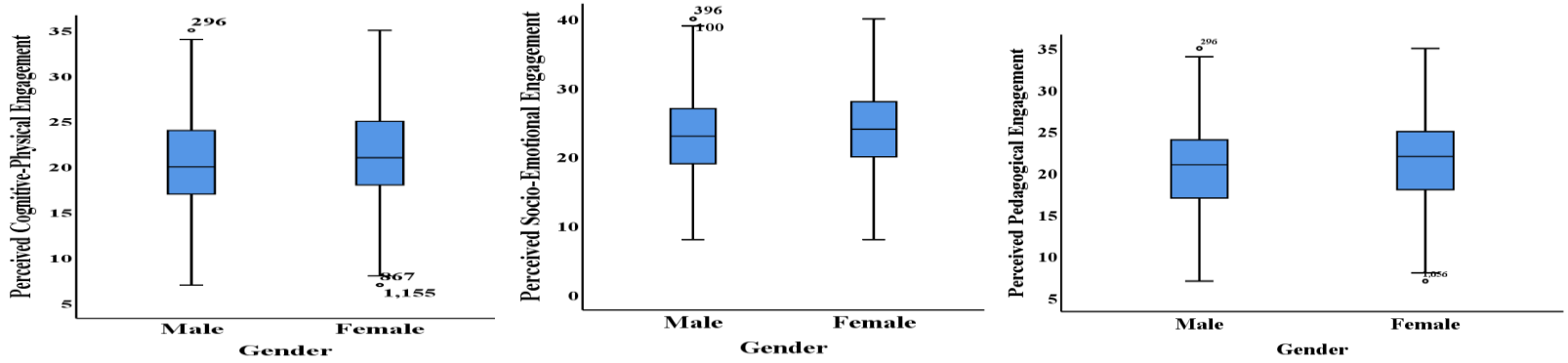


Figure 4. 2

Box plots of Perceived Teacher Engagement dimensions across students' gender



Results (Table 4.3) indicated that the mean score of PCPE was M= 20.280 (SD= 5.300), of PSEE was M= 23.330 (SD= 5.988), and that of PPE was M= 20.670 (SD= 5.301) for boys (N= 621) whereas, girls (N= 611) were associated with a numerically higher mean score of PCPE: M= 21.160 (SD= 4.958), the mean score of PSEE: M= 24.150 (SD= 5.783), and the mean score of PPE: M= 21.860 (SD= 5.013). Further, the numerical differences in the mean scores of PCPE $t(1230)= 3.004$, $p<0.01$; of PSEE $t(1230)= 2.436$, $p<0.05$, and of PPE $t(1230)= 4.067$, $p<0.001$ of boys and girls were found to be statistically significant (see Table 4.3). Thus, the mean score of perceived teacher engagement of boys and girls differ significantly across three teacher engagement dimensions (viz. PCPE, PSEE, and PPE). These results lead to rejecting $H_0 1$. Hence, the results showed that girls perceived higher teacher engagement in three engagement dimensions (viz. PCPE, PSEE, and PPE) as compared to that of boys.

Table 4. 1

Descriptive statistics associated with Perceived teacher engagement dimensions

		Mean			Skewness		Kurtosis	
	Gender	Statistic	Std. Error	SD	Statistic	Std. Error	Statistic	Std. Error
PCPE	Male	20.280	0.213	5.300	0.030	0.098	-0.197	0.196
	Female	21.160	0.201	4.958	-0.049	0.099	-0.135	0.197
PSEE	Male	23.330	0.240	5.988	0.011	0.098	-0.179	0.196
	Female	24.150	0.234	5.783	-0.017	0.099	-0.218	0.197
PPE	Male	20.670	0.213	5.301	0.053	0.098	-0.200	0.196
	Female	21.860	0.203	5.013	-0.062	0.099	-0.214	0.197

Figure 4. 3

Q-Q plots of Perceived Teacher Engagement dimensions separately for Males and Females

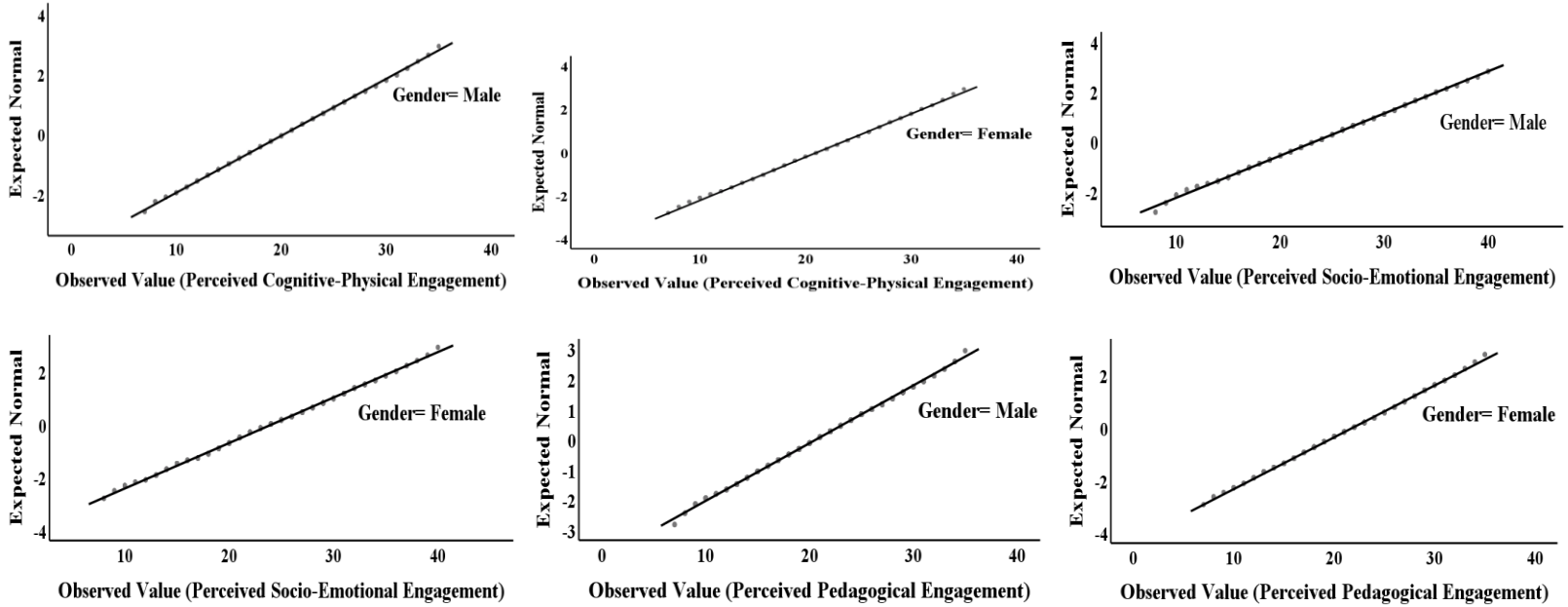
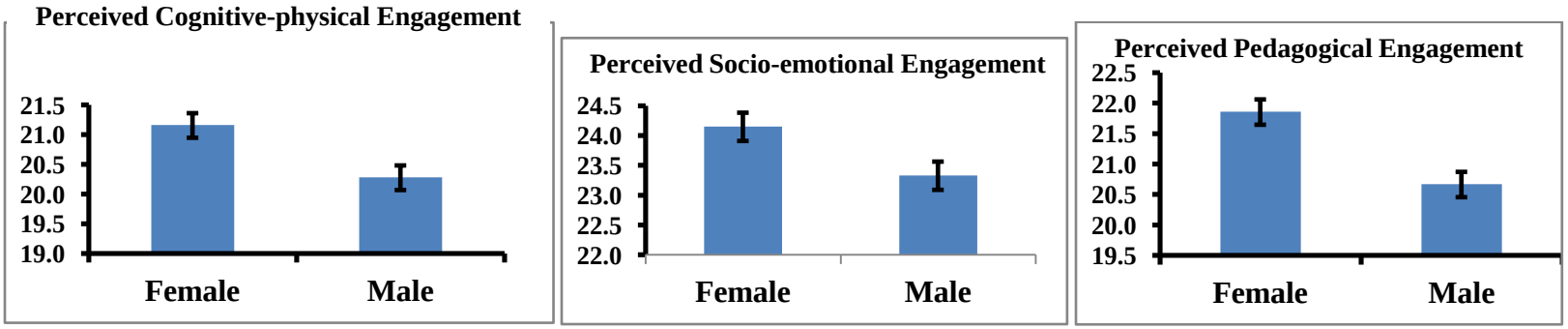


Figure 4. 4

The plot of mean scores of Perceived Teacher Engagement dimensions across students' gender



Further, the effect size of the statistically significant mean differences was calculated for each dimension of perceived teacher engagement to test whether the differences in the mean scores of PCPE, PSEE, and PPE of the two groups were practically impressive (Cohen, 1988). There are several standardized measures available to report the effect size of the significant mean difference between two independent groups. The Cohen's *d* is considered suitable metric when two comparing groups possess identical SDs and are of equal sample size (Turner & Bernard, 2006).

However, Hedges' *g* becomes more appropriate alternative for the groups having different sample sizes as the metric offers a measure of weighted effect size considering the relative sample size of the two groups under study (Turner & Bernard, 2006). Hence, Hedges' g was found to be the appropriate measure of effect size for these comparisons as it deals with two groups with unequal sample sizes. The calculated values of Hedges' g coefficient were .171 for PCPE, .139 for PSEE, and .231 for PPE (see Table 4.3). In all cases, the effects were practically small based on Hedges' guidelines [g= 0.2 (small effect), g= 0.5 (medium effect), and g= 0.8 (large effect); Hedges & Olkin, 1985).

Table 4. 2

Results of Normality tests for Perceived Cognitive-physical Engagement, Perceived Socio-emotional Engagement, and Perceived Pedagogical Engagement separately for Male and Female groups

	Gender	Kolmogorov-Smirnov Test			Shapiro-Wilk Test		
		Statistic	df	Sig.	Statistic	df	Sig.
PCPE	Male	0.019	621	0.200	0.995	621	0.058
	Female	0.018	611	0.200	0.996	611	0.194
PSEE	Male	0.022	621	0.200	0.995	621	0.056
	Female	0.025	611	0.200	0.995	611	0.061
PPE	Male	0.024	621	0.200	0.996	621	0.108
	Female	0.024	611	0.200	0.998	611	0.632

Table 4. 3

Gender-wise M, SD, N, and t-values of Perceived Cognitive-physical Engagement, Perceived Socio-emotional Engagement, and Perceived Pedagogical Engagement

Perceived teacher engagement dimensions	Gender	Group statistics			Levene's Test for Equality of Variances		t-test for Equality of Means			Effect size (Hedges' *g)*
		N	M	SD	F	Sig.	t	df	p	
PCPE	Male	621	20.280	5.300	2.381	0.123	3.004	1230	<.01	0.171
	Female	611	21.160	4.958						
PSEE	Male	621	23.330	5.988	0.373	0.541	2.436	1230	<.05	0.139
	Female	611	24.150	5.783						
PPE	Male	621	20.670	5.301	1.286	0.257	4.067	1230	<.001	0.231
	Female	611	21.860	5.013						

4.2.2 The gender difference in student engagement of boys and girls

Objective 2: To compare the mean scores of student engagement (viz. cognitive engagement, behavioral engagement, and emotional engagement) of boys and girls.

$H_0$2: There is no significant difference in the mean scores of student engagement (viz. cognitive engagement, behavioral engagement, and emotional engagement) of boys and girls.

The null hypothesis $H_0$2 deals with two variables: gender and student engagement. In $H_0$2, the components of student engagement viz. cognitive, behavioral, and emotional engagement are all continuous variables. Whereas, gender is a categorical variable with two independent as well as unrelated levels namely, male and female. During data collection process, no respondent was measured more than once. The observations for all the respondents were independent of each other. For girls (N= 611), the mean scores of CE (M_{CE}= 21.550±4.933), BE (M_{BE}= 24.340±5.875), and of EE (M_{EE}= 24.420±5.676) were numerically higher than those of the boys (N= 621) with mean scores (see Table 4.6) of CE (M_{CE}= 20.650±4.613), BE (M_{BE}= 23.170±5.812), and of EE (M_{EE}= 23.150±5.946). The 'numerical differences' have been depicted in Figure 4.6.

Further, in order to examine the statistical significance of 'the numerical differences' in terms of mean scores of the criterion variables for boys and girls, the null hypotheses were tested using the independent samples t-tests (two-tailed). Prior to this, the assumptions associated with this statistical technique were checked. Firstly, there were no significant outliers in the two groups (i.e. male and female) separately for cognitive, behavioral and emotional engagement, as assessed by inspection of the box-plots (Figure 4.8).

Figure 4. 5

Q-Q plots of Student Engagement dimensions separately for Males and Females

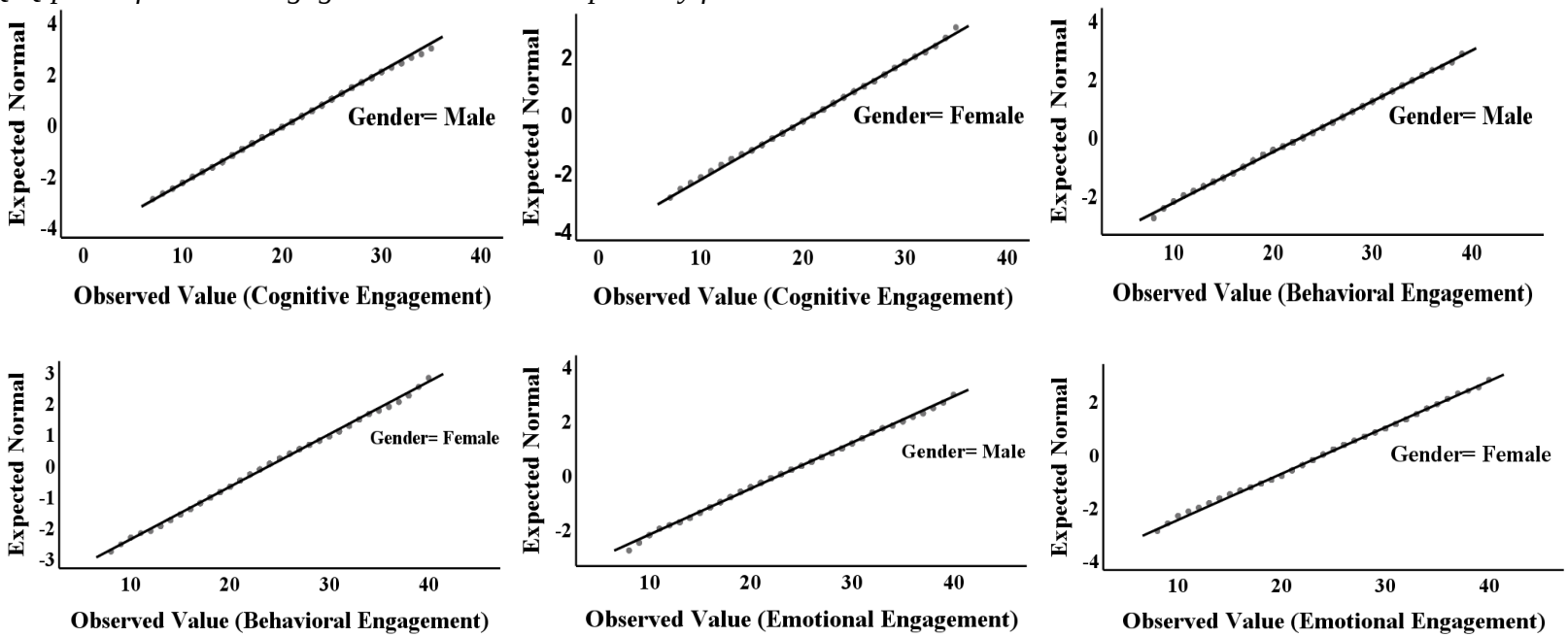
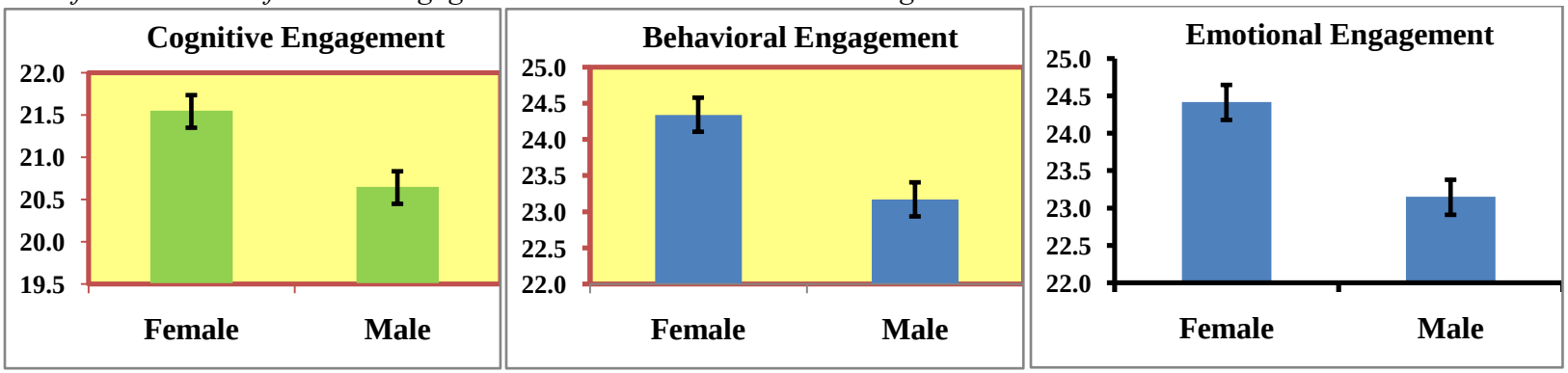


Figure 4. 6

Plot of mean scores of Student Engagement dimensions across students' gender



Secondly, from the descriptive statistics (see Table 4.4) of three engagement dimensions, the value of kurtosis and skewness indicated that each of the groups (i.e. male and female) were approximately normally distributed, separately (Schmider, Ziegler, Danay, Beyer, & Buhner, 2010). The normality of cognitive, behavioral and emotional engagement across gender was further supported by the corresponding Q-Q plots (see Figure 4.5) and the histograms (see Figure 4.7) associated with those criterion variables and also from the results of Shapiro-Wilk test (1965) and Kolmogorov-Smirnov test (see Table 4.5).

Thirdly, the results of Levene's Test (1960) (F= 1.782, p= 0.182 for CE, F= .059, p= 0.808 for BE, and F= 2.865, p= 0.091 for EE) ensured the homogeneity of variances of the criterion variables across gender (Table 4.6). Thus, the data satisfied all the assumptions of independent samples t-test.

Table 4. 4

Descriptive statistics associated with Student Engagement dimensions

	Gender	Mean		SD	Skewness		Kurtosis	
		Statistic	Std. Error		Statistic	Std. Error	Statistic	Std. Error
CE	Male	20.65	0.185	4.613	0.070	0.092	-0.064	0.162
	Female	21.55	0.200	4.933	-0.075	0.094	-0.087	0.133
BE	Male	23.17	0.233	5.812	0.009	0.098	-0.192	0.102
	Female	24.34	0.238	5.875	0.082	0.097	-0.203	0.143
EE	Male	23.15	0.239	5.946	0.106	0.099	-0.257	0.137
	Female	24.42	0.230	5.676	-0.090	0.097	-0.037	0.181

Figure 4. 7

Histograms for Student Engagement dimensions separately for Males and Females

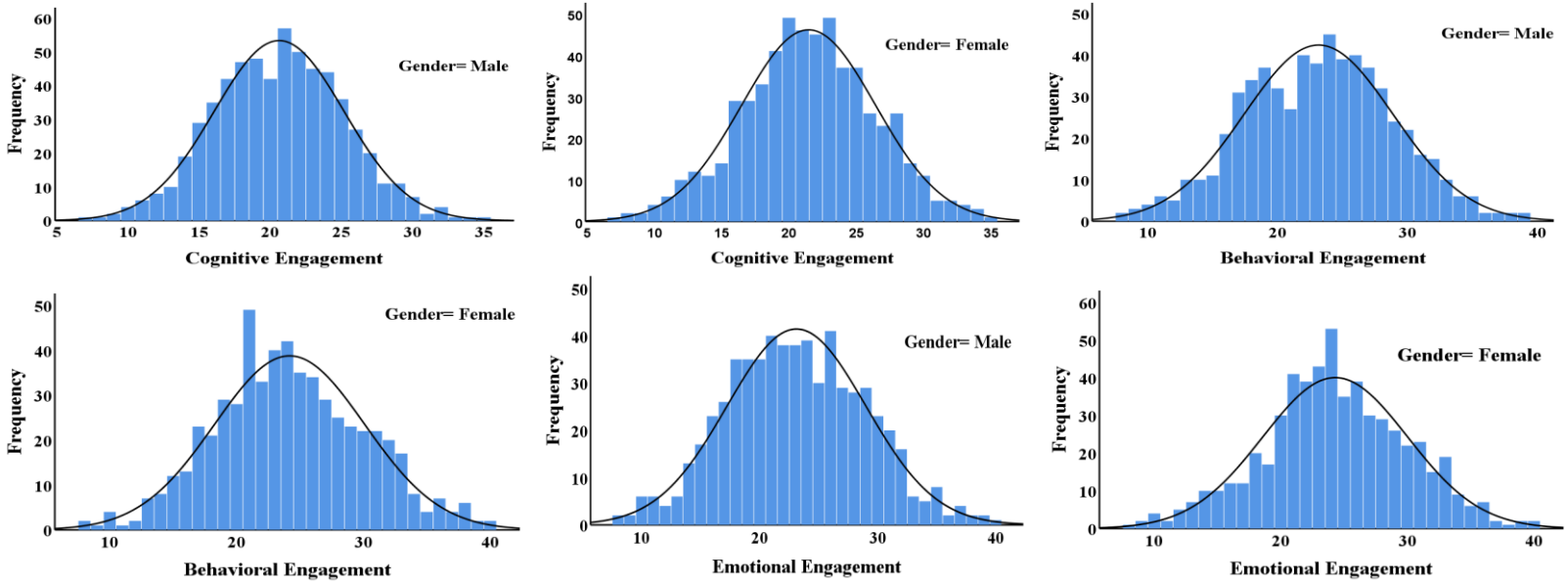
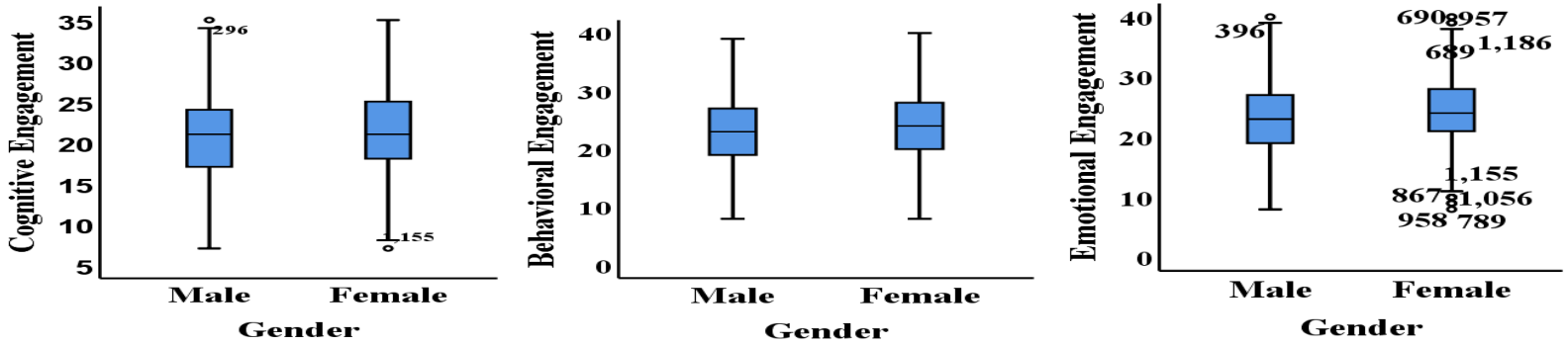


Figure 4. 8

Box-plots of Student Engagement dimensions across their gender



Results (Table 4.6) demonstrated that the mean score of CE was M= 20.650 (SD= 4.613), mean score of BE was M= 23.170 (SD= 5.812), and mean score of EE was M= 23.150 (SD= 5.946) for boys (N= 621). On the other hand, girls (N= 611) were associated with numerically higher mean scores of CE: M= 21.550 (SD= 4.933), mean score of BE: M= 24.340 (SD= 5.875), and mean score of EE: M= 24.420 (SD= 5.676). Further, the numerical differences in the mean scores of mean scores of CE $t(1230)= 3.294$, $p<0.01$; of BE $t(1230)= 3.494$, $p<0.001$, and of EE $t(1230)= 3.846$, $p<0.001$ of boys and girls were found to be statistically significant (see Table 4.6).

Thus, the mean score of student engagement of female students was significantly higher than that of male students across all three engagement dimensions (viz. CE, BE, and EE). These results lead to reject the null hypothesis ($H_0 2$). Hence, the results indicated that the girls were found to be more engaged cognitively, behaviorally, and emotionally than the boys. Further, the values of Hedges' g coefficient were .189 for CE, .200 for BE, and .218 for EE (see Table 4.6). In all cases, the effect size of statistically significant mean differences was practically small based on Hedges' guidelines (Hedges & Olkin, 1985).

Table 4. 5

Results of Normality tests for Cognitive Engagement, Behavioral Engagement, and Emotional Engagement separately for Male and Female groups

Student engagement dimensions	Gender	Kolmogorov-Smirnov Test			Shapiro-Wilk Test		
		Statistic	df	Sig.	Statistic	df	Sig.
Cognitive Engagement	Male	0.024	621	0.200	0.997	621	0.235
	Female	0.025	611	0.200	0.998	611	0.615
Behavioral Engagement	Male	0.020	621	0.200	0.996	621	0.178
	Female	0.023	611	0.200	0.996	611	0.189
Emotional Engagement	Male	0.018	621	0.200	0.995	621	0.056
	Female	0.024	611	0.200	0.996	611	0.178

Table 4. 6

Gender-wise M, SD, N, and t-values of Student Engagement dimensions

Student Engagement dimensions	Gender	Group statistics			Levene's Test for Equality of Variances		t-test for Equality of Means			Effect size (Hedge's g)
		N	M	SD	F	Sig.	t	df	p	
Cognitive Engagement	Male	621	20.65	4.613	1.782	0.182	3.294	1230	<.01	0.189
	Female	611	21.55	4.933						
Behavioral Engagement	Male	621	23.17	5.812	0.059	0.808	3.494	1230	<.001	0.200
	Female	611	24.34	5.875						
Emotional Engagement	Male	621	23.15	5.946	2.865	0.091	3.846	1230	<.001	0.218
	Female	611	24.42	5.676						

4.2.3 Gender gap in academic achievement of the students

Objective 3: To compare the mean scores of academic achievement of boys and girls.

$H_0$3: There is no significant difference in the mean scores of academic achievement of boys and girls.

The null hypothesis $H_0$3, deals with two variables: gender and academic achievement. Academic achievement is a continuous variable, whereas, gender is a categorical variable with two independent as well as unrelated levels namely, male and female. The observations for all the respondents were independent of each other. For girls (N= 611), the mean scores of academic achievement (M_{ACH}= 64.377±6.224) was numerically higher than those of the boys (N= 621) with mean scores (see Table 4.9) of academic achievement (M_{ACH}= 63.217±6.238). The 'numerical difference' has been depicted in Figure 4.11. Further, in order to find the statistical significance of 'the numerical difference' in terms of mean scores of achievement of males and females, the null hypothesis (i.e. $H_0$3) was tested using independent samples t-test (two-tailed).

Prior to this, the assumptions associated with this statistical technique were checked. Firstly, there were no significant outliers in the two groups (i.e. male and female) separately in terms of academic achievement, as assessed by inspection of the box-plots (see Figure 4.9) of the two categorical independent groups (i.e. male and female). Secondly, from the descriptive statistics (Table 4.7) of academic achievement, the values of kurtosis and skewness indicated that the two groups (i.e. male and female) were approximately normally distributed, separately (Schmider, Ziegler, Danay, Beyer, & Buhner, 2010). The normality of academic achievement across gender was further supported by the Q-Q plots (Figure 4.10) and the histograms (Figure 4.9) associated with gender-wise academic achievement and also from the statistically insignificant results of Shapiro-Wilk test (1965) and Kolmogorov-Smirnov test (Table 4.8). Thirdly, the results of Levene's Test (F= 1.243, p= 0.289) ensured homogeneity of variances of academic achievement across students' gender (Table 4.9). Thus, the data satisfied all the assumptions of independent samples t-test and thereby qualified for applying the test.

Figure 4. 9

Box-plots and Histograms for Academic achievement separately for Males and Females

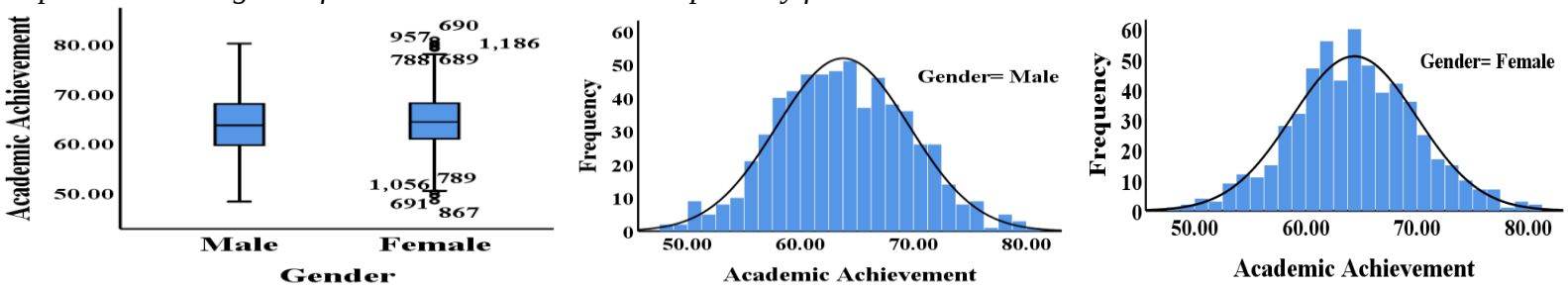


Figure 4. 10

Q-Q plots of Student Engagement dimensions separately for Males and Females

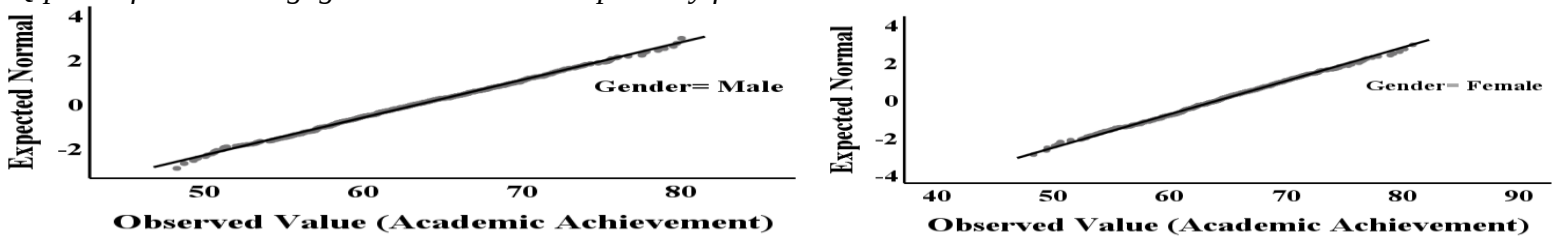
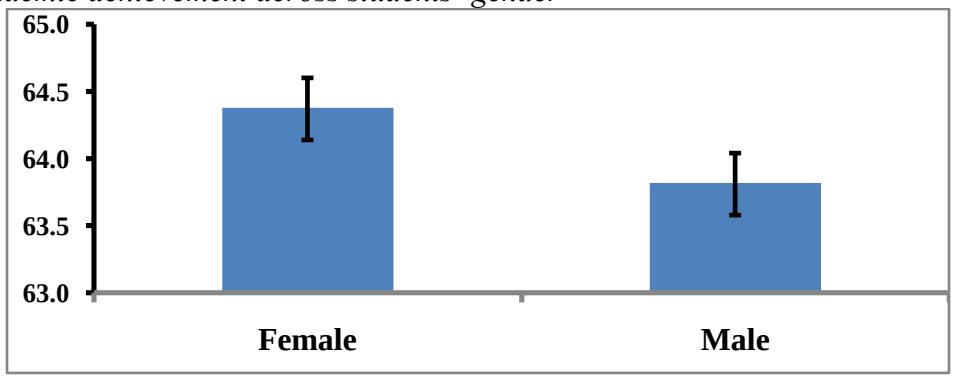


Figure 4. 11

Plot of mean scores of Academic achievement across students' gender



Results (Table 4.9) showed that the mean academic achievement score was M= 63.217 (SD= 6.238) for boys (N= 621). Whereas, girls (N= 611) were associated with a numerically higher mean score of academic achievement: M= 64.377 (SD= 6.224). Further, the numerical differences in the mean score of academic achievement $t(1230)= 2.211$, $p<0.05$ of boys and girls was found to be statistically significant (Table 4.9). Thus, the mean score of girls' achievement was significantly higher as compared to boys. These results lead to reject the null hypothesis ($H_0$3). Hence, the results indicated that the girls were found to be academically more successful than the boys. Further, the value of Hedges' g coefficient was .186 (Table 4.9). Hence, the effect size of the statistically significant mean differences was practically small based on Hedges' guidelines (Hedges & Olkin, 1985).

4.2.4 Mediation effect of Perceived teacher engagement (viz. perceived cognitive-physical, perceived socio-emotional, and perceived pedagogical engagement) on the relationship between gender and student engagement

Objective 4: To study the mediation effect of Perceived teacher engagement (viz. perceived cognitive-physical, perceived socio-emotional, and perceived pedagogical engagement) on the relationship between gender and student engagement

$H_0$4: There is no significant mediation effect of Perceived teacher engagement (viz. perceived cognitive-physical, perceived socio-emotional, and perceived pedagogical engagement) on the relationship between gender and student engagement.

This null hypothesis ($H_0$4) deals with student engagement as the outcome variable that includes three components namely, cognitive, behavioral, and emotional engagement. This leads to three sub-hypotheses ($H_0$4a-4c) of $H_0$4.

Table 4. 7

Descriptive statistics associated with Academic achievement of the students

	Gender	Mean		SD	Skewness		Kurtosis	
		Statistic	Std. Error		Statistic	Std. Error	Statistic	Std. Error
Academic achievement	Male	63.817	0.238	5.938	0.092	0.098	-0.218	0.196
	Female	64.377	0.224	5.544	0.040	0.099	0.111	0.197

Table 4. 8

Results of Normality tests for Academic achievement for Male and Female groups

	Gender	Kolmogorov-Smirnov Test			Shapiro-Wilk Test		
		Statistic	df	Sig.	Statistic	df	Sig.
Academic achievement	Male	0.024	621	.200	0.997	621	0.237
	Female	0.025	611	.200	0.998	611	0.621

Table 4. 9

Gender-wise M, SD, N, and t-values of students' Academic achievement

	Gender	Group statistics			Levene's Test for Equality of Variances		t-test for Equality of Means			Effect size (Hedge's *g*)
		N	M	SD	F	Sig.	t	df	p	
Academic achievement	Male	621	63.217	6.238	1.243	0.289	2.211	1230	<.05	0.186
	Female	611	64.377	6.224						

4.2.4.1 Mediation effect of Perceived teacher engagement (viz. PCPE, PSEE, and PPE) on the relationship between gender and cognitive engagement

$H_0$4a: There is no significant mediation effect of Perceived teacher engagement (viz. PCPE, PSEE, and PPE) on the relationship between gender and cognitive engagement.

The null hypothesis $H_0$4a is multivariate in nature as it deals with five variables: students' gender, perceived cognitive-physical engagement (PCPE), perceived socio-emotional engagement (PSEE), and perceived pedagogical engagement (PPE), and cognitive engagement (CE). All the variables are continuous variables except students' gender which is a categorical variable with two levels namely, male and female. The mediation hypothesis ($H_0$4a) was tested following parallel mediation analysis.

Whenever conducting a mediation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.12). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.53 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}= 5.63) did not exceed the threshold value (i.e. 9.49 with df=4 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual. Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.12) and Q-Q plot (Figure 4.12) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the statistically insignificant results of Kolmogrov-Smirnov test (statistic= .019, df= 1232, p= .200) and the Shapiro-Wilk test (W= .998, df= 1232, p=.917) (Field, 2009).

Figure 4. 12

Histogram (extreme left), Normal Q-Q plot (middle) and Box Plot (extreme right) of the residual

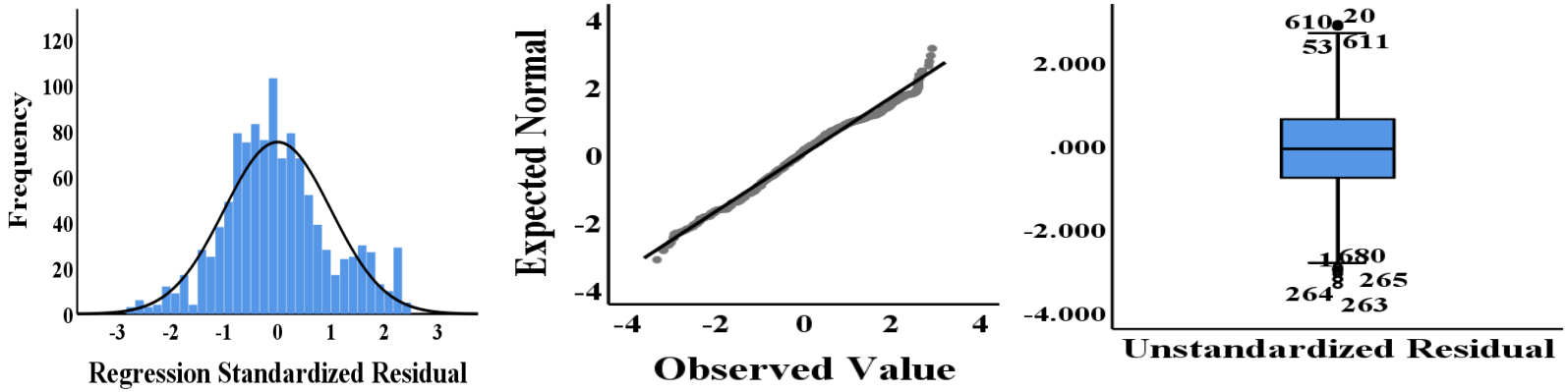
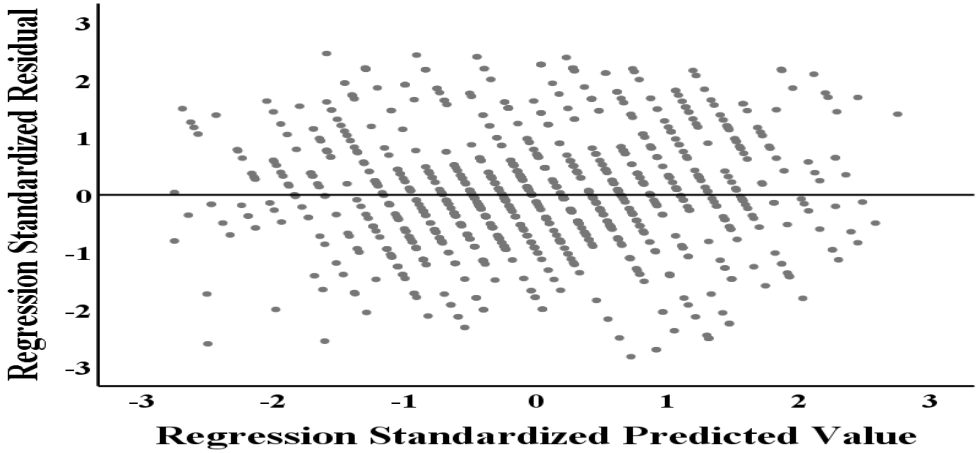


Figure 4. 13

The Residual Plot of the dependent variable (Academic achievement)



Third, the value of Durbin-Watson statistic is 2.72 that falls within the acceptable range of 1.00 to 3.00 (Field, 2013). Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.13). Fourth, Figure 4.14 depicts the linear relationships among the criterion variables where each plot showed the value of R^2_{Linear}>0.3 (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately. Fifth, Figure 4.13 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .677, p= .836) and Koenker test (LM= .619, p= .751) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.10, it can be seen that the VIF<10 (Myers, 1990) and Tolerance>0.2 (Menard, 1995) for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured.

Table 4. 10

Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Gender	0.53	1.87
Perceived Pedagogical Engagement (PPE)	0.61	1.64
Perceived Socio-Emotional Engagement (PSEE)	0.58	1.73
Perceived Cognitive-physical Engagement (PCPE)	0.67	1.49

Therefore, the data met all the statistical assumptions required for the mediation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the mediation analysis may be generalized in the target population.

Figure 4. 14

Simple Scatter plot of Cognitive Engagement against Perceived Cognitive-physical Engagement, Perceived Socio-Emotional Engagement, and Perceived Pedagogical Engagement

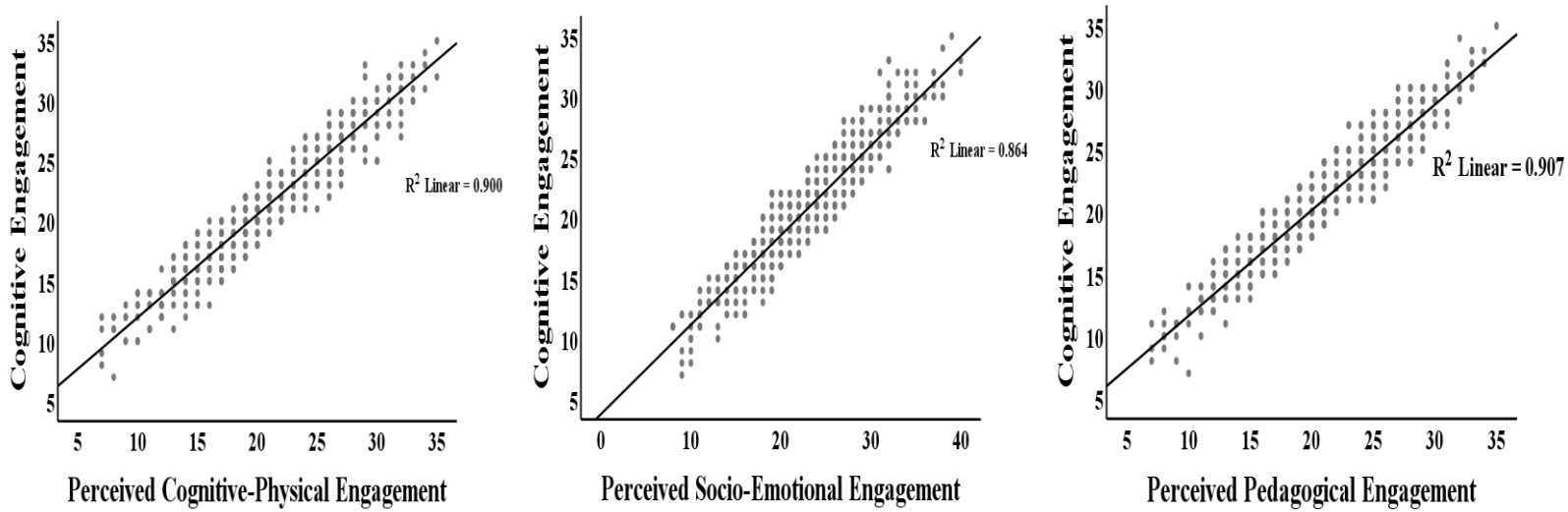


Table 4. 11

Correlation Matrix for bi-variate correlations (Pearson correlation) among the variables in the study

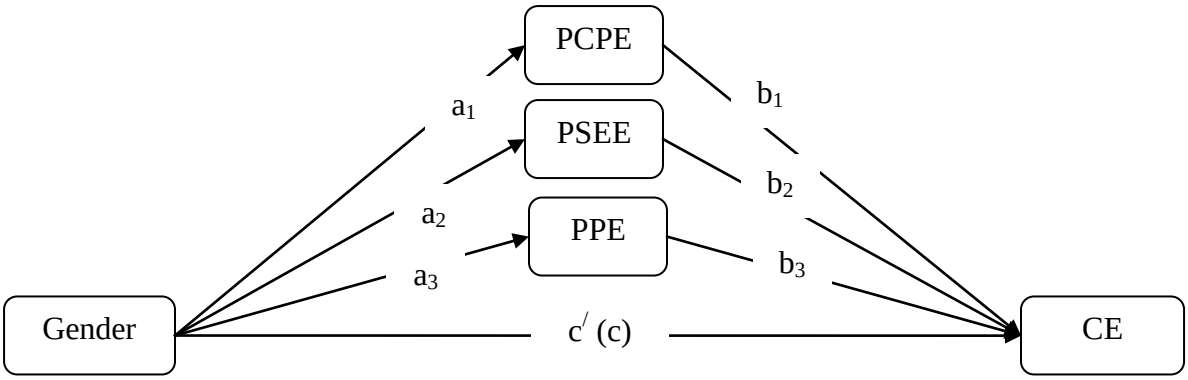
	CE	BE	EE	PCPE	PSEE	PPE	ACH
CE	--						
BE	.39*	--					
EE	.31*	.36*	--				
PCPE	.42*	.43*	.45*	--			
PSEE	.41*	.33*	.38*	.35*	--		
PPE	.46*	.44*	.31*	.37*	.44*	--	
ACH	.51**	.36*	.45*	.48**	.53**	.43*	--

*p<0.05,**p<0.01

The parallel mediation analysis was run by selecting the Perceived teacher engagement dimensions (viz. perceived cognitive-physical, perceived socio-emotional, and perceived pedagogical engagement). The three mediation relationships in the hypothesized theoretical path model (Figure 4.15) were then examined and evaluated (Figure 4.16).

Figure 4. 15

Hypothesized path model of the mediation effect for the three teacher engagement dimensions (viz. PCPE, PSEE, and PPE) on the relationship between gender and CE



Note. a_i is effect of gender on perceived teacher engagement dimensions; b_i is effect of perceived teacher engagement dimensions (viz. PCPE, PSEE, and PPE) on CE; $c^{/}$ is direct effect; c is the total effect in absence of any mediator, and a_ib_i is the indirect effect via the i^{th} Mediator variable

The results indicated that the *Total effect model* is significant: R^2= 0.009, F(1, 1230)= 10.852, p<0.01 (Table 4.12). The results also demonstrated that students' gender positively predicts students' cognitive engagement (c= .828, 95% CIs: [0.362, 1.294]; see Table 4.12). Further, results from the three *Mediator variable models* show that gender positively influenced students' perceived cognitive-physical engagement (a_1= .817, 95% CIs: [.159, 1.475]; Mediator variable model 1, see Table 4.12), perceived socio-emotional engagement (a_2= 0.879, 95% CIs: [0.305, 1.452]; Mediator variable model 2, see Table 4.12), and perceived pedagogical engagement (a_3= .134, 95% CIs: [.043, .225]; Mediator variable model 3, see Table 4.12). In turn, students' perceived cognitive-physical engagement positively influenced students' cognitive engagement (b_1= 0.119, 95% CIs: [0.073, 0.164]); so did students' perceived socio-emotional engagement (b_2= 0.459, 95%

CIs: [0.404, 0.514]). However, students' perceived pedagogical engagement did not significantly influenced cognitive engagement (b_3= 0.102, 95% CIs: [-0.025, 0.229]) (see Table 4.12).

Further, analyzing the indirect effects from the *Indirect effect model*, results revealed that students' perceived cognitive-physical engagement significantly mediated the association between gender and students' cognitive engagement: a_1*b_1= 0.097, 95% BootLLCI= 0.015, 95% BootULCI= 0.179] (Hayes, 2013). Similarly, the indirect effects for perceived socio-emotional engagement (a_2*b_2= 0.403, 95% BootLLCI= 0.138, 95% BootULCI= 0.668]) was also statistically significant. However, for perceived pedagogical engagement, the indirect effect (a_3*b_3= 0.014, 95% BootLLCI= -0.025, 95% BootULCI= 0.053]) (see Table 4.12) was statistically not significant. The total indirect effect exerted jointly by the perceived teacher engagement dimensions (viz. PCPE, PSEE, and PPE) was also statistically significant: (Total indirect effect= .514, 95% BootLLCI= 0.197, 95% BootULCI= .831]; see Table 4.12) which is 62.077% of the total effect.

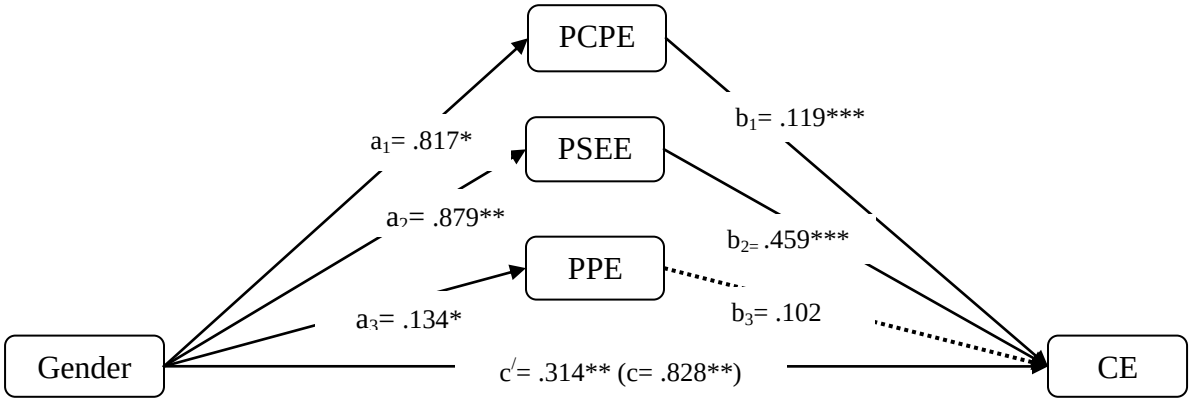
As the indirect effects of the mediators were statistical significant, it is required to calculate the effect size to find the practical significance of those effects. Wen and Fan (2015) suggested ratio of the indirect effect to the total effect (P_M) as the traditional mediation effect size measure (except for the mediations where the indirect and direct effects bear opposite signs; Preacher and Kelley, 2011). The P_M for the mediators (viz. PCPE and PSEE) were found to be .117 and .487 respectively (Table 4.12).

Nevertheless, it was found from the *Direct effect model* that the results also suggest that after accounting for the mediating role of the three perceived teacher engagement dimensions (viz. PCPE, PSEE, and PPE), gender still significantly predicted students' cognitive engagement ($c^{/}$= 0.314, SE= .093, 95% CIs: [.202, .426]) (see Table 4.12). Therefore, it was found that the direct effect of gender was lessened in predicting cognitive engagement but it was still statistically significant. Thus, it can be said that the sub-dimensions of perceived teacher engagement (except PPE) partially mediated the association between gender and CE.

Besides, the percentage of the mediation effect (see Table 4.42) showed that the proportion of the total effect of gender on cognitive engagement that operates indirectly through PCPE is 11.715% and through PSEE is 48.671%. These results provide evidence that the gender gap in cognitive engagement is significantly explained by the gender gap in perceived teacher engagement (except PPE). Thus, gender differences in all perceived teacher engagement dimensions (except PPE) play key roles in explaining gender gap in students' cognitive engagement. In sum, the indirect effects exerted by the teacher engagement dimensions (except PPE) significantly influenced students' cognitive engagement. Thus, except PPE, the other two teacher engagement dimensions namely, PCPE and PSEE were found to be significant mediators on the association between gender and CE. Yet the direct effect of students' gender on their cognitive engagement was still significant indicating this as a case of partial mediation. Further, the indirect effect operated through PCPE was lesser than that through PSEE. Thus, PSEE was found to be a better mediator on the association between gender and CE as well as a better predictor of CE. Finally, it can be said that gender gap in PCPE and in PSEE is a significant cause in explaining the gender difference in CE.

Figure 4. 16

Structural model of the total, direct and indirect effects for the three teacher engagement dimensions (viz. PCPE, PSEE, and PPE) on the association between gender and CE



Note. *p < .05, **p < .01, ***p < .001

a_n is effect of gender on perceived teacher engagement dimensions; b_n is effect of perceived teacher engagement dimensions on cognitive engagement; $c^{/}$ is direct effect; c is total effect in the absence of any mediator(s) in the model.

Table 4. 12

Results of mediation analysis for Hypothesis 4a

	B	SE	t	95% [LLCI, ULCI]
Total effect model: Gender→ CE				
R^2=.009, F(1,1230)=10.852, p<.01				
Constant	19.758	.429	46.047***	[18.916, 20.600]
Gender	.828	.251	3.294**	[.362, 1.294]
Mediator variable model 1: Gender→PCPE				
R^2=.007, F(1,1230)=9.022, p<.01				
Constant	19.400	.461	42.052***	[18.495, 20.305]
Gender	.817	.336	2.436*	[.159, 1.475]
Mediator variable model 2: Gender→PSEE				
R^2=.005, F(1,1230)=5.934, p<.05				
Constant	22.515	.529	42.550***	[21.476, 23.553]
Gender	.879	.293	3.004**	[.305, 1.452]
Mediator variable model 3: Gender→PPE				
R^2=.013, F(1,1230)=16.541, p<.001				
Constant	19.471	.464	41.984***	[18.561, 20.381]
Gender	.134	.064	2.094*	[.043, .225]
Dependent variable model: Outcome variable= CE				
R^2=.889, F(4,1227)=2458.593, p<.001				
Constant	2.387	.229	10.437***	[1.939, 2.836]
Gender	.314	.093	3.376**	[.202, .426]
PCPE	.119	.023	5.121***	[.073, .164]
PSEE	.459	.028	16.340***	[.404, .514]
PPE	.102	.067	1.522	[-.025, .229]
Direct effect model: Gender→ CE	.314	.093	3.376**	[.202, .426]

Indirect effect models

	Effect (B)	SE	95% [LLCI, ULCI]	Nature of Mediation	P_M	% of Mediation
Gender → PCPE (M_1) → CE	.097	.048	[.015, .179]	Partial Mediation	.117	11.715
Gender → PSEE (M_2) → CE	.403	.137	[.138, .668]	Partial Mediation	.487	48.671
Gender → PPE (M_3) → CE	.014	.009	[-.025, .053]	No Mediation	---	---
Gender → *PCPE, PSEE, &* PPE → CE	.514	.058	[.197,.831]	---	.621	62.077

Note.*p<.05, **p<.01, ***p<.001

4.2.4.2 Mediation effect of Perceived teacher engagement (viz. perceived cognitive-physical, perceived socio-emotional, and perceived pedagogical engagement) on the relationship between gender and behavioral engagement

$H_0$4b: There is no significant mediation effect of Perceived teacher engagement (viz. perceived cognitive-physical, perceived socio-emotional, and perceived pedagogical engagement) on the relationship between gender and behavioral engagement.

The null hypothesis $H_0$4b is multivariate in nature as it deals with five variables: students' gender, perceived cognitive-physical engagement (PCPE), perceived socio-emotional engagement (PSEE), and perceived pedagogical engagement (PPE), and behavioral engagement (BE). All the variables are continuous variables except students' gender which is a categorical variable with two levels namely, male and female. The mediation hypothesis ($H_0$4b) was tested following parallel mediation analysis.

Whenever conducting a mediation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.18). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.71 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}=5.91) did not exceeded the threshold value (i.e. 9.49 with df=4 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual.

Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.18) and Q-Q plot (Figure 4.18) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the

statistically insignificant results of Kolmogrov-Smirnov test (statistic= .022, df= 1232, p= .200) and the Shapiro-Wilk test (W= .996, df= 1232, p=.862) (Field, 2009).

Third, the value of Durbin-Watson statistic is 2.64 that falls within the acceptable range of 1.00 to 3.00 (Field, 2013). Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.19). Fourth, Figure 4.17 depicts the linear relationships among the criterion variables where each plot showed the value of $R^2_{Linear}>0.3$ (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately.

Fifth, Figure 4.19 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .668, p= .836) and Koenker test (LM= .617, p= .751) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.13, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured.

Table 4. 13

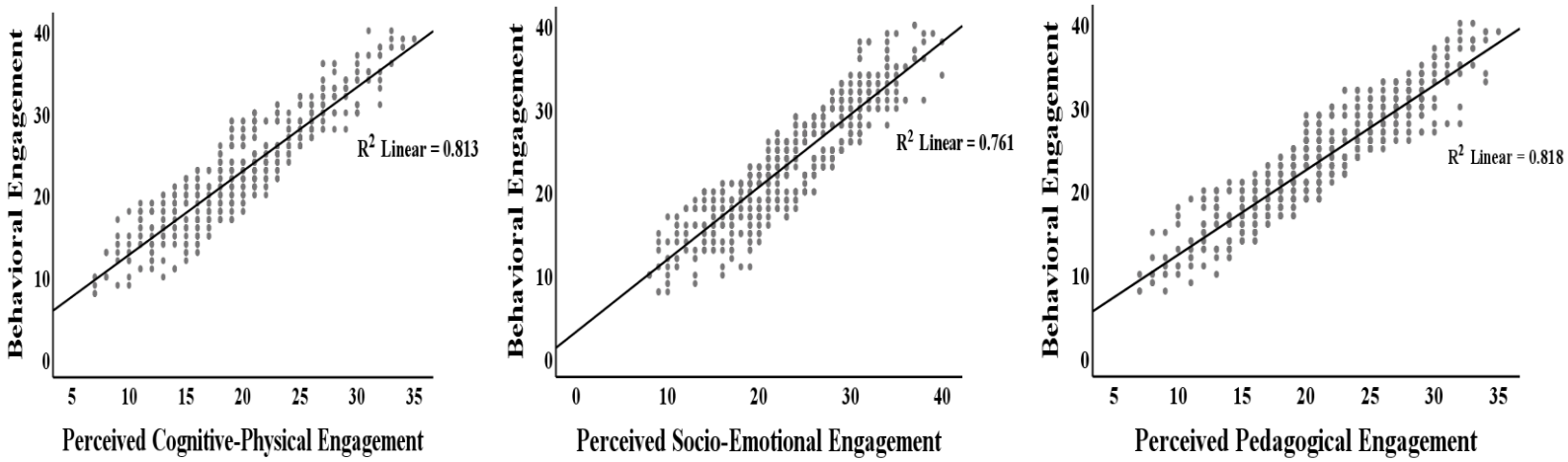
Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Perceived Cognitive-physical Engagement (PCPE)	0.49	2.04
Perceived Socio-Emotional Engagement (PSEE)	0.67	1.49
Perceived Pedagogical Engagement (PPE)	0.62	1.61
Gender	0.71	1.41

Therefore, the data met all the statistical assumptions required for the mediation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the mediation analysis may be generalized in the target population.

Figure 4. 17

Simple Scatter plot of Behavioral Engagement against Perceived Cognitive-physical Engagement, Perceived Socio-Emotional Engagement, and Perceived Pedagogical Engagement



The parallel mediation analysis was run by selecting the Perceived teacher engagement dimensions (viz. perceived cognitive-physical, perceived socio-emotional, and perceived pedagogical engagement). The three mediation relationships in the hypothesized theoretical path model (see Figure 4.20) were then examined and evaluated (see Figure 4.21). The results demonstrated that the *Total effect model* is significant: R^2= 0.010, F(1, 1230)= 12.205, p<0.001 (see Table 4.14). Students' gender positively predicts students' behavioral engagement (c= 1.114, 95% CIs: [0.510, 1.718]; Table 4.14). Further, results from the three *Mediator variable models* show that gender positively influenced students' perceived cognitive-physical engagement (a_1= 0.817, 95% CIs: [0.159, 1.475]; Mediator variable model 1; see Table 4.14), perceived socio-emotional engagement (a_2= .879, 95% CIs: [.305, 1.452]; Mediator variable model 2; Table 4.14), and perceived pedagogical engagement (a_3= .134, 95% CIs: [.043, .225]; Mediator variable model 3, Table 4.14).

In turn, students' perceived cognitive-physical engagement positively influenced students' behavioral engagement (b_1= 0.147, 95% CIs: [0.080, 0.215]) and so did students' perceived socio-emotional engagement (b_2= 0.511, p<0.001, 95% CIs: [0.430, 0.593]). However, students' perceived pedagogical engagement did not significantly influenced students' behavioral engagement (b_3= 0.103, 95% CIs: [-0.042, .248]) (see Table 4.14). Further, analyzing the indirect effects from the *Indirect effect model*, results revealed that students' perceived cognitive-physical engagement significantly mediated the association between gender and students' behavioral engagement: a_1*b_1= 0.120, 95% BootLLCI= 0.024, 95% BootULCI= 0.216] (Hayes, 2013). Similarly, the indirect effects for perceived socio-emotional engagement (a_2*b_2= 0.449, 95% BootLLCI= 0.149, 95% BootULCI= 0.749]) were statistically significant. However, the indirect effects for perceived pedagogical engagement (a_3*b_3= 0.014, 95% BootLLCI= -0.034, 95% BootULCI= 0.062]) (see Table 4.14) was found to be statistically not significant. The total indirect effect exerted jointly by all the three perceived teacher engagement dimensions (viz. PCPE, PSEE, and PPE) was also statistically significant: (Total indirect effect= .583, 95% BootLLCI= 0.160, 95% BootULCI= 1.006]; see Table 4.14) which is 52.334% of the total effect. Further, the P_M for the mediators (viz. PCPE and PSEE) were found to be .108 and .403, respectively (see Table 4.14).

Figure 4. 18

Histogram (extreme left), Normal Q-Q plot (middle), and Box Plot (extreme right) of the residual

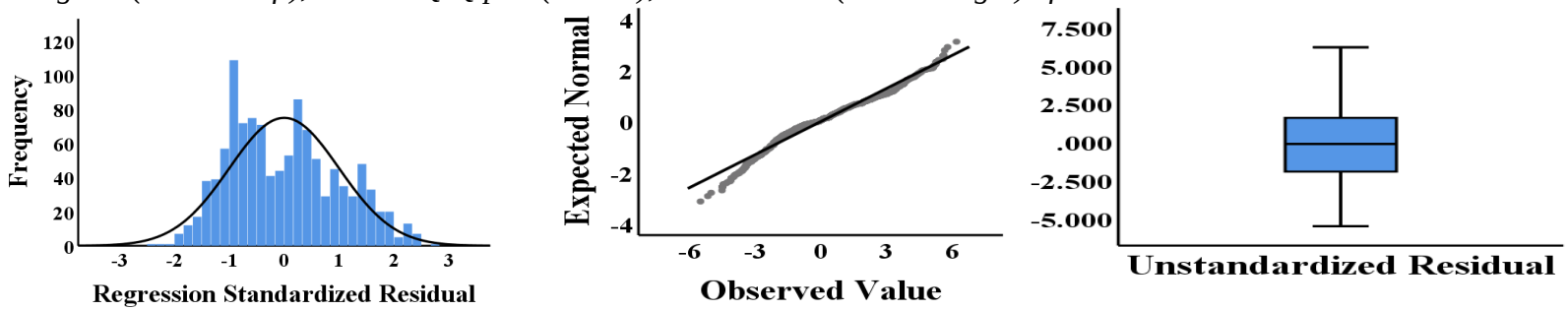


Figure 4. 19

The Residual Plot of the dependent variable (Academic achievement)

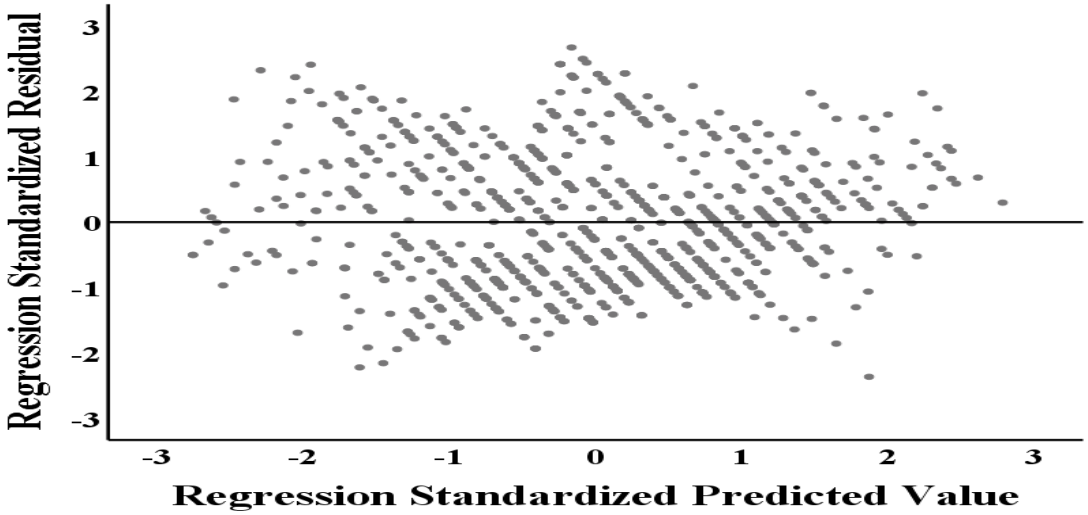
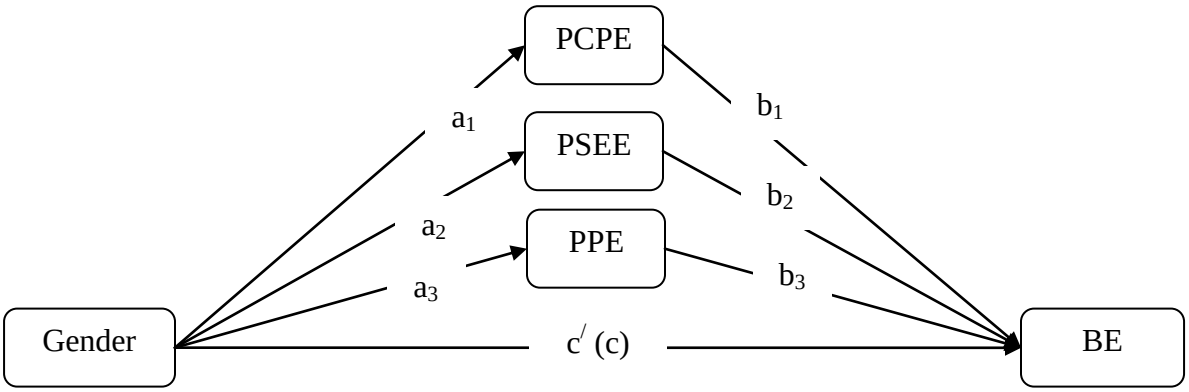


Figure 4. 20

Hypothesized path model of the mediation effect for the three teacher engagement dimensions (viz. PCPE, PSEE, and PPE) on the relationship between gender and BE



Note. a_i is effect of gender on teacher engagement dimensions; b_i is effect of teacher engagement dimensions (viz. PCPE, PSEE, and PPE) on BE; $c^{/}$ is direct effect; c is the total effect in absence of any mediator, and a_ib_i is the indirect effect via the i^{th} Mediator variable

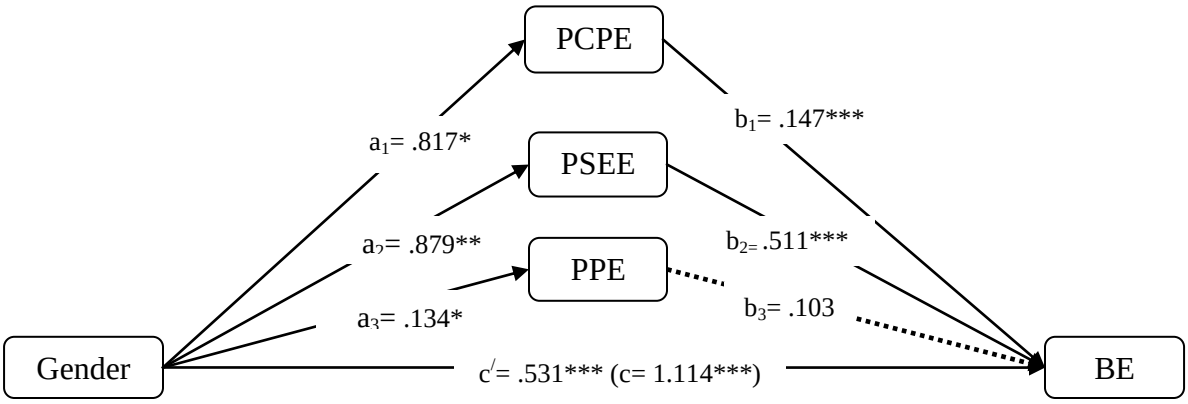
Nevertheless, it was found from the *Direct effect model* that the results also suggest that after accounting for the mediating role of the perceived teacher engagement dimensions (except PPE), gender still significantly predicted students' behavioral engagement ($c^{/}$=0.531, 95% CIs: [0.233, 0.829]) (see Table 4.14). Therefore, it was found that the effect of gender was disappeared in predicting behavioral engagement. Thus, it can be said that the sub-dimensions of perceived teacher engagement (except PPE) partially mediated the association between gender and BE.

Besides, the percentage of the mediation effect (see Table 4.14) show that the proportion of the total effect of gender on behavioral engagement that operates indirectly through PCPE is 10.772% and through PSEE is 40.305%. These results provide evidence that the gender gap in behavioral engagement is significantly explained by the gender gap in perceived teacher engagement (except PPE). All perceived teacher engagement dimensions (except PPE) play key roles in explaining gender gap in students' behavioral engagement. In sum, the indirect effects exerted by the teacher engagement dimensions (except PPE) significantly influenced students' behavioral engagement. Thus, except

PPE, the other two teacher engagement dimensions namely, PCPE and PSEE were found to be significant mediators on the association between gender and BE. Yet the direct effect of students' gender on their behavioral engagement was still significant indicating this as a case of partial mediation. Further, the indirect effect operated through PCPE was lesser than that through PSEE. Thus, PSEE was found to be a better mediator on the association between gender and behavioral engagement as well as a better predictor of behavioral engagement. Finally, it can be said that gender gap in PCPE and in PSEE is a significant cause in explaining the gender difference in BE.

Figure 4. 21

Structural model of the total, direct and indirect effects for the three teacher engagement dimensions (viz. PCPE, PSEE, and PPE) on the relationship between gender and their BE



Note. *p < .05, **p < .01, ***p < .001

a_n is effect of gender on teacher engagement dimensions; b_n is effect of teacher engagement dimensions on behavioral engagement; $c^{/}$ is direct effect; c is total effect in the absence of any mediator(s) in the model.

Table 4. 14

Results of mediation analysis for Hypothesis 4b

	B	SE	t	95% [LLCI, ULCI]
Total effect model: Gender→ BE				
R^2=.010, F(1,1230)=12.205, p<.001				
Constant	22.011	.525	41.911***	[20.980, 23.041]
Gender	1.114	.319	3.494***	[.510, 1.718]
Mediator variable model 1: Gender→PCPE				
R^2=.007, F(1,1230)=9.022, p<.01				
Constant	19.400	.461	42.052***	[18.495, 20.305]
Gender	.817	.336	2.436*	[.159, 1.475]
Mediator variable model 2: Gender→PSEE				
R^2=.005, F(1,1230)=5.934, p<.05				
Constant	22.515	.529	42.550***	[21.476, 23.553]
Gender	.879	.293	3.004**	[.305, 1.452]
Mediator variable model 3: Gender→PPE				
R^2=.013, F(1,1230)=16.541, p<.001				
Constant	19.471	.464	41.984***	[18.561, 20.381]
Gender	.134	.064	2.094*	[.043, .225]
Dependent variable model: Outcome variable= BE				
R^2=.838, F(4,1227)=1583.838, p<.001				
Constant	1.375	.339	4.058***	[.710, 2.040]
Gender	.531	.137	3.870***	[.233, .829]
PCPE	.147	.034	4.280***	[.080, .215]
PSEE	.511	.042	12.283***	[.430, .593]
PPE	.103	.054	1.907	[-.042, .248]
Direct effect model: Gender→ BE	.531	.137	3.870***	[.233, .829]

Indirect effect models

	Effect (B)	SE	95% [LLCI, ULCI]	Nature of Mediation	P_M	% of Mediation
Gender → PCPE (M_1) → BE	.120	.052	[.024, .216]	Partial Mediation	.108	10.772
Gender → PSEE (M_2) → BE	.449	.155	[.149, .749]	Partial Mediation	.403	40.305
Gender → PPE (M_3) → BE	.014	.031	[-.034, .062]	No Mediation	---	---
Gender → *PCPE, PSEE, &* PPE → BE	.583	.246	[.160, 1.006]	---	.523	52.334

Note.*p<.05, **p<.01, ***p<.001

4.2.4.3 Mediation effect of Perceived teacher engagement (viz. perceived cognitive-physical, perceived socio-emotional, and perceived pedagogical engagement) on the relationship between gender and emotional engagement

$H_0$4c: There is no significant mediation effect of Perceived teacher engagement (viz. perceived cognitive-physical, perceived socio-emotional, and perceived pedagogical engagement) on the relationship between gender and emotional engagement.

The null hypothesis $H_0$4c is multivariate in nature as it deals with five variables: students' gender, perceived cognitive-physical engagement (PCPE), perceived socio-emotional engagement (PSEE), and perceived pedagogical engagement (PPE), and emotional engagement (EE). All the variables are continuous variables except students' gender which is a categorical variable with two levels namely, male and female. The mediation hypothesis ($H_0$4c) was tested following parallel mediation analysis.

Whenever conducting a mediation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.22). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.66 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}=5.68) did not exceeded the threshold value (i.e. 9.49 with df=4 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual.

Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.22) and Q-Q plot (Figure 4.22) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the

statistically insignificant results of Kolmogrov-Smirnov test (statistic= .014, df= 1232, p= .200) and the Shapiro-Wilk test (W= .998, df= 1232, p=.877) (Field, 2009).

Third, the value of Durbin-Watson statistic is 2.33 that falls within the acceptable range of 1.00 to 3.00 (Field, 2013). Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.23). Fourth, Figure 4.24 depicts the linear relationships among the criterion variables where each plot showed the value of $R^2_{Linear}>0.3$ (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately.

Fifth, Figure 4.23 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .659, p= .836) and Koenker test (LM= .613, p= .751) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.15, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured.

Table 4. 15

Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Perceived Cognitive-physical Engagement (PCPE)	0.55	1.82
Perceived Socio-Emotional Engagement (PSEE)	0.51	1.96
Perceived Pedagogical Engagement (PPE)	0.43	2.33
Gender	0.46	2.17

Therefore, the data met all the statistical assumptions required for the mediation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the mediation analysis may be generalized in the target population.

Figure 4. 22

Histogram (extreme left), Normal Q-Q plot (middle), and Box Plot (extreme right) of the residual

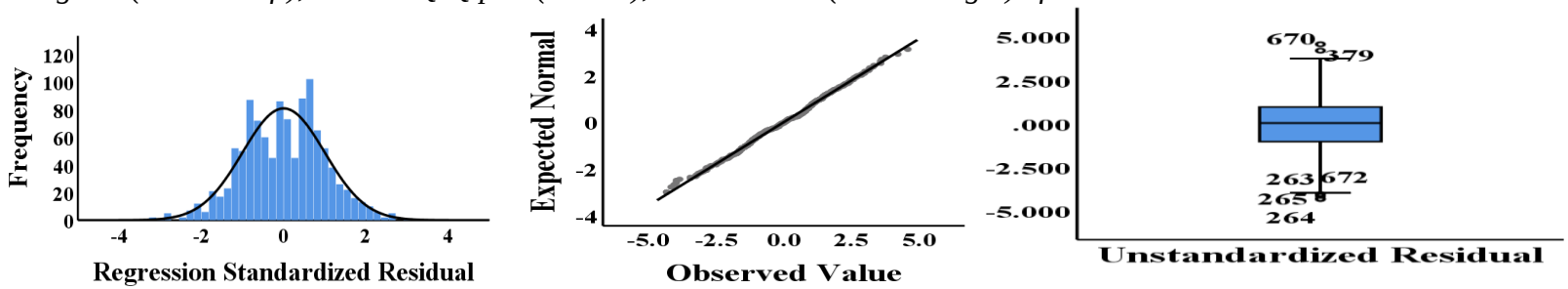


Figure 4. 23

The Residual Plot of the dependent variable (Academic achievement)

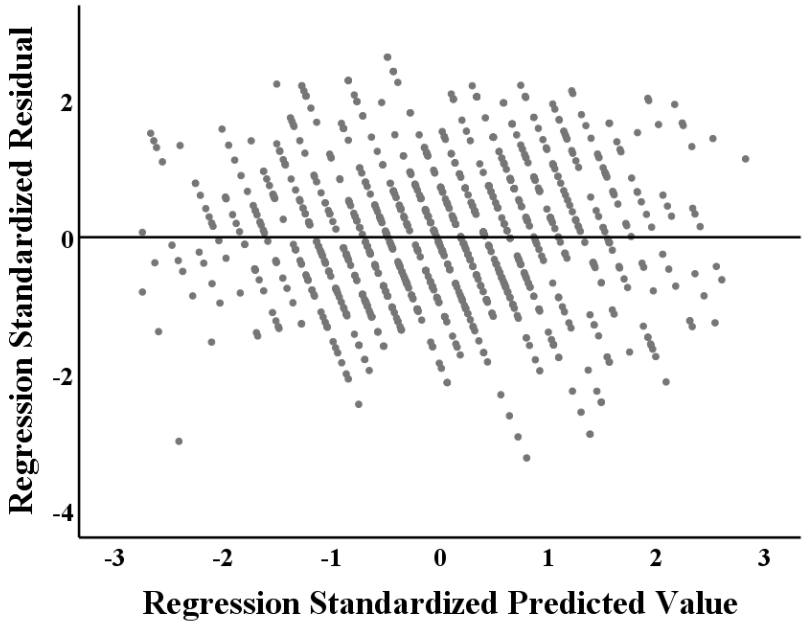
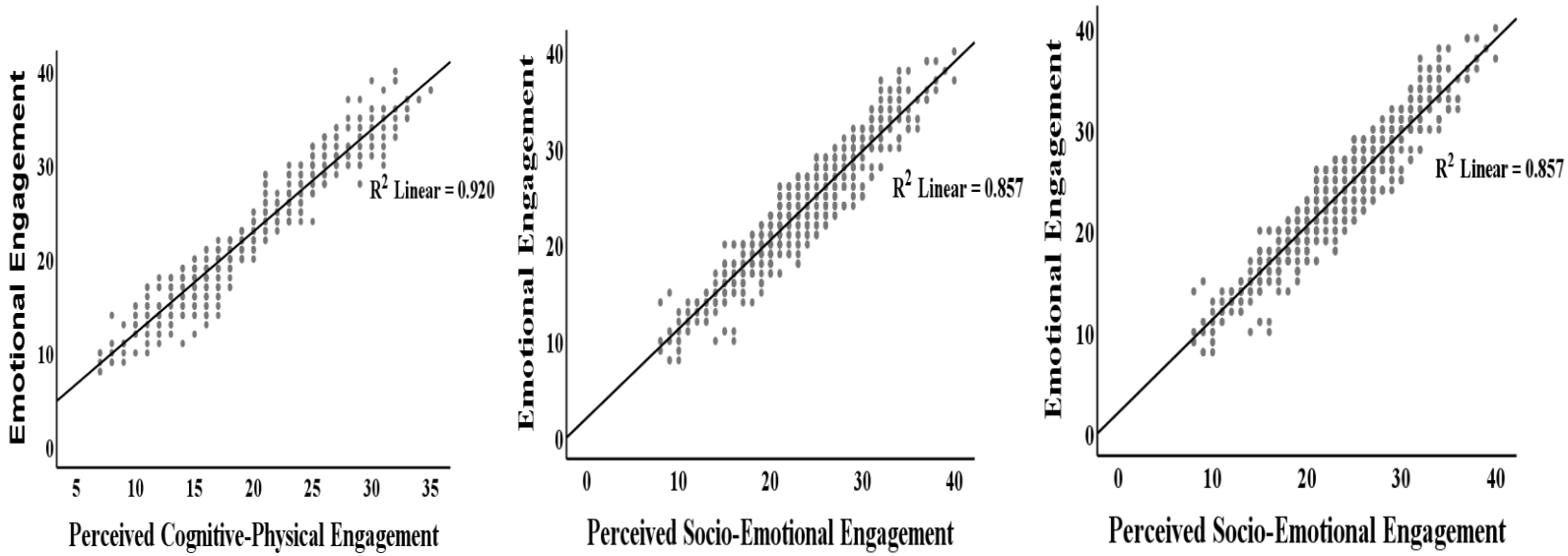


Figure 4. 24

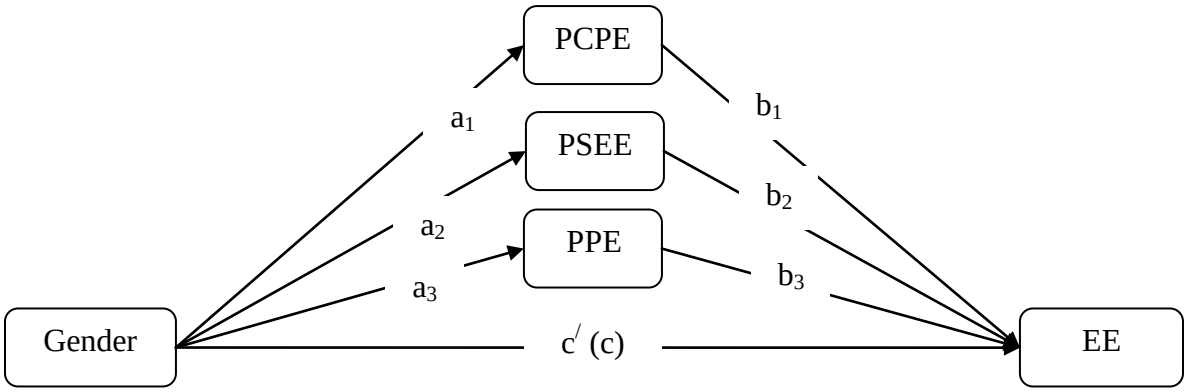
Simple Scatter plot of Emotional Engagement against Perceived Cognitive-physical Engagement, Perceived Socio-Emotional Engagement, and Perceived Pedagogical Engagement



The parallel mediation analysis was run by selecting the teacher engagement dimensions (viz. perceived cognitive-physical, perceived socio-emotional, and perceived pedagogical engagement). The three mediation relationships in the hypothesized theoretical path model (Figure 4.25) were then examined and evaluated (Figure 4.26).

Figure 4. 25

Hypothesized path model of the mediation effect for the three teacher engagement dimensions (viz. PCPE, PSEE, and PPE) on the relationship between gender and EE



Note. a_i is effect of gender on teacher engagement dimensions; b_i is effect of teacher engagement dimensions (viz. PCPE, PSEE, and PPE) on EE; $c^{/}$ is direct effect; c is the total effect in absence of any mediator, and a_ib_i is the indirect effect via the i^{th} Mediator variable

The results indicated that the *Total effect model* was statistically significant: R^2= 0.012, F(1, 1230)= 14.793, p<0.001 (Table 4.16). Students' gender positively predicts students' emotional engagement (c= 1.274, 95% CIs: [0.624, 1.924]; Table 4.16). Further, results from the three *Mediator variable models* show that gender positively influenced students' perceived cognitive-physical engagement (a_1= .817, 95% CIs: [.159, 1.475]; Mediator variable model 1, see Table 4.16), perceived socio-emotional engagement (a_2= 0.879, 95% CIs: [0.305, 1.452]; Mediator variable model 2, Table 4.16), and perceived pedagogical engagement (a_3= .134, 95% CIs: [.043, .225]; Mediator variable model 3, see Table 4.16). In turn, students' perceived cognitive-physical engagement positively

influenced students' emotional engagement (b_1= 0.230, 95% CIs: [0.184, 0.277]) and so did students' perceived socio-emotional engagement (b_2= 0.540, 95% CIs: [0.483, 0.596]). However, students' perceived cognitive-physical engagement did not significantly influenced students' perceived pedagogical engagement (b_3= 0.091, p<0.001, 95% CIs: [-0.033, 0.215]) (see Table 4.16).

Further, analyzing the indirect effects from the *Indirect effect model*, results revealed that students' perceived cognitive-physical engagement significantly mediated the association between gender and EE: a_1*b_1= 0.188, 95% BootLLCI= 0.035, 95% BootULCI= 0.341] (Hayes, 2013). Similarly, the indirect effects for perceived socio-emotional engagement (a_2*b_2= 0.474, 95% BootLLCI= 0.163, 95% BootULCI= 0.785]) were also statistically significant. However, the indirect effects for perceived pedagogical engagement (a_3*b_3= 0.012, 95% BootLLCI= -0.049, 95% BootULCI= 0.073]) (see Table 4.46) was statistically not significant. The total indirect effect exerted jointly by all the three perceived teacher engagement dimensions (viz. PCPE, PSEE, and PPE) was also statistically significant: (Total indirect effect= .674, 95% BootLLCI= 0.425, 95% BootULCI= 0.923]; see Table 4.46) which is 52.904% of the total effect. Further, the P_M for the mediators (viz. PCPE and PSEE) were found to be .148 and .372, respectively (Table 4.16). Nevertheless, it was found from the *Direct effect model* that the results also suggest that even after accounting for the mediating role of the three perceived teacher engagement dimensions (viz. PCPE, PSEE, and PPE), gender still had a positive and significant effect on EE ($c^{/}$=0.600, 95% CIs: [.362, 0.838]) (Table 4.16).

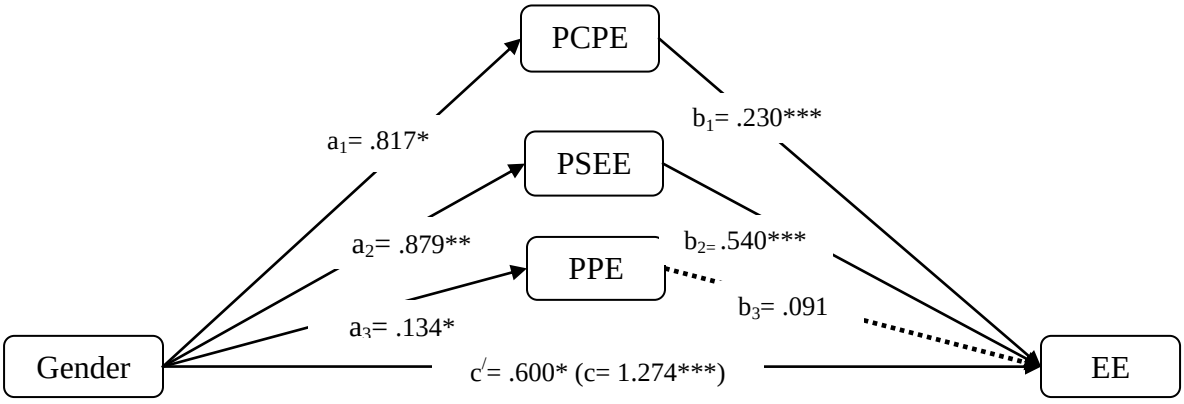
Therefore, it was found that even the effect of gender was lessened predicting emotional engagement, still the effect was significant. Thus, it can be said that the sub-dimensions of perceived teacher engagement (except PPE) partially mediated the association between gender and emotional engagement.

Besides, the percentage of the mediation effect (Table 4.16) showed that the proportion of the total effect of gender on emotional engagement that operated indirectly through PCPE was 14.757% and through PSEE is 37.206%. These results provide evidence that the gender difference in emotional engagement is significantly explained by the gender gap in perceived teacher engagement (except PPE). All perceived teacher engagement

dimensions (except PPE) play key roles in explaining gender gap in students' emotional engagement. In sum, the indirect effects exerted by the teacher engagement dimensions (except PPE) significantly influenced students' emotional engagement. Thus, except PPE, the other two teacher engagement dimensions namely, PCPE and PSEE were found to be significant mediators on the association between gender and EE. Yet the direct effect of students' gender on their emotional engagement was still significant indicating this as a case of partial mediation. Further, the indirect effect operated through PCPE was lesser than that through PSEE. Thus, PSEE was found to be a better mediator on the association between gender and EE as well as a better predictor of EE. Finally, it can be said that gender gap in PCPE and in PSEE is a significant cause in explaining the gender disparity in EE.

Figure 4. 26

Structural model of the total, direct and indirect effects for the three teacher engagement dimensions (viz. PCPE, PSEE, and PPE) on the relationship between gender and their EE



Note. *p < .05, **p < .01, ***p < .001

a_n is effect of gender on teacher engagement dimensions; b_n is effect of teacher engagement dimensions on emotional engagement; $c^{/}$ is direct effect; c is total effect in the absence of any mediator(s) in the model.

Table 4. 16

Results of mediation analysis for Hypothesis 4c

	B	SE	t	95% [LLCI, ULCI]
Total effect model: Gender→ EE				
R^2=.012, F(1,1230)=14.793, p<.001				
Constant	21.874	.523	41.865***	[20.849, 22.899]
Gender	1.274	.331	3.846***	[.624, 1.924]
Mediator variable model 1: Gender→PCPE				
R^2=.007, F(1,1230)=9.022, p<.01				
Constant	19.400	.461	42.052***	[18.495, 20.305]
Gender	.817	.336	2.436*	[.159, 1.475]
Mediator variable model 2: Gender→PSEE				
R^2=.005, F(1,1230)=5.934, p<.05				
Constant	22.515	.529	42.550***	[21.476, 23.553]
Gender	.879	.293	3.004**	[.305, 1.452]
Mediator variable model 3: Gender→PPE				
R^2=.013, F(1,1230)=16.541, p<.001				
Constant	19.471	.464	41.984***	[18.561, 20.381]
Gender	.134	.064	2.094*	[.043, .225]
Dependent variable model: Outcome variable= EE				
R^2=.923, F(4,1227)=3655.472, p<.001				
Constant	.242	.233	1.037	[-.216, .699]
Gender	.600	.294	2.041*	[.362, .838]
PCPE	.230	.024	9.740***	[.184, .277]
PSEE	.540	.029	18.847***	[.483, .596]
PPE	.091	.067	1.358	[-.033, .215]
Direct effect model: Gender→ EE	.600	.294	2.041*	[.362, .838]

Indirect effect models

	Effect (B)	SE	95% [LLCI, ULCI]	Nature of Mediation	P_M	% of Mediation
Gender → PCPE (M_1) → EE	.188	.083	[.035, .341]	Partial Mediation	.148	14.757
Gender → PSEE (M_2) → EE	.474	.163	[.163, .785]	Partial Mediation	.372	37.206
Gender → PPE (M_3) → EE	.012	.100	[-.049, .073]	No Mediation	---	---
Gender → *PCPE, PSEE, &* PPE → EE	.674	.320	[.425, .923]	---	.530	52.904

Note.*p<.05, **p<.01, ***p<.001

4.2.5 Moderation effect of students' gender on the relationship between perceived teacher engagement and student engagement

Objective 5: To study the moderation effect of students' gender on the relationship between perceived teacher engagement and student engagement

$H_0$5: There is no significant moderation effect of students' gender on the relationship between perceived teacher engagement and student engagement

This null hypothesis ($H_0$5) is associated with perceived teacher engagement as the focal predictor variable that includes three components namely, perceived cognitive-physical, perceived socio-emotional, and perceived pedagogical engagement. This leads to three sub-hypotheses ($H_0$5a-5c) of $H_0$5.

> $H_0$5a: There is no significant moderation effect of students' gender on the relationship between perceived cognitive-physical engagement and student engagement
>
> $H_0$5b: There is no significant moderation effect of students' gender on the relationship between perceived socio-emotional engagement and student engagement
>
> $H_0$5c: There is no significant moderation effect of students' gender on the relationship between perceived pedagogical engagement and student engagement

4.2.5.1 Moderation effect of students' gender on the relationship between perceived cognitive-physical engagement and student engagement

$H_0$5a: There is no significant moderation effect of students' gender on the relationship between perceived cognitive-physical engagement and student engagement

The null hypothesis ($H_0$5a) deals with perceived teacher engagement as the outcome variable that includes three components namely, cognitive, behavioral, and emotional engagement. This leads to three sub-hypotheses ($H_0$5a.1-5a.3) of $H_0$5a.

> $H_0$5a.1: There is no significant moderation effect of students' gender on the relationship between perceived cognitive-physical engagement and students' cognitive engagement
>
> $H_0$5a.2: There is no significant moderation effect of students' gender on the relationship between perceived cognitive-physical engagement and students' behavioral engagement
>
> $H_0$5a.3: There is no significant moderation effect of students' gender on the relationship between perceived cognitive-physical engagement and students' emotional engagement

4.2.5.1.1 Moderation effect of students' gender on the relationship between perceived cognitive-physical engagement and students' cognitive engagement

$H_0$5a.1: There is no significant moderation effect of students' gender on the relationship between perceived cognitive-physical engagement and students' cognitive engagement

The null hypothesis ($H_0$5a.1) is multivariate in nature as it deals with four variables: Gender, PCPE, their interaction (i.e. Gender*PCPE), and cognitive engagement (CE). All the variables are continuous except Gender, which is a categorical variable with two levels namely, male and female. Thus, the null hypothesis (i.e. $H_0$5a.1) was tested following Moderation analysis.

Whenever conducting a moderation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be

meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.27). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.74 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}=5.82) did not exceeded the critical value (i.e. 7.81 with df=3 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual.

Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.27) and Q-Q plot (Figure 4.27) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the statistically insignificant results of Kolmogrov-Smirnov test (statistic= .018, df= 1232, p= .200) and the Shapiro-Wilk test (W= .998, df= 1232, p=.917) (Field, 2009).

Third, the value of Durbin-Watson statistic is 2.38. Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.28). Fourth, Figure 4.14 depicts the linear relationships among the criterion variables where each plot showed the value of R^2_{Linear}>0.3 (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately.

Fifth, Figure 4.28 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .670, p= .836) and Koenker test (LM= .613, p= .751) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Figure 4. 27

Histogram (extreme left), Normal Q-Q plot (middle) and Box Plot (extreme right) of the residual

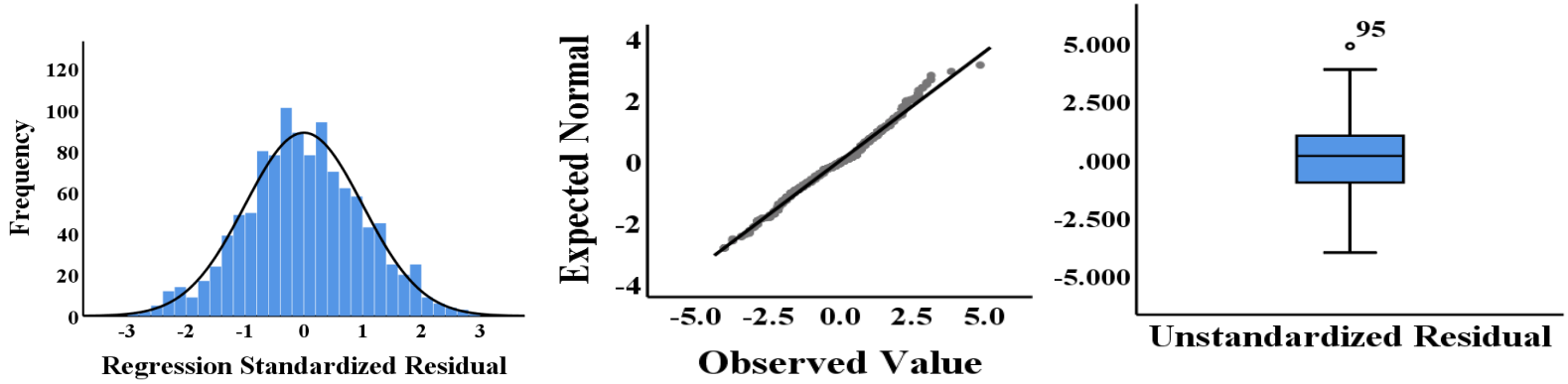
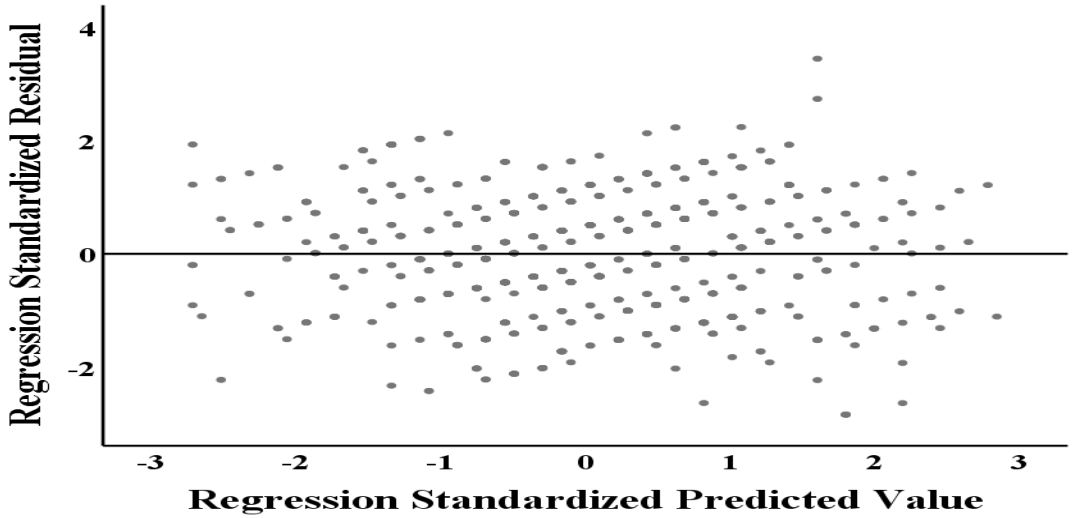


Figure 4. 28

The Residual Plot of the dependent variable (Cognitive Engagement)



Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.17, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured.

Table 4. 17

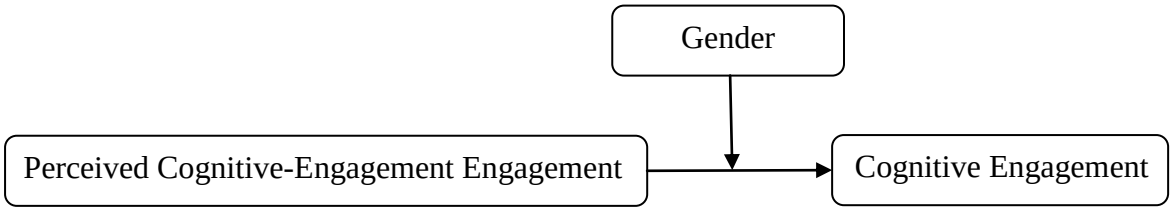
Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Gender	0.61	1.64
Gender*PCPE	0.38	2.63
Perceived Cognitive-physical Engagement (PCPE)	0.69	1.45

Therefore, the data met all the statistical assumptions required for the moderation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the moderation analysis may be generalized in the target population.

Figure 4. 29

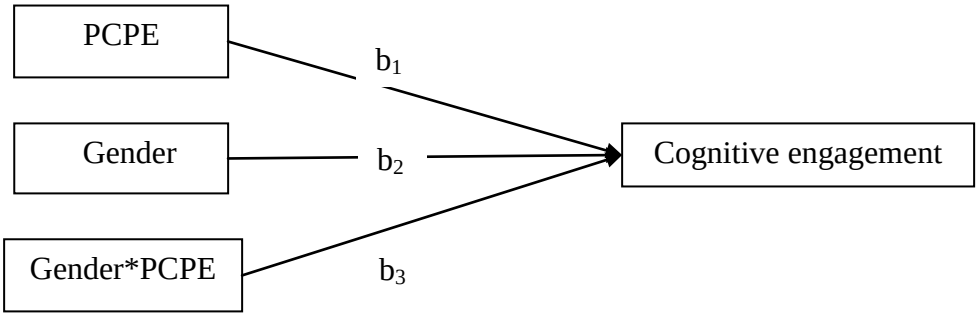
Hypothesized (conceptual) path model for the moderation effect of gender on the relationship between PCPE and cognitive engagement



Further, a follow up analysis as prescribed by Aiken, West, and Reno (1991) was performed by plotting Cognitive engagement against PCPE, separately for male and female students. Further, simple slope analyses were performed to examine whether the slopes of the regression lines differed significantly for different gender.

Figure 4. 30

Statistical model for the moderation effect of gender on the relationship between PCPE and cognitive engagement



A basic model considering PCPE as independent variable, CE as the dependent variable, and gender as the moderator variable was constructed (see Figure 4.29) and was examined by performing Moderation analysis (Figure 4.30 and 4.31). The overall moderation model was significant: R^2= .869, F(3, 1228)= 2717.412, p<.001, (see Table 4.18). Further, the effect of PCPE on CE was positive and significant, (B= .722, 95% CI [.663, .781], p<0.001; see Table 4.18). Again, the effect of Gender on CE was positive and significant, (B= 1.895, 95% CI [1.333, 2.457], p<0.001; see Table 4.18]. However, the effect of interaction between PCPE and students' gender on CE was found to be statistically not significant (B= .008, 95% CI [-.029, .045], p=.857; see Table 4.18].

Further, R^2-change for inclusion of the interaction term (Gender*PCPE) in the moderation model was not significant: R^2-change= .000, F(1, 1228)= .026, p=.857. This implies that the interaction term did not contribute significantly to the moderation model. These results do not permit to identify gender as a significant moderator in this case. It can be said that PCPE influenced students' cognitive engagement to the same extent for the students regardless of their gender. Hence, PCPE was found to be equally important for boys and girls for promoting their cognitive engagement.

Further, to know the trend of influence of the interaction between gender and PCPE on cognitive engagement, a graph was plotted. From Graph 1, it can be seen that there is no interaction effect of Gender and PCPE on students' CE. Therefore, the association between the focal predictor PCPE and the outcome variable CE did not depend upon students' gender. Thus, it can be said that how PCPE influence CE did not depend on that

fact that a student is boy or girl. These findings provide conclusive evidences that gender difference in PCPE did not significantly contribute in explaining the gender disparity in cognitive engagement of the students.

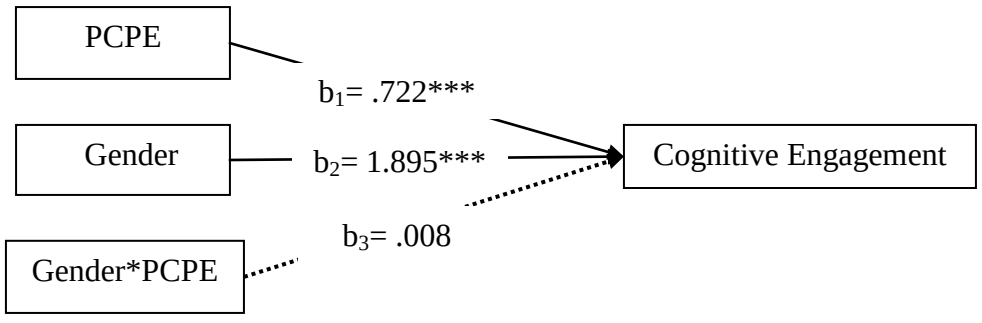
Table 4. 18

Moderating effect of gender on the relationship between PCPE and cognitive engagement

Regression path	B	SE	t	p	LLCI	ULCI
Predictor=PCPE, Moderator=Gender, Outcome variable=CE						
R^2=.869, F (3, 1228)= 2717.412, p<.001						
Constant	5.925	.632	9.378	<.001	4.685	7.164
PCPE	.722	.030	24.150	<.001	.663	.781
Gender	1.895	.414	4.584	<.001	1.333	2.457
*Interaction: PCPE*Gender*	.008	.019	0.421	.857	-.029	.045
Test (s) of highest order unconditional interaction(s)						
	R^2-change	*F*	*df_1*	*df_2*	*P*	
*PCPE*Gender*	.000	.026	1	1228	.857	

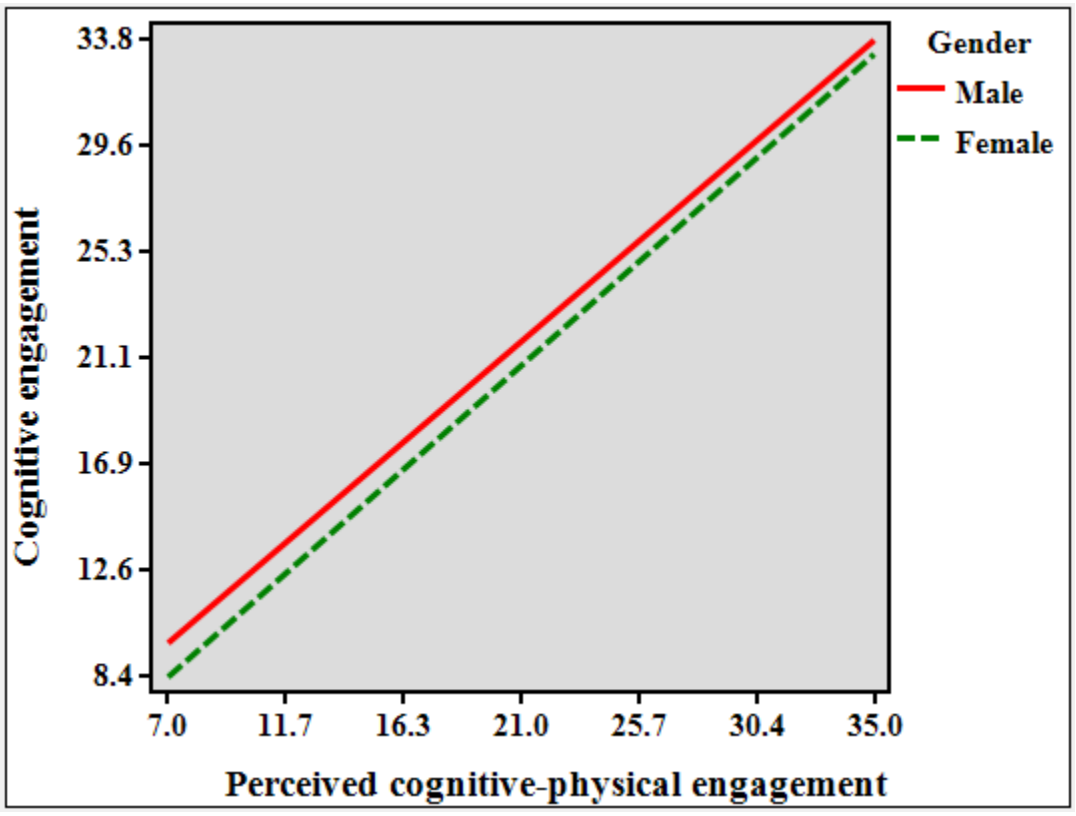
Figure 4. 31

Statistical model for the moderation effect of gender on the association between PCPE and cognitive engagement



Graph 4.1

The plots of effect of interaction between PCPE and students' gender on cognitive engagement



4.2.5.1.2 Moderation effect of students' gender on the relationship between perceived cognitive-physical engagement and students' behavioral engagement

$H_0$5a.2: There is no significant moderation effect of students' gender on the relationship between perceived cognitive-physical engagement and students' behavioral engagement

The null hypothesis ($H_0$5a.2) is multivariate in nature as it deals with four variables: Gender, Perceived cognitive-physical engagement (PCPE), interaction (i.e. Gender*PCPE), and behavioral engagement (BE). All the variables are continuous except

Gender, which is a categorical variable with two levels namely, male and female. Thus, the null hypothesis (i.e. $H_0$5a.2) was tested following Moderation analysis.

Whenever conducting a moderation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.32). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.61 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}=5.99) did not exceeded the threshold value (i.e. 7.81 with df=3 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual.

Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.32) and Q-Q plot (Figure 4.32) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the statistically insignificant results of Kolmogrov-Smirnov test (statistic= .013, df= 1232, p= .200) and the Shapiro-Wilk test (W= .995, df= 1232, p=.817) (Field, 2009).

Third, the value of Durbin-Watson statistic is 2.57 that falls within the acceptable range of 1.00 to 3.00 (Field, 2013). Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.33). Fourth, Figure 4.17 depicts the linear relationships among the criterion variables where each plot showed the value of R^2_{Linear}>0.3 (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately.

Fifth, Figure 4.33 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto,

2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .678, p= .836) and Koenker test (LM= .623, p= .751) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.19, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured.

Table 4. 19

Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Gender	0.72	1.39
Gender*PCPE	0.65	1.54
Perceived Cognitive-physical Engagement (PCPE)	0.62	1.61

Therefore, the data met all the statistical assumptions required for the moderation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the moderation analysis may be generalized in the target population.

Figure 4. 32

Histogram (extreme left), Q-Q Plot (middle) and Box Plot (extreme right) of the residuals

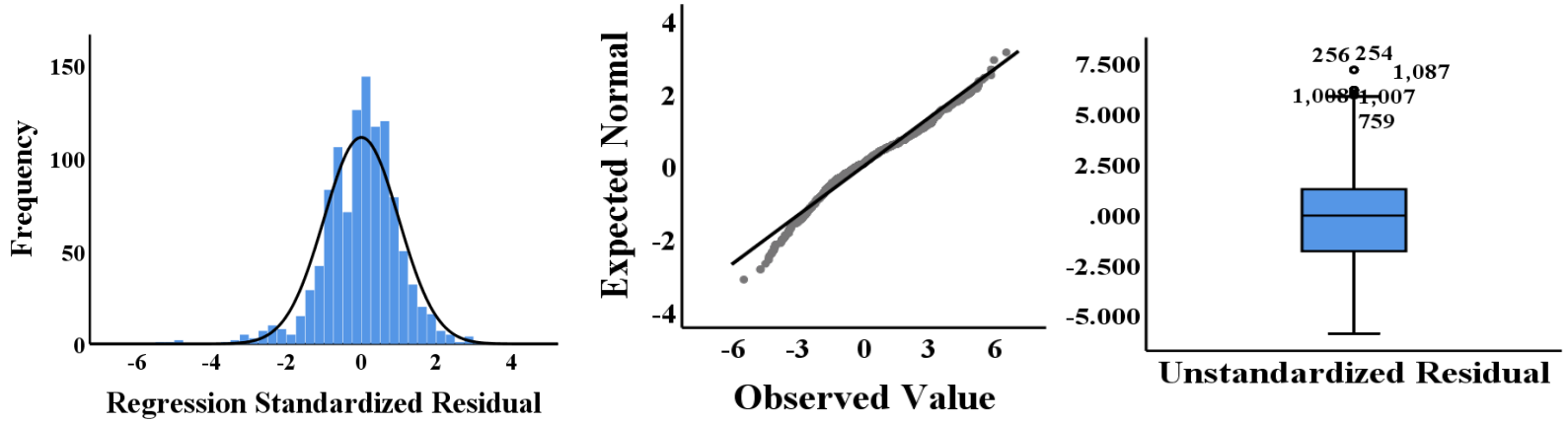
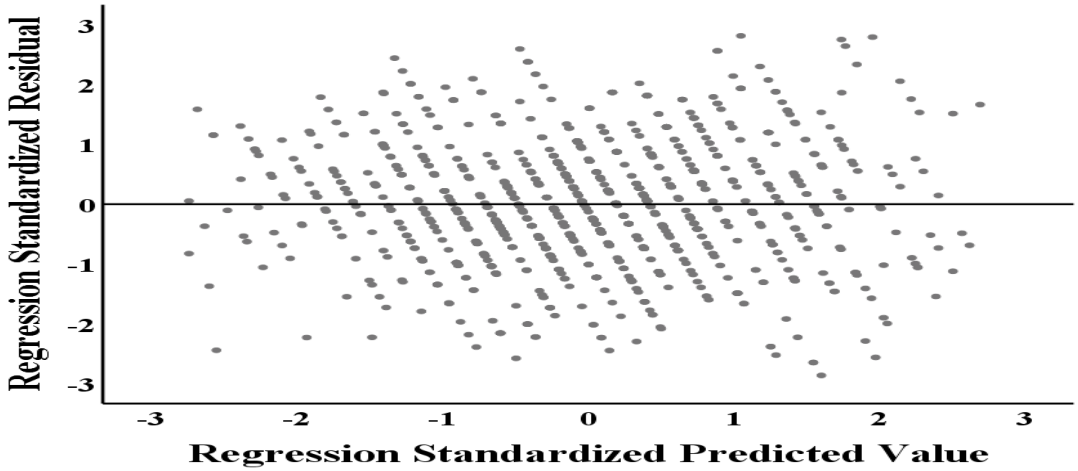


Figure 4. 33

Residual Plot of the dependent variable (Behavioral Engagement)



The Moderation analysis was run by selecting students' gender. The hypothesized moderation model (see Figure 4.34 and 4.35) was then examined and evaluated (see Figure 4.36).

Figure 4. 34

Hypothesized (conceptual) path model for the moderation effect of gender on the relationship between perceived cognitive-physical engagement and behavioral engagement

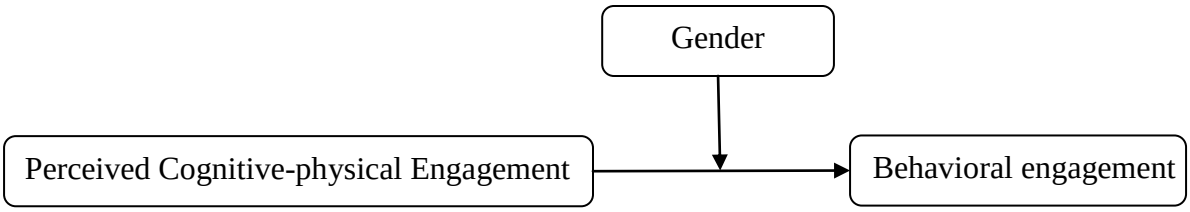
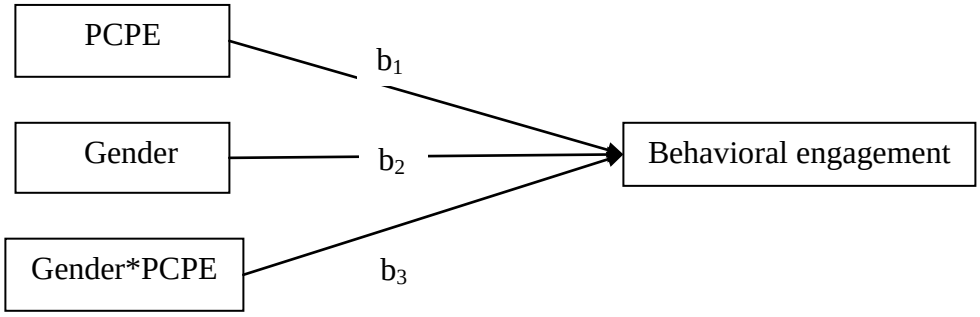


Figure 4. 35

Statistical model for the moderation effect of gender on the relationship between PCPE and behavioral engagement



A basic model considering PCPE as independent variable, BE as the dependent variable, and gender as the moderator variable was constructed (see Figure 4.34) and was examined by performing Moderation analysis.

The overall moderation model was significant: R^2= .814, F(3, 1228)= 1786.538, p<.001, (see Table 4.20). Further, the effect of PCPE on BE was positive and significant, (B= .999, 95% CI [.913, 1.085], p<0.001; see Table 4.20). Again, the effect of Gender on BE was positive and significant, (B= .113, 95% CI [.042, .184], p<0.05; see Table 4.20].

However, the effect of interaction between perceived cognitive-physical engagement and students' gender on BE was found to be not significant (B= .018, 95% CI [-.037, .074], p=0.522; see Table 4.20].

Additionally, to know the trend of influence of the interaction between gender and PCPE on behavioral engagement, Graph 2 was plotted where no interaction was found. Therefore, the relationship between the focal predictor PCPE and behavioral engagement did not depend upon students' gender. Thus, it can be said that how PCPE influence BE did not depend on the fact that a student is boy or girl. R^2-change for inclusion of the interaction term (Gender*PCPE) in the moderation model was not significant: R^2-change= .0001, F (1, 1228)= .410, p=.522. This implies that the interaction term did not contribute significantly to the moderation model. These results do not permit to identify gender as a significant moderator in this case. It can be said that PCPE influences BE to the same extent for the students regardless of their gender. Hence, PCPE was found to be equally important for boys and girls for promoting their Behavioral engagement.

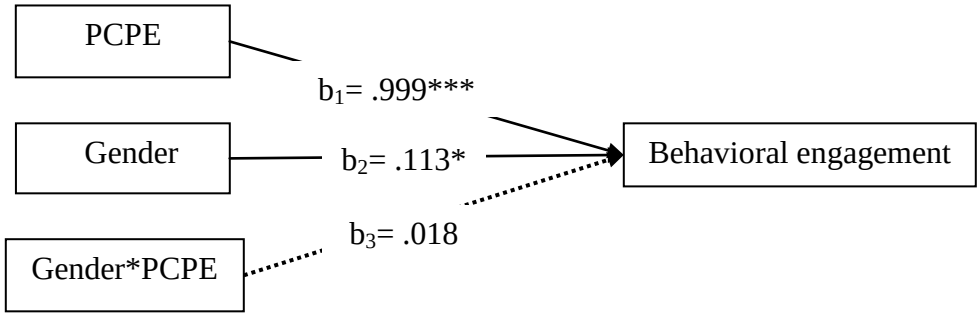
Table 4. 20

Moderating effect of gender on the relationship between PCPE and BE

Regression path	B	SE	t	p	LLCI	ULCI
Predictor=PCPE, Moderator=Gender, Outcome variable=BE						
R^2=.814, F (3, 1228)=1786.538, p<.001						
Constant	2.659	.923	2.880	<.01	.848	4.471
PCPE	.999	.044	22.706	<.001	.913	1.085
Gender	.113	.049	2.312	<.05	.042	.184
*Interaction: PCPE*Gender*	.018	.028	.640	.522	-.037	.074
Test(s) of highest order unconditional interaction(s)						
	R^2-change	F	df_1	df_2	p	
*PCPE*Gender*	.0001	.410	1	1228	.522	

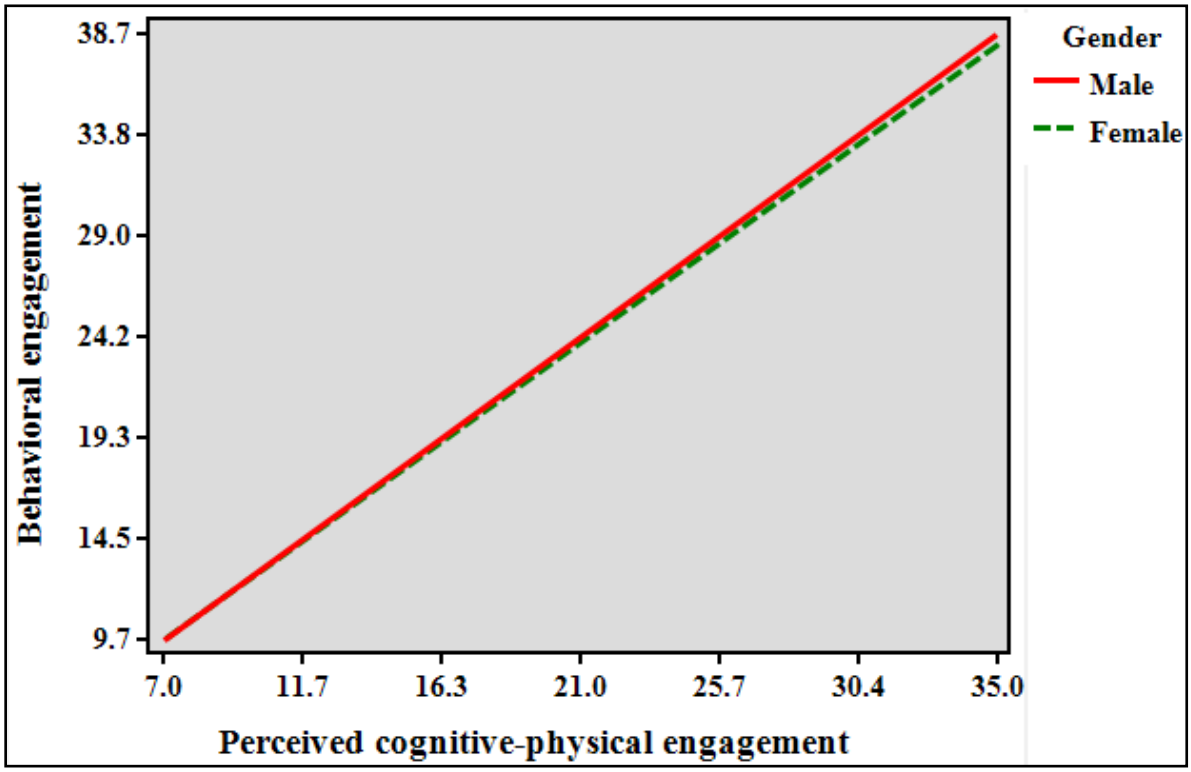
Figure 4. 36

Statistical model for the moderation effect of gender on the relationship between PCPE and BE



Graph 4.2

The plots of effect of interaction between perceived cognitive-physical engagement and students' gender on behavioral engagement



4.2.5.1.3 Moderation effect of students' gender on the relationship between perceived cognitive-physical engagement and students' emotional engagement

$H_0$5a.3: There is no significant moderation effect of students' gender on the relationship between perceived cognitive-physical engagement and students' emotional engagement

The null hypothesis ($H_0$5a.3) is multivariate in nature as it deals with four variables: Gender, Perceived cognitive-physical engagement (PCPE), interaction (i.e. Gender*PCPE), and emotional engagement (EE). All the variables are continuous except Gender, which is a categorical variable with two levels namely, male and female. Thus, the null hypothesis (i.e. $H_0$5a.3) was tested following Moderation analysis.

Whenever conducting a moderation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.37). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.77 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}=5.79) did not exceeded the threshold value (i.e. 7.81 with df=3 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual.

Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.37) and Q-Q plot (Figure 4.37) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the statistically insignificant results of Kolmogrov-Smirnov test (statistic= .018, df= 1232, p= .200) and the Shapiro-Wilk test (W= .996,df= 1232, p=.917) (Field, 2009).

Third, the value of Durbin-Watson statistic is 2.48 that falls within the acceptable range of 1.00 to 3.00 (Field, 2013). Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.38). Fourth, Figure 4.24 depicts the linear relationships among the criterion variables where each plot showed the value of R^2_{Linear}>0.3 (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately.

Fifth, Figure 4.38 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .663, p= .836) and Koenker test (LM= .612, p= .751) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.21, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured.

Table 4. 21

Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Perceived Cognitive-physical Engagement (PCPE)	0.41	2.44
Gender	0.33	3.03
Gender*PCPE	0.76	1.32

Therefore, the data met all the statistical assumptions required for the moderation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the moderation analysis may be generalized in the target population.

Figure 4. 37

Histogram (extreme left), Q-Q Plot (middle) and Box Plot (extreme right) of the residual

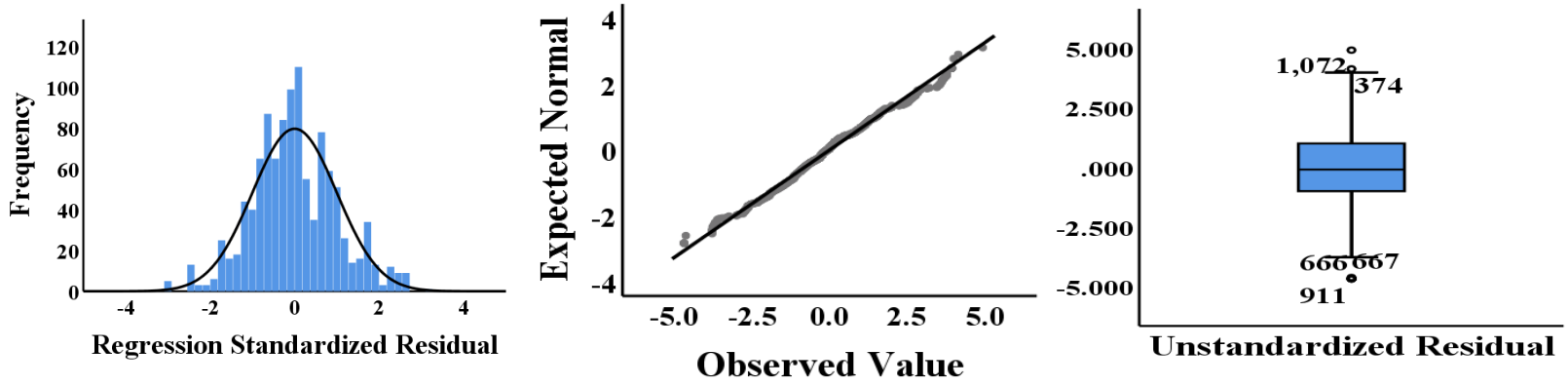
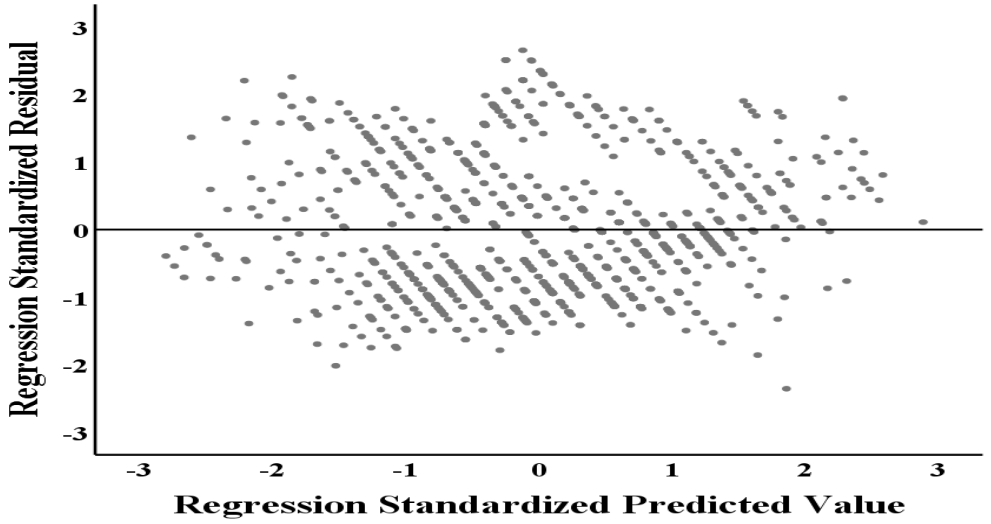


Figure 4. 38

Residual Plot of the dependent variable (Emotional Engagement)



The Moderation analysis was run by selecting students' gender. The hypothesized moderation model (see Figure 4.39 and 4.40) was then examined and evaluated (see Figure 4.41).

Figure 4. 39

Hypothesized (conceptual) path model for the moderation effect of gender on the relationship between perceived cognitive-physical engagement and emotional engagement

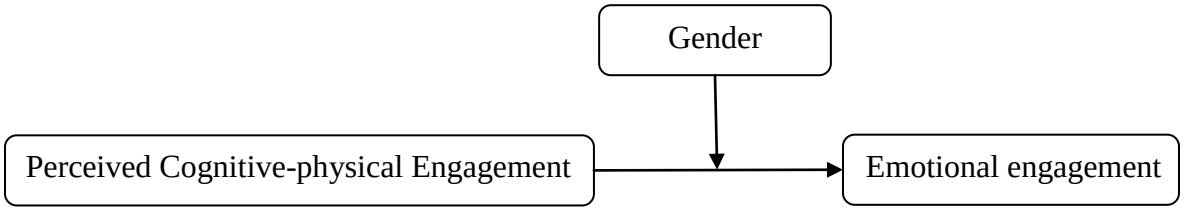
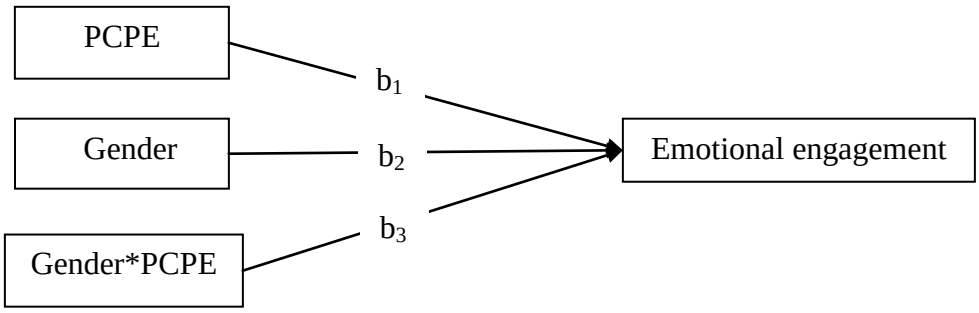


Figure 4. 40

Statistical model for the moderation effect of gender on the relationship between PCPE and Emotional engagement



A basic model considering PCPE as independent variable, EE as the dependent variable, and gender as the moderator variable was constructed (see Figure 4.40) and was examined by performing Moderation analysis. The overall moderation model was significant: R^2= .894, F(3, 1228)= 3438.643, p<.001, (see Table 4.22). Further, the effect of PCPE on EE was positive and significant, (B= 1.064, 95% CI [.100, 2.028], p<0.001; see Table 4.22). Again, the effect of Gender on EE was positive and significant, (B= .254, 95% CI [.071, .437], p<0.05; see Table 4.22].

However, the effect of interaction between perceived cognitive-physical engagement and students' gender on emotional engagement was found to be statistically not significant (B= .004, 95% CI [-.038, .046], p=0.856; see Table 4.22].

Additionally, to know the trend of influence of the interaction between gender and PCPE on EE, Graph 3 was plotted where no interaction was found. Therefore, the relationship between the focal predictor PCPE and emotional engagement did not depend upon students' gender. Thus, it can be said that how PCPE influence EE did not depend on the fact that a student is boy or girl. R^2-change for inclusion of the interaction term (Gender*PCPE) in the moderation model was not significant: R^2-change= .000, F (1, 1228)= .033, p=.856. This implies that the interaction term did not contribute significantly to the moderation model. These results do not permit to identify gender as a significant moderator in this case. Therefore, it can be said that PCPE influences EE to the same extent for the students regardless of their gender. Hence, PCPE was found to be equally beneficial for boys and girls for promoting their emotional engagement.

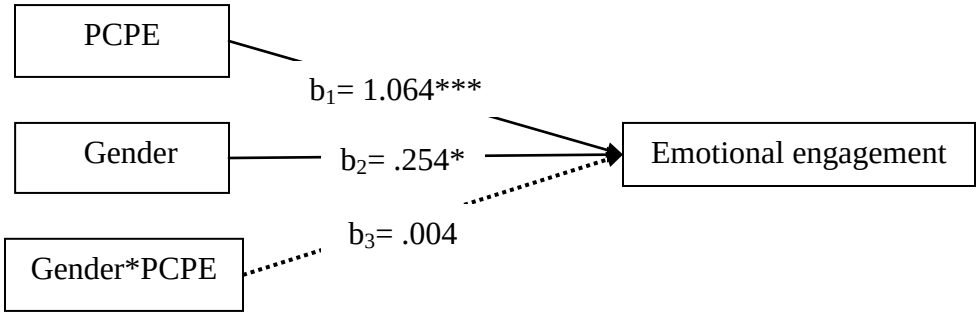
Table 4. 22

Moderating effect of gender on the relationship between perceived cognitive-physical engagement and emotional engagement

Regression path	B	SE	t	p	LLCI	ULCI
Predictor=PCPE, Moderator=Gender, Outcome variable=EE						
R^2=.894, F (3, 1228)=3438.643, p<.001						
Constant	1.235	.602	2.051	<.05	.132	2.338
PCPE	1.064	.033	32.381	<.001	.100	2.028
Gender	.254	.126	2.013	<.05	.071	.437
*Interaction: PCPE*Gender*	.004	.022	.181	.856	-.038	.046
Test(s) of highest order unconditional interaction(s)						
	R^2-change	F	df_1	df_2	p	
*PCPE*Gender*	.000	.033	1	1228	.856	

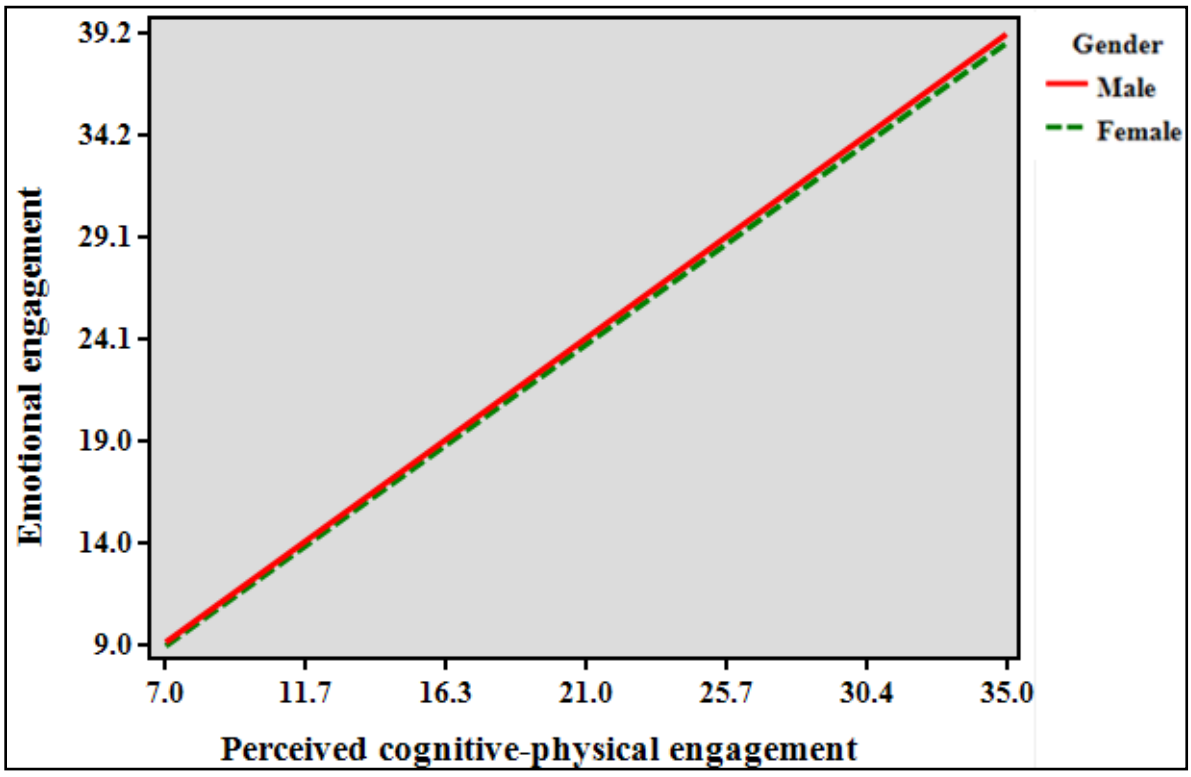
Figure 4. 41

Statistical model for the moderation effect of gender on the association between PCPE and EE



Graph 4.3

The plots of effect of interaction between perceived cognitive-physical engagement and students' gender on emotional engagement



4.2.5.2 Moderation effect of students' gender on the relationship between perceived socio-emotional engagement and students engagement

$H_0$5b: There is no significant moderation effect of students' gender on the relationship between perceived socio-emotional engagement and student engagement

The null hypothesis ($H_0$5b) deals with student engagement as the outcome variable that includes three components namely, perceived cognitive, behavioral, and emotional engagement. This leads to three sub-hypotheses ($H_0$5b.1-5b.3) of $H_0$5b.

> $H_0$5b.1: There is no significant moderation effect of students' gender on the relationship between perceived socio-emotional engagement and students' cognitive engagement
>
> $H_0$5b.2: There is no significant moderation effect of students' gender on the relationship between perceived socio-emotional engagement and students' behavioral engagement
>
> $H_0$5b.3: There is no significant moderation effect of students' gender on the relationship between perceived socio-emotional engagement and students' emotional engagement

4.2.5.2.1 Moderation effect of students' gender on the relationship between perceived socio-emotional engagement and students' cognitive engagement

$H_0$5b.1: There is no significant moderation effect of students' gender on the relationship between perceived socio-emotional engagement and students' cognitive engagement

The null hypothesis ($H_0$5b.1) is multivariate in nature as it deals with four variables: Gender, Perceived socio-emotional engagement (PSEE), interaction (i.e. Gender*PSEE), and cognitive engagement (CE). All the variables are continuous except Gender, which is a categorical variable with two levels namely, male and female. Thus, the null hypothesis (i.e. $H_0$5b.1) was tested following Moderation analysis.

Whenever conducting a moderation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of

multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.42). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.77 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}=5.14) did not exceeded the critical value (i.e. 7.81 with df=3 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual.

Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.42) and Q-Q plot (Figure 4.42) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the statistically insignificant results of Kolmogrov-Smirnov test (statistic= .011, p= .200) and the Shapiro-Wilk test (W= .995, p=.635) (Field, 2009).

Third, the value of Durbin-Watson statistic is 2.57 (Field, 2013). Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.43). Fourth, Figure 4.14 depicts the linear relationships among the criterion variables where each plot showed the value of R^2_{Linear}>0.3 (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately.

Fifth, Figure 4.43 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .668, p= .836) and Koenker test (LM= .604, p= .751) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Figure 4. 42

Histogram (extreme left), Q-Q Plot (middle) and Box Plot (extreme right) of residual

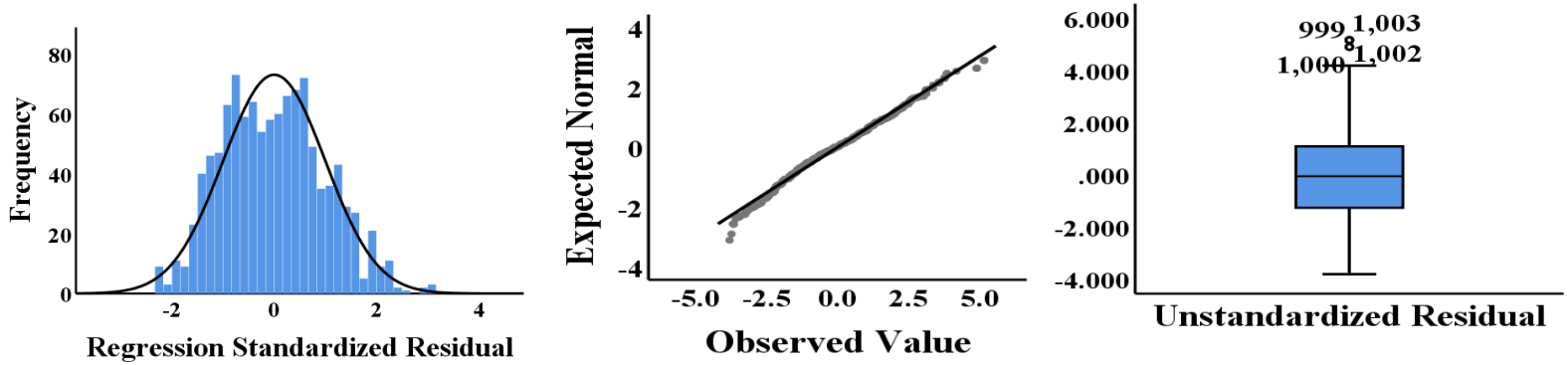
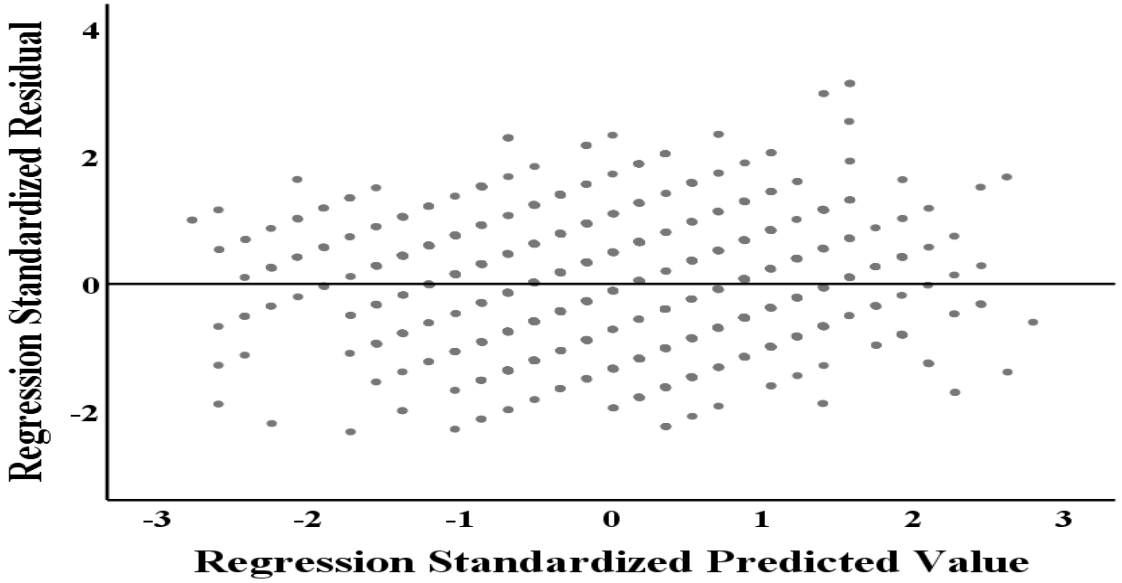


Figure 4. 43

Residual Plot of the dependent variable (Cognitive Engagement)



Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.23, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured.

Table 4. 23

Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Gender	0.87	1.15
Gender*PSEE	0.78	1.28
Perceived Socio-Emotional Engagement (PSEE)	0.62	1.61

Therefore, the data met all the statistical assumptions required for the moderation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the moderation analysis may be generalized in the target population.

The Moderation analysis was run by selecting students' gender. The hypothesized moderation model (see Figure 4.44 and 4.45) was then examined and evaluated (see Figure 4.46).

Figure 4. 44

Hypothesized (conceptual) path model for the moderation effect of gender on the association between PSEE and CE

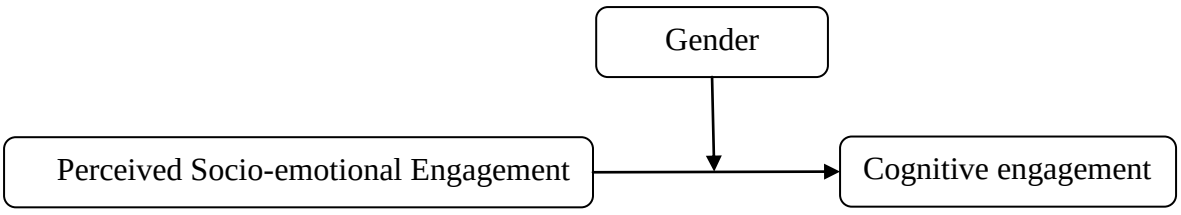
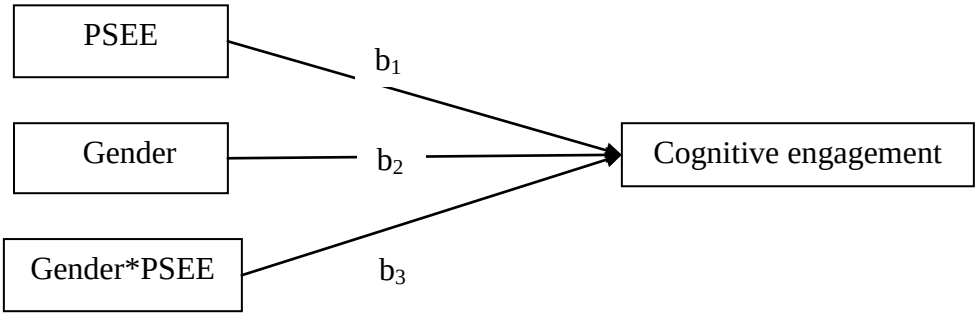


Figure 4. 45

Statistical model for the moderation effect of gender on the association between PSEE and Cognitive engagement



A basic model considering PSEE as independent variable, CE as the dependent variable, and gender as the moderator variable was constructed (see Figure 4.45) and was examined by performing Moderation analysis. The overall moderation model was significant: R^2= .800, F(3, 1228)= 1631.481, p<.001, (see Table 4.24). Further, the effect of PSEE on CE was positive and significant, (B= .719, 95% CI [.655, .783], p<0.001; see Table 4.24). Again, the effect of Gender on CE was positive and significant, (B= 1.215, 95% CI [.288, 2.142], p<0.01; see Table 4.24]. Further, the effect of interaction between PSEE and students' gender on CE was also found to be positive and statistically significant (B= .098, 95% CI [.060, .136], p<.001; see Table 4.24].

Further, R^2-change for inclusion of the interaction term (Gender*PSEE) in the moderation model was significant: R^2-change= .003, F(1, 1228)= 25.612, p<.001. This implies that the interaction term contributed significantly to the moderation model. On the basis of the results, students' gender was considered as a significant moderator in this case. Therefore, it can be said that PSEE influenced students' cognitive engagement differently depending upon their gender. The effect size for the moderation effect was found to be .639 (see Table 4.24) which is a large effect ($f^2 \geq 0.35$) following the Cohen's (1988) guidelines.

Further, the analysis of the conditional effects of gender on cognitive engagement show that both for males and females, the effect of PSEE on cognitive engagement were

significant (B= .820, p<.001 for males and females, B= .918, p<.001). Further, the simple slopes analysis also shows that the slopes for PSEE predicting CE at each level of gender are: b_{Boys}= .918, SE= .014, p<0.001, 95% CIs: [.890, .946] for the girls and b_{Girls}= .820, SE= .013, p<0.001, 95% CIs: [.794, .846] for the boys. Therefore, b_{Boys} was found to be significantly higher than b_{Girls}. Thus, it can be said that the association between PSEE and CE was stronger for male students. Hence, PCPE was found to be more beneficial for boys than girls for promoting their CE.

Further, to know the trend of influence of the interaction between gender and PSEE on cognitive engagement, a graph was plotted. From Graph 4, it can be seen that there is an interaction effect of Gender and PSEE on students' CE. Further, it can also be seen that irrespective of students' gender, CE constantly increases with the increase in PSEE. This trend of the relationship between CE and PSEE remains similar both for boys and girls. However, the interaction graph was significantly steeper for the boys than that of the girls. Thus, it can be said that the effect of PSEE on CE did not remain same across gender rather for boys, the effect is significantly stronger. These findings provide conclusive evidences that gender gap in PSEE significantly contributed in explaining the gender gap in cognitive engagement. The boys become cognitively more engaged in learning than girls when boys perceived significantly more socio-emotional engagement of teachers in teaching.

In sum, the interaction effect between PSEE and gender (i.e. PSEE* gender) was found to be statistically significant. As a result, presence of differential effects of PSEE on cognitive engagement of boys and girls were confirmed. It can be said that PSEE influenced CE differently for males and females. Indeed, PSEE was more related to boys' cognitive engagement than that of girls as the relationship between PSEE and CE was stronger for boys than for girls. Thus, PSEE was more important for boys in promoting their cognitive engagement as opposed to girls. Finally, it can be said that PSEE served as a protective factor for boys' cognitive engagement.

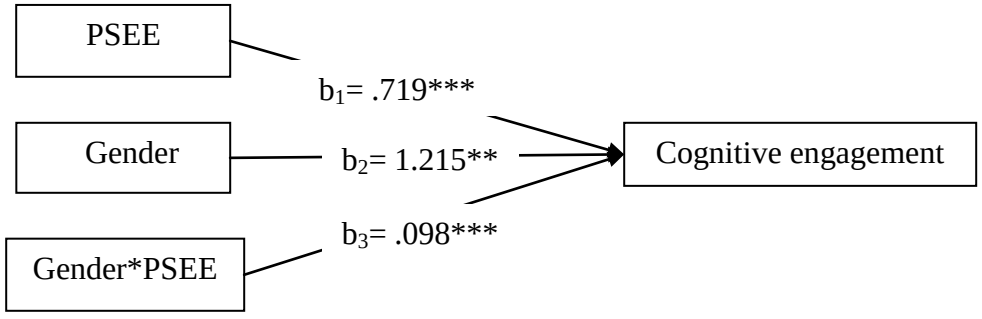
Table 4. 24

Moderating effect of gender on the association between PSEE and CE

Regression path	B	SE	t	p	LLCI	ULCI
Predictor=PSEE, Moderator=Gender, Outcome variable=CE						
R^2=.800, F (3, 1228)=1631.481, p<.001						
Constant	3.583	.789	4.543	<.001	2.036	5.130
PSEE	.719	.033	21.788	<.001	.655	.783
Gender	1.215	.355	3.422	<.01	.288	2.142
*Interaction: PSEE*Gender*	.098	.019	5.061	<.001	.060	.136
Conditional Effects						
Female group	.820	.013	62.307	<.001	.794	.846
Male group	.918	.014	64.716	<.001	.890	.946
Effect size (f-square)= .639						
Test(s) of highest order unconditional interaction(s)						
	R^2-change	F	df_1	df_2	p	
*PSEE*Gender*	.003	25.612	1	1228	<.001	

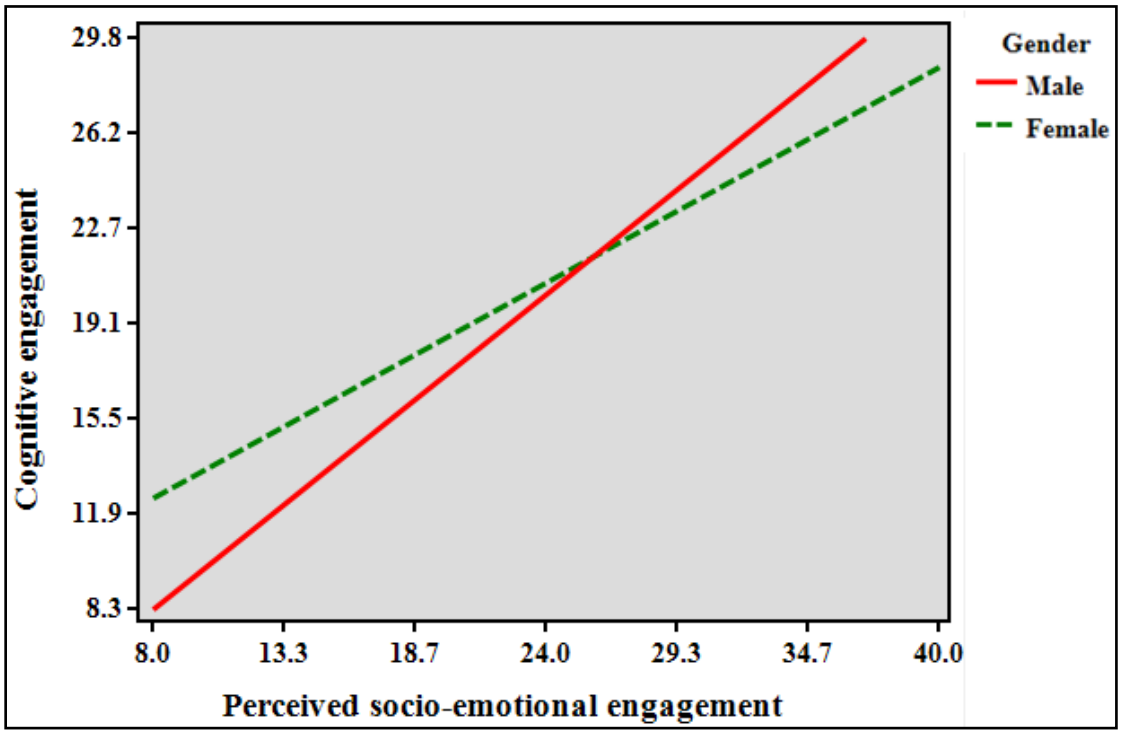
Figure 4. 46

Statistical model for the moderation effect of gender on the association between PSEE and CE



Graph 4.4

The plots of effect of interaction between PSEE and students' gender on Cognitive engagement



4.2.5.2.2 Moderation effect of students' gender on the relationship between perceived socio-emotional engagement and students' behavioral engagement

$H_0$5b.2: There is no significant moderation effect of students' gender on the relationship between perceived socio-emotional engagement and students' behavioral engagement.

The null hypothesis ($H_0$5b.2) is multivariate in nature as it deals with four variables: Gender, Perceived socio-emotional engagement (PSEE), interaction (i.e. Gender*PSEE), and behavioral engagement (BE). All the variables are continuous except Gender, which is a categorical variable with two levels namely, male and female. Thus, the null hypothesis (i.e. $H_0$5b.2) was tested following Moderation analysis.

Whenever conducting a moderation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.47). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.71 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}=5.66) did not exceeded the critical value (i.e. 7.81 with df=3 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual.

Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.47) and Q-Q plot (Figure 4.47) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the statistically insignificant results of Kolmogrov-Smirnov test (statistic= .015, df= 1232, p= .200) and the Shapiro-Wilk test (W= .997, df= 1232, p=.953) (Field, 2009).

Third, the value of Durbin-Watson statistic is 2.38 (Field, 2013). Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.48). Fourth, Figure 4.17 depicts the linear relationships among the criterion variables where each plot showed the value of R^2_{Linear}>0.3 (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately. Fifth, Figure 4.48 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .667, p= .836) and Koenker test (LM= .609, p= .751) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.25, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured.

Table 4. 25

Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Perceived Socio-Emotional Engagement (PSEE)	0.47	2.13
Gender*PSEE	0.65	1.54
Gender	0.81	1.23

Therefore, the data met all the statistical assumptions required for the moderation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the moderation analysis may be generalized in the target population.

The Moderation analysis was run by selecting students' gender. The hypothesized moderation model (see Figure 4.49 and 4.50) was then examined and evaluated (see Figure 4.51).

Figure 4. 47

Hypothesized (conceptual) path model for the moderation effect of gender on the association between PSEE and BE

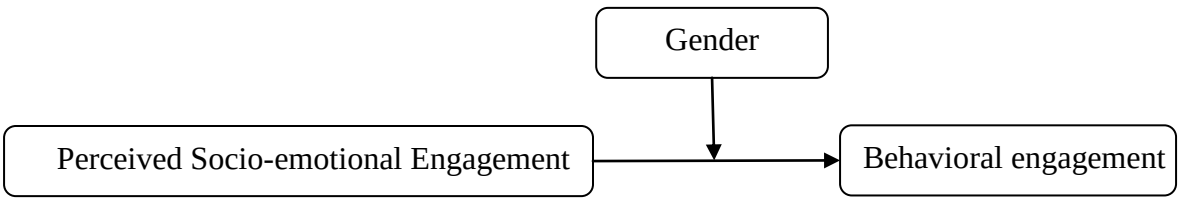


Figure 4. 48

Histogram (extreme left), Q-Q Plot (middle) and Box Plot (extreme right) of the residual

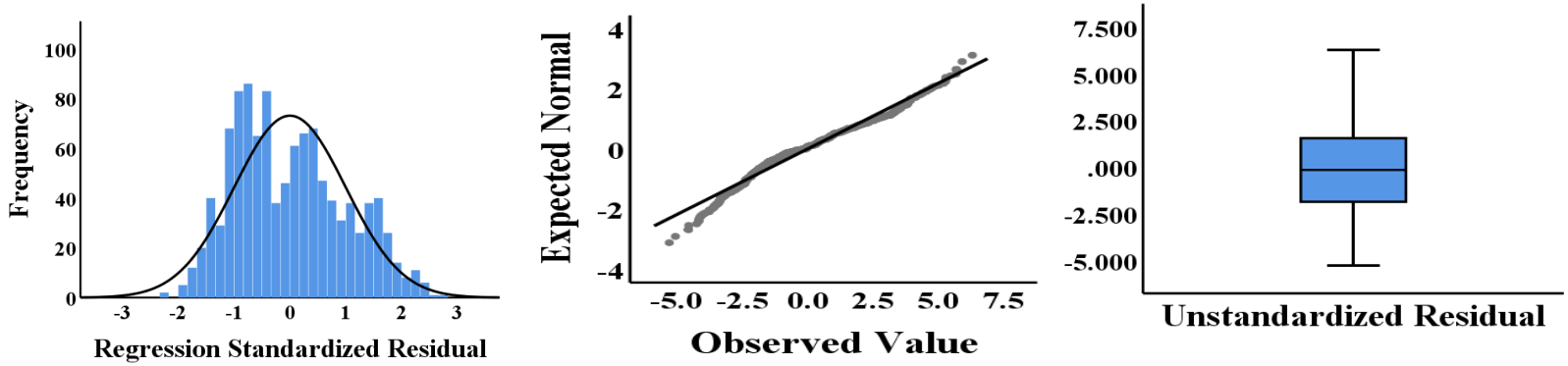


Figure 4. 49

Residual Plot of the independent variable (Behavioral Engagement)

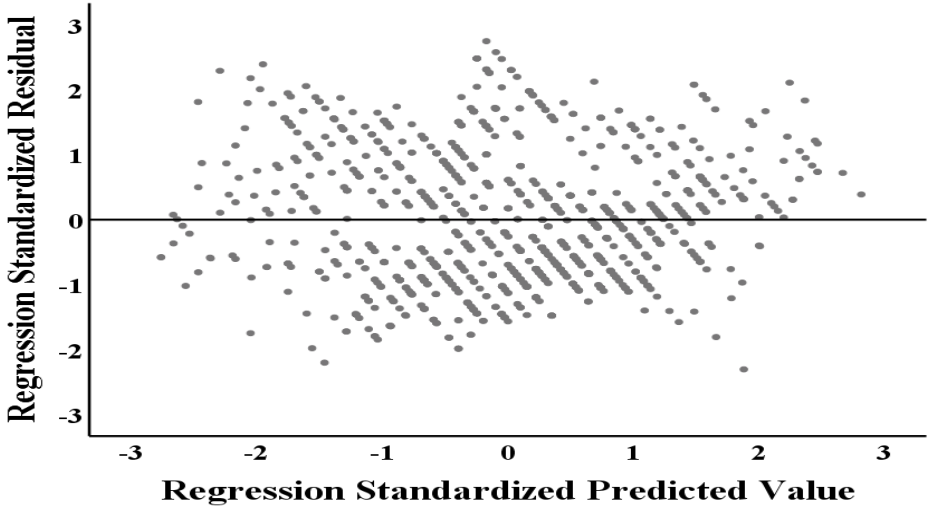
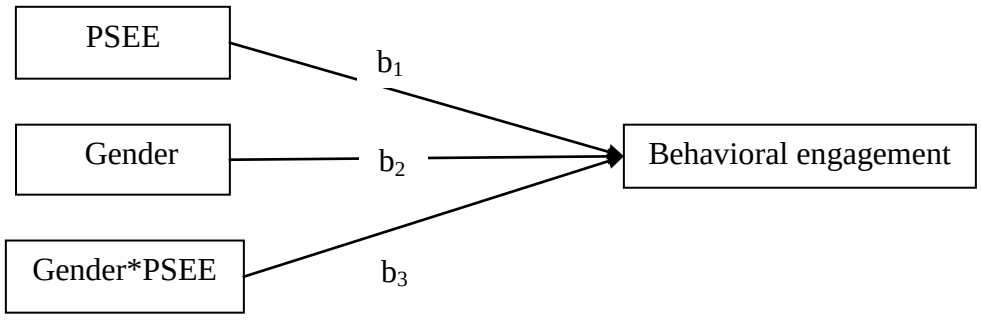


Figure 4. 50

Statistical model for the moderation effect of gender on the association between PSEE and Behavioral engagement



A basic model considering PSEE as independent variable, BE as the dependent variable, and gender as the moderator variable was constructed (see Figure 4.50) and was examined by performing Moderation analysis. The overall moderation model was significant: R^2= .757, F(3, 1228)= 1274.257, p<.001, (see Table 4.26). Further, the effect of PSEE on BE was positive and significant, (B= .822, 95% CI [.736, .908], p<0.001; see Table 4.26). Again, the effect of Gender on BE was positive and significant, (B= 1.187, 95% CI [.436, 1.938], p<0.01; see Table 4.26].

Further, the interaction effect between PSEE and students' gender on BE was also positive and statistically significant (B= .069, 95% CI [.030, .108], p<.001; see Table 4.26]. Further, R^2-change for inclusion of the interaction term (Gender*PPE) in the moderation model was significant: R^2-change= .001, F(1, 1228)= 12.321, p<.001 (see Table 4.26). This implies that the interaction term contributed significantly to the moderation model. On the basis of the results, students' gender was considered as a significant moderator in this case. Therefore, it can be said that PSEE influenced students' behavioral engagement differently depending upon their gender. The effect size for the moderation effect was found to be .631 (see Table 4.26) which is a large effect ($f^2 \geq 0.35$) following the Cohen's (1988) guidelines.

Further, the analysis of the conditional effects of gender on behavioral engagement shows that for both males and females, the effect of PSEE on behavioral engagement is significant (B= .826, p<.001 for males and females, B= .895, p<.001). Further, the simple slopes analysis also shows that the slopes for PSEE predicting BE at each level of gender are: b_{Boys}= .895, SE= .014, p<0.001, 95% CIs: [.867, .923] for the girls and b_{Girls}= .826, SE= .013, p<0.001, 95% CIs: [.800, .852] for the boys. Therefore, b_{Boys} was found to be significantly higher than b_{Girls}. Further, it can be said that the association between PSEE and BE was stronger for males. Hence, PSEE was found to be more beneficial for boys than girls for promoting their behavioral engagement.

Further, to know the trend of influence of the interaction between gender and PSEE on behavioral engagement, a graph was plotted. From Graph 5, it can be seen that there is an interaction effect of Gender and PSEE on students' BE. Further, it can also be seen that irrespective of students' gender, BE constantly increases with the increase in PSEE. This trend of the relationship between BE and PSEE remained similar both for boys and girls. However, the interaction graph was significantly steeper for the boys than that of the girls. Therefore, the relationship between the focal predictor PSEE and BE was found to be influenced by gender. Thus, it can be said that the effect of PSEE on BE did not remain same across gender rather for boys, the effect is significantly stronger. These findings provide conclusive evidences that gender gap in PSEE significantly contributed in explaining the gender gap in behavioral engagement. The boys become behaviorally more engaged in learning than the girls when boys perceived significantly more socio-emotional engagement of teachers in teaching.

In sum, the interaction effect between PSEE and gender (i.e. PSEE* gender) was found to be statistically significant. As a result, presence of differential effects of PSEE on behavioral engagement of boys and girls were confirmed. It can be said that PSEE influenced BE differently for males and females. Indeed, PSEE was more related to boys' behavioral engagement than that of girls as the association between PSEE and BE was stronger for boys than for girls. Thus, PSEE was more important for boys in promoting their behavioral engagement as opposed to girls. Finally, it can be said that PSEE served as a protective factor for boys' behavioral engagement.

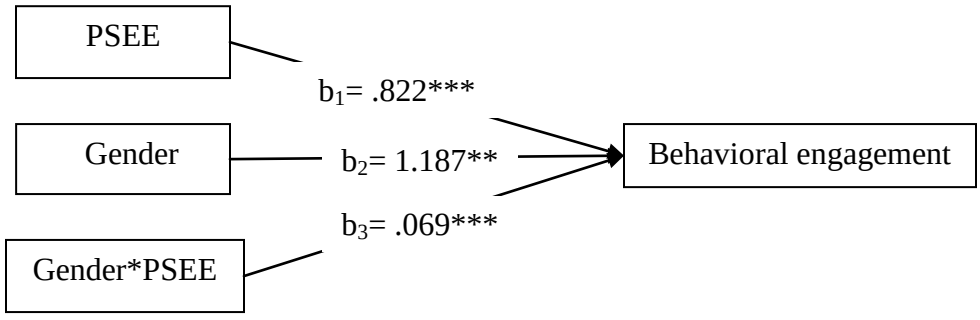
Table 4. 26

Moderating effect of gender on the association between PSEE and BE

Regression path	B	SE	t	p	LLCI	ULCI
Predictor=PSEE, Moderator=Gender, Outcome variable=BE						
R^2=.757, F (3, 1228)=1274.257, p<.001						
Constant	3.553	1.063	3.341	<.01	1.467	5.639
PSEE	.822	.044	18.741	<.001	.736	.908
Gender	1.187	.377	3.148	<.01	.436	1.938
*Interaction: PSEE*Gender*	.069	.020	3.450	<.001	.030	.108
Conditional Effects						
Female group	.826	.013	63.538	<.001	.800	.852
Male group	.895	.014	63.929	<.001	.867	.923
Effect size (f square) = .631						
Test(s) of highest order unconditional interaction(s)						
	R^2-change	F	df_1	df_2	p	
*PSEE*Gender*	.001	12.321	1	1228	<.001	

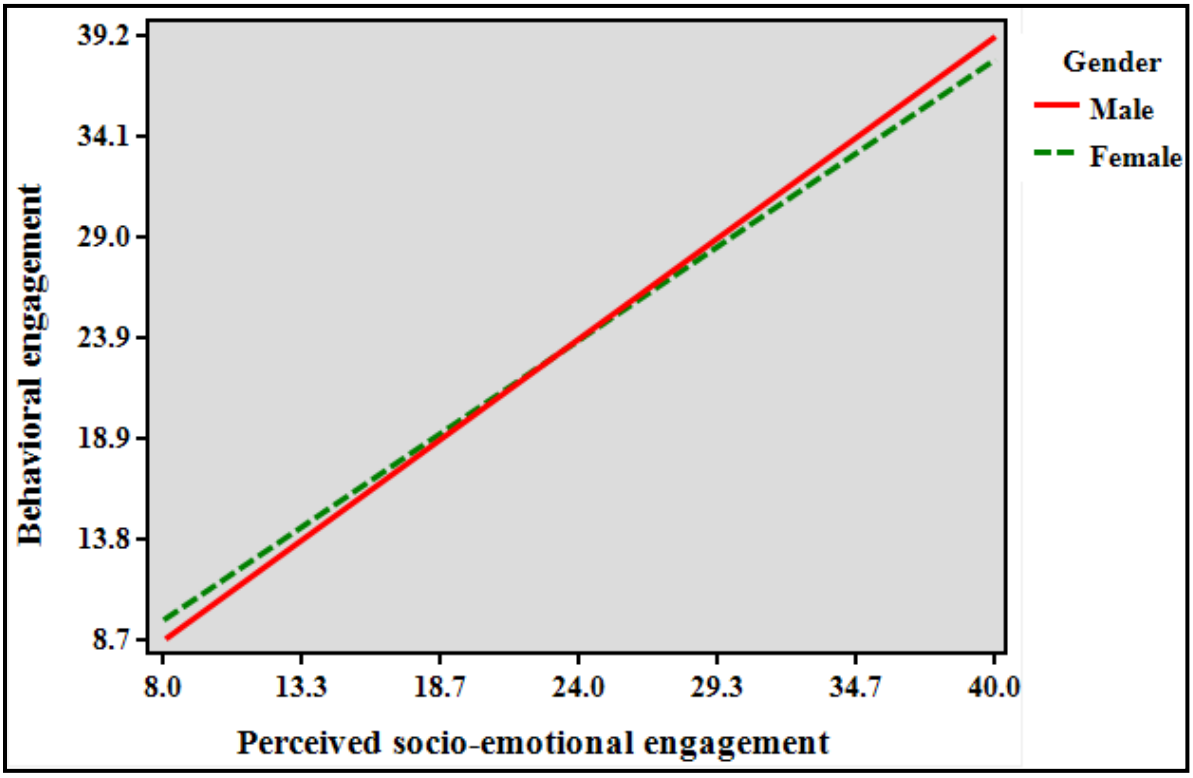
Figure 4. 51

Statistical model for the moderation effect of gender on the association between PSEE and BE



Graph 4.5

The plots of effect of interaction between Perceived socio-emotional engagement and gender on Behavioral engagement



4.2.5.2.3 Moderation effect of students' gender on the relationship between perceived socio-emotional engagement and students' emotional engagement

$H_0$5b.3: There is no significant moderation effect of students' gender on the relationship between perceived socio-emotional engagement and students' emotional engagement

The null hypothesis ($H_0$5b.3) is multivariate in nature as it deals with four variables: Gender, Perceived socio-emotional engagement (PSEE), interaction (i.e. Gender*PSEE), and emotional engagement (EE). All the variables are continuous except Gender, which is a categorical variable with two levels namely, male and female. Thus, the null hypothesis (i.e. $H_0$5b.3) was tested following Moderation analysis.

Whenever conducting a moderation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.52). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.51 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}=5.07) did not exceeded the critical value (i.e. 7.81 with df=3 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual.

Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.52) and Q-Q plot (Figure 4.52) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the statistically insignificant results of Kolmogrov-Smirnov test (statistic= .013, df= 1232, p= .200) and the Shapiro-Wilk test (W= .997, df= 1232, p=.882) (Field, 2009).

Third, the value of Durbin-Watson statistic is 2.30 (Field, 2013). Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.53). Fourth, Figure 4.24 depicts the linear relationships among the criterion variables where each plot showed the value of R^2_{Linear}>0.3 (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately.

Fifth, Figure 4.53 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .667, p= .836) and

Koenker test (LM= .625, p= .751) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.27, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured.

Table 4. 27

Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Gender	0.37	2.70
Gender*PSEE	0.30	3.33
Perceived Socio-Emotional Engagement (PSEE)	0.68	1.47

Therefore, the data met all the statistical assumptions required for the moderation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the moderation analysis may be generalized in the target population.

Figure 4. 52

Histogram (extreme left), Q-Q Plot (middle) and Box Plot (extreme right) of the residual

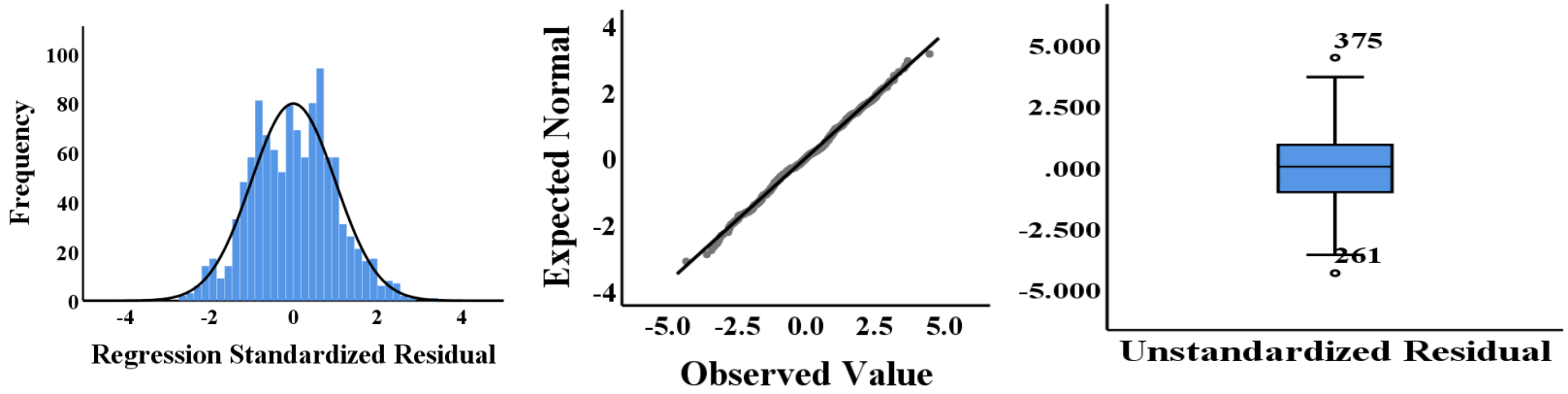
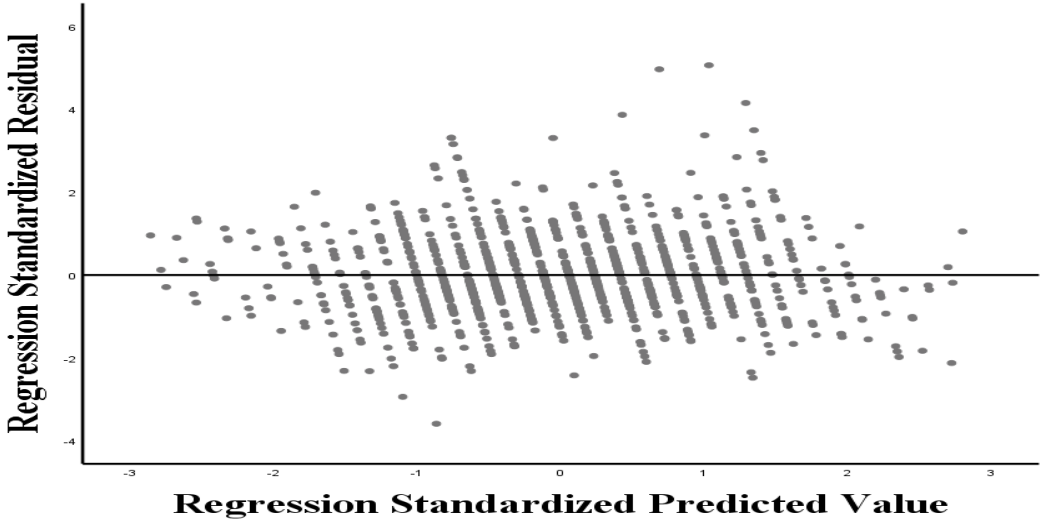


Figure 4. 53

Residual Plot of the dependent variable (Emotional Engagement)



The Moderation analysis was run by selecting students' gender. The hypothesized moderation model (see Figure 4.54 and 4.55) was then examined and evaluated (see Figure 4.56).

Figure 4. 54

Hypothesized (conceptual) path model for the moderation effect of Gender on the relationship between perceived socio-emotional engagement and emotional engagement

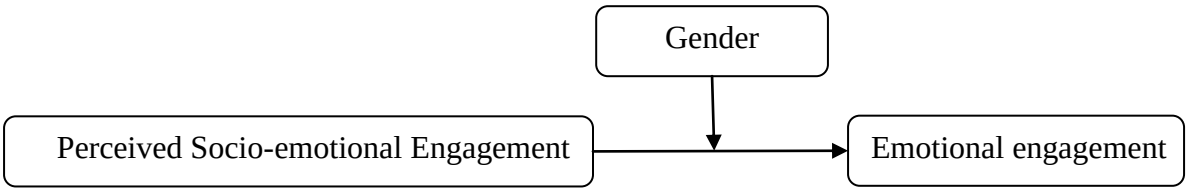
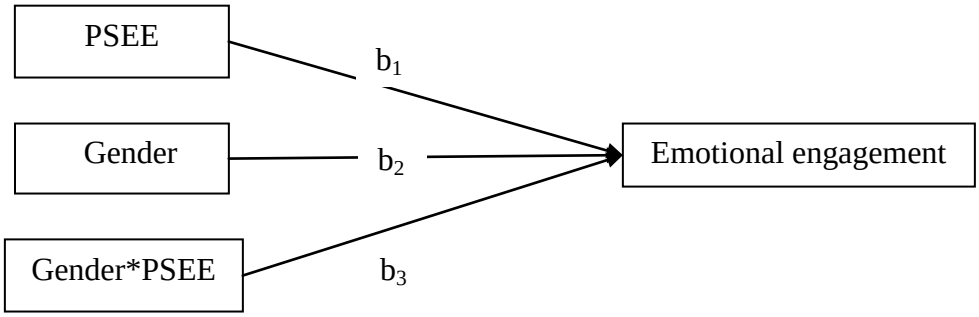


Figure 4. 55

Statistical model for the moderation effect of gender on the association between PSEE and Emotional engagement



A basic model considering PSEE as independent variable, EE as the dependent variable, and gender as the moderator variable was constructed (see Figure 4.55) and was examined by performing Moderation analysis. The overall moderation model was significant: R^2= .846, F(3, 1228)= 2241.849, p<.001, (see Table 4.28). Further, the effect of PSEE on EE was positive and significant, (B= .956, 95% CI [.887, 1.024], p<0.001; see Table 4.28). Again, the effect of Gender on EE was positive and significant, (B= 1.315, 95% CI [.244, 2.386], p<0.05; see Table 4.28]. Further, the interaction effect between PSEE and students' gender on EE was also positive and statistically significant (B= .050, 95% CI [.023, .077], p<.05; see Table 4.28].

Further, R^2-change for inclusion of the interaction term (Gender*PSEE) in the moderation model was significant: R^2-change= .0005, F(1, 1228)= 8.127, p<.05 (see Table 4.28). This implies that the interaction term contributed significantly to the moderation model. On the basis of the results, students' gender was considered as a significant moderator in this case. Therefore, It can be said that PSEE influenced students' emotional engagement differently depending upon their gender. The effect size for the moderation effect was found to be 4.411 (see Table 4.28) which is a large effect ($f^2 \geq 0.35$) following the Cohen's (1988) guidelines.

Further, the analysis of the conditional effects of gender on emotional engagement shows that for both males and females, the effect of PSEE on behavioral engagement is significant (B= .998, p<.001 for girls and for boys, B= 1.047, p<.001). Further, the simple slopes analysis also shows that the slopes for PSEE predicting EE at each level of gender are: b_{Boys}= 1.047, SE= .020, p<0.001, 95% CIs: [1.007, 1.087] for the boys and b_{Girls}= .998, SE= .019, p<0.001, 95% CIs: [.960, 1.035] for the girls. Therefore, b_{Boys} was found to be significantly higher than b_{Girls}. Thus, there is a significant differential effect of PSEE on boys' and girls' emotional engagement. Further, it can be said that the association between PSEE and EE was stronger for males. Hence, PSEE was found to be more beneficial for boys than girls for promoting their emotional engagement.

Further, to know the trend of influence of the interaction between gender and PSEE on emotional engagement, a graph was plotted. From Graph 6, it can be seen that there is an interaction effect of Gender and PSEE on students' EE. Further, it can also be seen that irrespective of students' gender, EE constantly increases with the increase in PSEE. This trend of the relationship between EE and PSEE remained similar both for boys and girls. However, the interaction graph was significantly steeper for the boys than that of the girls. Therefore, the relationship between the focal predictor PSEE and the outcome variable EE was found to be influenced by gender. Thus, it can be said that the effect of PSEE on EE did not remain same across gender rather for boys, the effect is significantly stronger. These findings provide conclusive evidences that gender gap in PSEE significantly contributed in explaining the gender gap in emotional engagement. The boys

become emotionally more engaged in learning than the girls when boys perceived significantly more socio-emotional engagement of teachers in teaching.

In sum, the interaction effect between PSEE and gender (i.e. PSEE* gender) was found to be statistically significant. As a result, presence of differential effects of PSEE on emotional engagement of boys and girls were confirmed. It can be said that PSEE influenced EE differently for males and females. Indeed, PSEE was more related to boys' emotional engagement than that of girls as the relationship between PSEE and EE was stronger for males than females. Thus, PSEE was more important for boys in promoting their emotional engagement as opposed to girls. Finally, it can be said that PSEE served as a protective factor for boys' emotional engagement.

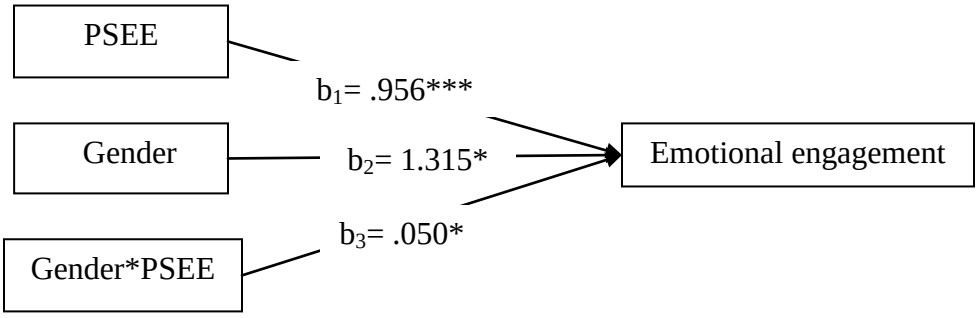
Table 4. 28

Moderating effect of gender on the relationship between PSEE and EE

Regression path	B	SE	t	p	LLCI	ULCI
Predictor=PSEE, Moderator=Gender, Outcome variable=EE						
R^2=.846, F (3, 1228)=2241.849, p<.001						
Constant	.306	.103	2.971	<.01	.191	.421
PSEE	.956	.035	27.459	<.001	.887	1.024
Gender	1.315	.546	2.410	<.05	.244	2.386
*Interaction: PSEE*Gender*	.050	.024	2.092	<.05	.023	.077
Conditional Effects						
Female group	.998	.019	52.130	<.001	.960	1.035
Male group	1.047	.020	52.350	<.001	1.007	1.087
Effect size (f square) = 4.411						
Test(s) of highest order unconditional interaction(s)						
	R^2-change	F	df_1	df_2	p	
*PSEE*Gender*	.0005	8.127	1	1228	<.05	

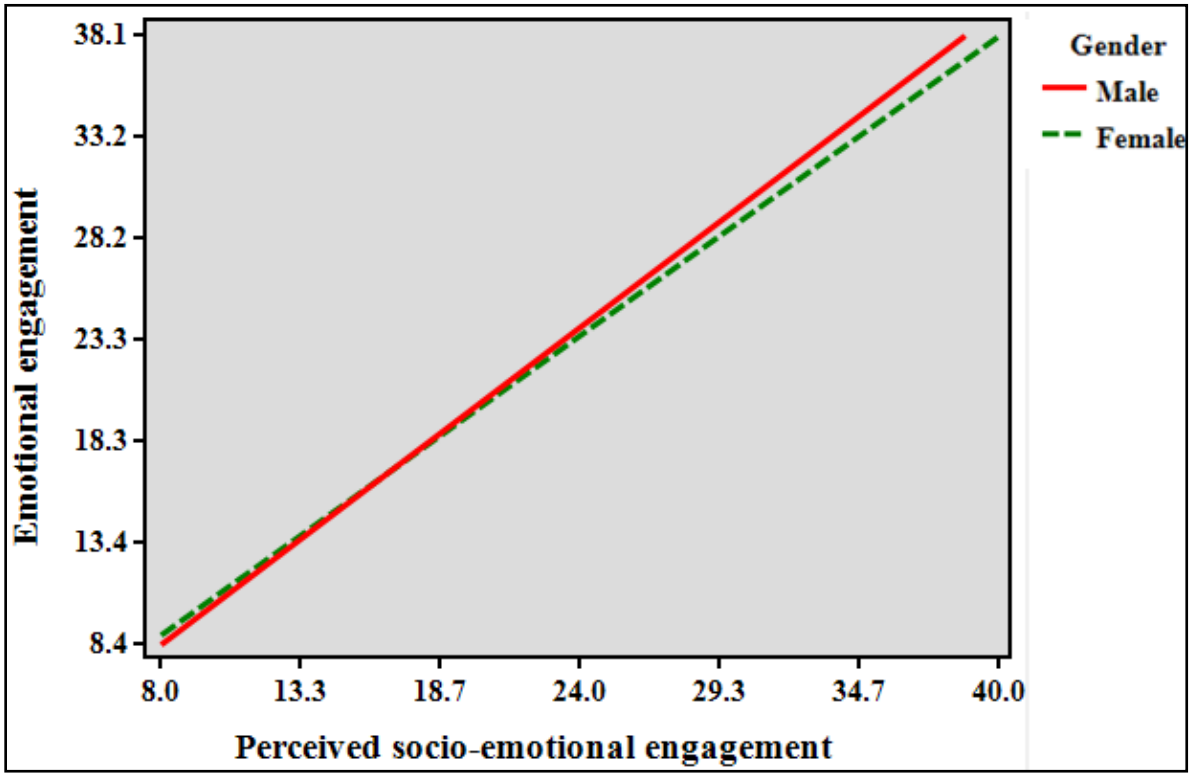
Figure 4. 56

Statistical model for the moderation effect of gender on the association between PSEE and EE



Graph 4.6

The plots of effect of interaction between perceived socio-emotional engagement and students' gender on emotional engagement



4.2.5.3 Moderation effect of students' gender on the relationship between perceived pedagogical engagement and student engagement

$H_0$5c: There is no significant moderation effect of students' gender on the relationship between perceived pedagogical engagement and student engagement

The following null hypothesis ($H_0$5c) deals with student engagement as the outcome variable that includes three components namely, cognitive, behavioral, and emotional engagement. This leads to three sub-hypotheses ($H_0$5c.1-5c.3) of $H_0$5c.

> $H_0$5c.1: There is no significant moderation effect of students' gender on the relationship between perceived pedagogical engagement and students' cognitive engagement
>
> $H_0$5c.2: There is no significant moderation effect of students' gender on the relationship between perceived pedagogical engagement and students' behavioral engagement
>
> $H_0$5c.3: There is no significant moderation effect of students' gender on the relationship between perceived pedagogical engagement and students' emotional engagement

4.2.5.3.1 Moderation effect of students' gender on the relationship between perceived pedagogical engagement and students' cognitive engagement

$H_0$5c.1: There is no significant moderation effect of students' gender on the relationship between perceived pedagogical engagement and students' cognitive engagement

The null hypothesis ($H_0$5c.1) is multivariate in nature as it deals with four variables: Gender, perceived pedagogical engagement (PPE), their interaction (i.e. Gender*PPE), and cognitive engagement (CE). All the variables are continuous except Gender, which is a categorical variable with two levels namely, male and female. Thus, the null hypothesis (i.e. $H_0$5c.1) was tested following Moderation analysis.

Whenever conducting a moderation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.57). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.67 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}=5.78) did not exceeded the critical value (i.e. 7.81 with df=3 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual.

Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.57) and Q-Q plot (Figure 4.57) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the statistically insignificant results of Kolmogrov-Smirnov test (statistic= .012, df= 1232, p= .200) and the Shapiro-Wilk test (W= .995, df= 1232, p=.368) (Field, 2009).

Third, the value of Durbin-Watson statistic is 2.33 (Field, 2013). Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.58). Fourth, Figure 4.14 depicts the linear relationships among the criterion variables where each plot showed the value of R^2_{Linear}>0.3 (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately. Fifth, Figure 4.58 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .669, p= .836) and Koenker test (LM= .610, p= .751) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Figure 4. 57

Histogram (extreme left), Q-Q Plot (middle), and Box Plot (extreme right) of the residual

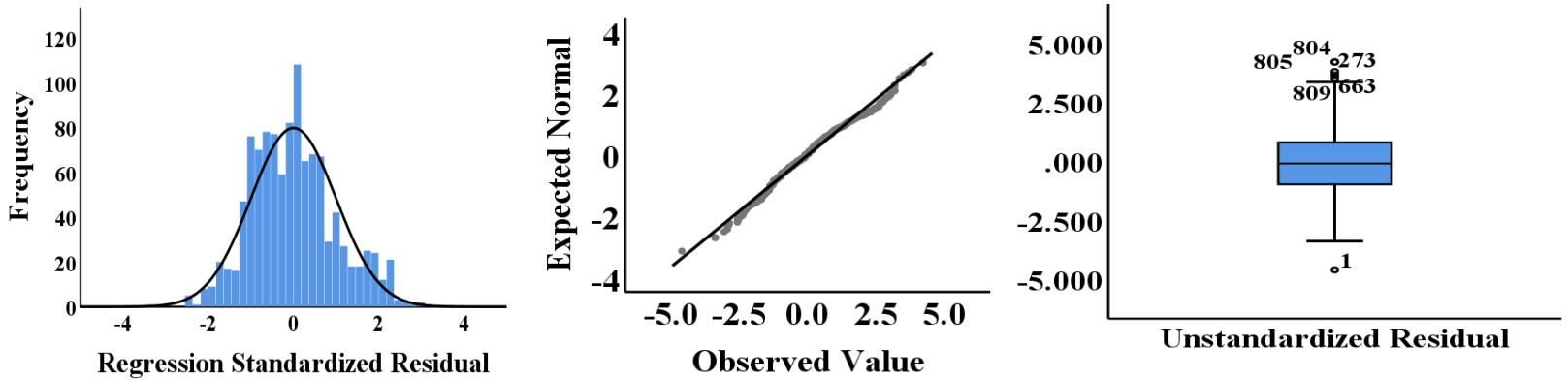
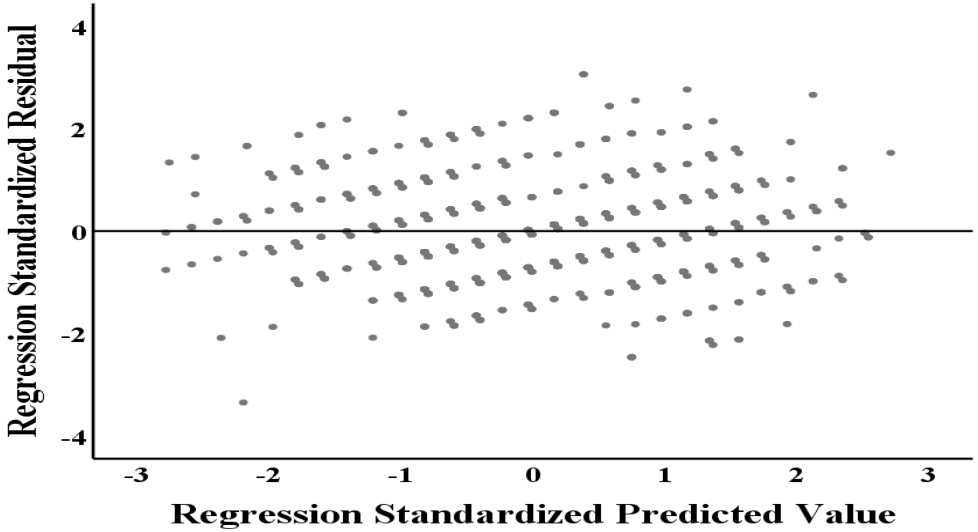


Figure 4. 58

Residual Plot of the dependent variable (Cognitive Engagement)



Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.29, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured.

Table 4. 29

Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Gender	0.47	2.13
Gender*PPE	0.43	2.33
Perceived Pedagogical Engagement (PPE)	0.49	2.04

Therefore, the data met all the statistical assumptions required for the moderation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the moderation analysis may be generalized in the target population.

The Moderation analysis was run by selecting students' gender. The hypothesized moderation model (see Figure 4.59 and 4.60) was then examined and evaluated (see Figure 4.61).

Figure 4. 59

Hypothesized (conceptual) path model for the moderation effect of gender on the association between PPE and CE

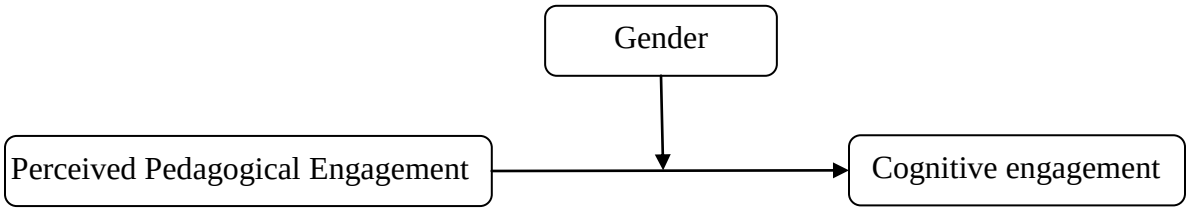
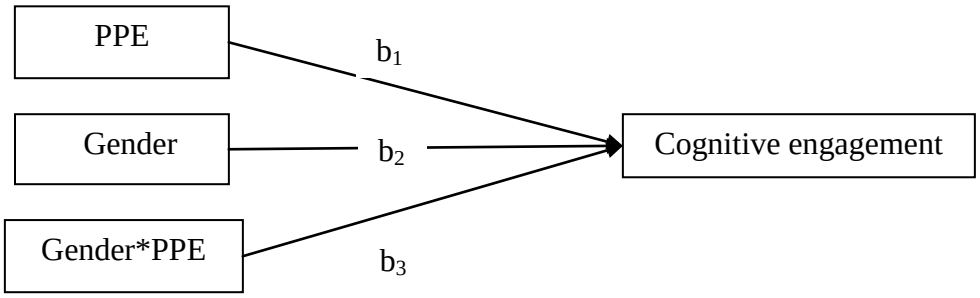


Figure 4. 60

Statistical model for the moderation effect of gender on the association between PPE and CE



A basic model considering PPE as independent variable, cognitive engagement as the dependent variable, and gender as the moderator variable was constructed (see Figure 4.60) and was examined by performing Moderation analysis. The overall moderation model was significant: R^2= .863, F(3, 1228)= 2582.968, p<.001, (see Table 4.30). Further, the effect of PPE on cognitive engagement was positive and significant, (B= .757, 95% CI [.697, .817], p<0.001; see Table 4.30). Again, the effect of Gender on CE was positive and significant, (B= 1.600, 95% CI [.733, 2.467], p<0.001; see Table 4.30]. However, the interaction effect between perceived pedagogical engagement and students' gender on cognitive engagement was statistically not significant (B= .004, 95% CI [-.037, .045], p=0.857; see Table 4.30].

Additionally, to know the trend of influence of the interaction between gender and PPE on CE, Graph 7 was plotted where no interaction was found. Therefore, the relationship between the focal predictor PPE and CE did not depend upon students' gender. Thus, it can be said that how PPE influence CE did not depend on the fact that a student is boy or girl. These findings provide conclusive evidences that gender gap in PPE did not significantly contribute in explaining the gender gap in CE. Further, R^2-change for inclusion of the interaction term (Gender*PPE) in the moderation model was not significant: R^2-change= .000, F (1, 1228)= .032, p=.857. This implies that the interaction term did not contribute significantly to the moderation model. These results do not permit to identify gender as a significant moderator in this case. Therefore, it can be said that PPE influences CE to the same extent for the students regardless of their gender.

In sum, the interaction effect between PPE and gender (i.e. PPE* gender) was found to be statistically not significant. As a result, presence of differential effects of PPE on cognitive engagement of males and females were not confirmed. It can be said that PPE did not influence CE differently for males and females. Further, PPE was found to be equally related to boys' and girls' cognitive engagement. Thus, PPE was equally beneficial for promoting cognitive engagement of both boys as well as girls.

Figure 4. 61

Statistical model for the moderation effect of gender on the association between PPE and CE

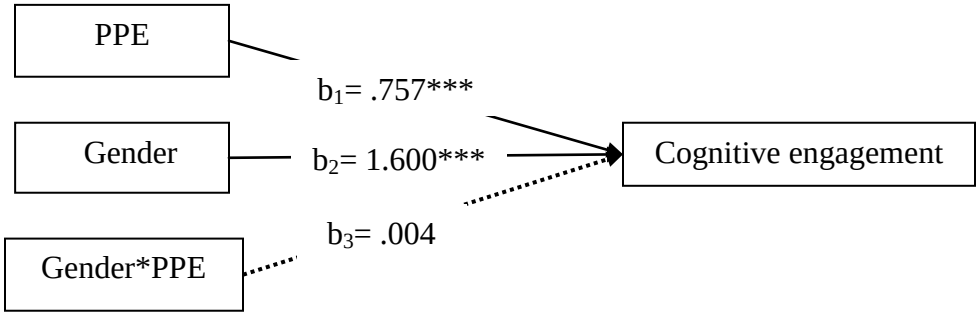


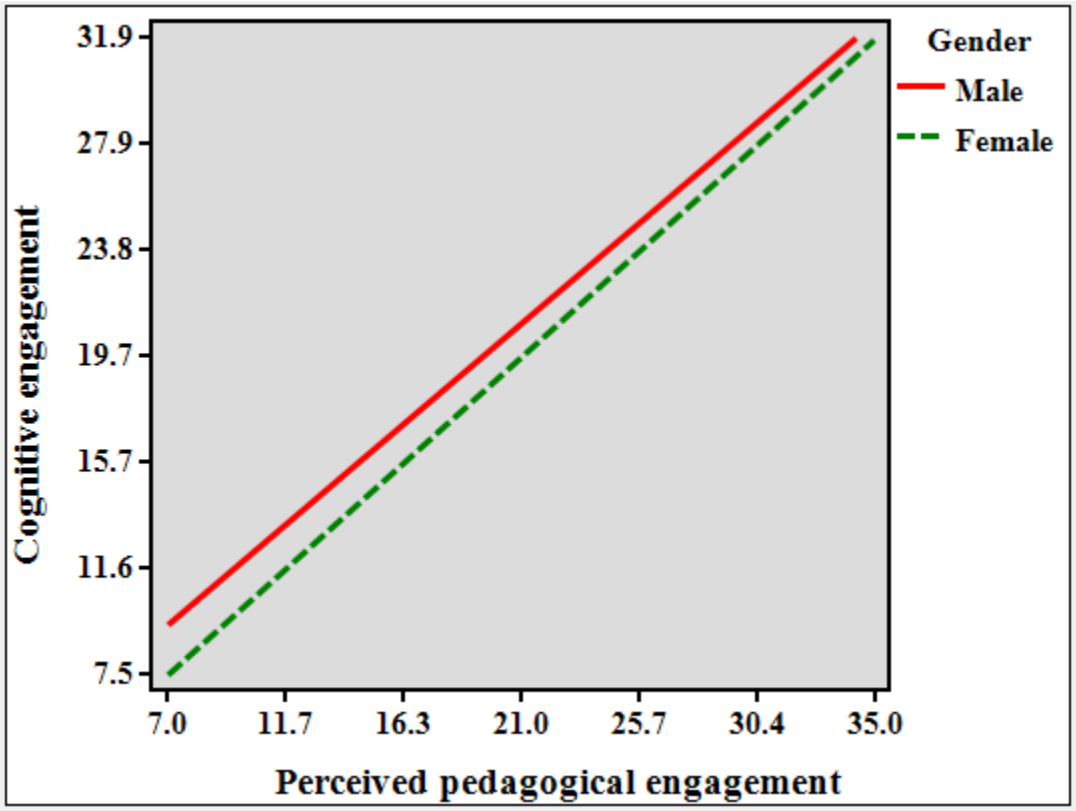
Table 4. 30

Moderating effect of gender on the relationship between PPE and CE

Regression path	B	SE	t	p	LLCI	ULCI
Predictor=PPE, Moderator=Gender, Outcome variable=CE						
R^2=.863, F (3, 1228)= 2582.968, p<.001						
Constant	5.529	.658	8.402	<.001	3.893	7.164
PPE	.757	.030	25.233	<.001	.697	.817
Gender	1.600	.431	3.713	<.001	.733	2.467
*Interaction: PPE*Gender*	.004	.022	.180	.857	-.037	.045
Test (s) of highest order unconditional interaction(s)						
	R^2-change	*F*	*df_1*	*df_2*	*p*	
*PPE*Gender*	.001	.032	1	1228	.857	

Graph 4.7

The plots of effect of interaction between PPE and gender on Cognitive engagement



4.2.5.3.2 Moderation effect of students' gender on the relationship between perceived pedagogical engagement and students' behavioral engagement

$H_0$5c.2: There is no significant moderation effect of students' gender on the relationship between perceived pedagogical engagement and students' behavioral engagement

The null hypothesis ($H_0$5c.2) is multivariate in nature as it deals with four variables: Gender, perceived pedagogical engagement (PPE), their interaction (i.e. Gender*PPE), and behavioral engagement (BE). All the variables are continuous except Gender, which is a categorical variable with two levels namely, male and female. Thus, the null hypothesis (i.e. $H_0$5c.2) was tested following Moderation analysis.

Whenever conducting a moderation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.62). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.70 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}=5.67) did not exceeded the critical value (i.e. 7.81 with df=3 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual.

Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.62) and Q-Q plot (Figure 4.62) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the statistically insignificant results of Kolmogrov-Smirnov test (statistic= .016, df= 1232, p= .200) and the Shapiro-Wilk test (W= .998, df= 1232, p=.819) (Field, 2009).

Third, the value of Durbin-Watson statistic is 2.51 (Field, 2013). Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.63). Fourth, Figure 4.17 depicts the linear relationships among the criterion variables where each plot showed the value of R^2_{Linear}>0.3 (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately.

Fifth, Figure 4.63 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .662, p= .836) and

Koenker test (LM= .626, p= .751) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.31, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured.

Table 4. 31

Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Gender	0.31	3.23
Gender*PPE	0.51	1.96
Perceived Pedagogical Engagement (PPE)	0.68	1.47

Therefore, the data met all the statistical assumptions required for the moderation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the moderation analysis may be generalized in the target population.

Figure 4. 62

Histogram (extreme left), Q-Q Plot (middle) and Box Plot (extreme right) of the residual

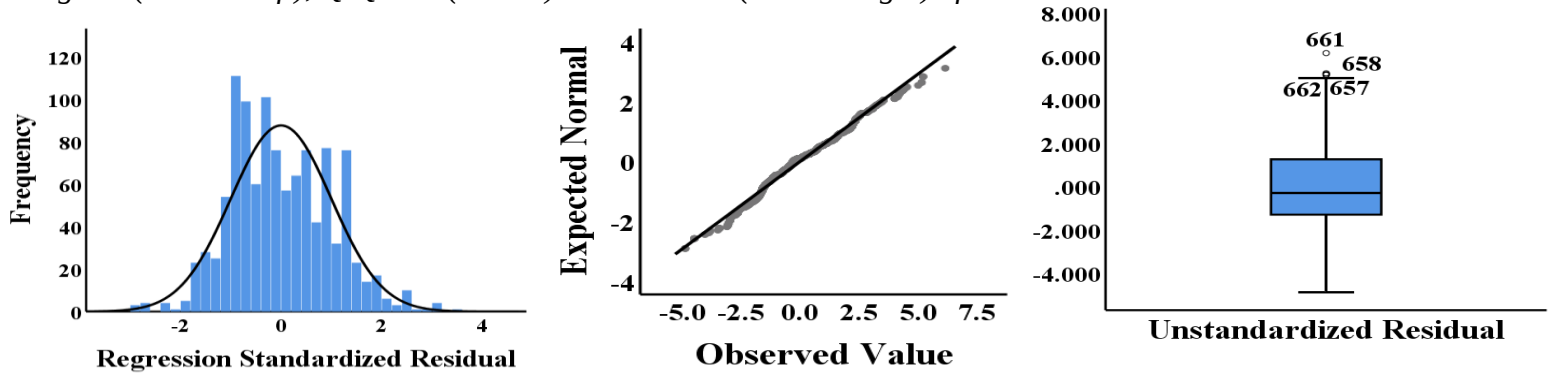
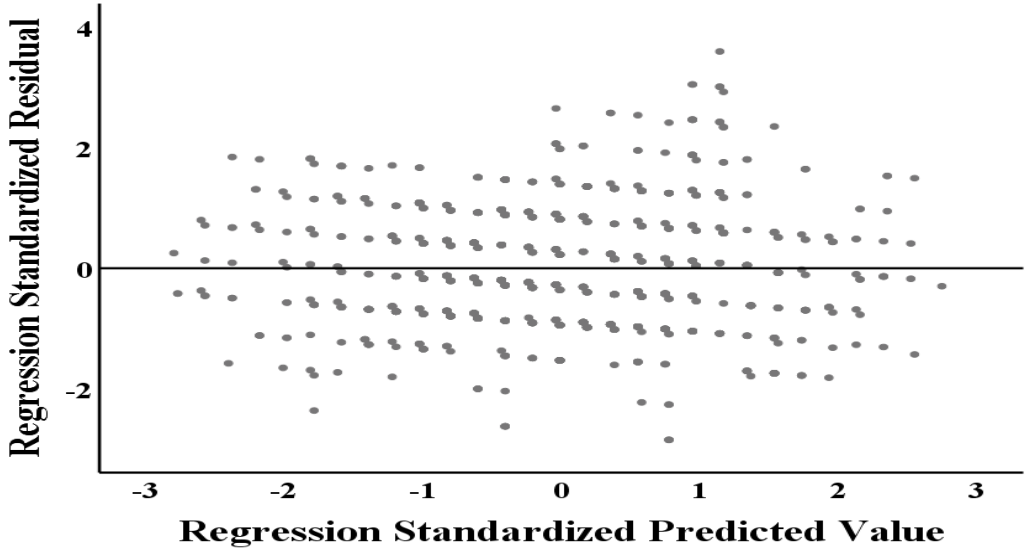


Figure 4. 63

Residual Plot of the dependent variable (Behavioral Engagement)



The Moderation analysis was run by selecting students' gender. The hypothesized moderation model (see Figure 4.64 and 4.65) was then examined and evaluated (see Figure 4.66).

Figure 4. 64

Hypothesized (conceptual) path model for the moderation effect of gender on the association between PPE and BE

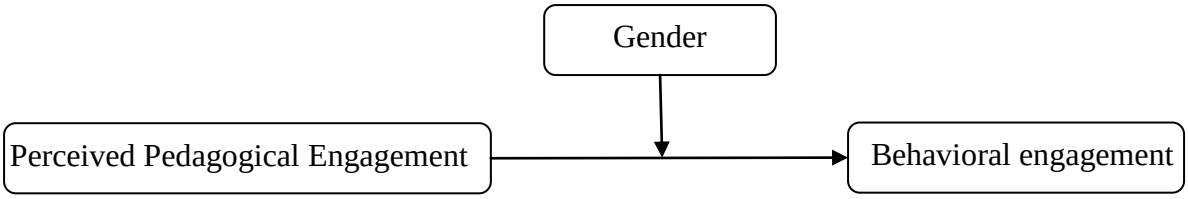
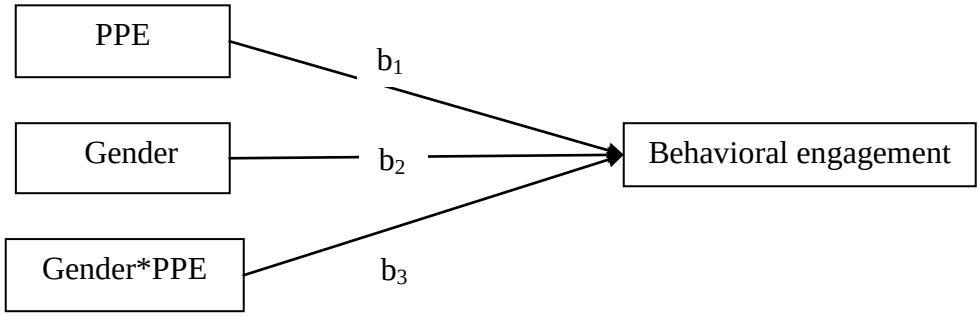


Figure 4. 65

Statistical model for the moderation effect of gender on the association between PPE and BE



A basic model considering PPE as independent variable, BE as the dependent variable, and gender as the moderator variable was constructed (see Figure 4.65) and was examined by performing Moderation analysis. The overall moderation model was significant: R^2= .815, F(3, 1228)= 1805.389, p<.001, (see Table 4.32). Further, the effect of PPE on BE was positive and significant, (B= .948, 95% CI [.863, 1.034], p<0.001; see Table 4.32). Again, the effect of Gender on BE was positive and significant, (B= 1.112, 95% CI [.200, 2.024], p<0.05; see Table 4.32]. However, the interaction effect between perceived pedagogical engagement and students' gender on BE was found to be statistically not significant (B= .027, 95% CI [-.028, .082], p=0.333; see Table 4.32]. Additionally, to know the trend of influence of the interaction between gender and PPE on behavioral engagement, Graph 8 was plotted where no interaction was found.

Therefore, the relationship between the focal predictor PPE and behavioral engagement did not depend upon students' gender. Thus, it can be said that how PPE influence BE did not depend on the fact that a student is boy or girl. These findings provide conclusive evidences that gender gap in PPE did not significantly contribute in explaining the gender difference in BE. Further, R^2-change for inclusion of the interaction term (Gender*PPE) in the moderation model was not significant: R^2-change= .0002, F (1, 1228)= .937, p=.333. This implies that the interaction term did not contribute significantly to the moderation model. These results do not permit to identify gender as a significant moderator in this case. Therefore, it can be said that PPE influences BE to the same extent for the students regardless of their gender. Hence, PPE was found to be equally beneficial for boys and girls for promoting their behavioral engagement.

In sum, the interaction effect between PPE and gender (i.e. PPE*gender) was found to be statistically not significant. As a result, presence of differential effects of PPE on behavioral engagement of boys and girls were not confirmed. It can be said that PPE did not influence BE differently for males and females. Further, PPE was found to be equally related to boys' and girls' behavioral engagement. Thus, PPE was equally beneficial for promoting behavioral engagement of both boys as well as girls.

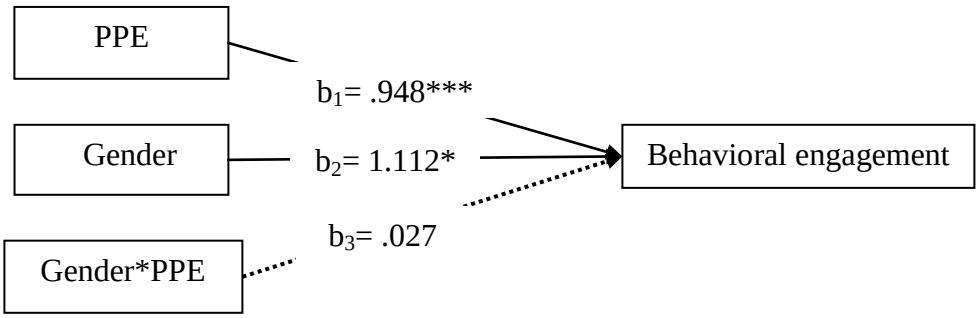
Table 4. 32

Moderating effect of gender on the association between PPE and BE

Regression path	B	SE	t	p	LLCI	ULCI
Predictor=PPE, Moderator=Gender, Outcome variable=BE						
R^2=.815, F (3, 1228)= 1805.389, p<.001						
Constant	3.664	.936	3.913	<.001	1.827	5.501
PPE	.948	.043	22.058	<.001	.863	1.034
Gender	1.112	.517	2.149	<.05	.200	2.024
*Interaction: PPE*Gender*	.027	.028	.968	.333	-.028	.082
Test (s) of highest order unconditional interaction(s)						
	R^2-change	*F*	*df_1*	*df_2*	*p*	
*PPE*Gender*	.0002	.937	1	1228	.333	

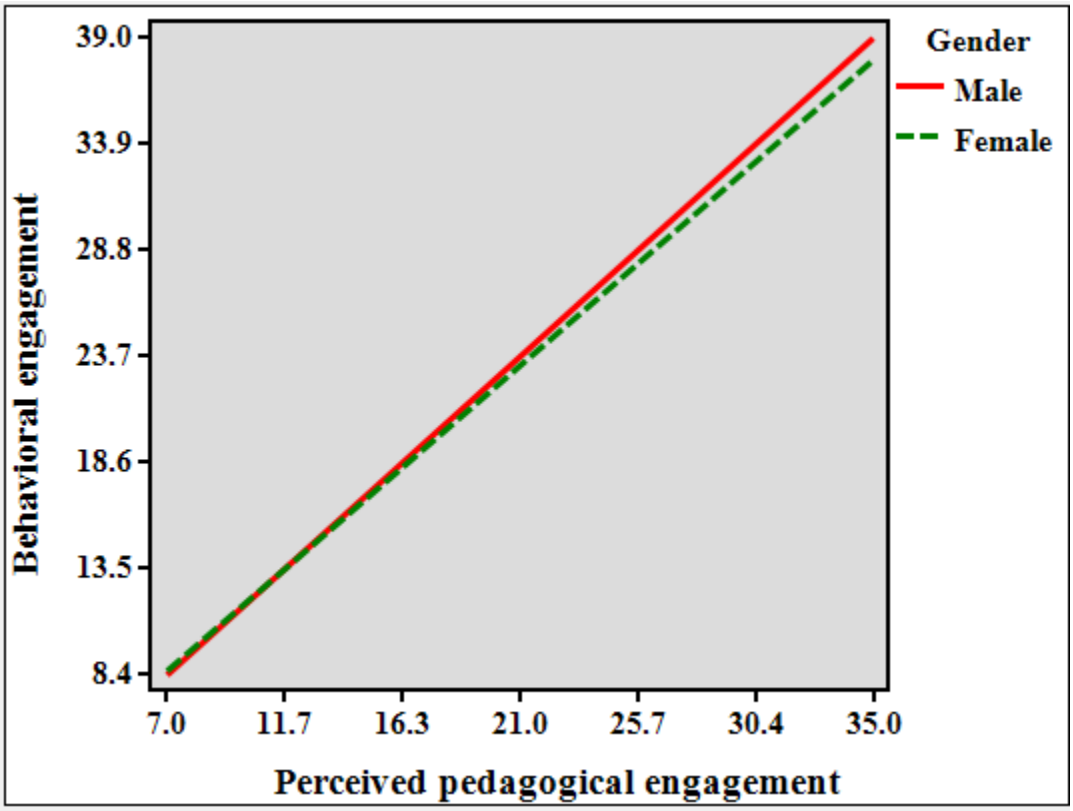
Figure 4. 66

Statistical model for the moderation effect of gender on the association between PPE and BE



Graph 4.8

The plots of effect of interaction between PPE and gender on behavioral engagement



4.2.5.3.3 Moderation effect of students' gender on the relationship between perceived pedagogical engagement and students' emotional engagement

$H_0$5c.3: There is no significant moderation effect of students' gender on the relationship between perceived pedagogical engagement and students' emotional engagement

The null hypothesis ($H_0$5c.3) is multivariate in nature as it deals with four variables: Gender, Perceived pedagogical engagement (PPE), interaction (i.e. Gender*PPE), and emotional engagement (EE). All the variables are continuous except Gender, which is a categorical variable with two levels namely, male and female. Thus, the null hypothesis (i.e. $H_0$5c.3) was tested following Moderation analysis.

Whenever conducting a moderation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.67). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.78 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}=5.92) did not exceeded the critical value (i.e. 7.81 with df=3 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual.

Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.67) and Q-Q plot (Figure 4.67) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the statistically insignificant results of Kolmogrov-Smirnov test (statistic= .016, df= 1232, p= .200) and the Shapiro-Wilk test (W= .996, df= 1232, p=.801) (Field, 2009).

Third, the value of Durbin-Watson statistic is 2.63 (Field, 2013). Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.68). Fourth, Figure 4.24 depicts the linear relationships among the criterion variables where each plot showed the value of $R^2_{Linear}>0.3$ (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately.

Fifth, Figure 4.68 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .672, p= .836) and Koenker test (LM= .621, p= .751) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.33, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured.

Table 4. 33

Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Gender	0.29	3.45
Gender*PPE	0.52	1.92
Perceived Pedagogical Engagement (PPE)	0.69	1.45

Therefore, the data met all the statistical assumptions required for the mediation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the mediation analysis may be generalized in the target population.

Figure 4. 67

Histogram (extreme left), Q-Q Plot (middle) and Box Plot (extreme right) of the residual

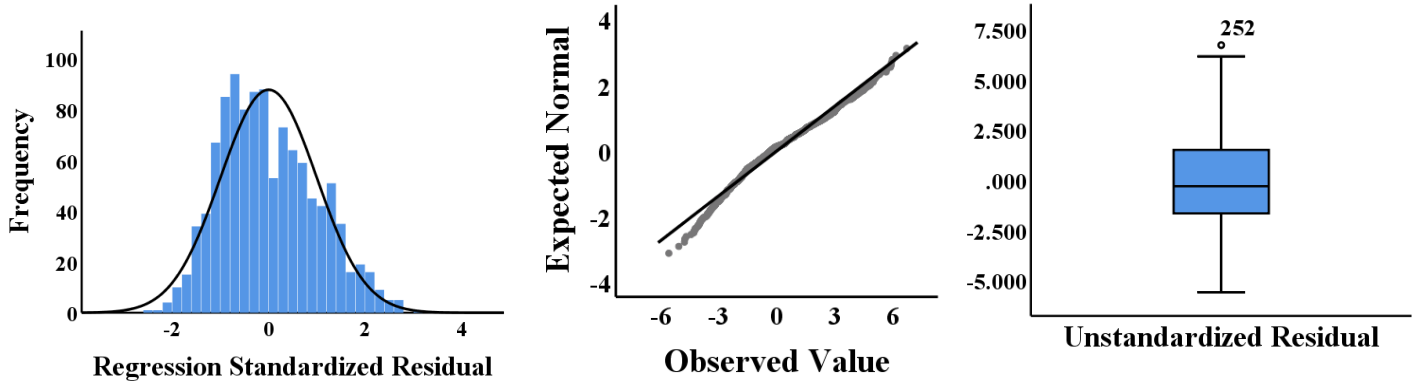
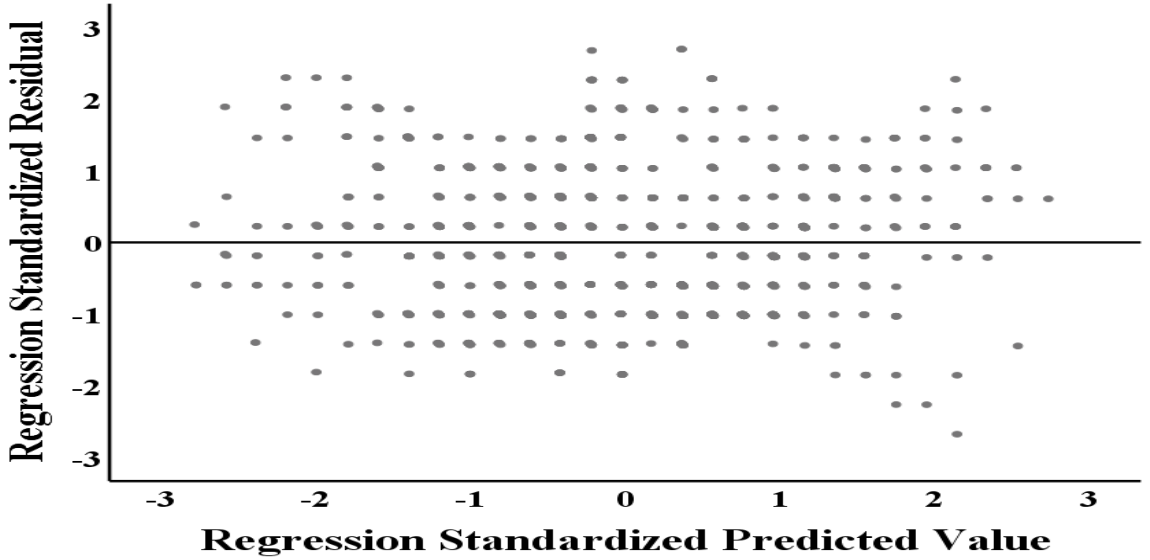


Figure 4. 68

Residual Plot of the independent variable (Emotional Engagement)



The Moderation analysis was run by selecting students' gender. The hypothesized moderation model (see Figure 4.69 and 4.70) was then examined and evaluated (see Figure 4.71).

Figure 4. 69

Hypothesized (conceptual) path model for the moderation effect of Gender on the association between PPE and EE

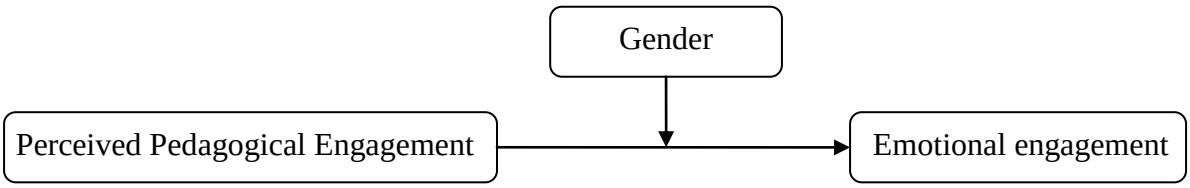
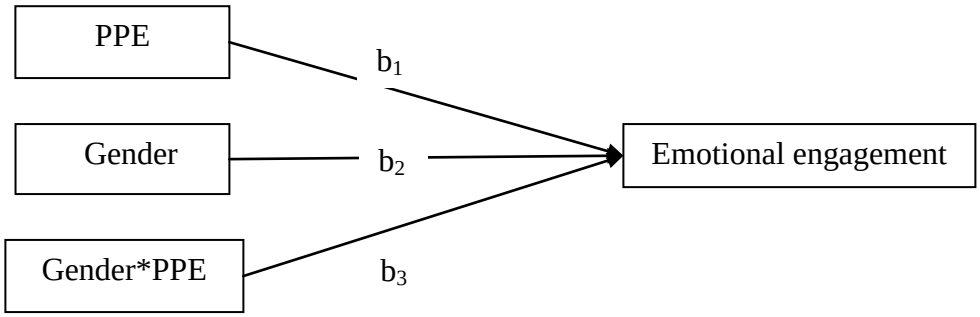


Figure 4. 70

Statistical model for the moderation effect of gender on the association between PPE and EE



A basic model considering PPE as independent variable, EE as the dependent variable, and gender as the moderator variable was constructed (see Figure 4.69) and was examined by performing Moderation analysis. The overall moderation model was significant: R^2= .893, F(3, 1228)= 3419.538, p<.001, (see Table 4.34). Further, the effect of PPE on EE was positive and significant, (B= 1.072, 95% CI [1.008, 1.137], p<0.001; see Table 4.34). Again, the effect of Gender on EE was positive and significant, (B= 1.118, 95% CI [.234, 2.002], p<0.01; see Table 4.34]. However, the interaction effect between perceived pedagogical engagement and students' gender on emotional engagement was found to be statistically not significant (B= .006, 95% CI [-.052, .064], p=0.796; see Table 4.34].

Additionally, to know the trend of influence of the interaction between gender and PPE on emotional engagement, Graph 9 was plotted where no interaction was found. Therefore, the relationship between the focal predictor PPE and emotional engagement did not depend upon students' gender. Thus, it can be said that how PPE influence EE did

not depend on the fact that a student is boy or girl. These findings provide conclusive evidences that gender gap in PPE did not significantly contribute in explaining the gender gap in emotional engagement. Further, R^2-change for inclusion of the interaction term (Gender*PPE) in the moderation model was not significant: R^2-change= .000, F (1, 1228)= .067, p=.796. This implies that the interaction term did not contribute significantly to the moderation model. These results do not permit to identify gender as a significant moderator in this case. It can be said that PPE influences EE to the same extent for the students regardless of their gender. Hence, PPE was found to be equally beneficial for boys and girls for promoting their emotional engagement.

In sum, the interaction effect between PPE and gender (i.e. PPE*gender) was found to be statistically not significant. As a result, presence of differential effects of PPE on emotional engagement of boys and girls were not confirmed. It can be said that PPE did not influence EE differently for males and females. Further, PPE was found to be equally related to boys' and girls' emotional engagement. Thus, PPE was equally beneficial for promoting emotional engagement of both boys as well as girls.

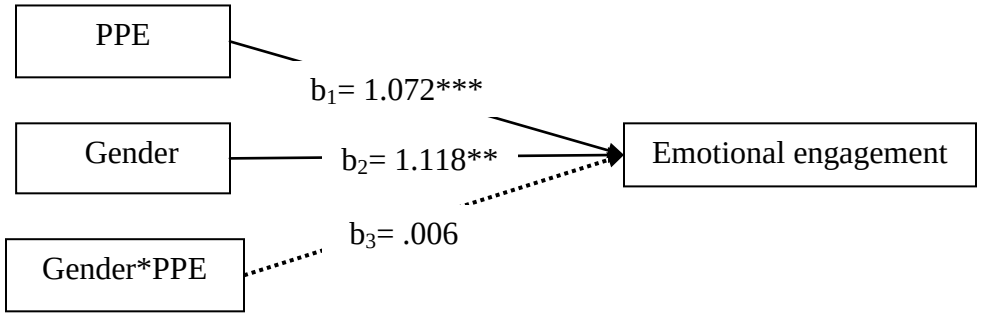
Table 4. 34

Moderating effect of gender on the relationship between PPE and EE

Regression path	B	SE	t	p	LLCI	ULCI
Predictor=PPE, Moderator=Gender, Outcome variable=EE						
R^2=.893, F (3, 1228)=3419.538, p<.001						
Constant	.988	.397	2.489	<.05	.663	1.313
PPE	1.072	.033	32.623	<.001	1.008	1.137
Gender	1.118	.343	3.256	<.01	.234	2.002
*Interaction: PPE*Gender*	.006	.023	.259	.796	-.052	.064
Test(s) of highest order unconditional interaction(s)						
	R^2-change	F	df_1	df_2	p	
*PPE*Gender*	.000	.067	1	1228	.796	

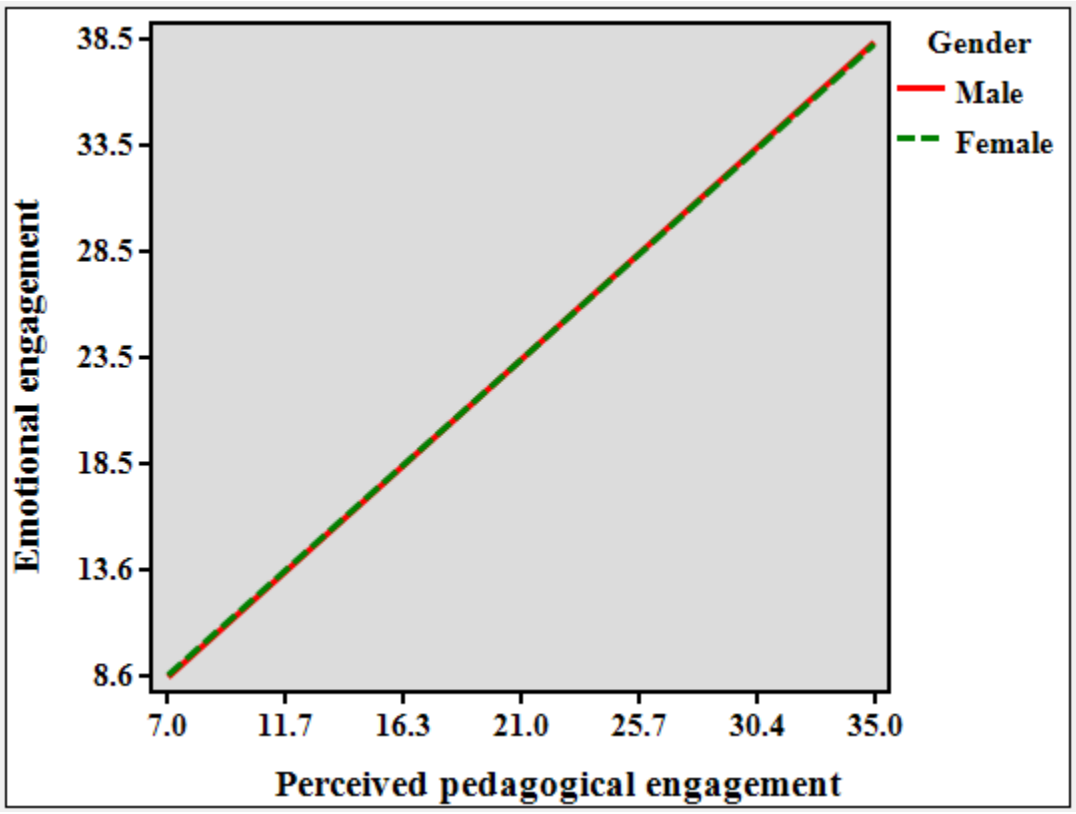
Figure 4. 71

Statistical model for the moderation effect of gender on the association between PPE and EE



Graph 4.9

The plots of effect of interaction between Perceived pedagogical engagement and students' gender on emotional engagement



4.2.6 Mediation effect of student engagement (viz. cognitive, behavioral, and emotional engagement) on the relationship between students' gender and their academic achievement

Objective 6: To study the mediation effect of student engagement (viz. cognitive, behavioral and emotional engagement) on the relationship between students' gender and their academic achievement

$H_0$6: There is no significant mediation effect of student engagement (viz. cognitive, behavioral and emotional engagement) on the relationship between students' gender and their academic achievement.

The null hypothesis ($H_0$6) is multivariate in nature as it deals with five variables: students' gender, CE, BE, EE and achievement. All the variables are continuous variables except gender which is a categorical variable with two levels namely, male and female. The mediation hypothesis ($H_0$6) was tested following parallel mediation analysis.

Whenever conducting a mediation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.72). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.84 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}=5.47) did not exceeded the threshold value (i.e. 9.49 with df=4 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual.

Figure 4. 72

Histogram (extreme left), Normal Q-Q plot (middle) and Box plot (extreme right) of the residual

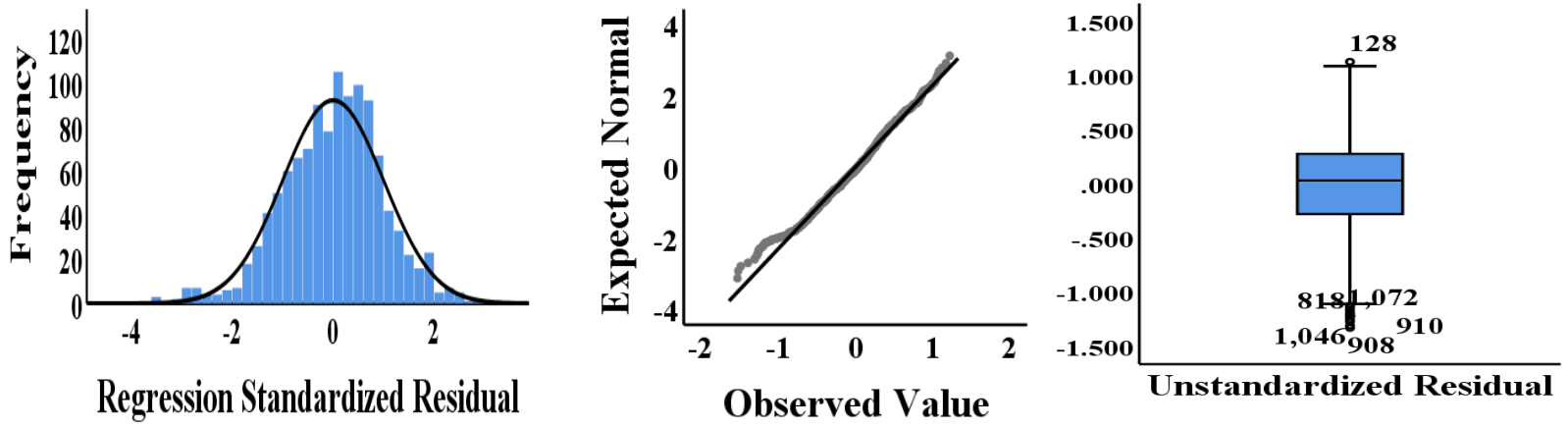
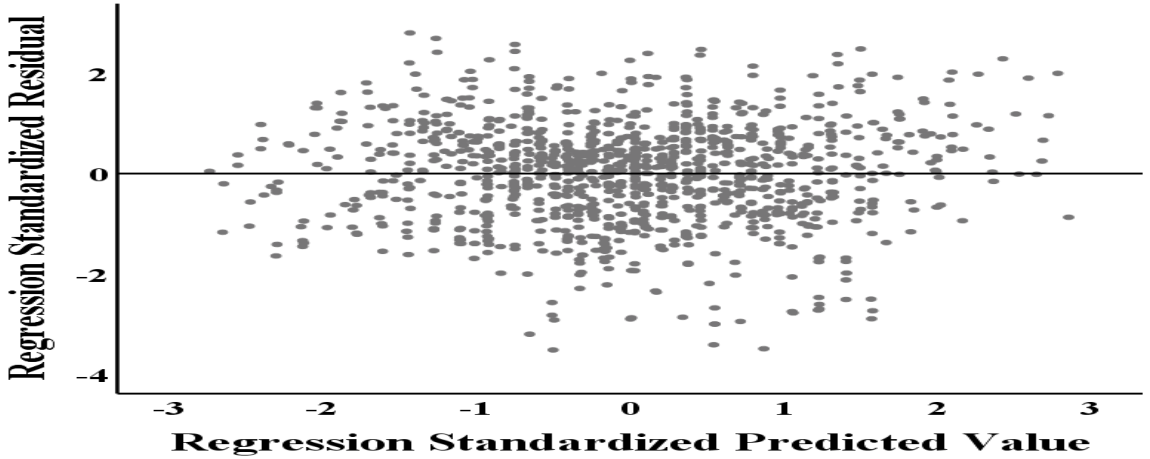


Figure 4. 73

The Residual Plot of the dependent variable (Academic achievement)



Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.72) and Q-Q plot (Figure 4.72) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the statistically insignificant results of Kolmogrov-Smirnov test (statistic= .017, df= 1232, p= .200) and the Shapiro-Wilk test (W= .996, df= 1232, p=.885) (Field, 2009).

Third, the value of Durbin-Watson statistic is 2.37. Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.73). Fourth, Figure 4.93 depicts the linear relationships among the criterion variables where each plot showed the value of $R^2_{Linear}>0.3$ (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately. Fifth, Figure 4.73 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .668, p= .836) and Koenker test (LM= .608, p= .751) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.35, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured. Therefore, the data met all the statistical assumptions required for the mediation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the mediation analysis may be generalized in the target population.

The parallel mediation analysis was run by selecting the student engagement dimensions (viz. cognitive, behavioral, emotional engagement). The three mediation relationships in the hypothesized theoretical path model (Figure 4.74) were then examined and evaluated (Figure 4.75).

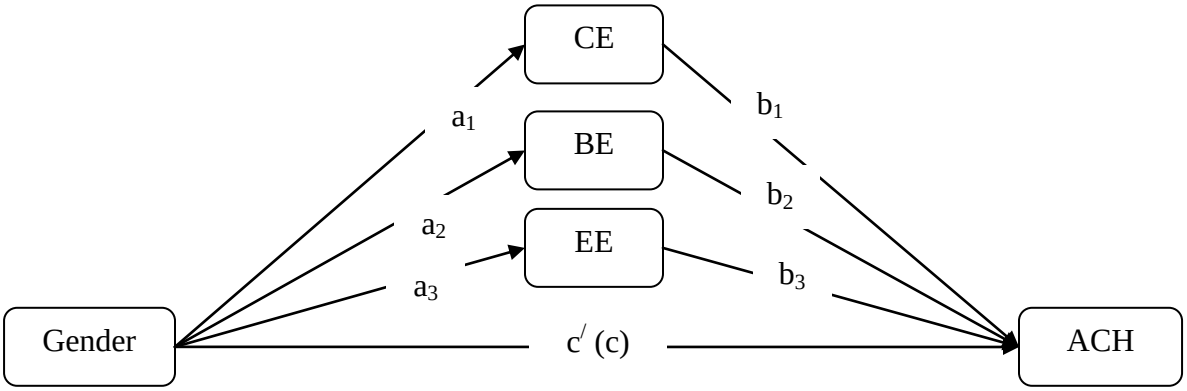
Table 4. 35

Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Cognitive Engagement	0.35	2.86
Behavioral Engagement	0.28	3.57
Emotional Engagement	0.47	2.13
Gender	0.77	1.30

Figure 4. 74

Hypothesized path model of the mediation effect for the three student engagement dimensions (viz. CE, BE, and EE) on the association between gender and achievement



Note. a_i is effect of Gender on student engagement dimensions; b_i is effect of student engagement dimensions on achievement; $c^{/}$ is direct; c is the total in absence of any mediator, and a_ib_i is the indirect effect via the i^{th} Mediator variable

The results indicated that the *Total effect model* is significant: R^2= .892, F(1, 1230)= 12.928, p<0.001 (see Table 4.36). Students' gender positively predicts students' academic achievement (c= 1.911, 95% CIs: [1.265, 2.557]; see Table 4.36). Further, results from the three *Mediator variable models* show that gender positively influenced students' cognitive engagement (a_1= 0.896, 95% CIs: [0.362, 1.430]; Mediator variable model 1, see Table 4.36), behavioral engagement (a_2= .713, 95% CIs: [.382, 1.044]; Mediator variable model 2, see Table 4.36), and emotional engagement (a_3= 1.163, 95%

CIs: [.510, 1.817]; Mediator variable model 3, see Table 4.36). In turn, students' cognitive engagement positively influenced students' academic achievement (b_1= 0.061, 95% CIs: [0.039, 0.083]); so did students' emotional engagement (b_3= 0.969, 95% CIs: [0.950, 0.989]) (see Table 4.36). However, students' behavioral engagement (b_2= 0.017, 95% CIs: [-0.213, 0.247]) did not significantly influenced academic achievement (see Table 4.36). Further, analyzing the indirect effects from the *Indirect effect model*, results demonstrated that students' cognitive engagement significantly mediated the relationship between gender and students' achievement: a_1*b_1= 0.055, 95% BootLLCI= 0.019, 95% BootULCI= 0.091] (Hayes, 2013). Similarly, the indirect effects for emotional engagement (a_3*b_3= 1.127, 95% BootLLCI= 0.808, 95% BootULCI= 1.446]) (see Table 4.36) were also statistically significant. However, the indirect effect for behavioral engagement a_2*b_2= 0.012, 95% BootLLCI= -0.015, 95% BootULCI= 0.039] (see Table 4.36) was not statistically significant.

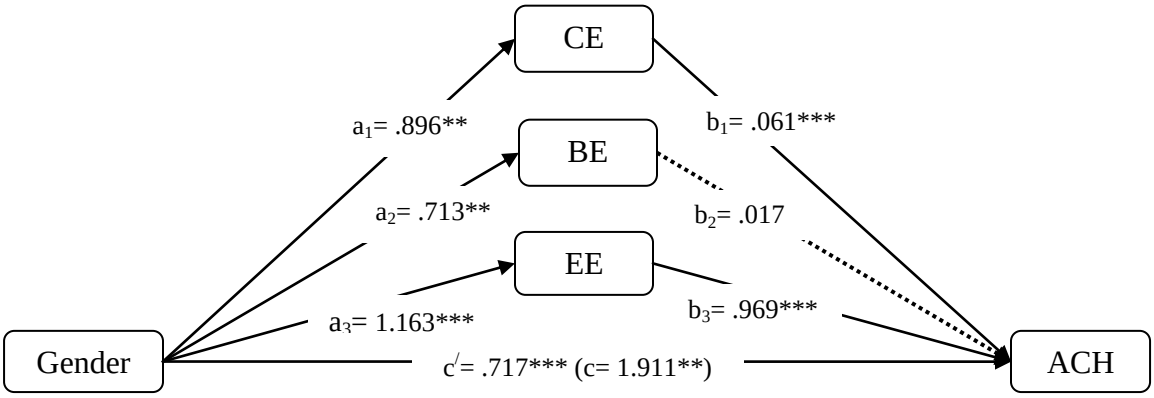
Therefore, all student engagement dimensions (except BE) mediated the association between gender and achievement, significantly. The total indirect effect exerted jointly by the mediators (viz. CE and EE) was also statistically significant: (Total indirect effect= 1.194, 95% BootLLCI= 0.463, 95% BootULCI= 1.925]; see Table 4.36) which is 62.480% of the total effect. Further, the P_M for the mediators (viz. CE and EE) were found to be .029 and .590 respectively (see Table 4.36). Nevertheless, it was found from the *Direct effect model* that the results also suggest that even after accounting for the mediating role of the student engagement dimensions (viz. cognitive and emotional engagement), gender still has a positive impact on students' achievement ($c^{/}$=0.717, 95% CIs: [.543, .891]) (see Table 4.36). Therefore, it was found that even the effect of gender was lessened predicting achievement, still the effect was significant. Thus, it can be said that cognitive and emotional engagement partially mediated the association between gender and achievement.

Besides, the percentage of the mediation effect (see Table 4.36) showed that the proportion of the total effect of gender on academic achievement that operates indirectly through cognitive engagement is 2.878% and through emotional engagement is 58.974%. These results provide evidence that the gender difference in achievement is significantly

explained by the gender gap in student engagement dimensions (except BE). Thus, student engagement dimensions namely, emotional engagement and cognitive engagement play key roles in explaining gender difference in students' achievement. In sum, the indirect effects exerted by the student engagement dimensions (except BE) significantly influenced students' achievement. Thus, except BE, the other two student engagement dimensions namely, CE and EE were found to be significant mediators on the association between gender and achievement. Yet the direct effect of students' gender on their achievement was still significant indicating this as a case of partial mediation. Further, the indirect effect operated through CE was lesser than that through EE. Thus, EE was found to be a better mediator on the association between gender and achievement as well as a better predictor of academic achievement. Finally, it can be said that gender difference in CE and in EE is a significant cause in explaining the gender difference in students' achievement.

Figure 4. 75

Structural model of the total, direct and indirect effects for the three student engagement dimensions (viz. CE, BE, and EE) on the relationship between gender and their achievement



Note. *p < .05, **p < .01, ***p < .001

a_n is effect of gender on three student engagement dimensions; b_n is effect of student engagement dimensions on achievement; $c^{/}$ is direct effect; c is total effect in the absence of any mediator(s) in the model.

Table 4. 36

Results of mediation analysis for Hypothesis 6

	B	SE	t	95% [LLCI, ULCI]
Total effect model: Gender→ ACH				
R^2=.892, F(1,1230)=12.928, p<.001				
Constant	63.257	.516	122.487***	[62.244, 64.270]
Gender	1.911	.705	2.711**	[1.265, 2.557]
Mediator variable model 1: Gender→CE				
R^2=.009, F(1,1230)=10.852, p<.01				
Constant	19.758	.429	46.047***	[18.916, 20.600]
Gender	.896	.272	3.294**	[.362, 1.430]
Mediator variable model 2: Gender→BE				
R^2=.010, F(1,1230)=12.205, p<.001				
Constant	22.011	.525	41.911***	[20.980, 23.041]
Gender	.713	.331	2.154**	[.382, 1.044]
Mediator variable model 3: Gender→EE				
R^2=.012, F(1,1230)=14.793, p<.001				
Constant	21.874	.523	41.865***	[20.849, 22.899]
Gender	1.163	.333	3.494***	[.510, 1.817]
Dependent variable model: Outcome variable= ACH				
R^2=.988, F(4,1227)=25157.504, p<.001				
Constant	41.671	.094	442.217***	[41.486, 41.856]
Gender	.717	.036	19.917***	[.543, .891]
CE	.061	.011	5.351***	[.039, .083]
BE	.017	.014	1.214	[-.213, .247]
EE	.969	.010	95.479***	[.950, .989]
Direct effect model: Gender→ ACH	.717	.036	19.917***	[.543, .891]

Indirect effect models

	Effect (B)	SE	95% [LLCI, ULCI]	Nature of Mediation	P_M	% of Mediation
Gender → CE (M_1) → ACH	.055	.022	[.019, .091]	Partial Mediation	.029	2.878
Gender → BE (M_2) → ACH	.012	.009	[-.015, .039]	No Mediation	---	---
Gender → EE (M_2) → ACH	1.127	.322	[.808, 1.446]	Partial Mediation	.590	58.974
Gender → *CE, BE, &* EE → ACH	1.194	.326	[.463,1.925]	---	.625	62.480

Note.*p<.05, **p<.01, ***p<.001

4.2.7 Moderation effect of students' gender on the relationship between student engagement and their academic achievement

Objective 7: To study the moderation effect of gender on the relationship between student engagement and their academic achievement.

$H_0$7: There is no significant moderation effect of gender on the relationship between student engagement and their academic achievement.

This null hypothesis ($H_0$7) deals with student engagement as the focal predictor variable that includes three components namely, cognitive, behavioral, and emotional engagement. This leads to three sub-hypotheses ($H_0$7a-7c) of $H_0$7.

4.2.7.1 Moderation effect of gender on the relationship between students' cognitive engagement and their academic achievement.

$H_0$7a: There is no significant moderation effect of gender on the relationship between students' cognitive engagement and their academic achievement.

The null hypothesis ($H_0$7a) is multivariate in nature as it deals with four variables: Gender, cognitive engagement (CE), their interaction (i.e. Gender*CE), and academic achievement (ACH). All the variables are continuous except Gender, which is a categorical variable with two levels namely, male and female.

Thus, the null hypothesis (i.e. $H_0$7a) was tested following Moderation analysis. Whenever conducting a moderation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.76). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to

0.75 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}=5.67) did not exceeded the critical value (i.e. 7.81 with df=3 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual.

Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.76) and Q-Q plot (Figure 4.76) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the statistically insignificant results of Kolmogrov-Smirnov test (statistic= .017, df= 1232, p= .200) and the Shapiro-Wilk test (W= .996, df= 1232, p=.917) (Field, 2009).

Third, the value of Durbin-Watson statistic is 1.98. Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.77). Fourth, Figure 4.93 depicts the linear relationships among the criterion variables where each plot showed the value of R^2_{Linear}>0.3 (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately.

Fifth, Figure 4.77 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .641, p= .811) and Koenker test (LM= .598, p= .747) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.37, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured.

Figure 4. 76

Histogram (extreme left), Normal Q-Q plot (middle) and Box plot (extreme right) of the residual

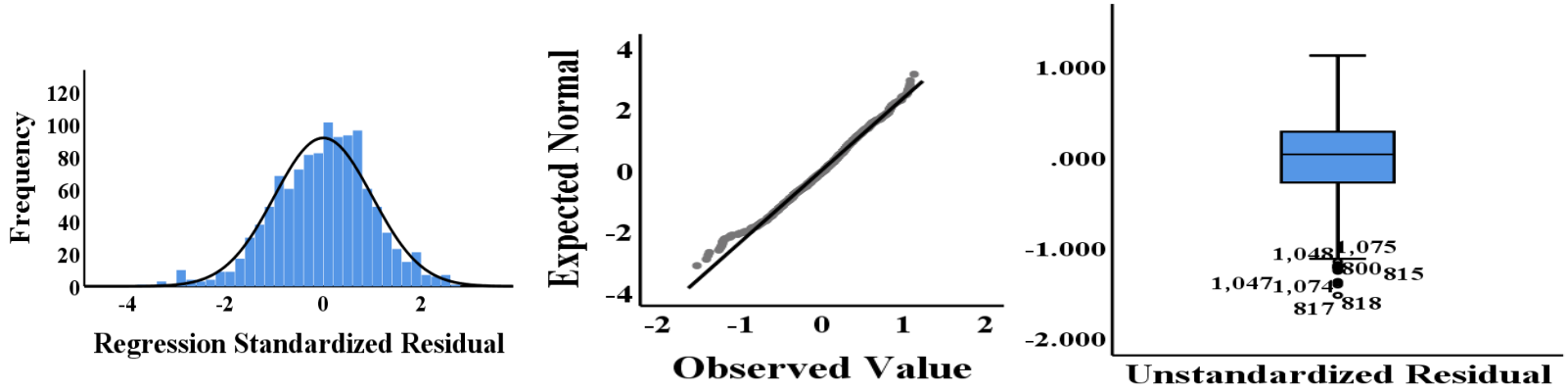


Figure 4. 77

The Residual Plot of the dependent variable (Academic achievement)

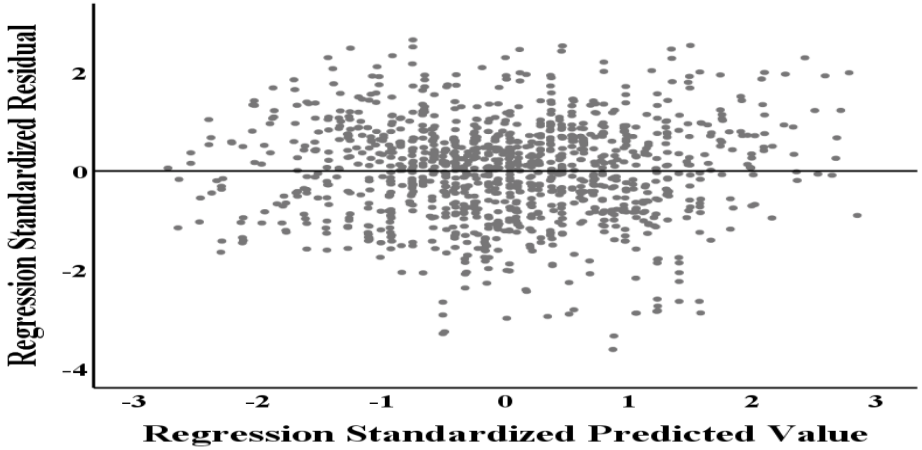


Table 4. 37

Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

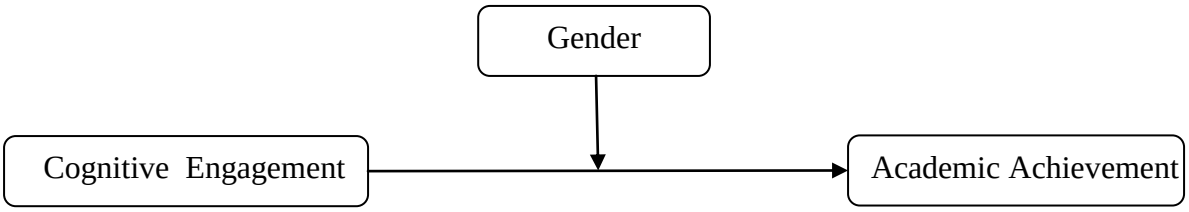
Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Cognitive Engagement (CE)	0.38	2.63
Gender	0.55	1.82
Gender*CE	0.58	1.72

Therefore, the data met all the statistical assumptions required for the moderation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the moderation analysis may be generalized in the target population.

The Moderation analysis was run by selecting students' gender. The hypothesized moderation model (see Figure 4.78 and 4.79) was then examined and evaluated (see Figure 4.80).

Figure 4. 78

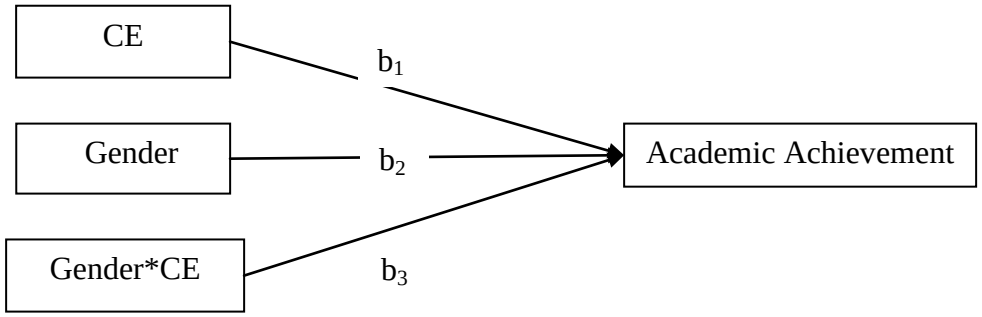
Hypothesized (conceptual) path model for the moderation effect of gender on the association between CE and achievement



Further, a follow up analysis as prescribed by Aiken, West, and Reno (1991) was performed by plotting Academic achievement against CE, separately for male and female students. Further, simple slope analyses were performed to examine whether the slopes of the regression lines differed significantly for different gender.

Figure 4. 79

Statistical model for the moderation effect of gender on the association between CE and achievement



A basic model considering CE as independent variable, academic achievement as the dependent variable, and gender as the moderator variable was constructed (see Figure 4.78) and was examined by performing Moderation analysis. The overall moderation model was significant: R^2= .888, F(3, 1228)= 3233.282, p<.001, (see Table 4.38). Further, the effect of CE on achievement was positive and significant, (B= 1.470, 95% CIs [1.398, 1.543], p<0.001; see Table 4.38). Again, the effect of Gender on achievement was positive and significant, (B= 4.264, 95% CI [3.285, 5.243], p<0.001; see Table 4.38]. However, the effect of interaction between cognitive engagement and students' gender on academic achievement was found to be statistically not significant (B= .017, 95% CIs [-.005, .039], p=0.362; see Table 4.38].

Additionally, to know the trend of influence of the interaction between gender and CE on academic achievement, Graph 10 was plotted where no interaction was found. Therefore, the relationship between the focal predictor CE and academic achievement did not depend upon students' gender. Thus, it can be said that how CE influence achievement did not depend on the fact that a student is boy or girl. These findings provide conclusive evidences that gender gap in CE did not significantly contribute in explaining the gender difference in achievement. Further, R^2-change for inclusion of the interaction term (Gender*CE) in the moderation model was not significant: R^2-change= .000, F (1, 1228)= 1.824, p=.362. This implies that the interaction term did not contribute significantly to the moderation model. These results do not permit to identify gender as a significant moderator in this case.

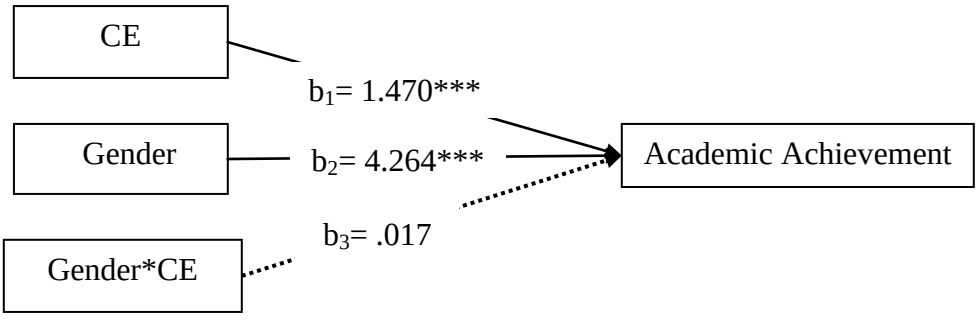
Table 4. 38

Moderating effect of gender on the association between CE and achievement

Regression path	B	SE	t	p	LLCI	ULCI
Predictor=CE, Moderator=Gender, Outcome variable=ACH						
R^2*=.888, F (3, 1228)= 3233.282, p<.001*						
Constant	33.804	.793	42.642	<.001	32.249	35.360
CE	1.470	.037	39.575	<.001	1.398	1.543
Gender	4.264	.499	8.543	<.001	3.285	5.243
*Interaction: CE*Gender*	.017	.013	1.308	.362	-.005	.039
Test (s) of highest order unconditional interaction(s)						
	R^2*-change*	*F*	df_1	df_2	*p*	
*CE*Gender*	.000	1.824	1	1228	.362	

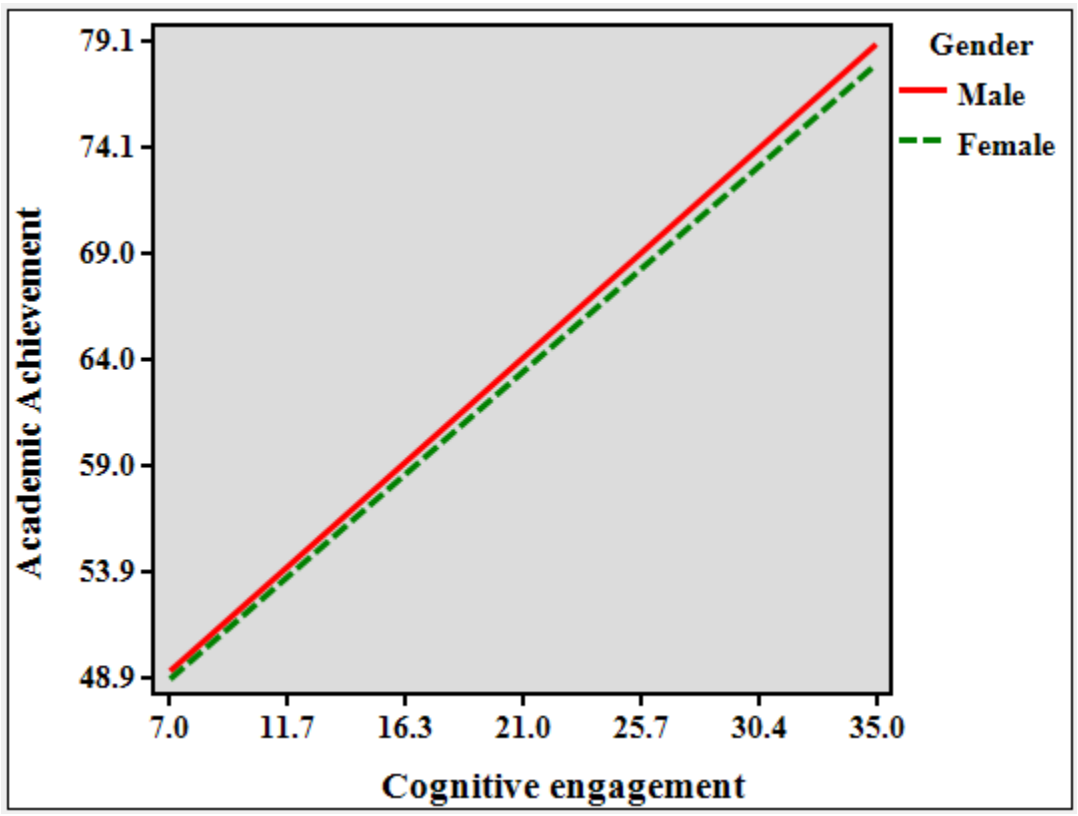
Figure 4. 80

Statistical model for the moderation effect of gender on the association between CE and achievement



Graph 4.10

The plots of effect of interaction between cognitive engagement and gender on achievement



4.2.7.2 Moderation effect of gender on the relationship between students' behavioral engagement and their academic achievement.

$H_0$7b: There is no significant moderation effect of gender on the relationship between students' behavioral engagement and their academic achievement.

The null hypothesis ($H_0$7b) is multivariate in nature as it deals with four variables: Gender, behavioral engagement (BE), their interaction (i.e. Gender*BE), and academic achievement (ACH). All the variables are continuous except Gender, which is a categorical variable with two levels namely, male and female. Thus, the null hypothesis (i.e. $H_0$7b) was tested following Moderation analysis.

Whenever conducting a moderation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.81). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.66 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}=5.87) did not exceeded the critical value (i.e. 7.81 with df=3 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual.

Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.81) and Q-Q plot (Figure 4.81) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the statistically insignificant results of Kolmogrov-Smirnov test (statistic= .015, df= 1232, p= .200) and the Shapiro-Wilk test (W= .998, df= 1232, p=.917) (Field, 2009).

Third, the value of Durbin-Watson statistic is 2.26. Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.82). Fourth, Figure 4.93 depicts the linear relationships among the criterion variables where each plot showed the value of R^2_{Linear}>0.3 (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately.

Fifth, Figure 4.82 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .672, p= .836) and

Koenker test (LM= .622, p= .751) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.39, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured. Therefore, the data met all the statistical assumptions required for the moderation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the moderation analysis may be generalized in the target population.

Table 4. 39

Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Behavioral Engagement (BE)	0.63	1.59
Gender*BE	0.54	1.85
Gender	0.59	1.69

The Moderation analysis was run by selecting students' gender. The hypothesized moderation model (see Figure 4.83 and 4.84) was then examined and evaluated (see Figure 4.85).

Figure 4. 81

Hypothesized (conceptual) path model for the moderation effect of gender on the association between behavioral engagement and achievement

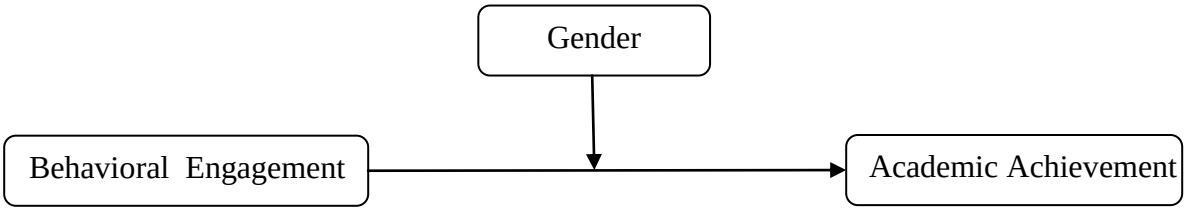


Figure 4. 82

Histogram (extreme left), Normal Q-Q plot (middle) and Box plot (extreme right) of the residual

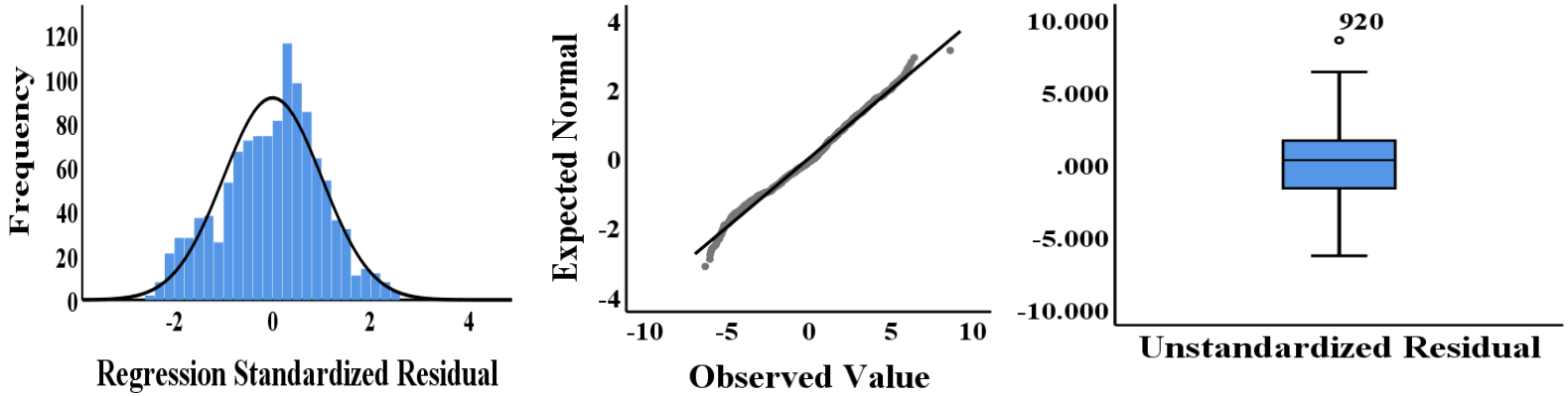


Figure 4. 83

The Residual Plot of the dependent variable (Academic achievement)

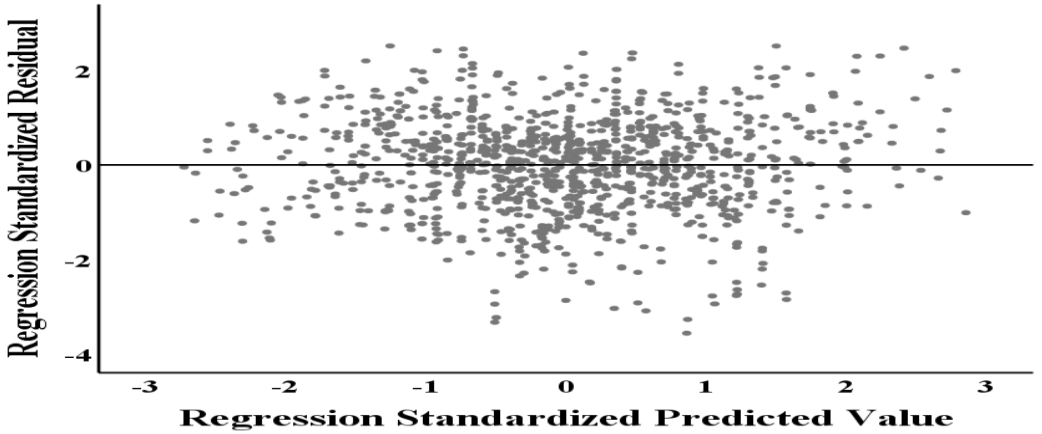
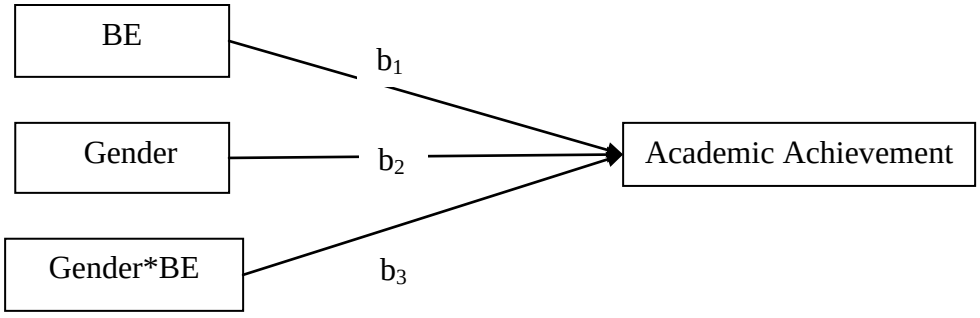


Figure 4. 84

Statistical model for the moderation effect of gender on the association between BE and achievement



A basic model considering BE as independent variable, academic achievement as the dependent variable, and gender as the moderator variable was constructed (see Figure 4.84) and was examined by performing Moderation analysis. The overall moderation model was significant: R^2= .810, F(3, 1228)= 1748.091, p<.001, (see Table 4.40). Further, the effect of BE on achievement was positive and significant, (B= .981, 95% CI [.905, 1.057], p<0.001; see Table 4.40). Again, the effect of Gender on achievement was positive and significant, (B= 1.066, 95% CI [.073, 2.059], p<0.01; see Table 4.40]. However, the effect of interaction between behavioral engagement and students' gender on academic achievement was found to be statistically not significant (B= .037, 95% CI [-.030, .104], p=0.482; see Table 4.40].

Additionally, to know the trend of influence of the interaction between gender and BE on academic achievement, Graph 11 was plotted where no interaction was found. Therefore, the relationship between the focal predictor BE and academic achievement did not depend upon students' gender. Thus, it can be said that how BE influence achievement did not depend on the fact that a student is boy or girl. These findings provide conclusive evidences that gender gap in BE did not significantly contribute in explaining the gender difference in achievement. Further, R^2-change for inclusion of the interaction term (Gender*BE) in the moderation model was not significant: R^2-change= .0001, F (1, 1228)= .068, p=.796. This implies that the interaction term did not contribute

significantly to the moderation model. These results do not permit to identify gender as a significant moderator in this case.

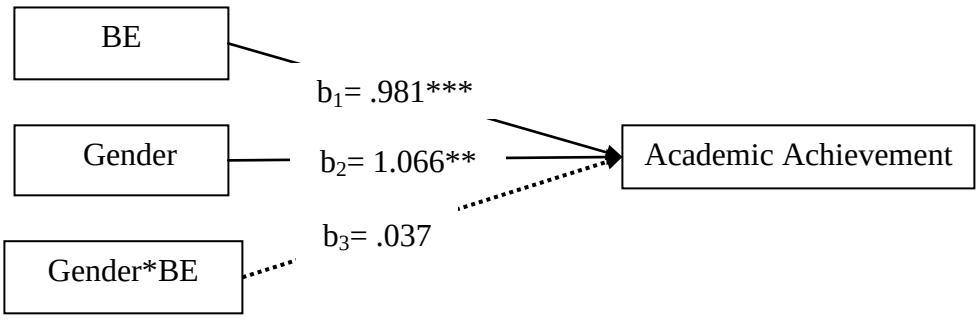
Table 4. 40

Moderating effect of gender on the association between BE and achievement

Regression path	B	SE	t	p	LLCI	ULCI
Predictor=BE, Moderator=Gender, Outcome variable=ACH						
R^2=.810, F (3, 1228)= 1748.091, p<.001						
Constant	41.507	.934	44.428	<.001	39.674	43.340
BE	.981	.039	25.339	<.001	.905	1.057
Gender	1.066	.383	2.781	<.01	.073	2.059
*Interaction: BE*Gender*	.037	.025	1.480	.482	-.030	.104
Test (s) of highest order unconditional interaction(s)						
	R^2-change	*F*	*df_1*	*df_2*	*p*	
*BE*Gender*	.0001	.068	1	1228	.796	

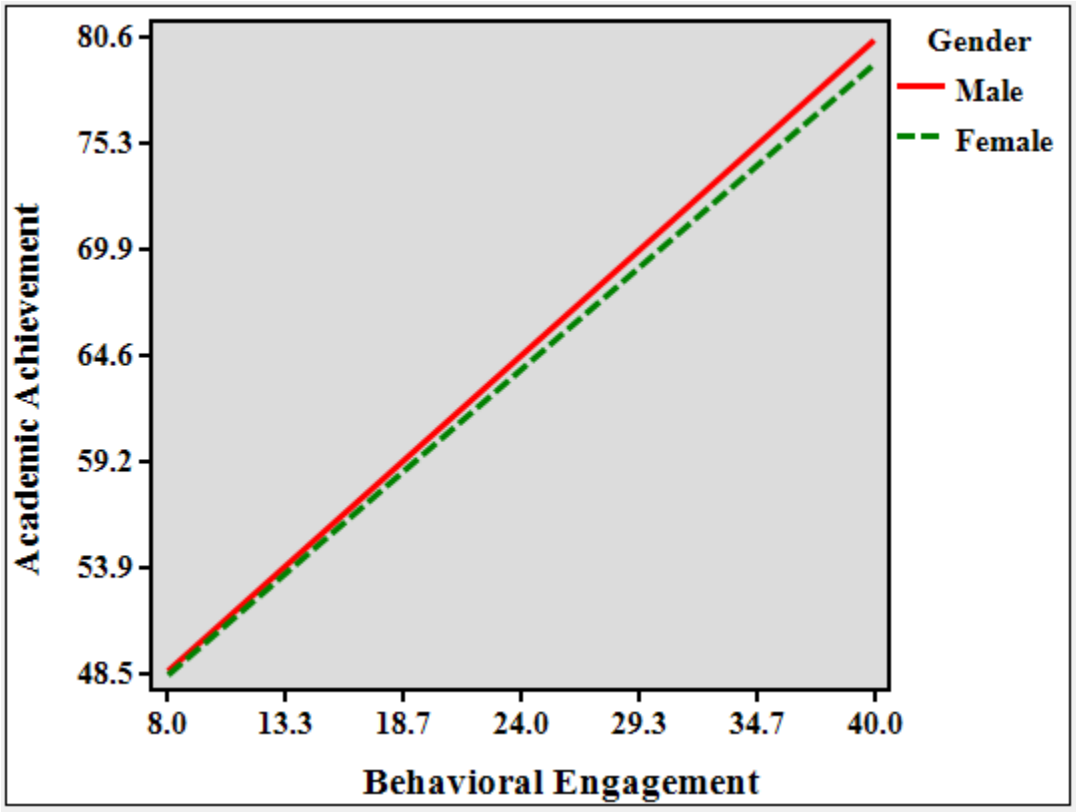
Figure 4. 85

Statistical model for the moderation effect of gender on the association between BE and achievement



Graph 4.11

The plots of effect of interaction between BE and students' gender on academic achievement of the students



4.2.7.3 Moderation effect of gender on the relationship between students' emotional engagement and their academic achievement.

$H_0$7c: There is no significant moderation effect of gender on the relationship between students' emotional engagement and their academic achievement.

The null hypothesis ($H_0$7c) is multivariate in nature as it deals with four variables: Gender, emotional engagement (EE), their interaction (i.e. Gender*EE), and academic achievement (ACH). All the variables are continuous except Gender, which is a categorical variable with two levels namely, male and female. Thus, the null hypothesis (i.e. $H_0$7c) was tested following Moderation analysis.

Whenever conducting a moderation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.86). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.69 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}=5.11) did not exceeded the critical value (i.e. 7.81 with df=3 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual.

Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.86) and Q-Q plot (Figure 4.86) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the statistically insignificant results of Kolmogrov-Smirnov test (statistic= .015, df= 1232, p= .200) and the Shapiro-Wilk test (W= .998, df= 1232, p=.845) (Field, 2009).

Third, the value of Durbin-Watson statistic is 2.45 that falls within the acceptable range of 1.00 to 3.00 (Field, 2013). Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.87). Fourth, Figure 4.93 depicts the linear relationships among the criterion variables where each plot showed the value of R^2_{Linear}>0.3 (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately. Fifth, Figure 4.87 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .613, p= .716) and Koenker test (LM= .591, p= .691) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.41, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured.

Table 4. 41

Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Gender	0.83	1.20
Emotional Engagement (EE)	0.92	1.09
Gender*EE	0.52	1.92

Therefore, the data met all the statistical assumptions required for the moderation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the moderation analysis may be generalized in the target population.

The Moderation analysis was run by selecting students' gender. The hypothesized moderation model (see Figure 4.88 and 4.89) was then examined and evaluated (see Figure 4.90).

Figure 4. 86

Hypothesized (conceptual) path model for the moderation effect of gender on the association between EE and achievement

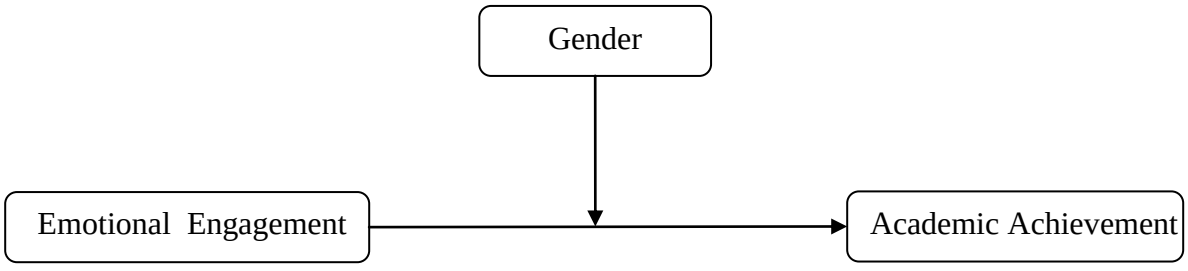


Figure 4. 87

Histogram (extreme left), Normal Q-Q plot (middle) and Box plot (extreme right) of the residual

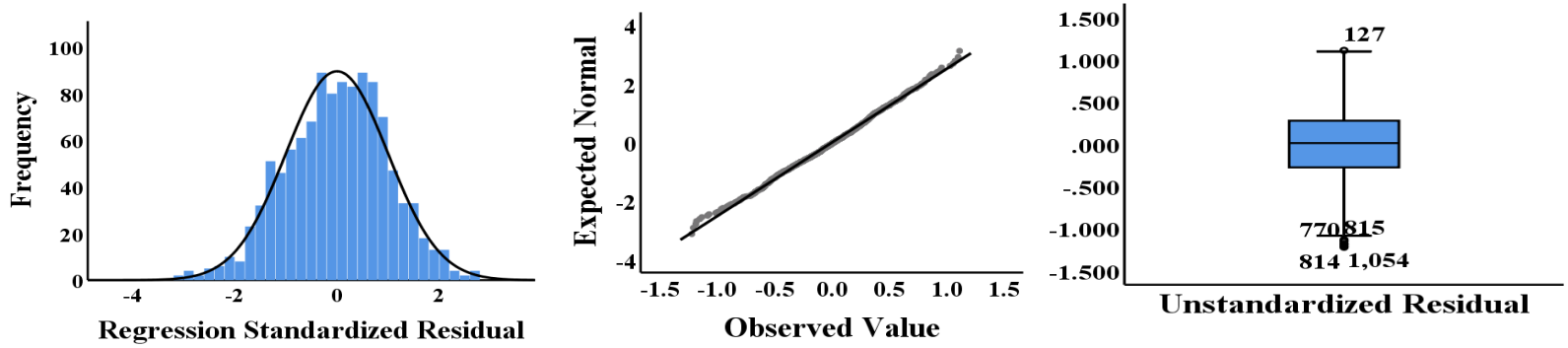


Figure 4. 88

The Residual Plot of the dependent variable (Academic achievement)

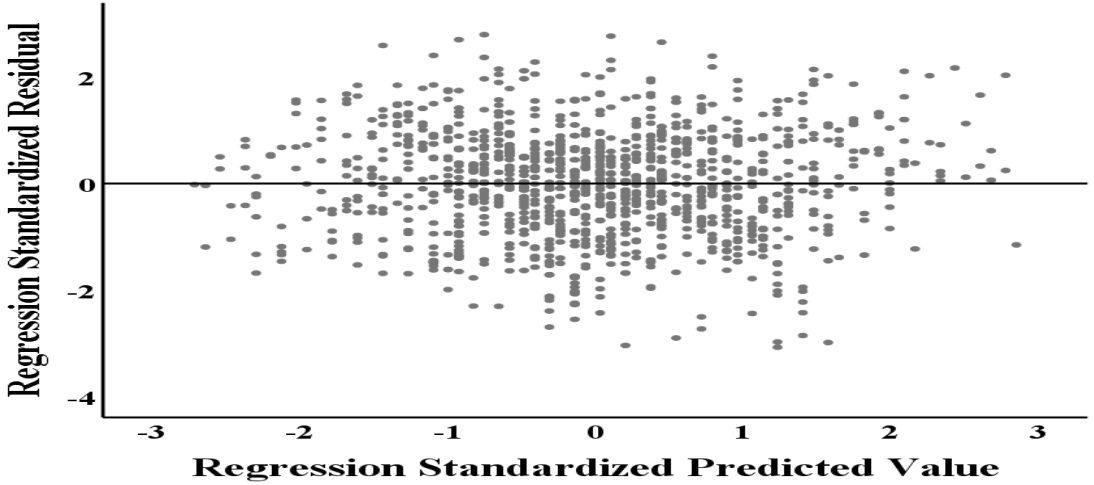
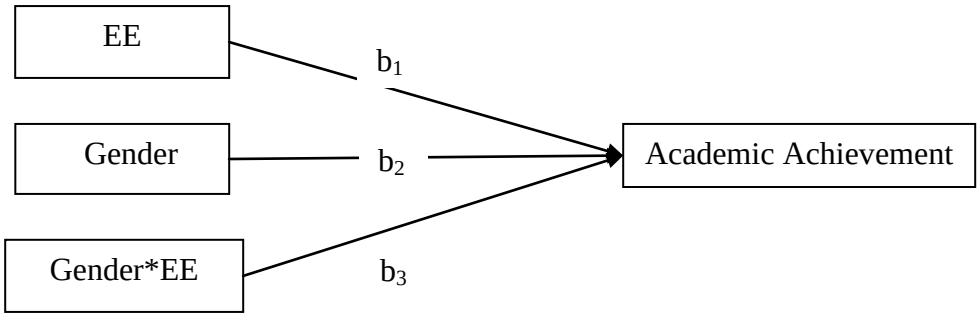


Figure 4. 89

Statistical model for the moderation effect of gender on the association between EE and achievement



A basic model considering EE as independent variable, academic achievement as the dependent variable, and gender as the moderator variable was constructed (see Figure 4.88) and was examined by performing Moderation analysis. The overall moderation model was significant: R^2= .988, F(3, 1228)= 33057.556, p<.001, (see Table 4.42). Further, the effect of EE on achievement was positive and significant, (B= 1.025, 95% CI [1.006, 1.045], p<0.001; see Table 4.42). Again, the effect of Gender on achievement was positive and significant, (B= .346, 95% CI [.061, .631], p<0.05; see Table 4.42]. Further, the effect of interaction between emotional engagement and students' gender on academic achievement was also found to be positive and statistically significant (B= .029, 95% CI [.011, .047], p<.001; see Table 4.42].

Further, R^2-change for inclusion of the interaction term (Gender*EE) in the moderation model was significant: R^2-change= .0002, F(1, 1228)= 22.020, p<.001. This implies that the interaction term contributed significantly to the moderation model. On the basis of the results, students' gender was considered a significant moderator in this case. Therefore, there was statistically significant differential effect of EE on boys' and girls' achievement. It can be said that EE influenced students' academic achievement differently depending upon their gender. The effect size for the moderation effect was found to be .876 (see Table 4.42) which is a large effect ($f^2 \geq 0.35$) following the Cohen's (1988) guidelines.

Further, the conditional analysis shows that for males and females, the effect of EE on achievement is significant (B= .996, p<.001 for boys and for girls, B= .967, p<.001). Further, the simple slopes analysis was conducted to compare the degree of interaction effect of gender and EE on achievement for boys and girls, separately. The simple slopes analysis also shows that the slopes for emotional engagement predicting achievement at each level of gender are: b_{Boys}= .996, SE= .004, p<0.001, 95% CIs: [.988, 1.005] for the boys and b_{Girls}= .967, SE= .005, p<0.001, 95% CIs: [.958, .976] for the girls.

Further, to know the trend of influence of the interaction between gender and EE on academic achievement, a graph was plotted. From Graph 12, it can be seen that there is an interaction effect of gender and EE on students' achievement. Further, it can also be seen that irrespective of students' gender, academic achievement constantly increases with the increase in EE. This trend of the relationship between academic achievement and EE remains similar both for boys and girls. However, the interaction graph was significantly steeper for the boys than that of the girls. Therefore, the relationship between the focal predictor EE and achievement was found to be influenced by gender. Thus, it can be said that the effect of EE on achievement did not remain same across gender rather for boys, the effect is significantly stronger. These findings provide conclusive evidences that gender gap in EE significantly contributed in explaining the gender difference in achievement. The boys were found to have significantly higher emotional engagement in their learning and hence were found to be academically more successful than the girls.

In sum, the interaction effect between EE and gender (i.e. EE*gender) was found to be statistically significant. Thus, students' gender was found to be a significant moderator in this case. As a result, presence of differential effects of EE on academic achievement of boys and girls were confirmed. It can be said that EE influenced academic achievement differently for males and females. Indeed, EE was more related to boys' achievement than that of girls as the relationship between EE and achievement was stronger for boys than for girls. Thus, EE was more important for boys in promoting their academic achievement as opposed to girls. Finally, it can be said that EE served as a protective factor for boys' academic achievement.

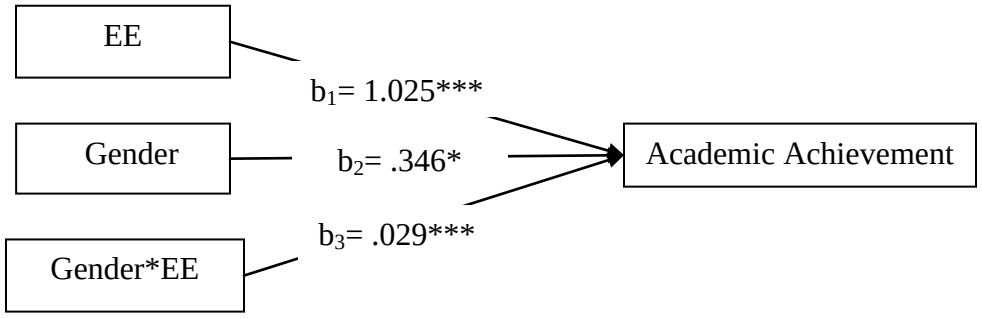
Table 4. 42

Moderating effect of gender on the association between EE and achievement

Regression path	B	SE	t	p	LLCI	ULCI
Predictor=EE, Moderator=Gender, Outcome variable=ACH						
R^2=.988, F (3, 1228)= 33057.556, p<.001						
Constant	40.751	.235	173.403	<.001	40.290	41.212
EE	1.025	.010	102.550	<.001	1.006	1.045
Gender	.346	.156	2.214	<.05	.061	.631
*Interaction: EE*Gender*	.029	.006	4.833	<.001	.011	.047
Conditional Effects						
Female group	.967	.005	193.410	<.001	.958	.976
Male group	.996	.004	249.125	<.001	.988	1.005
Effect size (f square) = .876						
Test (s) of highest order unconditional interaction(s)						
	R^2-change	*F*	*df_1*	*df_2*	*p*	
*EE*Gender*	.0002	22.020	1	1228	<.001	

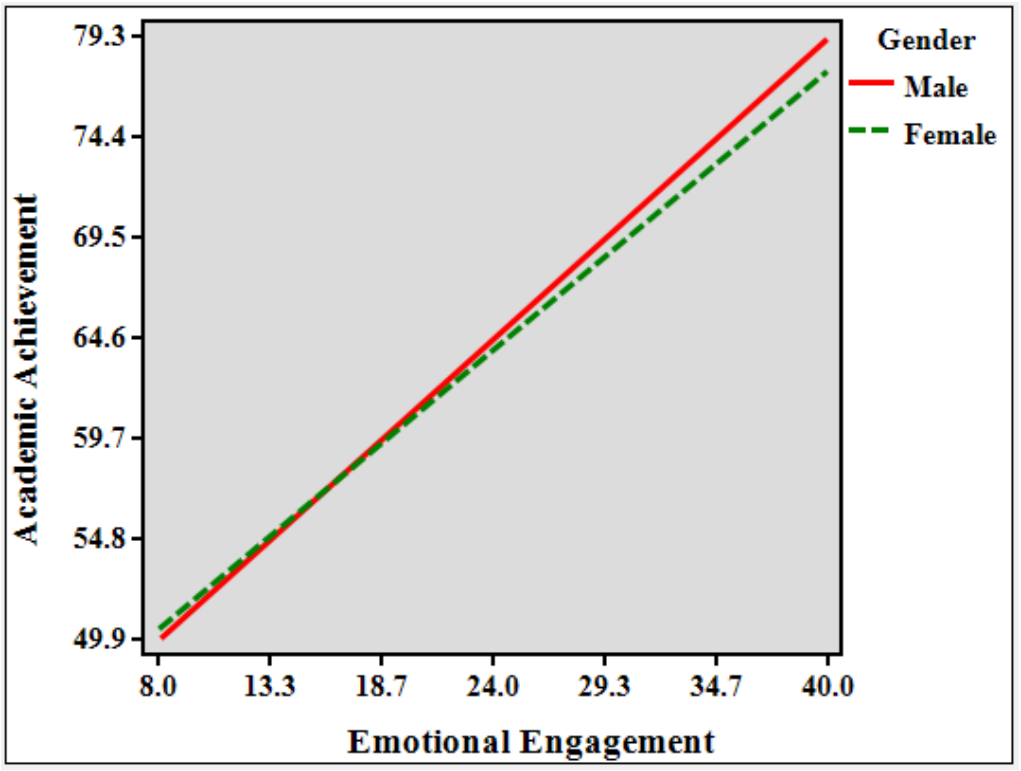
Figure 4. 90

Statistical model for the moderation effect of gender on the association between EE and achievement



Graph 4.12

The plots of effect of interaction between EE and students' gender on achievement



4.2.8 Mediation effect of student engagement (viz. cognitive, behavioral, and emotional engagement) on the relationship between students' Perceived teacher engagement and their academic achievement

Objective 8: To study the mediation effect of student engagement (viz. CE, BE, and EE) on the relationship between students' perceived teacher engagement and their academic achievement

$H_0$8: There is no significant mediation effect of student engagement (viz. CE, BE, and EE) on the relationship between perceived teacher engagement and academic achievement.

This null hypothesis ($H_0$8) deals with Perceived teacher engagement as the predictor variable that includes three components namely, perceived cognitive-physical engagement, perceived socio-emotional engagement, and perceived pedagogical engagement. This leads to three sub-hypotheses ($H_0$8a-8c) of $H_0$8.

4.2.8.1 Mediation effect of three student engagement dimensions (viz. CE, BE, and EE) on the relationship between students' perceived cognitive-physical engagement and their achievement

$H_0$8a: There is no significant mediation effect of student engagement on the relationship between perceived cognitive-physical engagement and academic achievement.

The null hypothesis ($H_0$8a) is multivariate in nature as it deals with five variables: PCPE, CE, BE, EE and achievement. All the variables are continuous variables and none of those were measured more than once for a particular respondent. The mediation hypothesis ($H_0$8a) was tested following parallel mediation analysis. Whenever conducting a mediation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.91). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.81 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}= 6.12) did not exceeded the threshold value (i.e. 9.49 with df=4 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual. Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.91) and Q-Q plot (Figure 4.91) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed.

Figure 4. 91

Histogram (extreme left), Normal Q-Q plot (middle) and Box-plot (extreme right) of the residual

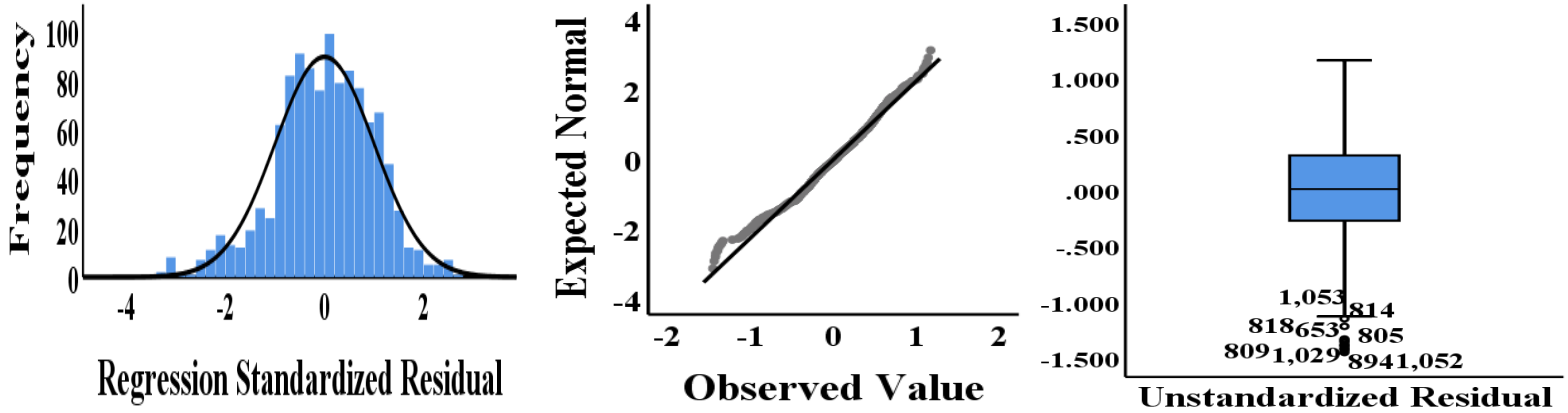
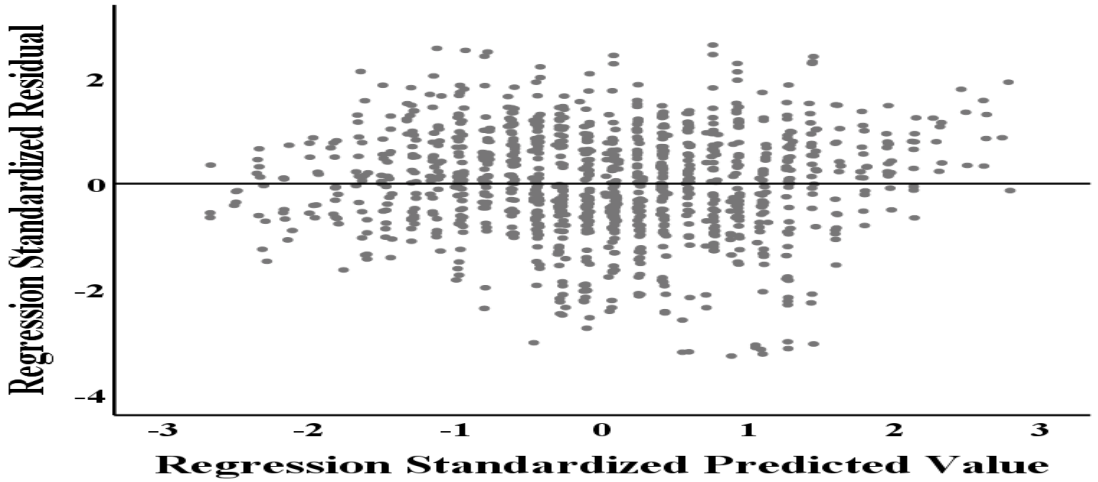


Figure 4. 92

The Residual Plot of the dependent variable (Academic achievement)



Further, normality of the unstandardized residual was confirmed from the statistically insignificant results of Kolmogrov-Smirnov test (statistic= .022, df= 1232, p= .200) and the Shapiro-Wilk test (W= .997, df= 1232, p=.836) (Field, 2009). Third, the value of Durbin-Watson statistic is 2.26. Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.92). Fourth, the Figure 4.93 depicts the linear relationships among the criterion variables where each plot showed the value of $R^2_{Linear}>0.3$ (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately.

Fifth, Figure 4.92 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .623, p= .836) and Koenker test (LM= .607, p= .751) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.43, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured. Therefore, the data met all the statistical assumptions required for the mediation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the mediation analysis may be generalized in the target population.

Table 4. 43

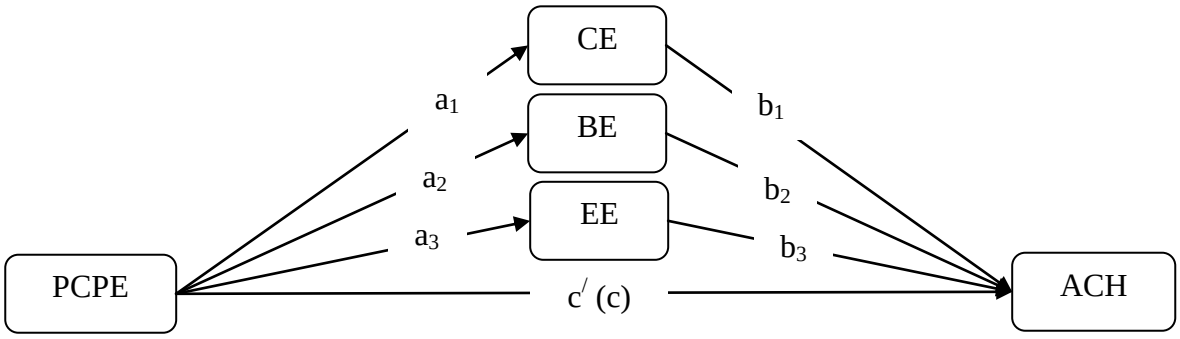
Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Cognitive Engagement	0.98	1.02
Behavioral Engagement	0.86	1.16
Emotional Engagement	0.71	1.41
Perceived Cognitive-physical Engagement	0.68	1.47

The parallel mediation analysis was run by selecting the student engagement dimensions (viz. cognitive, behavioral, emotional engagement). The three mediation relationships in the hypothesized theoretical path model (Figure 4.94) were then examined and evaluated (Figure 4.95).

Figure 4. 93

Hypothesized path model of the mediation effect for the three student engagement dimensions (viz. CE, BE, and EE) on the relationship between PCPE and achievement

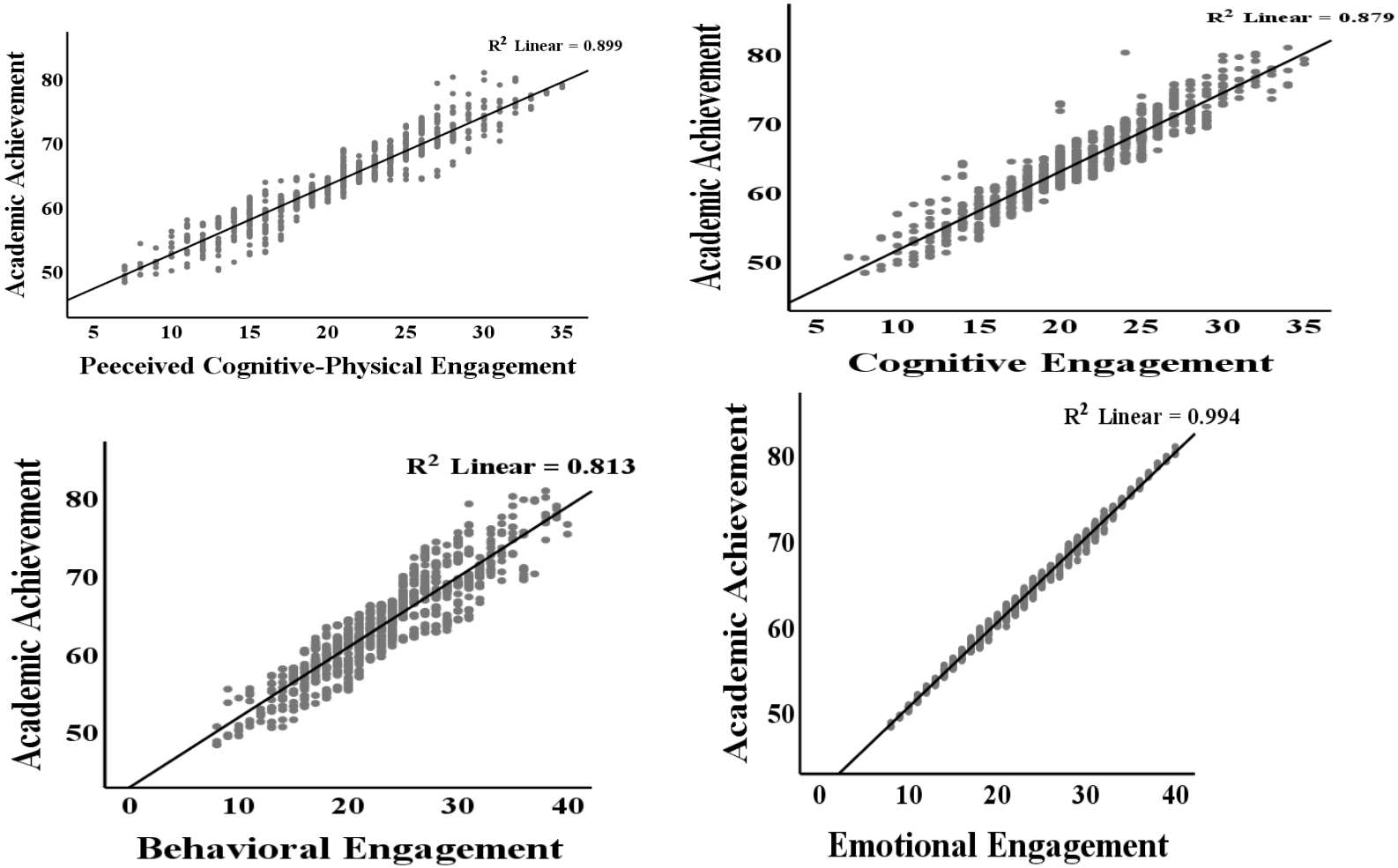


Note. a_i is effect of PCPE on student engagement dimensions; b_i is effect of student engagement dimensions on achievement; $c^{/}$ is direct effect; c is the total effect in absence of any mediator, and a_ib_i is the indirect effect via the i^{th} Mediator variable

The results showed that the *Total effect model* is significant: R^2= 0.897, F(1, 1230)= 10708.316, p<0.001 (see Table 4.44). Students' perceived cognitive-physical engagement positively predicts students' academic achievement (c= 1.173, p<0.001, 95% CIs: [0.960, 1.386]; see Table 4.44). Further, results from the three *Mediator variable models* show that Perceived cognitive-physical engagement positively influenced students' cognitive engagement (a_1= 1.028, p<0.001, 95% CIs: [1.000, 1.055]; Mediator variable model 1, see Table 4.44), behavioral engagement (a_2= 0.866, p<0.001, 95% CIs: [0.847, 0.885]; Mediator variable model 2, see Table 4.44), and emotional engagement (a_3= 1.073, p<0.001, 95% CIs: [1.052, 1.093]; Mediator variable model 3, see Table 4.44). In turn, students' cognitive engagement positively influenced students' academic achievement (b_1= 0.056, p<0.001, 95% CIs: [0.019, 0.093]); so did students' behavioral engagement (b_2= 0.028, p<0.05, 95% CIs: [0.002, 0.054]) and emotional engagement (b_3= 0.909, p<0.001, 95% CIs: [0.884, 0.933]) (see Table 4.44).

Figure 4. 94

Simple Scatter plot of academic achievement against CE, BE, EE, and PCPE



Further, analyzing the indirect effects from the *Indirect effect model*, results showed that students' cognitive engagement mediated the association between perceived cognitive-physical engagement and students' achievement: a_1*b_1= 0.058, 95% BootLLCI= 0.041, 95% BootULCI= 0.075] (Hayes, 2013). Similarly, the indirect effects for behavioral engagement (a_2*b_2= 0.024, 95% BootLLCI= 0.005, 95% BootULCI= 0.045]) and for emotional engagement (a_3*b_3= 0.975, 95% BootLLCI= 0.937, 95% BootULCI= 1.013]) (see Table 4.44) were also statistically significant. Therefore, three student engagement dimensions (viz. CE, BE, and EE) mediated the association between PCPE and achievement, significantly. The total indirect effect exerted jointly by all the three student engagement dimensions (viz. CE, BE, and EE) was also statistically significant: (Total indirect effect= 1.057, 95% BootLLCI= 0.990, 95% BootULCI= 1.124]; see Table 4.44) which is 90.111% of the total effect. Further, the P_M for the three mediators (viz. CE, BE, and EE) were found to be .049, .020, and .831 respectively (see Table 4.44).

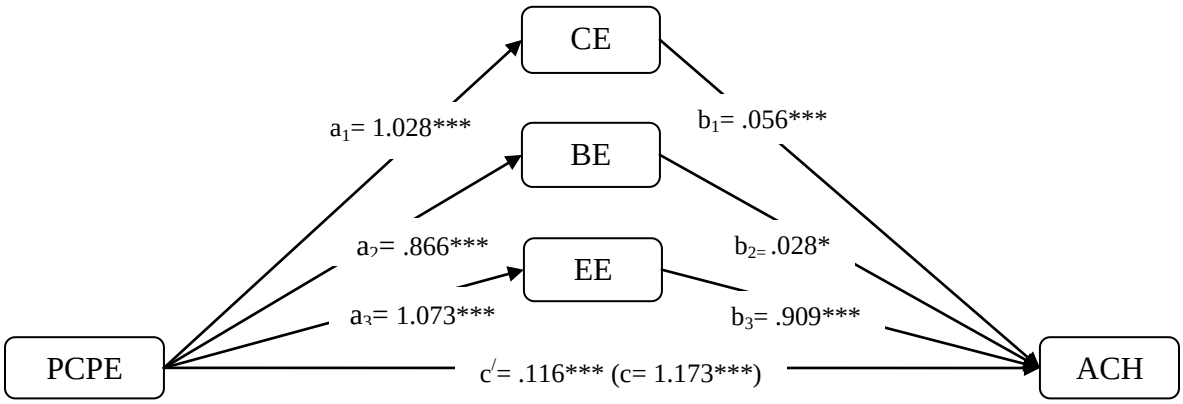
Nevertheless, it was found from the *Direct effect model* that the results also suggest that even after accounting for the mediating role of the three student engagement dimensions (viz. CE, BE, and EE), PCPE still has a positive impact on students' achievement ($c^{/}$=0.116, p<0.001, 95% CIs: [0.91, 0.142]) (see Table 4.44). Therefore, it was found that even the effect of PCPE was lessened predicting academic achievement, still the effect was significant. Thus, it can be said that three student engagement dimensions partially mediated the association between PCPE and achievement. Besides, the percentage of the mediation effect (see Table 4.44) showed that the proportion of the total effect of Perceived cognitive-physical engagement on achievement that operates indirectly through cognitive engagement is 4.945%, through behavioral engagement is 2.046%, and through emotional engagement is 83.120%.

In sum, the indirect effects exerted by three student engagement dimensions (viz. CE, BE, and EE) significantly influenced students' academic achievement. Thus, the three student engagement dimensions were found to be significant mediators on the association between PCPE and achievement. Yet the direct effect of PCPE on their achievement was still significant indicating this as a case of partial mediation. Further, the indirect effect that operated through BE was lesser than that through CE, and further lesser than through

EE. Thus, EE was found to be a better mediator on the association between PCPE and academic achievement as well as a better predictor of academic achievement as compared to CE and BE. Thus, it can be said that gender gap in three student engagement dimensions is a significant cause in explaining the relationship between PCPE and achievement. The findings provide evidence that the students who perceive teachers' cognitive-physical engagement more are more engaged in learning. Hence, teachers' cognitive-physical engagement in teaching motivates students to engage in their classroom learning.

Figure 4. 95

Structural model of the total, direct and indirect effects for the three student engagement dimensions (viz. CE, BE, and EE) on the relationship between PCPE and achievement



Note. *p < .05, **p < .01, ***p < .001

a_n is effect of PCPE on student engagement dimensions; b_n is effect of student engagement dimensions on achievement; $c^{/}$ is direct effect; c is total effect in the absence of any mediator(s) in the model.

Table 4. 44

Results of Mediation analysis for Hypothesis 8a

	B	SE	t	95% [LLCI, ULCI]
Total effect model: PCPE→ Academic achievement				
R^2=.897, F(1,1230)=10708.316, p<.001				
Constant	42.188	.218	193.397***	[41.760, 42.616]
PCPE	1.173	.011	106.636***	[.960, 1.386]
Mediator variable model 1: PCPE→CE				
R^2=.866, F(1,1230)=7959.789, p<.001				
Constant	3.155	.207	15.223***	[2.748, 3.561]
PCPE	1.028	.014	73.135***	[1.000, 1.055]
Mediator variable model 2: PCPE→BE				
R^2=.813, F(1,1230)=5348.657, p<.001				
Constant	2.461	.300	8.205***	[1.873, 3.050]
PCPE	.866	.010	86.600***	[.847, .885]
Mediator variable model 3: PCPE→EE				
R^2=.893, F(1,1230)=10244.867, p<.001				
Constant	1.561	.226	6.902***	[1.117, 2.005]
PCPE	1.073	.011	97.545***	[1.052, 1.093]
Dependent variable model: Outcome variable= Academic achievement				
R^2=.985, F(4,1227)=20669.869, p<.001				
Constant	40.819	.090	452.934***	[40.642, 40.996]
PCPE	.116	.013	8.874***	[.091, .142]
CE	.056	.009	6.413***	[.019, .093]
BE	.028	.013	2.094*	[.002, .054]
EE	.909	.013	69.923***	[.884, .933]
Direct effect model: PCPE→ Academic achievement	.116	.013	8.874***	[.091, .142]

Indirect effect models

	Effect (B)	SE	95% [LLCI, ULCI]	Nature of Mediation	P_M	% of Mediation
PCPE → CE (M_1) → Academic achievement	.058	.009	[.041, .075]	Partial Mediation	.049	4.945
PCPE → BE (M_2) → Academic achievement	.024	.010	[.005, .045]	Partial Mediation	.020	2.046
PCPE → EE (M_3) → Academic achievement	.975	.019	[.937, 1.013]	Partial Mediation	.831	83.120
PCPE → *CE, BE, &* EE → Academic achievement	1.057	.021	[.990, 1.124]	---	.901	90.111

Note.*p<.05, **p<.01, ***p<.001

4.2.8.2 Mediation effect of student engagement (viz. cognitive, behavioral, and emotional engagement) on the relationship between students' Perceived Socio-emotional engagement and their academic achievement

$H_0$8b: There is no significant mediation effect of student engagement (viz. CE, BE, and EE) on the relationship between students' perceived socio-emotional engagement and their academic achievement.

The null hypothesis ($H_0$8b) is multivariate in nature as it deals with five variables: PSEE, CE, BE, EE and achievement. All the variables are continuous variables and none of those were measured more than once for a particular respondent. The mediation hypothesis ($H_0$8b) was tested following parallel mediation analysis.

Whenever conducting a mediation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.96). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.71 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}=5.66) did not exceeded the threshold value (i.e. 9.49 with df=4 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual.

Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.96) and Q-Q plot (Figure 4.96) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the statistically insignificant results of Kolmogrov-Smirnov test (statistic= .015, df= 1232, p= .200) and the Shapiro-Wilk test (W= .998, df= 1232, p=.823) (Field, 2009).

Third, the value of Durbin-Watson statistic is 2.27. Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.97). Fourth, the Figure 4.98 depicts the linear relationships among the criterion variables where each plot showed the value of R^2_{Linear}>0.3 (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately.

Fifth, Figure 4.97 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .668, p= .836) and Koenker test (LM= .624, p= .751) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.45, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured.

Therefore, the data met all the statistical assumptions required for the mediation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the mediation analysis may be generalized in the target population.

Table 4. 45

Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Cognitive Engagement	0.66	1.52
Behavioral Engagement	0.74	1.35
Emotional Engagement	0.97	1.03
Perceived Socio-Emotional Engagement	0.75	1.33

Figure 4. 96

Histogram (extreme left), Q-Q Plot (middle) and Box plot (extreme right) of the residual

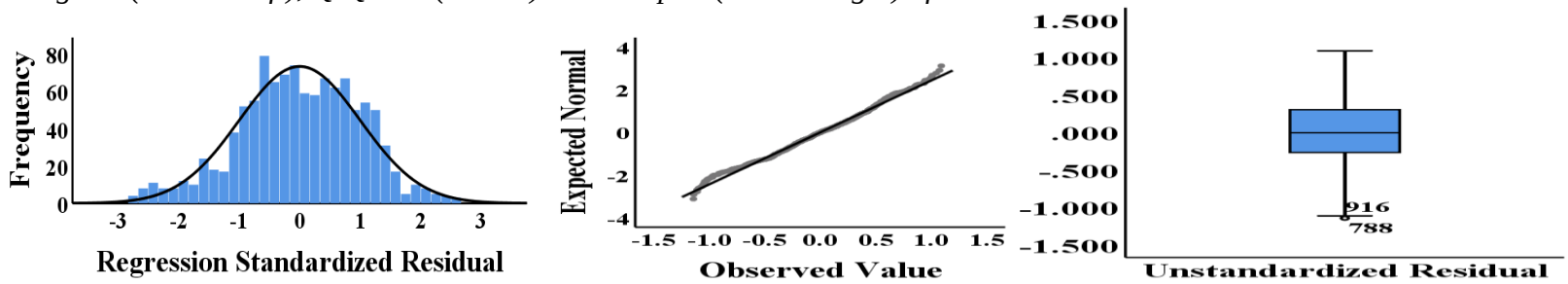
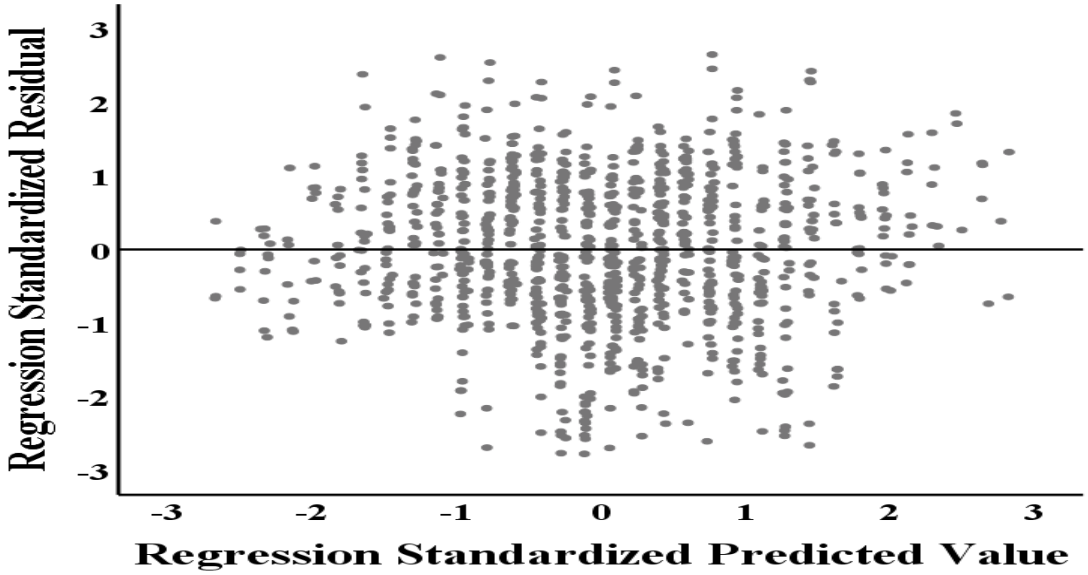


Figure 4. 97

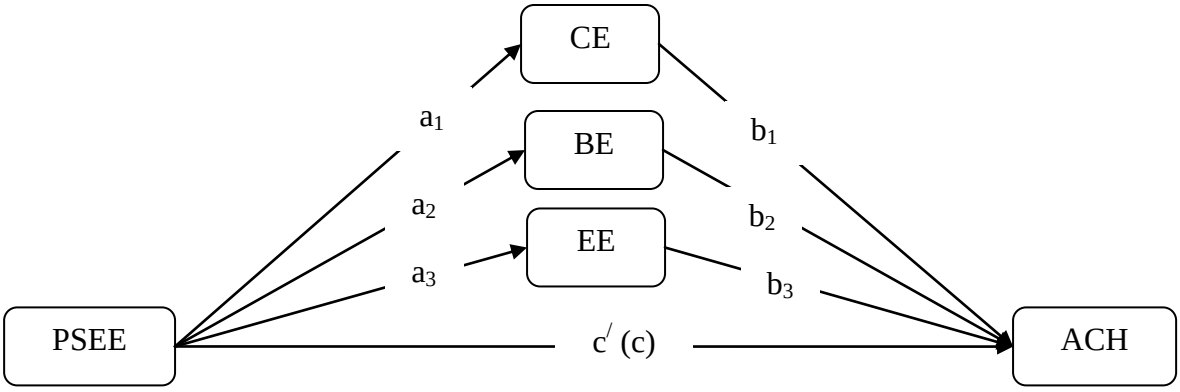
Residual plot of the dependent variable (Academic achievement)



The parallel mediation analysis was run by selecting the student engagement dimensions (viz. cognitive, behavioral, emotional engagement). The three mediation relationships in the hypothesized theoretical path model (Figure 4.99) were then examined and evaluated (Figure 4.100).

Figure 4. 98

Hypothesized path model of the mediation effect for the three student engagement dimensions (viz. CE, BE, and EE) on the relationship between PSEE and achievement

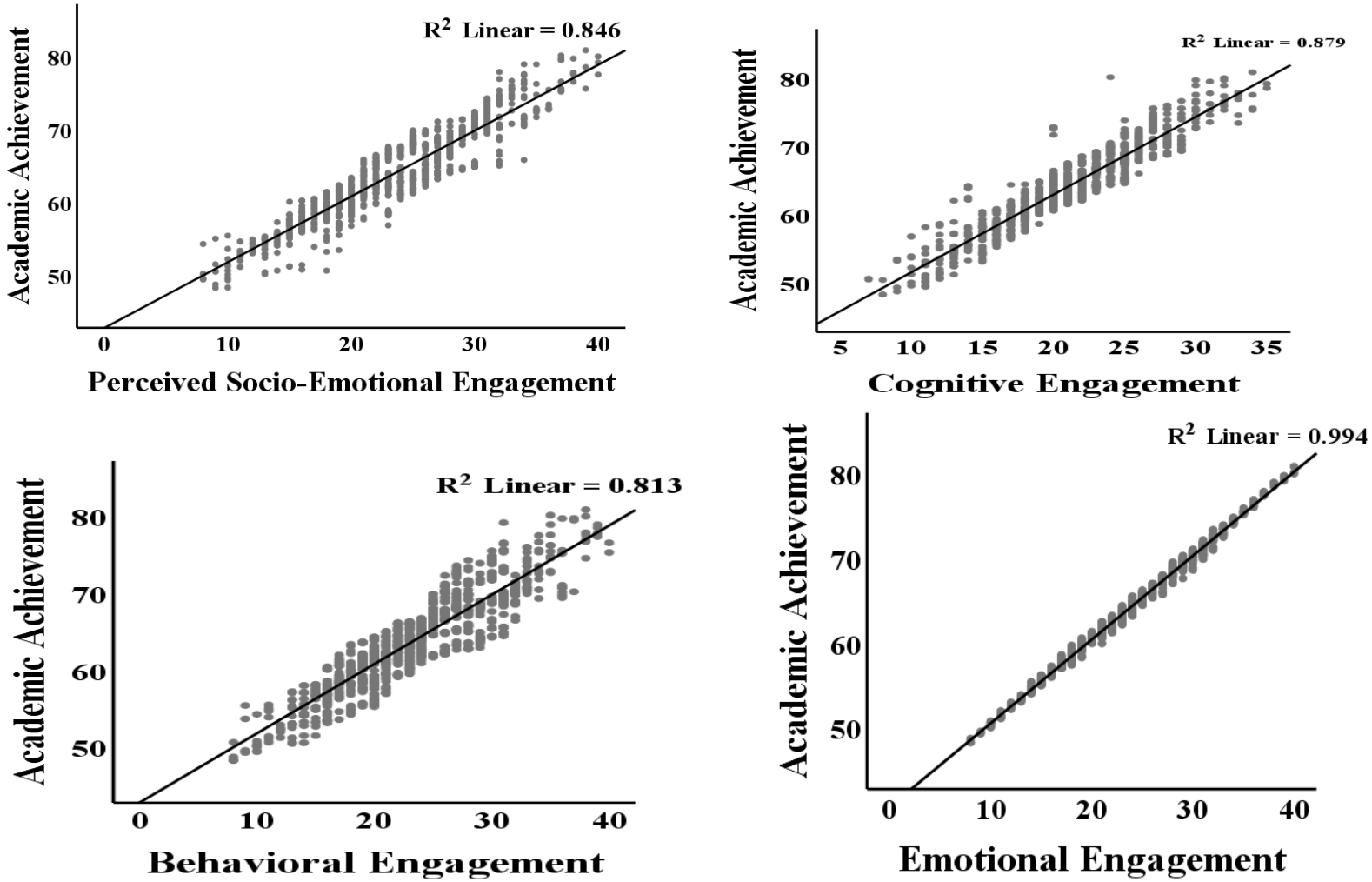


Note. a_i is effect of PSEE on student engagement dimensions; b_i is effect of student engagement dimensions on achievement; $c^{/}$ is direct effect; c is the total effect in absence of any mediator, and a_ib_i is the indirect effect via the i^{th} Mediator variable

The demonstrated that the *Total effect model* is significant: R^2= 0.845, F(1, 1230)= 6684.627, p<0.001 (see Table 4.46). Students' perceived socio-emotional engagement positively predicts students' academic achievement (c= .976, p<0.001, 95% CIs: [0.589, 1.363]; see Table 4.46).

Figure 4. 99

Simple Scatter plot of Academic Achievement against CE, BE, EE and PSEE



Further, results from the three *Mediator variable models* show that Perceived socio-emotional engagement positively influenced students' cognitive engagement (a_1= .865, p<0.001, 95% CIs: [.837, .892]; Mediator variable model 1, see Table 4.46), behavioral engagement (a_2= 0.726, p<0.001, 95% CIs: [0.706, 0.746]; Mediator variable model 2, see Table 4.46), and emotional engagement (a_3= .910, p<0.001, 95% CIs: [.888, .932]; Mediator variable model 3, see Table 4.46). In turn, students' cognitive engagement positively influenced students' academic achievement (b_1= 0.046, p<0.001, 95% CIs: [0.018, 0.074]); so did students' behavioral engagement (b_2= 0.053, p<0.001, 95% CIs: [0.027, 0.078]) and emotional engagement (b_3= 0.929, p<0.001, 95% CIs: [0.905, 0.954]) (see Table 4.46). Further, analyzing the indirect effects from the *Indirect effect model*, results revealed that CE mediated the association between PSEE and students' achievement: a_1*b_1= 0.040, 95% BootLLCI= 0.019, 95% BootULCI= 0.061] (Hayes, 2013). Similarly, the indirect effects for behavioral engagement (a_2*b_2= 0.038, 95% BootLLCI= 0.022, 95% BootULCI= 0.054]) and for emotional engagement (a_3*b_3= 0.846, 95% BootLLCI= 0.817, 95% BootULCI= .874]) (see Table 4.46) were also statistically significant. The total indirect effect exerted jointly by all the three student engagement dimensions (viz. CE, BE, and EE) was also statistically significant: (Total indirect effect= .924, 95% BootLLCI= 0.573, 95% BootULCI= 1.275]; see Table 4.46) which is 94.672% of the total effect. Further, the P_M for the three mediators (viz. CE, BE, and EE) were found to be .041, .039, and .867 respectively (see Table 4.46).

Nevertheless, it was found from the *Direct effect model* that the results also suggest that even after accounting for the mediating role of the three student engagement dimensions (viz. cognitive, behavioral, and emotional engagement), perceived socio-emotional engagement still has a positive impact on students' achievement ($c^{/}$=0.052, p<0.001, 95% CIs: [0.034, 0.069]) (see Table 4.46). Therefore, it was found that even the effect of PSEE was lessened predicting academic achievement, still the effect was significant. Thus, it can be said that the three student engagement dimensions (viz. CE, BE, and EE) partially mediated the association between PSEE and achievement.

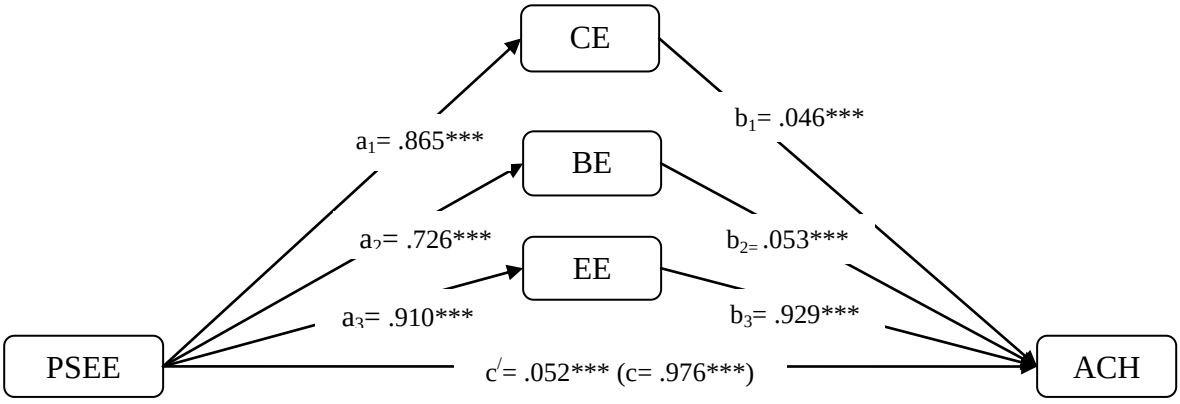
Besides, the percentage of the mediation effect (see Table 4.46) showed that the proportion of the total effect of PSEE on achievement that operates indirectly through

cognitive engagement is 4.098%, through behavioral engagement is 3.893%, and through emotional engagement is 86.680%.

In sum, the indirect effects exerted by three student engagement dimensions (viz. CE, BE, and EE) significantly influenced students' academic achievement. Thus, the three student engagement dimensions were found to be significant mediators on the association between PSEE and achievement. Yet the direct effect of PSEE on their achievement was still significant indicating this as a case of partial mediation. Further, the indirect effect that operated through BE was lesser than that through CE, and further lesser than through EE. Thus, EE was found to be a better mediator on the association between PSEE and achievement as well as a better predictor of achievement as compared to CE and BE. Thus, it can be said that gender gap in three student engagement dimensions is a significant cause in explaining the relationship between PSEE and achievement. The findings provide evidence that the students who perceive teachers' socio-emotional engagement more are more engaged in learning and achieve more. Hence, teachers' socio-emotional engagement in teaching motivates students to engage in their classroom learning.

Figure 4. 100

Structural model of the total, direct and indirect effects for the three student engagement dimensions (viz. CE, BE, and EE) on the relationship between PSEE and achievement



Note. *p < .05, **p < .01, ***p < .001
a_n is effect of PSEE on student engagement dimensions; b_n is effect of student engagement dimensions on achievement; $c^{/}$ is direct effect; c is total effect in the absence of any mediator(s) in the model.

Table 4. 46

Results of mediation analysis for Hypothesis 8b

	B	SE	t	95% [LLCI, ULCI]
Total effect model: PSEE→ Academic achievement				
R^2=.845, F(1,1230)=6684.627, p<.001				
Constant	42.829	.268	159.808***	[42.303, 43.355]
PSEE	.976	.012	81.760***	[.589, 1.363]
Mediator variable model 1: PSEE→CE				
R^2=.798, F(1,1230)=4871.731, p<.001				
Constant	3.864	.254	15.189***	[3.365, 4.364]
PSEE	.865	.014	61.593***	[.837, 892]
Mediator variable model 2: PSEE→BE				
R^2=.755, F(1,1230)=3793.736, p<.001				
Constant	3.225	.343	9.393***	[2.552, 3.899]
PSEE	.726	.010	72.600***	[.706, .746]
Mediator variable model 3: PSEE→EE				
R^2=.843, F(1,1230)=6617.378, p<.001				
Constant	2.179	.274	7.963***	[1.642, 2.716]
PSEE	.910	.011	82.727***	[.888, .932]
Dependent variable model: Outcome variable= Academic achievement				
R^2=.985, F(4,1227)=19931.663, p<.001				
Constant	40.748	.092	443.639***	[40.568, 40.928]
PSEE	.052	.009	5.727***	[.034, .069]
CE	.046	.009	5.233***	[.018, .074]
BE	.053	.013	4.075***	[.027, .078]
EE	.929	.013	74.077***	[.905, .954]
Direct effect model: PSEE→ Academic achievement	.052	.009	5.727***	[.034, .069]

Indirect effect models

	Effect (B)	SE	95% [LLCI, ULCI]	Nature of Mediation	P_M	% of Mediation
PSEE → CE (M_1) → Academic achievement	.040	.007	[.019, .061]	Partial Mediation	.041	4.098
PSEE → BE (M_2) → Academic achievement	.038	.009	[.022, .054]	Partial Mediation	.039	3.893
PSEE → EE (M_3) → Academic achievement	.846	.015	[.817, .874]	Partial Mediation	.867	86.680
PSEE → *CE, BE, &* EE → Academic achievement	.924	.014	[.573, 1.275]	---	.947	94.672

Note.*p<.05, **p<.01, ***p<.001

4.2.8.3 Mediation effect of student engagement (viz. cognitive, behavioral, and emotional engagement) on the relationship between students' Perceived Pedagogical engagement and their academic achievement

$H_0$8c: There is no significant mediation effect of student engagement (viz. CE, BE, and EE) on the relationship between perceived pedagogical engagement and academic achievement.

The null hypothesis ($H_0$8c) is multivariate in nature as it deals with five variables: PPE, CE, BE, EE and achievement. All the variables are continuous variables and none of those were measured more than once for a particular respondent. The mediation hypothesis ($H_0$8c) was tested following parallel mediation.

Whenever conducting a mediation analysis, the aim is to generalize the sample model to the entire population. To do so the data need to meet several statistical assumptions of multiple regression analysis. If the data are violating the assumptions, it will be meaningless generalizing the conclusions to the target population because the results might be biased or misleading.

First, the Box-plot of the residual did not show any influential outlier in the residual (see Figure 4.101). Besides, the values of Cook's distance (Cook, 1977) ranged from 0.00 to 0.53 and never exceeded the threshold value of 1.00 (Cook & Weisberg, 1982) showing absence of outlier in the dataset. Further, the maximum value of the Mahalanobis (Mahalanobis, 1930) statistic (i.e. M_{Max}= 4.89) did not exceeded the threshold value (i.e. 9.49 with df=4 at 0.05 level) and thus, indicated the absence of any multivariate outlier in the residual.

Second, the normality of the residual was examined with the help of the visual inspections of the normality plots of the residual namely, Histogram plot (Figure 4.101) and Q-Q plot (Figure 4.101) of the unstandardized residual. Besides, to confirm the indications of the visual inspections of the normality plots, normality tests were performed. Further, normality of the unstandardized residual was confirmed from the statistically insignificant results of Kolmogrov-Smirnov test (statistic= .016, df=1232, p= .200) and the Shapiro-Wilk test (W= .996, df= 1232, p=.917) (Field, 2009).

Third, the value of Durbin-Watson statistic is 2.43. Therefore, there is no problem of 'Autocorrelation' with the data. This was also supported by the residual plot (Figure 4.102). Fourth, the Figure 4.103 depicts the linear relationships among the criterion variables where each plot showed the value of R^2_{Linear}>0.3 (Neter, Kutner, Nachtsheim, & Wasserman, 1996), separately.

Fifth, Figure 4.102 also indicated the homoskedasticity of the residual as the residual points are not too scattered and hover around the *Fit line*. Further, Breusch-Pagan and Koenker test was performed using a macro developed by Ahmad Daryanto (Daryanto, 2020). Both tests i.e. Breusch-Pagan test (Lagrange Multiplier (LM)= .670, p= .836) and Koenker test (LM= .614, p= .751) were not significant and thus, ensured that the assumption of homoskedasticity has not been violated.

Finally, the correlation matrix (Table 4.11) of the variables depicted no high value of bivariate correlation coefficients among the IVs. This shows that the IVs are not highly correlated to each other indicating the absence of multicollinearity among the IVs. Further, from Table 4.47, it can be seen that the VIF<10 and Tolerance>0.2 for all the IVs. Hence, the absence of multicollinearity in the dataset is ensured.

Therefore, the data met all the statistical assumptions required for the mediation analysis and hence, ensured the absence of any bias. Thus, the findings and conclusions from the mediation analysis may be generalized in the target population.

Table 4. 47

Collinearity diagnostics of the Parallel Mediation Model with reference to Variance Inflation Factor (VIF) and Tolerance

Predictor variables in the Model	Collinearity Statistics	
	Tolerance	VIF
Cognitive Engagement	0.47	2.13
Behavioral Engagement	0.42	2.38
Emotional Engagement	0.59	1.69
Perceived Pedagogical Engagement	0.44	2.27

Figure 4. 101

Histogram (extreme left), Q-Q Plot (middle) and Box Plot (extreme right) of the residual

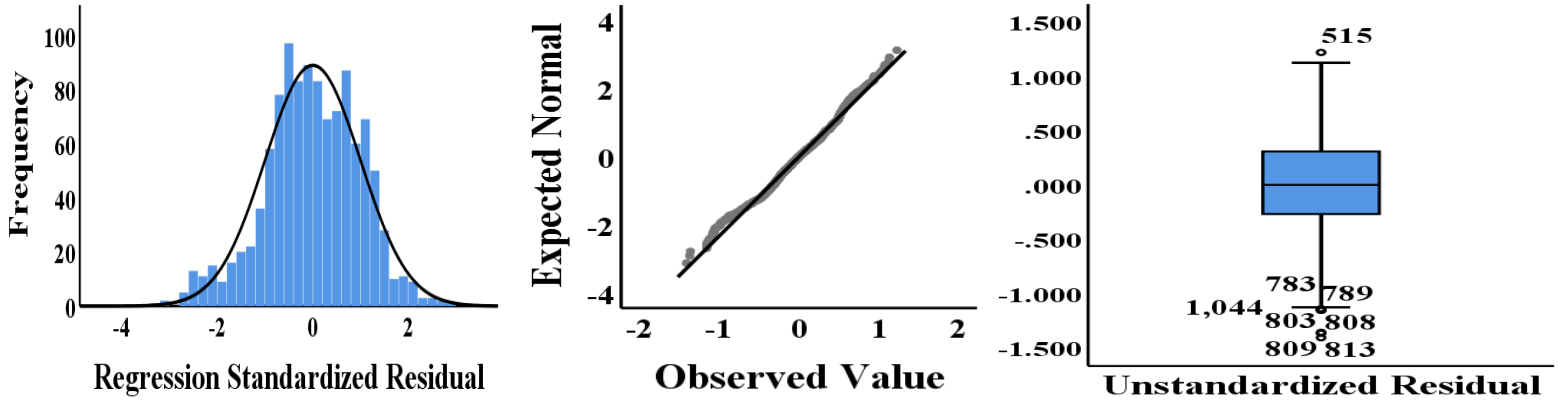
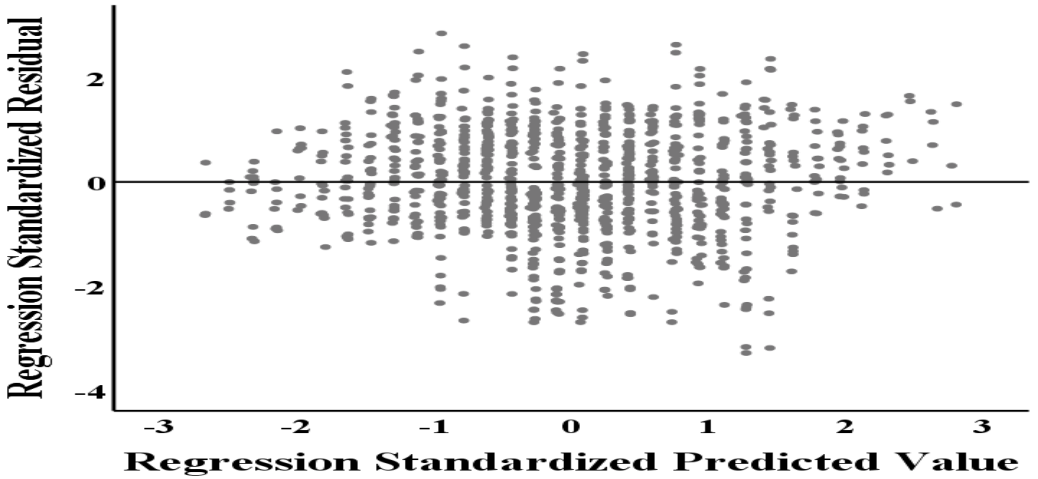


Figure 4. 102

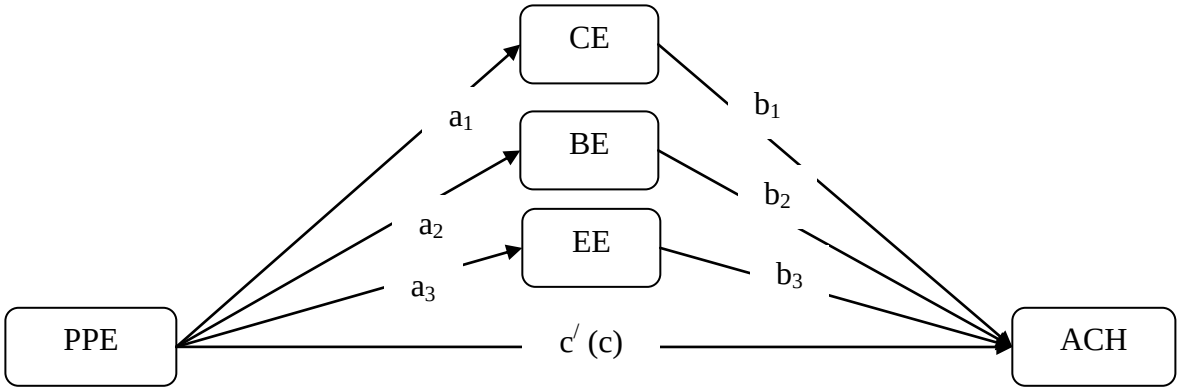
Residual Plot of the dependent variable (Academic achievement)



The parallel mediation analysis was run by selecting the student engagement dimensions (viz. cognitive, behavioral, emotional engagement). The three mediation relationships in the hypothesized theoretical path model (see Figure 4.104) were then examined and evaluated (see Figure 4.105).

Figure 4. 103

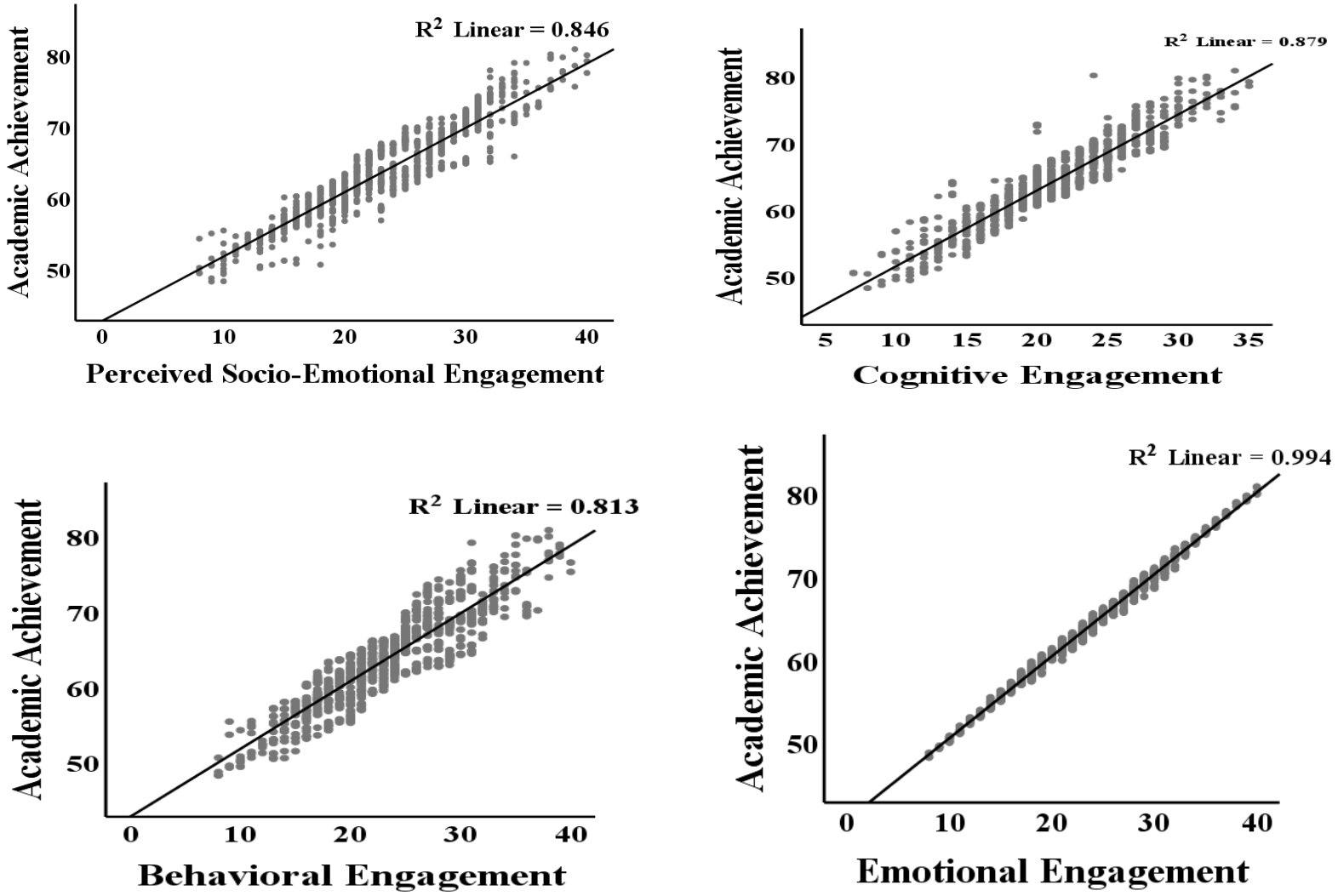
Hypothesized path model of the mediation effect for the three student engagement dimensions (viz. CE, BE, and EE) on the relationship between PPE and achievement



Note. a_i is effect of PPE on student engagement dimensions; b_i is effect of student engagement dimensions on achievement; $c^{/}$ is direct effect; c is the total effect in absence of any mediator, and a_ib_i is the indirect effect via the i^{th} Mediator variable

Figure 4. 104

Simple Scatter plot of Academic Achievement against CE, BE, EE, and PPE



The results indicated that the *Total effect model* is significant: R^2= 0.896, F(1, 1230)= 10568.894, p<0.001 (Table 4.48). Students' perceived pedagogical engagement positively predicts students' academic achievement (c= 1.159, p<0.001, 95% CIs: [1.013, 1.305]; see Table 4.48).

Further, results from the three *Mediator variable models* show that Perceived Pedagogical engagement positively influenced students' cognitive engagement (a_1= 0.857, p<0.001, 95% CIs: [0.838, 0.876]; Mediator variable model 1, see Table 4.48), behavioral engagement (a_2= 1.020, p<0.001, 95% CIs: [.993, 1.048]; Mediator variable 2, see Table 4.48), and emotional engagement (a_3= 1.064, p<0.001, 95% CIs: [1.043, 1.085]; Mediator variable 3, see Table 4.48). In turn, students' cognitive engagement positively influenced students' academic achievement (b_1= 0.056, p<0.001, 95% CIs: [0.019, 0.093]); so did students' behavioral engagement (b_2= 0.034, p<0.05, 95% CIs: [0.008, 0.060]) and emotional engagement (b_3= 0.911, p<0.001, 95% CIs: [0.887, 0.936]; see Table 4.48).

Further, analyzing the indirect effects from the *Indirect effect model*, results demonstrated that students' cognitive engagement mediated the association between perceived pedagogical engagement and achievement: a_1*b_1= 0.048, 95% BootLLCI= 0.022, 95% BootULCI= 0.074] (Hayes, 2013). Similarly, the indirect effects for behavioral engagement (a_2*b_2= 0.035, 95% BootLLCI= 0.010, 95% BootULCI= 0.060) and for emotional engagement (a_3*b_3= 0.970, 95% BootLLCI= 0.935, 95% BootULCI= 1.004]; see Table 4.48) were also statistically significant.

Therefore, three student engagement dimensions (viz. CE, BE, and EE) mediated the association between PSEE and achievement, significantly. The total indirect effect exerted jointly by all the three student engagement dimensions (viz. CE, BE, and EE) was also statistically significant: (Total indirect effect= 1.053, 95% BootLLCI= 0.913, 95% BootULCI= 1.193]; see Table 4.48) which is 90.854% of the total effect. Further, the P_M for the three mediators (viz. CE, BE, and EE) were found to be .041, .030, and .837 respectively (see Table 4.48).

Nevertheless, it was found from the *Direct effect model* that the results also suggest that even after accounting for the mediating role of the three student engagement dimensions (viz. cognitive, behavioral, and emotional engagement), perceived pedagogical engagement still has a positive impact on students' achievement ($c^{/}$=0.106, p<0.001, 95% CIs: [0.81, 0.132]) (see Table 4.48).

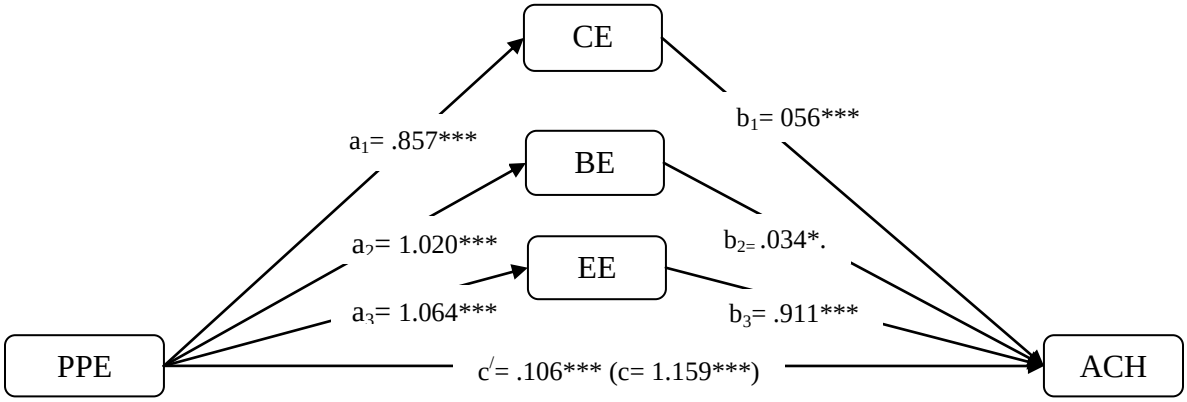
Therefore, it was found that even the effect of PPE was lessened predicting academic achievement, still the effect was significant. Thus, it can be said that the student engagement dimensions (viz. CE, BE, and EE) partially mediated the association between PPE and achievement.

Besides, the percentage of the mediation effect (see Table 4.48) showed that the proportion of the total effect of Perceived pedagogical engagement on academic achievement that operates indirectly through cognitive engagement is 4.142%, through behavioral engagement is 3.020%, and through emotional engagement is 90.854%.

In sum, the indirect effects exerted by three student engagement dimensions (viz. CE, BE, and EE) significantly influenced students' academic achievement. Thus, the three student engagement dimensions were found to be significant mediators on the association between PPE and achievement. Yet the direct effect of PPE on their achievement was still significant indicating this as a case of partial mediation. Further, the indirect effect that operated through BE was lesser than that through CE, and further lesser than through EE. Thus, EE was found to be a better mediator on the association between PPE and achievement as well as a better predictor of achievement as compared to CE and BE. Thus, it can be said that gender gap in three student engagement dimensions is a significant cause in explaining the relationship between PPE and achievement. These findings provide evidence that the students who perceive teachers' pedagogical engagement more are more engaged in learning and achieve more. Hence, teachers' pedagogical engagement in teaching motivates students to engage in their classroom learning.

Figure 4. 105

Structural model of the total, direct and indirect effects for the three student engagement dimensions (viz. CE, BE, and EE) on the association between PPE and achievement



Note. *p < .05, **p < .01, ***p < .001

a_n is effect of PPE on student engagement dimensions; b_n is effect of student engagement dimensions on achievement; $c^{/}$ is direct effect; c is total effect in the absence of any mediator(s) in the model.

Table 4. 48

Results of mediation analysis for Hypothesis 8c

	B	SE	t	95% [LLCI, ULCI]
Total effect model: PPE→ Academic achievement				
R^2=.896, F(1,1230)=10568.894, p<.001				
Constant	41.812	.223	187.395***	[41.374, 42.250]
PPE	1.159	.011	105.636***	[1.013, 1.305]
Mediator variable model 1: PPE→CE				
R^2=.862, F(1,1230)=7660.476, p<.001				
Constant	2.882	.214	13.451***	[2.452, 3.312]
PPE	.857	.010	85.700***	[.838, .876]
Mediator variable model 2: PPE→BE				
R^2=.815, F(1,1230)=5407.231, p<.001				
Constant	2.059	.304	6.780***	[1.463, 2.655]
PPE	1.020	.014	73.534***	[.993, 1.048]
Mediator variable model 3: PPE→EE				
R^2=.893, F(1,1230)=10274.689, p<.001				
Constant	1.161	.230	5.053***	[.710, 1.611]
PPE	1.064	.010	101.364***	[1.043, 1.085]
Dependent variable model: Outcome variable= Academic achievement				
R^2=.985, F(4,1227)=20480.898, p<.001				
Constant	40.771	.090	450.771***	[40.593, 40.948]
PPE	.106	.013	8.185***	[.081, .132]
CE	.056	.009	6.317***	[.019, .093]
BE	.034	.013	2.552*	[.008, .060]
EE	.911	.013	71.947***	[.887, .936]
Direct effect model: PPE→ Academic achievement	.106	.013	8.185***	[.081, .132]

Indirect effect models

	Effect (B)	SE	95% [LLCI, ULCI]	Nature of Mediation	P_M	% of Mediation
PPE → CE (M_1) → Academic achievement	.048	.009	[.022, .074]	Partial Mediation	.041	4.142
PPE → BE (M_2) → Academic achievement	.035	.010	[.010, .060]	Partial Mediation	.030	3.020
PPE → EE (M_3) → Academic achievement	.970	.018	[.935, 1.004]	Partial Mediation	.837	83.693
PPE → *CE, BE, &* EE → Academic achievement	1.053	.019	[.913, 1.193]	---	.909	90.854

Note.*p<.05, **p<.01, ***p<.001