

Analysis On Factors Impacting
Education Test-Score Performance of 5'th and 9'th Grade Students

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Abstract:

As discussed in the first- step -analysis, the smart phone has a huge influence on the students' academic performance. However, the model to analysis the factors to impact the test-score performance of 5th and 9th students is not good enough. Therefore, the target of the study is to find further factors that will have influences on the students' academic performance. From the extensive survey conducted within primary and middle-school students in several Chinese, attitudes, interest, classmate relation, campus condition, satisfaction learning, strategy, subjects, manners, social morals, hard work, solidarity friendship, moral duty, sense honors all total 28 factors that may have impact on students' scores.

1.Introduction

In the first-step- analysis, the mobile phones were proved to have strong effect on students' academic achievement. But there are still many factors in the model we do not consider. For searching the really important factors, the author will take the method of principal component analysis, cross validation and model selections. The aim of the study is to find the best model that determine the academic performance of the 5th and 9th grade students.

2. Methods and Data Analysis

The school survey was conducted by questionnaire within primary and middle-school students in several Chinese provinces. It focuses on two different grade students' groups (5th and 9th). We here use principal component cross-validation and stepwise model selection to find the most significant factors that influence the academic performances of 5th and 9th grade students.

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3.Results and Discussion

The Table 1 shows the principal component analysis on the independent variable of 5th students (factors that collected from the survey). Among these 28 variables, we saw that we just need the first 21 components which can explain more than 95% of variance.

Table 1 The Principal Component Analysis of 5th students

Importance of components:	PC1	PC2	PC3	PC4	P
C5					
Standard deviation	289.0136	134.8312	118.59158	108.91789	101.131
95					
Proportion of Variance	0.3813	0.0830	0.06421	0.05416	0.046
69					
Cumulative Proportion	0.3813	0.4643	0.52854	0.58270	0.629
39					
	PC6	PC7	PC8	PC9	PC10
Standard deviation	87.65065	84.19276	82.11203	76.01038	74.09180
Proportion of Variance	0.03507	0.03236	0.03078	0.02638	0.02506
Cumulative Proportion	0.66446	0.69682	0.72761	0.75398	0.77904
	PC11	PC12	PC13	PC14	PC15
Standard deviation	72.52785	67.25800	65.80202	65.08689	59.78998
Proportion of Variance	0.02401	0.02065	0.01977	0.01934	0.01632
Cumulative Proportion	0.80306	0.82371	0.84348	0.86282	0.87914
	PC16	PC17	PC18	PC19	PC20
Standard deviation	57.92569	55.34918	53.89717	50.27731	48.92901
Proportion of Variance	0.01532	0.01399	0.01326	0.01154	0.01093
Cumulative Proportion	0.89446	0.90844	0.92171	0.93325	0.94418
	PC21	PC22	PC23	PC24	PC25
Standard deviation	48.13035	45.52968	43.99299	41.67423	41.52045
Proportion of Variance	0.01058	0.00946	0.00884	0.00793	0.00787
Cumulative Proportion	0.95475	0.96421	0.97305	0.98098	0.98885
	PC26	PC27	PC28		
Standard deviation	37.25924	32.46577	0.382		
Proportion of Variance	0.00634	0.00481	0.000		
Cumulative Proportion	0.99519	1.00000	1.000		

The Table 2 shows the principal component analysis on the independent variable of 9th students (factors that collected from the survey). Among these 28 variables, we saw that we just need the first 21 components which can explain more than 95% of

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variance.

Table 2 The Principal Component Analysis of 9th students

Importance of components:

	PC1	PC2	PC3	PC4	PC
5					
Standard deviation	244.0969	130.73840	115.29660	104.3669	89.2976
4					
Proportion of Variance	0.3381	0.09698	0.07542	0.0618	0.0452
4					
Cumulative Proportion	0.3381	0.43503	0.51045	0.5723	0.6174
9					
	PC6	PC7	PC8	PC9	PC10
Standard deviation	81.85157	75.97027	73.78364	70.51010	67.57488
Proportion of Variance	0.03801	0.03275	0.03089	0.02821	0.02591
Cumulative Proportion	0.65550	0.68825	0.71914	0.74734	0.77325
	PC11	PC12	PC13	PC14	PC15
Standard deviation	65.63317	60.99074	59.19839	57.12840	55.76189
Proportion of Variance	0.02444	0.02111	0.01988	0.01852	0.01764
Cumulative Proportion	0.79769	0.81880	0.83868	0.85720	0.87484
	PC16	PC17	PC18	PC19	PC20
Standard deviation	53.72822	52.91833	50.42785	46.52231	46.06063
Proportion of Variance	0.01638	0.01589	0.01443	0.01228	0.01204
Cumulative Proportion	0.89122	0.90710	0.92153	0.93381	0.94585
	PC21	PC22	PC23	PC24	PC25
PC26					
Standard deviation	43.04558	40.4801	39.43025	36.38244	34.47061
2.22906					
Proportion of Variance	0.01051	0.0093	0.00882	0.00751	0.00674
0.00589					
Cumulative Proportion	0.95636	0.9657	0.97448	0.98199	0.98873
0.99462					
	PC27	PC28			
Standard deviation	30.77706	0.5302			
Proportion of Variance	0.00537	0.0000			
Cumulative Proportion	1.00000	1.0000			

The Table 3 illustrates the results of backward and cross-validation selection selected components in Table 1 to build Linear Regression for predicting English Test-Score of 5th Students. It seems that the 4 variables has the least RMSE(98.25991).

Table 3: Results of backward model of English Test-Score of 5th Students in PC components

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	103.66064	0.1475541	85.20612	6.885379	0.07571218	6.826070
2	2	102.44804	0.1804195	82.62183	8.290728	0.09767660	8.470636
3	3	98.38116	0.2488684	78.71567	7.489119	0.11519093	6.931832
4	4	98.38683	0.2421856	78.19717	7.119786	0.10473833	6.755943
5	5	97.55421	0.2656555	78.36352	9.640966	0.12204601	9.665205
6	6	98.69360	0.2438234	79.50485	8.515345	0.11051802	8.060162
7	7	99.26903	0.2389251	80.02998	8.892458	0.11388535	7.753888

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8	8	99.42430	0.2355504	80.23107	9.434955	0.11520014	8.036141
9	9	99.22777	0.2381932	80.28012	9.662210	0.12000409	7.730895
10	10	99.81790	0.2268959	80.95899	9.091116	0.12017439	7.088459
11	11	99.03553	0.2369299	80.28897	8.809208	0.11996518	7.172256
12	12	98.54064	0.2450931	79.76120	8.579880	0.11932045	6.808899
13	13	98.55159	0.2438215	79.92042	7.981207	0.11417023	6.464402
14	14	98.25991	0.2472548	79.71427	8.033125	0.10717532	6.689506
15	15	97.79213	0.2530513	79.25268	8.575935	0.11215654	6.992857
16	16	97.27042	0.2602299	78.89108	8.429588	0.11531492	6.973657
17	17	97.33688	0.2585046	78.96429	8.377664	0.11184560	6.872161
18	18	97.30908	0.2587516	79.09428	8.454545	0.11138198	6.933156
19	19	97.20218	0.2609190	79.03426	8.458176	0.11269623	6.953179
20	20	97.33522	0.2591690	79.16706	8.543106	0.11313121	6.970178
21	21	97.35975	0.2590282	79.18118	8.559536	0.11352898	6.992859

The Table 4 shows the final selected components of backward selection method and its coefficients. (14 components)

Table 4: Coefficient of the final backward model of English Test-Score of 5th Students in PC components

(Intercept)	PC1	PC2	PC3	PC4
569.97379487	-0.13942124	-0.04009814	0.21142705	-0.08311115
PC5	PC6	PC7	PC8	PC9
-0.23031023	-0.02603587	0.04553007	-0.07624393	0.12641688
PC10	PC11	PC12	PC13	PC14
-0.18338740	0.11067562	0.22766629	-0.13464087	-0.15855369
PC15	PC16	PC17	PC18	PC21
-0.09611983	0.04990590	0.14680407	0.12007133	-0.07256116

The Table 5 illustrates the results of forward and cross-validation selection selected components in Table 1 to build Linear Regression for predicting English Test-Score of 5th Students. It seems that the 5 variables has the least RMSE (97.55032).

Table 5: Results of forward model of English Test-Score of 5th Students in PC components

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	103.66133	0.1411858	85.15395	5.762260	0.07525440	3.456241
2	2	103.04216	0.1509331	83.46747	4.304889	0.05774784	2.932333

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3	3	98.40772	0.2216054	78.52784	4.876523	0.08328748	4.224283
4	4	98.97900	0.2135179	79.10089	5.724395	0.10584972	4.351512
5	5	97.55032	0.2382213	78.43357	5.935305	0.12032777	5.355226
6	6	97.86631	0.2348027	78.85435	5.715801	0.10218525	5.239438
7	7	98.59299	0.2286643	79.15522	5.539668	0.09637373	5.079964
8	8	98.69356	0.2303550	79.62432	5.980282	0.09753274	5.340314
9	9	99.32287	0.2233862	80.18945	6.944773	0.10677312	6.328440
10	10	100.02632	0.2120169	80.52684	7.034660	0.10720542	6.358190
11	11	99.50697	0.2174309	80.05300	6.776950	0.10235164	5.910263
12	12	99.16467	0.2216645	79.70058	6.756945	0.09708999	6.573383
13	13	98.91781	0.2262442	79.92787	6.724407	0.09078294	6.777651
14	14	98.55986	0.2313011	79.38848	6.438728	0.09331565	6.619720
15	15	98.45198	0.2332915	79.32634	6.269239	0.09248313	6.682400
16	16	98.44151	0.2327251	79.49066	6.204294	0.09237554	6.582263
17	17	98.16117	0.2362287	79.35761	6.332865	0.09287264	6.740812
18	18	98.21102	0.2354741	79.49317	6.359723	0.09056694	6.816674
19	19	97.91866	0.2388804	79.31096	6.250647	0.09018228	6.729068
20	20	98.02309	0.2379893	79.32672	6.403539	0.09328841	6.714388
21	21	98.05632	0.2372287	79.37235	6.321279	0.09209797	6.665890

The table 6 shows the final selected components of forward selection method and its coefficients.

Table 6: Coefficient of the final forward model of

(Intercept)	PC1	PC3	PC5	PC10	P
569.9737949 C12 663	-0.1394212	0.2114271	-0.2303102	-0.1833874	0.2276

The table 7 demonstrates the results of stepwise and cross-validation selection selected components in Table 1 to build Linear Regression for predicting English Test-Score of 5th Students. The 3 variables has the smallest RMSE (98.18572).

Table 7: Results of stepwise model of English Test-Score of 5th Students in PC components

nvmax		RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	103.51798	0.1390771	85.21396	9.205258	0.05211057	8.947598
2	2	101.78069	0.1764516	82.45103	7.949162	0.06523395	7.212294
3	3	98.18572	0.2311891	78.62603	6.798652	0.08668306	5.513564
4	4	98.34358	0.2250104	78.72949	6.928802	0.06198156	6.677532
5	5	98.81557	0.2275370	79.27379	8.028963	0.08951888	8.313928
6	6	99.62974	0.2240764	79.98227	8.375940	0.08984669	8.662767
7	7	100.60179	0.2102741	80.59467	8.990805	0.07096918	9.981220
8	8	100.03024	0.2257468	79.80646	8.450699	0.08039212	9.131350
9	9	100.27242	0.2228624	80.51208	9.958317	0.09204273	10.454114
10	10	99.62329	0.2324809	80.33764	8.844298	0.08710931	9.648446

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11	11	99.38937	0.2326800	80.25024	10.834452	0.09043133	11.175037
12	12	99.54298	0.2323070	80.05062	10.865919	0.08753103	11.177065
13	13	99.74592	0.2308518	80.73513	11.247401	0.09742027	11.274708
14	14	99.77608	0.2299161	80.47125	11.155591	0.10685176	11.526946
15	15	99.11471	0.2410009	80.16452	11.599167	0.11796219	12.069090
16	16	99.36855	0.2389129	80.37329	10.622327	0.10874905	11.557843
17	17	98.65978	0.2478916	79.81929	11.877801	0.11436348	12.417342
18	18	98.20746	0.2523035	79.61551	11.535104	0.10514074	12.142620
19	19	99.19382	0.2396822	80.30259	11.892809	0.11486662	12.554470
20	20	98.73643	0.2453219	79.97824	12.028466	0.11211070	12.697715
21	21	99.21551	0.2401195	80.39990	11.933496	0.11523994	12.553167

The Table 8 is the final selected components of stepwise selection method and its coefficients. (5 components)

Table 8: Coefficient of the final stepwise model of English Test-Score of 5th Students in PC components

(Intercept)	PC1	PC3	PC5
569.9737949	-0.1394212	0.2114271	-0.2303102

In conclusion, by comparing these three methods, we get that the forward method has the smallest RMSE of cross-validation of the model. In this model, the components PC1, PC3, PC5, PC10, PC12 are needed in the model.

The table 9 shows the results of backward and cross-validation selection selected components in Table 1 to build Linear Regression for predicting Math Test-Score of 5th Students. We choose 4 max components model which has the smallest RMSE (96.15811).

Table 9: Results of backward model of Math Test-Score of 5th Students in PC components.

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	101.63793	0.05624755	80.30625	12.099054	0.05255154	7.596901
2	2	98.52229	0.12330853	77.71261	10.462627	0.10910969	7.116064
3	3	97.55361	0.13106022	76.16632	10.183272	0.11669200	7.724318
4	4	96.15811	0.15979603	74.65433	9.088350	0.12352403	6.990549
5	5	97.31459	0.14361667	75.95681	8.929836	0.13348277	6.583328
6	6	97.70976	0.13233138	76.65099	8.027426	0.12548296	6.161448
7	7	98.85517	0.11807211	77.23557	8.263457	0.12057378	6.045558
8	8	99.14480	0.11728773	77.21239	7.727613	0.12092537	5.846592
9	9	99.66713	0.10709479	77.58984	8.042480	0.10044634	5.747906

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10	10	100.03963	0.10226148	78.12987	7.905708	0.09586843	6.049791
11	11	99.97889	0.10613750	77.88757	7.661812	0.09627379	5.929815
12	12	99.90768	0.10597447	77.79233	8.124551	0.08965355	6.338267
13	13	99.77468	0.10560481	77.56080	8.311268	0.08985809	6.820024
14	14	99.64782	0.10661984	77.38378	8.493400	0.08688886	6.826200
15	15	99.27508	0.11075598	77.26751	8.229343	0.08986614	6.591178
16	16	98.84693	0.11649155	77.29090	8.744120	0.09055081	6.811313
17	17	98.64410	0.12185785	77.17785	8.451746	0.09372565	6.570752
18	18	98.32657	0.12628700	76.86215	8.700218	0.09595070	6.811022
19	19	98.00438	0.13100704	76.55189	8.945246	0.09619307	7.086440
20	20	97.78295	0.13410096	76.42492	9.010733	0.09802300	7.241462
21	21	97.55657	0.13662641	76.24876	9.139642	0.09751416	7.365583

Table 10 demonstrate the final selected components of backward selection method and its coefficients

Table 10: Coefficient of the final backward model of Math Test-Score of 5th Students in PC components

(Intercept)	PC1	PC5	PC9	PC11
559.71605128	-0.08704635	-0.21421214	0.20201382	0.24163381

The Table 11 shows the results of forward and cross-validation selection selected components in Table 1 to build Linear Regression for predicting Math Test-Score of 5th Students. 4 components model is the best of RMSE (96.09219)

Table 11: Results of forward model of Math Test-Score of 5th Students in PC components.

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	100.21841	0.07006293	79.10578	8.195330	0.05217892	5.967139
2	2	99.02113	0.08875416	78.33870	8.197846	0.06339281	5.559570
3	3	97.44128	0.11793031	76.20717	6.992255	0.06311165	4.684722
4	4	96.09219	0.14907552	74.81418	5.787025	0.06981308	3.792256
5	5	97.28130	0.12961267	76.34853	5.747483	0.05800471	3.769499
6	6	97.46429	0.13108643	76.89683	5.511873	0.06618614	4.099125
7	7	98.21754	0.12595414	77.32494	6.389539	0.06692107	4.179753
8	8	98.91907	0.11580723	77.56019	6.577798	0.06497193	4.679645
9	9	98.98902	0.11466278	77.50506	6.179655	0.06273580	4.576440
10	10	98.91053	0.11586954	77.48616	6.117475	0.06720056	5.052643
11	11	99.63851	0.10697140	77.83993	6.250264	0.06208018	4.827819
12	12	99.44840	0.10884043	77.65761	5.958675	0.06435606	4.887251
13	13	99.37030	0.10937309	77.88600	5.992428	0.06631076	5.560284
14	14	99.33798	0.11190495	78.12558	5.946000	0.07067628	5.765918
15	15	99.53691	0.11116853	78.40992	5.727782	0.07103087	5.778716
16	16	99.47664	0.11221764	78.27420	5.324567	0.06628118	5.476607
17	17	99.23439	0.11531866	78.05644	5.418101	0.06795461	5.674775

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18	18	98.60590	0.12335225	77.57526	5.328341	0.06863464	5.765860
19	19	98.09797	0.12924760	77.36079	5.157123	0.06842841	5.827347
20	20	97.64175	0.13544937	76.92761	5.023534	0.07179047	5.660606
21	21	97.57947	0.13620827	76.88219	5.028580	0.07206198	5.602315

The table 12 demonstrate the final selected components of forward selection method and its coefficients

Table 12: Coefficient of the final forward model of Math Test-Score of 5th Students in PC components

(Intercept)	PC1	PC5	PC9	PC11
559.71605128	-0.08704635	-0.21421214	0.20201382	0.24163381

The table 13 shows the results of stepwise and cross-validation selection selected components in Table 1 to build Linear Regression for predicting Math Test-Score of 5th Students. Four components are the best of RMSE (95.34064)

Table 13: Results of stepwise model of Math Test-Score of 5th Students in PC components

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	100.06850	0.07869022	79.30278	11.19017	0.07472971	8.163383
2	2	97.77748	0.11465011	77.29177	10.95121	0.08363799	8.112246
3	3	96.40222	0.13569089	75.36279	10.73975	0.06844068	7.893566
4	4	95.34064	0.15807291	74.41948	10.82269	0.09008862	8.790296
5	5	96.16061	0.14158703	75.61862	10.19731	0.08567326	8.339246
6	6	96.70054	0.13533676	76.20981	11.39176	0.08389411	9.407802
7	7	97.67607	0.12303310	77.02892	11.46080	0.08107631	9.395039
8	8	97.74070	0.12552791	77.16735	11.61639	0.08763642	9.308065
9	9	98.18599	0.12030290	77.23962	11.51135	0.08505090	9.445866
10	10	98.29146	0.12084923	77.43629	11.67090	0.08516351	9.191614
11	11	98.69097	0.12047852	77.57568	11.99346	0.09107578	9.717009
12	12	98.15093	0.12886953	77.47710	12.48768	0.09766371	10.062706
13	13	97.72538	0.13590218	76.66443	11.70681	0.10195758	9.806172
14	14	97.73178	0.13577569	76.98332	12.53749	0.10133673	10.252495
15	15	96.28824	0.15528792	76.78414	12.58542	0.10389363	10.461150
16	16	96.57147	0.14759883	76.30609	11.76927	0.10600718	10.068378
17	17	96.87537	0.14844220	76.44116	12.44195	0.10709067	10.465150
18	18	96.48003	0.15041375	76.14088	12.18853	0.09966096	10.183883
19	19	96.38716	0.15237977	75.94117	12.01559	0.10330157	10.021401
20	20	96.27260	0.15472796	76.03420	12.04764	0.10189080	10.036254
21	21	96.03794	0.15814633	75.82648	12.09046	0.10520277	10.022465

Table 14 demonstrate the final selected components of stepwise selection method and its coefficients

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Table 14: Coefficient of the final stepwise model of
Math Test-Score of 5th Students in PC components

(Intercept)	PC1	PC5	PC9	PC11
559.71605128	-0.08704635	-0.21421214	0.20201382	0.24163381

In conclusion, we choose the final forward model which has the least RMSE (95.34064) and contains 4 components PC1, PC5, PC9, PC11.

The table 15 shows the results of backward and cross-validation selection selected components in Table 2 to build Linear Regression for predicting English Test-Score of 9th Students. 6 components are needed of the least of RMSE (77.76025).

Table 15: Results of backward model of English
Test-Score of 9th Students in PC components

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	85.28169	0.1480245	68.67041	8.268766	0.09312030	5.325685
2	2	81.36258	0.2187112	65.11461	9.686505	0.07565153	6.720911
3	3	79.17925	0.2610016	61.87381	9.949617	0.07780383	6.848879
4	4	79.21875	0.2614623	61.23573	8.689928	0.08814831	6.367174
5	5	78.32412	0.2833912	60.89147	8.408060	0.09281516	6.147927
6	6	77.76025	0.2942341	60.57744	8.837714	0.10673730	6.467278
7	7	77.94685	0.2943438	60.46019	8.471639	0.10960410	6.513004
8	8	78.18706	0.2908940	60.46895	8.149398	0.11043535	6.307359
9	9	78.56176	0.2885914	60.91781	8.307626	0.11109396	6.677555
10	10	78.49018	0.2895448	60.80013	8.178019	0.11038872	6.435227
11	11	78.19256	0.2930042	60.65591	8.377416	0.11661968	6.670378
12	12	78.29851	0.2923026	60.58421	8.236996	0.11366252	6.443165
13	13	78.14640	0.2941156	60.23703	8.362382	0.11224854	6.663978
14	14	78.24323	0.2947078	60.29988	8.345027	0.11319485	6.578437
15	15	78.19413	0.2955781	60.19677	8.389032	0.11215507	6.607876
16	16	78.16327	0.2969160	60.17937	8.617648	0.11565371	6.694002
17	17	78.12013	0.2973635	60.14938	8.560783	0.11497305	6.641787
18	18	78.17102	0.2964813	60.19879	8.482851	0.11432714	6.473366
19	19	78.23319	0.2949015	60.28956	8.481419	0.11353296	6.474378
20	20	78.29399	0.2937026	60.36460	8.462719	0.11294748	6.481274
21	21	78.28903	0.2937634	60.35175	8.484047	0.11270726	6.478729

Table 16 demonstrate the final selected components of backward selection method and its coefficients

Table 16: Coefficient of the final backward model
of English Test-Score of 9th Students in PC
components

(Intercept)	PC1	PC2	PC4	PC5	P
569.6981282	0.1360242	-0.1458360	-0.2442379	0.1372645	-0.2448093
	PC14				

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0.1810908

Table 17 shows the results of forward and cross-validation selection selected components in Table 2 to build Linear Regression for predicting English Test-Score of 9th Students. 6 components are needed in this model (RMSE 77.97222).

Table 17: Results of forward model of English Test-Score of 9th Students in PC components

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	85.28920	0.1409968	68.54569	5.143737	0.07823997	3.874187
2	2	81.64255	0.2112024	65.08462	5.476656	0.05414014	4.360349
3	3	79.64300	0.2467383	62.05230	4.666330	0.06251127	3.234825
4	4	79.84598	0.2459529	62.10365	5.053006	0.06228841	4.792017
5	5	78.62984	0.2684990	61.37811	5.912154	0.06834434	4.268568
6	6	77.97222	0.2812579	60.76455	6.130001	0.08354894	3.104288
7	7	78.46690	0.2742488	61.16246	5.838930	0.08098520	3.782475
8	8	78.51582	0.2730709	60.81638	5.905747	0.07902626	3.790873
9	9	78.94487	0.2662659	61.21122	5.752218	0.08906611	4.170326
10	10	78.96078	0.2659723	61.10225	6.151942	0.09325944	4.269428
11	11	78.69186	0.2722233	60.82451	6.082345	0.08935527	3.836823
12	12	78.50030	0.2758061	60.61917	6.480103	0.09323769	4.159397
13	13	78.58016	0.2752854	60.60446	6.372613	0.09180585	4.093718
14	14	78.51829	0.2777052	60.42154	6.523394	0.09259429	4.442070
15	15	78.36644	0.2807275	60.23306	6.327274	0.09070646	4.352241
16	16	78.19239	0.2833832	60.12796	6.253615	0.09282666	4.330684
17	17	78.37062	0.2801210	60.30456	6.191200	0.09153405	4.364730
18	18	78.46081	0.2787161	60.39333	6.188062	0.09253239	4.334555
19	19	78.56721	0.2768304	60.47423	6.112057	0.09112141	4.231465
20	20	78.58688	0.2763703	60.51420	6.081388	0.09046144	4.198008
21	21	78.60152	0.2761142	60.55181	6.083006	0.09040886	4.163393

Table 18 demonstrate the final selected components of forward s election method and its coefficients

Table 19: Coefficient of the final forward model of English Test-Score of 9th Students in PC components

(Intercept)	PC1	PC2	PC4	PC5	P
C13 569.6981282	0.1360242	-0.1458360	-0.2442379	0.1372645	-0.2448
093					
PC14 0.1810908					

Table 20 shows the results of stepwise and cross-validation selection selected components in Table 2 to build Linear Regression for predicting English Test-Score of 9th Students. 8 components are needed

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in this model (RMSE 80.71882).

Table 20: Results of stepwise model of English

Test-Score of 9th Students in PC components

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	88.45349	0.1195927	70.98897	4.702926	0.04694936	3.825322
2	2	85.53998	0.1761458	67.85792	4.195741	0.04415421	3.364279
3	3	84.53518	0.1964037	66.19847	4.326775	0.04620185	3.621254
4	4	81.97259	0.2426336	63.62408	4.229900	0.04481868	3.177618
5	5	81.22778	0.2578074	62.78268	4.180097	0.05472817	3.251711
6	6	81.05256	0.2590987	62.71290	4.032250	0.05068150	2.990329
7	7	80.82019	0.2631758	62.49511	3.918797	0.04735428	3.034655
8	8	80.71882	0.2659181	62.22332	3.878313	0.04801722	2.921716
9	9	80.86121	0.2639786	62.30322	4.051296	0.04928048	2.819769
10	10	80.90657	0.2638732	62.48018	3.766517	0.04685998	2.497351
11	11	81.02113	0.2636224	62.59835	3.557124	0.04532394	2.570729
12	12	81.12197	0.2626455	62.44510	3.734041	0.04856843	2.685113
13	13	81.31419	0.2606855	62.61493	3.804759	0.04785981	2.622622
14	14	81.09441	0.2650468	62.49932	3.848097	0.04870306	2.660023
15	15	81.36930	0.2605194	62.72036	3.731707	0.04866247	2.511766
16	16	81.31131	0.2614763	62.72472	3.857385	0.04932435	2.666553
17	17	81.39839	0.2604661	62.73735	3.600256	0.04687415	2.451008
18	18	81.28642	0.2622881	62.70896	3.557902	0.04424472	2.401973
19	19	81.57593	0.2581671	62.91341	3.697362	0.04736706	2.587907
20	20	81.45852	0.2598790	62.79378	3.580937	0.04551606	2.515857
21	21	81.58829	0.2578504	62.89954	3.612163	0.04708022	2.551320

Table 21 demonstrate the final selected components

of stepwise selection method and its coefficients

Table 21: Coefficient of the final stepwise model of

English Test-Score of 9th Students in PC components

(Intercept)	PC1	PC2	PC4	PC5
569.69812821	0.13602418	-0.14583599	-0.24423790	0.13726449
PC8	PC12	PC13	PC14	
-0.07578535	-0.10582892	-0.24480927	0.18109081	

In conclusion, we choose the final backward model as it has the smallest RMSE (77.76025). The components in the model are PC1, PC2, PC4, PC5, PC13, PC14.

Table 22 shows the results of backward and cross-validation selection selected components in Table 2 to build Linear Regression for predicting Math Test-Score of 9th Students. 9 components are needed in this model (RMSE 80.35818).

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Table 23: Results of backward model of Math Test-

Score of 9th Students in PC components

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	86.61905	0.08838282	70.16967	8.916355	0.08379421	6.018933
2	2	86.05953	0.10799999	69.62089	8.315134	0.10132680	6.179503
3	3	82.37378	0.17656451	66.71979	8.449121	0.12907457	6.177415
4	4	82.60273	0.17328369	66.35621	8.802955	0.10783052	6.883909
5	5	81.97697	0.18072769	65.77462	8.781503	0.10337419	6.837692
6	6	81.31255	0.19093902	64.79582	8.389556	0.08443144	6.691995
7	7	81.13567	0.19347098	64.57744	8.529121	0.09646791	6.881678
8	8	80.51690	0.20549483	64.06610	8.451665	0.09427312	6.644490
9	9	80.35818	0.21052469	64.05343	8.032127	0.09290158	6.212958
10	10	80.63192	0.20553330	64.22056	7.699089	0.08342331	5.859405
11	11	80.86623	0.20492604	64.01559	7.820787	0.08087450	6.196725
12	12	80.95966	0.20443597	64.09166	7.681353	0.08039615	6.176053
13	13	80.50969	0.21397624	63.72741	7.847236	0.08836987	6.099059
14	14	80.71035	0.20960734	63.59725	8.074786	0.09309608	6.399742
15	15	80.73691	0.21051924	63.58245	8.261572	0.08959877	6.295835
16	16	80.55585	0.21482392	63.33129	8.300766	0.08880025	6.306260
17	17	80.55230	0.21511255	63.35653	8.287014	0.08767974	6.350793
18	18	80.52423	0.21610336	63.42134	8.606073	0.08943233	6.651783
19	19	80.45410	0.21765200	63.38061	8.555532	0.09025830	6.548394
20	20	80.43368	0.21771078	63.40654	8.556875	0.09258884	6.561058
21	21	80.42604	0.21752305	63.41487	8.503915	0.09135391	6.554911

Table 24 demonstrate the final selected components

of backward selection method and its coefficients

Table 24: Coefficient of the final backward model
of Math Test-Score of 9th Students in PC
components

(Intercept)	PC1	PC2	PC3	PC4
570.92587179	0.09737530	0.06704708	-0.12082020	-0.18917357
PC5	PC7	PC10	PC13	PC15
0.12681604	-0.09732012	-0.18692333	-0.33517383	-0.17984686

Table 25 shows the results of forward and cross-validation selection selected components in Table 2 to build Linear Regression for predicting Math Test-Score of 9th Students. 10 components are needed in this model (RMSE 79.48384).

Table 25: Results of forward model of Math Test-Score of 9th Students in PC components

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	86.35520	0.09014796	70.04132	9.214665	0.05927938	7.109982
2	2	85.67687	0.10778112	69.65767	10.053312	0.06782506	8.011263
3	3	81.88236	0.18370764	66.51875	10.372311	0.11141956	7.585704

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4	4	82.03329	0.18471249	66.28073	11.974610	0.13963202	8.169939	
5	5	81.10020	0.20606573	65.00670	11.832219	0.14315724	7.781366	
6	6	80.72247	0.21582896	64.54613	12.934825	0.14907727	9.053441	
7	7	79.79960	0.23528412	63.90916	14.117805	0.15892611	10.092347	
8	8	79.71411	0.23860198	63.82294	14.399842	0.16212421	10.645845	
9	9	79.52656	0.24389127	63.79337	14.921217	0.16996146	10.878043	
10	10	79.48384	0.24484404	63.93563	14.651943	0.16886484	10.504987	
11	11	80.01956	0.23753581	64.30549	14.980909	0.16788803	11.026557	
12	12	80.74227	0.22585550	64.81327	14.790117	0.16461499	10.936580	
13	13	80.87673	0.22460330	64.71808	14.997887	0.16478747	10.581737	
14	14	81.04304	0.22276953	64.76190	15.236947	0.16854222	10.642746	
15	15	80.95860	0.22180425	64.60110	14.808942	0.16763329	10.266136	
16	16	80.69522	0.22659811	64.32692	14.988909	0.17313255	10.519086	
17	17	80.61007	0.22608548	64.26027	14.786588	0.17234502	10.328869	
18	18	80.59294	0.22657984	64.17223	14.882774	0.17213744	10.354995	
19	19	80.35089	0.23074334	64.02437	14.915293	0.17300357	10.363358	
20	20	80.29797	0.23158221	64.00685	14.951378	0.17427888	10.354763	
21	21	80.31317	0.23152958	64.04069	14.987441	0.17505432	10.348666	

Table 26 demonstrate the final selected components of forward selection method and its coefficients

Table 26: Coefficient of the final forward model of Math Test-Score of 9th Students in PC components

(Intercept)	PC1	PC2	PC3	PC4
570.92587179	0.09737530	0.06704708	-0.12082020	-0.18917357
PC5	PC7	PC10	PC13	PC14
0.12681604	-0.09732012	-0.18692333	-0.33517383	0.12313019
PC15				
-0.17984686				

Table 27 shows the results of stepwise and cross-validation selection selected components in Table 2 to build Linear Regression for predicting Math Test-Score of 9th Students. 18 components are needed in this model (RMSE 79.78152).

Table 27: Results of stepwise model of Math Test-Score of 9th Students in PC components

1	1	86.43205	0.08573114	70.02955	8.934835	0.06713726	7.460598
2	2	85.42742	0.11965138	69.93064	9.370081	0.10684523	7.980978
3	3	82.26320	0.19392887	66.83284	10.216504	0.16103730	8.173148
4	4	83.16777	0.16937173	67.15976	10.124999	0.14901429	8.193005
5	5	82.07765	0.18680495	65.79757	10.313604	0.15710132	8.666823
6	6	81.17960	0.19633828	64.76771	9.525427	0.14942440	7.668168
7	7	82.57161	0.16486655	65.59312	8.614358	0.08083108	7.086247
8	8	80.55391	0.20279221	63.85081	8.497812	0.14536252	6.394987
9	9	81.12678	0.19268630	64.52707	8.378914	0.12290692	6.002085
10	10	80.16603	0.22168738	64.02244	9.341687	0.13422655	6.494646
11	11	80.83249	0.20355544	64.57691	9.182065	0.11996531	6.222929
12	12	80.38687	0.21005972	63.98804	9.124550	0.11346919	6.180886
13	13	80.30237	0.21250324	64.05834	9.175064	0.11876128	6.405913
14	14	79.93851	0.21859404	63.46475	8.789277	0.11391868	6.520982
15	15	80.41956	0.21237081	63.65593	9.420138	0.11576576	6.920425

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16	16	80.02109	0.21795362	63.10127	9.252152	0.11238676	6.952847
17	17	79.87103	0.21976937	63.13212	9.119274	0.11047570	6.629870
18	18	79.78152	0.22146663	63.12644	9.007275	0.10712342	6.680449
19	19	80.07823	0.21668423	63.53106	9.181013	0.11231027	6.371915
20	20	80.15891	0.21529918	63.53478	9.309507	0.10819010	6.532103
21	21	79.81761	0.22177387	63.16016	9.315671	0.11120843	6.814326

Table 28 demonstrate the final selected components of stepwise selection method and its coefficients

Table 28: Coefficient of the final stepwise model of

Math Test-Score of 9th Students in PC components

(Intercept)	PC1	PC2	PC3	PC4
570.92587179	0.09737530	0.06704708	-0.12082020	-0.18917357
PC5	PC7	PC8	PC9	PC10
0.12681604	-0.09732012	-0.04339513	-0.03333017	-0.18692333
PC11	PC12	PC13	PC14	PC15
0.04179846	0.08572502	-0.33517383	0.12313019	-0.17984686
PC17	PC18	PC20	PC21	
-0.06458521	0.07227643	0.10570962	0.12204899	

In conclusion, we choose the final forward model which has the smallest RMSE (79.48384). st

The components needed in the model are PC1, PC2, PC3, PC4, PC5, PC7, PC10, PC13, PC14, PC15

For the next step, it is reasonable to consider the real factors, then we focus on the original survey data and use above methods to seek the most important factors that influence the academic performance of students and make comparison with above PC models.

The Table 29 shows the results of backward and cross-validation selection to the survey data build Linear Regression for predicting English and Test-Score of 5th students. It seems that 8 variables are the best model of smallest RMSE (96.43758).

Table 29: Results of backward model of English Test-Score of 5th Students in original data

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	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	106.58521	0.1039808	86.87436	8.242044	0.09039469	7.417611
2	2	100.23835	0.2107657	81.06385	9.227429	0.11314422	7.409915
3	3	98.13572	0.2362969	78.91889	8.405403	0.09834229	7.876471
4	4	98.74595	0.2284293	80.13387	7.603703	0.08603540	7.465112
5	5	98.43746	0.2339547	79.57072	9.322027	0.11206176	8.423673
6	6	98.10340	0.2406705	79.62609	10.269334	0.12358725	10.454661
7	7	96.88159	0.2576293	78.57878	10.020870	0.11890374	9.984546
8	8	96.43758	0.2632854	78.41362	9.519453	0.10988767	9.400638
9	9	96.90991	0.2574095	78.72076	9.524241	0.10908784	9.565543
10	10	97.16982	0.2533058	78.69054	10.246976	0.11765243	10.245334
11	11	96.78307	0.2578848	78.51757	10.292177	0.11944186	10.117902
12	12	97.22296	0.2519995	78.80660	10.435047	0.12229329	10.241302
13	13	97.46067	0.2503018	78.90756	10.640954	0.12503455	10.457748
14	14	97.80197	0.2466426	79.44032	10.332058	0.12086584	10.236866
15	15	97.51163	0.2485661	79.53833	10.405177	0.12277524	10.339334
16	16	97.49860	0.2495965	79.70033	10.475061	0.12437897	10.611861
17	17	97.28353	0.2531286	79.56457	10.631252	0.12784588	10.877511
18	18	97.27596	0.2529997	79.52118	10.616188	0.12765872	10.799715
19	19	97.33461	0.2524063	79.60462	10.769907	0.13009650	10.978440
20	20	97.49119	0.2509441	79.57425	11.113977	0.13387351	11.106607
21	21	97.90660	0.2460191	79.77958	10.949817	0.13080825	11.026393
22	22	98.13650	0.2434011	79.96609	10.798086	0.12856999	10.866242
23	23	98.41039	0.2400690	80.15245	10.803643	0.12763852	10.897287
24	24	98.32588	0.2416834	80.04255	10.770348	0.12760130	10.858942
25	25	98.39385	0.2409276	80.08634	10.775847	0.12765532	10.866819
26	26	98.49455	0.2397761	80.16953	10.851972	0.12865248	10.921590
27	27	98.59462	0.2386775	80.26884	10.888720	0.12904477	10.948998
28	28	98.61359	0.2384379	80.30859	10.897059	0.12912645	10.953593

Table 30 demonstrate the final selected factors of backward selection method and its coefficients

Table 30: Coefficient of the final backward model of English Test-Score of 6th Students in original survey

(Intercept)	49.8582009	ATTITUDE_ENG.5	0.1819962
INTEREST_ENG.5	0.1873185	HOMEWOK_CORR_MATH	0.3371550
SATISIFACTION_LEARNING_ENG.5	0.1182473	STUDYINTEREST_MATH.5	-0.2147371
STEP_CLASSMATERELATION.5	8.9060675	MATH_ENG_STRESS_5	0.2077809
HARD_WORK.5	0.1280441		

Table 31 shows the results of forward and cross-validation selection to the survey data build Linear Regression for predicting English and Test-Score of 5th students. It seems that 8 variables are the best model of smallest RMSE (96.77736).

Table 31: Results of forward model of English Test-Score of 5th Students in original data

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Education Test-Score Performance of 5'th and 9'th Grade Students

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	106.30717	0.1171712	86.93493	6.927372	0.0911321	6.794523
2	2	100.08169	0.2083530	81.39738	7.746306	0.1240913	8.324279
3	3	97.85771	0.2378998	79.26678	7.904563	0.1260353	7.083754
4	4	97.21636	0.2476375	78.90874	7.558966	0.1129801	6.881921
5	5	97.55525	0.2440499	78.86344	8.629339	0.1171077	7.769884
6	6	97.24456	0.2480859	78.77327	8.476099	0.1168628	6.651940
7	7	96.91210	0.2516047	79.05892	8.607947	0.1207315	6.882358
8	8	96.77736	0.2562212	78.61978	9.181956	0.1254442	7.462151
9	9	97.07803	0.2519545	78.86226	9.074029	0.1189595	7.269339
10	10	97.25485	0.2505275	78.93747	9.321167	0.1195899	7.646306
11	11	97.57657	0.2459504	79.31271	9.294660	0.1172007	7.499377
12	12	98.30904	0.2383083	79.86459	9.613623	0.1223096	7.632558
13	13	98.33550	0.2360939	79.74850	9.600776	0.1271879	7.759900
14	14	98.50140	0.2338908	79.92396	9.581175	0.1259255	7.908688
15	15	98.83388	0.2291880	80.08811	9.469823	0.1260934	7.827391
16	16	99.09289	0.2276387	80.31254	9.804669	0.1271221	7.775522
17	17	98.89793	0.2301952	80.10063	9.678079	0.1267469	7.875595
18	18	99.23824	0.2265772	80.33400	9.952459	0.1325702	7.813691
19	19	99.17398	0.2272624	80.34522	10.016959	0.1330442	7.882455
20	20	99.38490	0.2240229	80.61422	9.568986	0.1282752	7.457553
21	21	99.62286	0.2215631	80.79415	9.568932	0.1288395	7.270145
22	22	99.48924	0.2234206	80.71797	9.519316	0.1280629	7.240697
23	23	99.69251	0.2212366	80.92967	9.520207	0.1275483	7.264241
24	24	99.67556	0.2218358	80.89863	9.598906	0.1274400	7.335090
25	25	99.72543	0.2213029	80.97170	9.604033	0.1275898	7.307681
26	26	99.77473	0.2207483	80.98516	9.583947	0.1273151	7.314609
27	27	99.78450	0.2207044	80.98245	9.624207	0.1278210	7.326661
28	28	99.79782	0.2205729	80.98797	9.631359	0.1278557	7.343408

Table 32 demonstrate the final selected factors of forward selection method and its coefficients

Table 32: Coefficient of the final forward model of English Test-Score of 6th Students in original survey

(Intercept)	ATTITUDE_ENG.5
49.8582009	0.1819962
INTEREST_ENG.5	HOMEWOK_CORR_MATH
0.1873185	0.3371550
SATISIFACTION_LEARNING_ENG.5	STUDYINTEREST_MATH.5
0.1182473	-0.2147371
STEP_CLASSMATERELATION.5	MATH_ENG_STRESS_5
8.9060675	0.2077809
HARD_WORK.5	
0.1280441	

Table 33 shows the results of stepwise and cross-validation selection to the survey data build Linear Regression for predicting English and Test-Score of 5th students. It seems that 11 variables are the best model of smallest RMSE (97.35267).

Table 33: Results of stepwise model of English Test-Score of 5th Students in original data

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Education Test-Score Performance of 5th and 9th Grade Students

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	107.31442	0.08970171	87.78679	6.421076	0.06696958	5.348012
2	2	100.80395	0.19618096	81.47100	5.713018	0.09310510	5.192990
3	3	99.17176	0.22712826	80.10917	6.931000	0.11455012	6.785977
4	4	99.06281	0.22583880	80.07863	7.387891	0.12153159	7.892417
5	5	98.71517	0.23545123	79.55295	6.564105	0.12375192	7.727642
6	6	99.08423	0.22403914	80.52927	5.881021	0.11509610	7.076667
7	7	100.61091	0.20486279	82.79300	4.498962	0.09101214	6.258348
8	8	98.70979	0.23854293	79.24878	7.987741	0.12350188	8.137921
9	9	99.16862	0.23310794	80.67195	7.448768	0.11306046	8.430625
10	10	97.96078	0.25025876	79.01075	6.600477	0.11084849	8.385936
11	11	97.35267	0.25998953	78.65302	7.407283	0.12805874	9.004991
12	12	97.63480	0.25827711	79.23945	7.589932	0.12269442	8.889582
13	13	97.71851	0.25877942	79.58047	8.030621	0.13194950	9.791784
14	14	97.78083	0.26034700	79.65571	8.039742	0.13194388	10.108107
15	15	98.71161	0.24632680	80.34078	8.194157	0.13090487	10.072346
16	16	98.64350	0.24777804	80.29825	8.075480	0.12691504	10.081598
17	17	97.90761	0.25253874	79.27122	6.979046	0.12379263	8.793556
18	18	98.80942	0.24706329	80.25638	8.846062	0.12843897	10.763212
19	19	98.57317	0.24886272	79.86715	8.572390	0.12902599	10.261283
20	20	98.65660	0.24838634	79.98866	8.742316	0.13344223	10.441710
21	21	99.03078	0.24338319	80.20378	8.766265	0.13143375	10.561089
22	22	98.72252	0.24743645	80.04574	8.732415	0.13091286	10.620652
23	23	99.03841	0.24209092	80.50304	8.178682	0.12864718	9.919866
24	24	99.09784	0.24218270	80.53874	8.707378	0.13131835	10.595587
25	25	99.18690	0.24237137	80.59237	8.836278	0.13165297	10.640286
26	26	98.98722	0.24154833	80.24436	8.124911	0.12735063	10.056246
27	27	99.36209	0.23956911	80.58668	8.728395	0.12956643	10.700425
28	28	99.32981	0.23926315	80.51570	8.689642	0.12966466	10.671424

Table 34 demonstrate the final selected factors of stepwise selection method and its coefficients

Table 34: Coefficient of the final stepwise model of English Test-Score of 5th Students in original survey

(Intercept)	ATTITUDE_ENG.5
56.41149441	0.17516942
INTEREST_ENG.5	CAMPUS_CONDITION.5
0.19882367	-0.09737558
HOMEWOK_CORR_MATH	SATISIFACTION_LEARNING_ENG.5
0.34965731	0.12199143
STUDYINTEREST_MATH.5	STEP_CLASSMATERELATION.5
-0.18384490	9.74382049
MATH_ENG_STRESS_5	SOCIAL_MORALS.5
0.20076194	0.12718986
HARD_WORK.5	AWARE.5
0.13672720	-0.09949934

In conclusion, we choose the final backward model which has the smallest RMSE (96.43758) e. The factors in this model are ATTITUDE_ENG.5, INTEREST_ENG.5, HOMEWOK_CORR_MATH, SATISIFACTION_LEARNING_ENG.5, STUDYINTEREST_MATH.5,

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STEP_CLASSMATERELATION.5,
MATH_ENG_STRESS_5, HARD_WORK.5.

Table 35 shows the results of backward and cross-validation selection to the survey data build Linear Regression for predicting English and Test-Score of 9th students. It seems that 21 variables are the best model of smallest RMSE (80.21411).

Table 35: Results of backward model of English Test-Score of 9th Students in original data

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	83.66072	0.1794085	66.36241	9.796247	0.10192285	6.638337
2	2	84.00385	0.1845479	66.32792	10.245981	0.10056032	7.043160
3	3	82.79470	0.2148798	65.49425	10.564889	0.11787272	6.959261
4	4	82.83267	0.2140188	65.11660	10.143914	0.10661602	6.174797
5	5	82.91717	0.2089214	65.02339	9.817277	0.10193166	5.583376
6	6	82.04321	0.2237993	64.20846	9.274375	0.10494245	5.117426
7	7	81.57647	0.2267652	63.93766	8.767673	0.09318010	5.155877
8	8	81.19701	0.2403731	63.42235	10.098583	0.09735923	5.924977
9	9	80.98055	0.2421854	63.15793	9.826191	0.08613078	6.062315
10	10	80.88516	0.2512945	62.62013	10.837025	0.08297857	6.904961
11	11	81.09273	0.2489484	62.76007	10.833319	0.08054404	7.067345
12	12	80.95239	0.2546106	62.40149	11.340282	0.08705853	7.297132
13	13	80.94299	0.2553517	62.25148	11.610223	0.08834593	7.665338
14	14	81.39985	0.2518247	62.94335	12.057495	0.08803407	8.121363
15	15	81.04501	0.2576026	62.71961	12.091007	0.09216970	8.115783
16	16	81.06045	0.2574060	62.68898	12.114600	0.09264068	8.425724
17	17	80.74615	0.2608889	62.58573	11.821052	0.09009228	8.348727
18	18	80.64507	0.2637695	62.83577	12.151052	0.09442841	8.618802
19	19	80.61433	0.2670258	62.86961	12.572302	0.09271981	8.679448
20	20	80.35889	0.2707159	62.58739	12.494425	0.09222761	8.679562
21	21	80.21411	0.2723505	62.41761	12.284475	0.09590323	8.522845
22	22	80.43046	0.2684600	62.51493	12.100159	0.09251063	8.326969
23	23	80.45931	0.2681856	62.50924	12.130005	0.09216951	8.384577
24	24	80.32303	0.2702368	62.41766	12.177759	0.09380132	8.481676
25	25	80.42001	0.2683606	62.48829	12.240527	0.09547636	8.605559
26	26	80.38308	0.2695383	62.43016	12.400652	0.09665818	8.707668
27	27	80.31669	0.2704321	62.35883	12.401302	0.09674404	8.716322
28	28	80.29344	0.2707911	62.33372	12.396538	0.09640002	8.720724

Table 36 demonstrate the final selected factors of backward selection method and its coefficients

Table 36: Coefficient of the final backward model of English Test-Score of 9th Students in original survey

(Intercept)

ATTITUDE_ENG.9

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31.45910460	0.10096977
INTEREST_ENG.9	CLASSMATERELATION.9
0.19943074	-0.05554998
CAMPUS_CONDITION.9	STUDYATTITUDE_MATH_9
-0.07246136	0.10391110
SATISIFACTION_LEARNING_MATH.9	THR_MATH_NEW.9
0.11354915	0.04131804
PISA_12_ST81_ENG.9	SATISIFACTION_LEARNING_ENG.9
0.05122670	0.08139264
STRATEGE_ENG.9	HOMEWOK_CORR_ENG.9
0.13557745	-0.10401341
STEP_CLASSMATERELATION.9	MATH_ENG_STRESS_9
-8.61765196	0.09099346
MANNERS.9	SOCIAL_MORALS.9
-0.17728490	0.14382921
SENSE_HONOR.9	HARD_WORK.9
0.09418611	-0.10764102
SOLIDARITY_FRIENDSHIP.9	MORAL_DUTY.9
0.06082465	-0.13292568
GRA_GEOMETRY.9	SELF_PROTECTION.9
0.19216913	0.28659911

Table 37 shows the results of forward and cross-validation selection to the survey data build Linear Regression for predicting English and Test-Score of 9th students. It seems that 26 variables are the best model of smallest RMSE (78.36493).

Table 37: Results of forward model of English Test-Score of 9th Students in original data

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	84.87665	0.1449221	67.60884	10.93630	0.04946970	8.309408
2	2	83.35106	0.1716555	66.22292	11.19073	0.06904395	8.021495
3	3	81.81599	0.2016933	64.78513	10.37354	0.07641515	7.435379
4	4	81.68481	0.2101377	64.06949	10.53578	0.09577533	8.361769
5	5	80.99181	0.2245732	63.13413	10.84498	0.10397591	8.241187
6	6	80.63301	0.2310784	63.20841	10.95601	0.09248901	8.029456
7	7	80.47836	0.2395280	63.34736	11.74061	0.10994278	8.418503
8	8	80.38441	0.2403015	63.11657	12.84157	0.12377686	9.304061
9	9	80.01220	0.2474213	62.58371	12.41130	0.10976454	9.120365
10	10	80.00599	0.2491695	62.60430	12.26842	0.10788574	9.129555
11	11	79.55687	0.2573135	62.27539	11.99599	0.10661347	9.102346
12	12	79.11081	0.2659141	61.72775	12.30943	0.10931340	9.420362
13	13	79.13310	0.2659344	61.94633	12.38770	0.11553588	9.682781
14	14	79.07023	0.2680414	61.77795	12.81478	0.11979917	10.193396
15	15	79.37241	0.2629374	62.15111	12.64110	0.11436678	10.009457
16	16	79.13385	0.2666728	62.09189	12.82707	0.11547219	10.100585
17	17	79.08544	0.2676876	62.01848	12.86080	0.11284603	9.942078
18	18	79.01369	0.2683984	61.90507	12.74055	0.11337351	9.633711
19	19	78.92952	0.2703610	61.81745	12.48284	0.11011917	9.260420
20	20	78.79081	0.2720974	61.79074	12.64931	0.11135627	9.337116
21	21	78.65291	0.2737143	61.57654	12.72735	0.11369148	9.273431
22	22	78.51893	0.2758123	61.45049	12.72541	0.11537376	9.233260
23	23	78.46572	0.2769493	61.41728	12.61349	0.11394195	9.171985
24	24	78.41849	0.2778227	61.34176	12.46344	0.11429563	9.022465
25	25	78.51376	0.2763176	61.39025	12.53534	0.11397577	9.093743
26	26	78.36493	0.2786878	61.23748	12.58323	0.11426675	9.200404
27	27	78.42621	0.2777642	61.25356	12.50793	0.11310266	9.139537

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28 28 78.42501 0.2777337 61.27290 12.49813 0.11293132 9.123987

Table 38 demonstrate the final selected factors of forward selection method and its coefficients

Table 38: Coefficient of the final forward model of English Test-Score of 9th Students in original survey

(Intercept)	53.96138580	ATTITUDE_ENG.9	0.10489767
INTEREST_ENG.9	0.20610078	CLASSMATERELATION.9	-0.05703110
STUDYINTEREST_MATH.9	-0.04427702	CAMPUS_CONDITION.9	-0.06992796
STUDYATTITUDE_MATH.9	0.10359152	SATISIFACTION_LEARNING_MATH.9	0.12533295
STRATEGY_MATH.9	0.03798594	THR_MATH_NEW.9	0.04638646
PISA_12_ST81_ENG.9	0.04566965	THR_ENG_NEW.9	-0.02247754
SATISIFACTION_LEARNING_ENG.9	0.08174035	STRATEGE_ENG.9	0.12817481
HOMEWOK_CORR_ENG.9	-0.09574697	STEP_CLASSMATERELATION.9	-8.44138829
MATH_ENG_STRESS.9	0.09123170	MANNERS.9	-0.18712672
SOCIAL_MORALS.9	0.13402812	SENSE_HONOR.9	0.09346656
HARD_WORK.9	-0.11522297	SOLIDARITY_FRIENDSHIP.9	0.06090776
MORAL_DUTY.9	-0.14923905	THRIFTY.9	0.03512577
MP_ADD.9	-0.03304371	GRA_GEOMETRY.9	0.19546438
SELF_PROTECTION.9	0.28526181		

Table 39 shows the results of stepwise and cross-validation selection to the survey data build Linear Regression for predicting English and Test-Score of 9th students. It seems that 21 variables are the best model of smallest RMSE (78.91380).

Table 39: Results of stepwise model of English Test-Score of 9th Students in original data

nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	85.23346	0.1542071	67.49322	8.648361	0.07753360	6.286938
2	85.10713	0.1519406	67.68731	8.632575	0.06517817	6.201341
3	84.33465	0.1755801	66.93217	9.217817	0.13196505	7.775059
4	84.21534	0.1829470	66.40881	9.362210	0.12514284	7.507945
5	82.73521	0.2038341	64.94619	9.370806	0.11356263	7.003310
6	83.34975	0.1950204	65.79993	9.306528	0.10910582	7.051463
7	82.08921	0.2192876	64.39764	8.547797	0.08125170	6.575521
8	82.23636	0.2150661	64.70252	9.551177	0.10687007	6.965613
9	80.68093	0.2384505	63.00174	8.058214	0.08364131	5.903869

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10	10	81.53484	0.2286926	63.94336	10.270907	0.10413878	7.528845
11	11	79.59480	0.2560295	62.36854	8.932574	0.09236309	6.639013
12	12	80.45645	0.2422077	62.61426	9.436092	0.08308227	7.721424
13	13	80.87578	0.2364724	63.28496	9.398410	0.11527003	7.424037
14	14	80.45387	0.2468499	62.94418	10.269385	0.10917981	7.856113
15	15	80.50986	0.2436687	62.64243	10.761430	0.10107343	8.330744
16	16	79.66966	0.2615002	62.09193	10.150323	0.10189994	8.246666
17	17	79.21634	0.2701028	61.69686	9.895039	0.09687027	8.389768
18	18	79.21483	0.2597426	62.23715	9.264171	0.09780843	7.572129
19	19	79.38852	0.2559411	62.06750	9.134457	0.08711507	8.357703
20	20	80.07489	0.2562017	62.32313	10.328393	0.09566608	8.390882
21	21	78.91380	0.2729647	61.30794	9.577403	0.09195051	7.972361
22	22	79.67840	0.2536248	62.45887	9.727888	0.09120513	8.235706
23	23	79.89151	0.2588231	61.69517	8.734276	0.06866993	7.315392
24	24	80.80691	0.2448159	62.30804	10.119762	0.10914081	8.068067
25	25	79.50380	0.2609131	61.74571	9.545888	0.09419545	7.872814
26	26	81.27221	0.2318797	62.78982	9.254507	0.06917826	7.499858
27	27	79.74660	0.2551348	61.79720	9.898783	0.10398266	8.280647
28	28	79.27167	0.2670838	61.60120	9.769941	0.09784146	7.925631

Table 40 demonstrate the final selected factors of

stepwise selection method and its coefficients

Table 40: Coefficient of the final stepwise model of English Test-Score of 9th Students in original survey

(Intercept)	ATTITUDE_ENG.9	
31.45910460	0.10096977	
INTEREST_ENG.9	CLASSMATERELATION.9	
0.19943074	-0.05554998	
CAMPUS_CONDITION.9	STUDYATTITUDE_MATH.9	
-0.07246136	0.10391110	
SATISIFACTION_LEARNING_MATH.9	THR_MATH_NEW.9	
0.11354915	0.04131804	
PISA_12_ST81_ENG.9	SATISIFACTION_LEARNING_ENG.9	
0.05122670	0.08139264	
STRATEGE_ENG.9	HOMEWOK_CORR_ENG.9	
0.13557745	-0.10401341	
STEP_CLASSMATERELATION.9	MATH_ENG_STRESS.9	
-8.61765196	0.09099346	
MANNERS.9	SOCIAL_MORALS.9	
-0.17728490	0.14382921	
SENSE_HONOR.9	HARD_WORK.9	
0.09418611	-0.10764102	
SOLIDARITY_FRIENDSHIP.9	MORAL_DUTY.9	
0.06082465	-0.13292568	
GRA_GEOMETRY.9	SELF_PROTECTION.9	
0.19216913	0.28659911	

In conclusion, we choose the final forward model as it has the smallest RMSE (78.36493). The factors in this model are ATTITUDE_ENG.9, INTEREST_ENG.9, CLASSMATERELATION.9, CAMPUS_CONDITION.9, STUDYATTITUDE_MATH.9, SATISIFACTION_LEARNING_MATH.9, THR_MATH_NEW.9, PISA_12_ST81_ENG.9, SATISIFACTION_LEARNING_ENG.9, STRATEGE_ENG.9, HOMEWOK_CORR_ENG.9, STEP_CLASSMATERELATION.9, MATH_ENG_STRESS.9, MANNERS.9, SOCIAL_MORALS.9, SENSE_HONOR.9, HARD_WORK.9, SOLIDARITY_FRIENDSHIP.9, MORAL_DUTY.9, GRA_GEOMETRY.9, SELF_PROTECTION.9

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Table 41 shows the results of backward cross-validation selection to the survey data build Linear Regression for predicting Math and Test-Score of 5th students. It seems that 6 variables are the best model of smallest RMSE (97.39460).

Table 41: Results of backward model of Math Test-Score of 5th Students in original data

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	97.84311	0.11057397	78.00083	10.444703	0.04765767	7.197569
2	2	98.11514	0.10881457	78.18481	10.056523	0.04630274	7.828095
3	3	98.83029	0.09618406	78.30735	10.428833	0.03470037	7.964987
4	4	97.63091	0.11549664	76.87042	10.328009	0.04001754	8.146223
5	5	98.15626	0.11135593	77.72338	9.634991	0.04128930	7.259743
6	6	97.39460	0.12858928	77.20906	9.329619	0.05889646	7.003984
7	7	98.76862	0.11731970	78.04837	9.728966	0.06396073	7.986774
8	8	98.85513	0.11971632	78.13624	9.244026	0.06307340	7.225781
9	9	99.53307	0.11340007	78.77058	9.213411	0.06727451	6.920388
10	10	98.71429	0.12573879	77.99611	9.108767	0.05310736	6.606173
11	11	98.14475	0.13558487	77.63536	8.802768	0.05257514	6.507373
12	12	97.90847	0.14064546	77.29983	8.983135	0.06282472	6.691281
13	13	97.77206	0.14606187	77.05637	9.224129	0.06913081	7.075517
14	14	97.51369	0.14998854	76.95643	9.309368	0.07352042	6.978320
15	15	97.96107	0.14153042	77.28139	9.383429	0.06962861	6.927270
16	16	98.11947	0.13999476	77.33411	9.729253	0.07139587	7.431965
17	17	98.11671	0.14207700	77.43305	9.916394	0.07424407	7.400346
18	18	98.19225	0.14318964	77.48216	10.121400	0.07755527	7.535687
19	19	98.24150	0.14310587	77.50424	10.225185	0.07873641	7.581666
20	20	98.12103	0.14324711	77.43616	10.199276	0.07529500	7.391243
21	21	98.08640	0.14366128	77.48404	10.259192	0.07631502	7.480181
22	22	98.00604	0.14507407	77.52704	10.188234	0.07812898	7.369411
23	23	97.98874	0.14556305	77.46869	10.156874	0.07907636	7.301145
24	24	97.96433	0.14657184	77.53188	10.249945	0.07921823	7.479184
25	25	97.84625	0.14904226	77.44536	10.291282	0.08189763	7.522371
26	26	97.79083	0.14961190	77.35641	10.341521	0.08293871	7.614108
27	27	97.66617	0.15153394	77.21049	10.316422	0.08366140	7.562421
28	28	97.69557	0.15194422	77.25063	10.388463	0.08490681	7.651549

The Table 42 demonstrate the final selected factors of backward selection method and its coefficients

Table 42: Coefficient of the final backward model of Math Test-Score of 5th Students in original survey

(Intercept)	ATTITUDE_ENG.5	THR_ENG_NEW.5	HOMEWOK_CORR_M
ATH			
178.5250480	0.2141206	-0.1887391	0.
2487281			
HOMEWOK_CORR_ENG.5	MATH_ENG_STRESS_5	SOCIAL_MORALS.5	

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0.1674041 0.1143441 0.1680319

Table 43 shows the results of forward cross-validation selection to the survey data build Linear Regression for predicting Math and Test-Score of 5th students. It seems that 2 variables are the best model of smallest RMSE (97.61422).

Table 43: Results of forward model of Math Test-Score of 5th Students in original data

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	97.83832	0.1049000	77.93062	10.264916	0.06116329	8.458077
2	2	97.61422	0.1141159	77.54858	10.502108	0.05497628	9.140548
3	3	98.25351	0.1042511	78.27758	10.262168	0.05870023	7.955360
4	4	98.15228	0.1161045	78.48255	10.727266	0.07124092	7.704065
5	5	98.91081	0.1066101	78.60514	10.778702	0.06829029	7.725138
6	6	98.44168	0.1163322	78.37209	10.232613	0.07263986	6.876581
7	7	98.61890	0.1156407	77.67175	9.638467	0.06975623	7.129889
8	8	97.62558	0.1257011	76.47218	9.083901	0.07098056	7.338067
9	9	97.95267	0.1200397	76.78740	8.658124	0.06973385	7.223165
10	10	98.62368	0.1138081	76.92399	8.639354	0.07517011	7.349862
11	11	99.02099	0.1083949	77.40641	8.839886	0.07127566	7.064241
12	12	98.78445	0.1129739	77.08777	8.399925	0.07439665	6.783392
13	13	98.66266	0.1150068	77.00653	7.894852	0.07319092	6.285704
14	14	98.84710	0.1108773	76.97865	8.133782	0.06589232	6.949120
15	15	98.80543	0.1120791	77.03701	7.879759	0.06752656	6.542332
16	16	98.70565	0.1131617	76.87660	7.894275	0.06720565	6.594806
17	17	98.40363	0.1168254	76.72443	8.075715	0.06393143	6.650401
18	18	98.44458	0.1177454	76.65948	8.396959	0.06114397	6.987474
19	19	98.43309	0.1177650	76.63111	8.593729	0.06254538	7.248793
20	20	98.46874	0.1179996	76.79040	8.625978	0.06339578	7.080467
21	21	98.67435	0.1160565	76.99188	8.659273	0.06644836	7.245101
22	22	98.70738	0.1155386	77.08509	8.783614	0.06774239	7.220437
23	23	98.65482	0.1158892	76.99128	8.877967	0.06493074	7.230532
24	24	98.74227	0.1149323	77.09074	8.742183	0.06278822	7.069529
25	25	98.51679	0.1174011	76.77774	8.730161	0.06398288	7.092798
26	26	98.53713	0.1174887	76.86698	8.767393	0.06247479	7.092490
27	27	98.47353	0.1183745	76.80816	8.754247	0.06307105	7.021966
28	28	98.45024	0.1186144	76.77550	8.760951	0.06252087	7.065518

Table 44 demonstrate the final selected factors of forward selection method and its coefficients

Table 44: Coefficient of the final forward model of Math Test-Score of 5th Students in original survey

(Intercept)	ATTITUDE_ENG_5	HOMEWOK_CORR_MATH
296.0711256	0.1937362	0.3078867

Table 45 shows the results of stepwise and cross-validation selection to the survey data build Linear

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students. It seems that 27 variables are the best
model of smallest RMSE (97.45196).

Table 45: Results of stepwise model of Math Test-Score of 5th Students in original data

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	98.38140	0.1340074	78.27307	11.06852	0.12267972	6.253139
2	2	99.31056	0.1095562	78.94063	12.72111	0.12619725	8.196681
3	3	98.54075	0.1093756	79.08854	12.21778	0.07245265	7.723392
4	4	97.76152	0.1419009	78.13329	13.20990	0.11068534	8.115417
5	5	97.92646	0.1189364	78.14034	12.92498	0.08962180	8.450876
6	6	97.78298	0.1324680	77.25412	14.52277	0.10787949	9.995402
7	7	97.47155	0.1359860	76.99488	13.52040	0.09966895	9.458503
8	8	98.82812	0.1146784	78.06529	14.33821	0.10308181	9.224968
9	9	98.45814	0.1252499	77.88360	14.57626	0.10235987	9.977088
10	10	98.46696	0.1350502	77.97262	15.02495	0.09353878	10.296057
11	11	98.37146	0.1284650	78.30834	13.46838	0.09037292	8.577588
12	12	97.87497	0.1409536	77.04605	15.37769	0.10816016	10.834508
13	13	98.12121	0.1403175	77.88161	14.91261	0.09781753	9.185447
14	14	98.16772	0.1403109	77.84504	15.01361	0.09736446	9.690441
15	15	97.71417	0.1494331	77.38794	15.63248	0.10619584	11.144013
16	16	97.57994	0.1511939	76.29694	14.59067	0.10120304	9.637321
17	17	98.39050	0.1405424	77.47619	15.70186	0.09555136	10.679103
18	18	98.81367	0.1352474	77.67711	15.53661	0.10605422	10.643464
19	19	97.95341	0.1442274	77.24926	15.04201	0.09321537	10.245918
20	20	98.34320	0.1446552	77.40087	15.77468	0.10210807	10.917883
21	21	98.04831	0.1410562	77.41012	14.95214	0.09186655	10.149406
22	22	98.07181	0.1433694	77.20178	15.40242	0.09352029	10.734134
23	23	98.49504	0.1365321	77.28043	15.09162	0.09285296	10.327849
24	24	97.70624	0.1477592	77.46660	15.21492	0.09457626	10.190017
25	25	97.45403	0.1490947	76.97338	14.95431	0.09445163	9.825713
26	26	98.05046	0.1451978	77.48908	15.12093	0.09229230	10.511494
27	27	97.45196	0.1487500	77.09416	14.66015	0.08827318	10.070035
28	28	98.03070	0.1455404	77.43309	15.30575	0.09364053	10.647288

The Table 46 demonstrate the final selected factors
of stepwise selection method and its coefficients

Table 46: Coefficient of the final stepwise model of
Math Test-Score of 5th Students in original survey

(Intercept)	174.859552703	ATTITUDE_ENG.5	0.195350924
INTEREST_ENG.5	0.033784231	CLASSMATERELATION.5	-0.096217970
CAMPUS_CONDITION.5	-0.162006819	SATISIFACTION_LEARNING_MATH.5	0.068396171
STRATEGY_MATH.5	0.035451131	THR_MATH_NEW.5	-0.047967438
PISA_12_ST81_ENG.5	0.009242554	THR_ENG_NEW.5	-0.165682324
HOMEWOK_CORR_MATH	0.249424201	STRATEGE_ENG.5	0.045092019
SATISIFACTION_LEARNING_ENG.5	-0.045859473	HOMEWOK_CORR_ENG.5	0.143577107
STUDYINTEREST_MATH.5		STEP_CLASSMATERELATION.5	

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-0.046776786	10.518360761
PISA_12_ST81_MATH.5	MATH_ENG_STRESS_5
0.104982387	0.109167839
MANNERS.5	SOCIAL_MORALS.5
-0.233720122	0.189964242
HARD_WORK.5	MP_ADD_5
0.034661371	-0.051183785
SOLIDARITY_FRIENDSHIP.5	MORAL_DUTY.5
0.063084836	0.117125506
THRIFTY.5	AWARE.5
0.057619500	-0.133020668
SENSE_HONOR.5	GRA_GEOMETRY.5
0.087400010	0.110288468

In conclusion, we choose the final backward model which has the smallest RMSE (97.39460). The factors in this model are ATTITUDE_ENG.5 THR_ENG_NEW.5 HOMEWOK_CORR_MATH HOMEWOK_CORR_ENG.5 MATH_ENG_STRESS_5 SOCIAL_MORALS.5

Table 47 shows the results of backward and cross-validation selection to the survey data build Linear Regression for predicting Math and Test-Score of 9th students. It seems that 20 variables are the best model of smallest RMSE (79.18542).

Table 47: Results of backward model of Math Test-Score of 9th Students in original data

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	83.08469	0.1478960	66.01277	11.473151	0.04922824	7.824142
2	2	80.42130	0.2040504	63.58141	11.397996	0.05847961	7.493960
3	3	81.09315	0.1896044	64.24517	10.087204	0.02981378	7.097762
4	4	80.91556	0.1952370	64.53194	10.797734	0.03213404	7.450601
5	5	81.12986	0.1955959	64.56807	10.809391	0.04831034	7.475404
6	6	81.89957	0.1820369	65.48749	10.669389	0.05450814	7.310257
7	7	82.34360	0.1778636	65.56939	10.246233	0.05285792	6.913898
8	8	82.28369	0.1792353	65.41424	10.389615	0.05140440	7.197263
9	9	81.99249	0.1867853	65.06921	10.811540	0.06261977	7.499186
10	10	82.00505	0.1871732	65.51503	10.767910	0.05910352	7.132131
11	11	82.02244	0.1879683	65.64629	10.619965	0.06312049	6.941136
12	12	81.58932	0.1943258	65.33496	10.371408	0.06059480	6.712746
13	13	81.09150	0.2036277	64.68652	10.454054	0.06835884	6.415745
14	14	80.01022	0.2237838	63.78871	10.502277	0.06566053	6.515208
15	15	79.86809	0.2258950	63.72523	10.513850	0.06049412	6.613057
16	16	79.67226	0.2304486	63.46784	10.801518	0.06885399	6.594236
17	17	79.30124	0.2362932	63.26120	9.953876	0.06298988	6.138307
18	18	79.35060	0.2373573	63.29583	9.480102	0.06539116	5.702374
19	19	79.24737	0.2412526	63.17823	9.770769	0.06768515	5.856316
20	20	79.18542	0.2421454	63.06054	9.940851	0.06702937	6.186048
21	21	79.40576	0.2387512	63.18048	9.851252	0.06534475	6.221542
22	22	79.49284	0.2369803	63.28822	9.812651	0.06227586	6.291957
23	23	79.44710	0.2383324	63.21396	9.746622	0.06449519	6.293639
24	24	79.54520	0.2366375	63.32662	9.674416	0.06385212	6.292114
25	25	79.57527	0.2362300	63.36824	9.659403	0.06364806	6.247003
26	26	79.68007	0.2347119	63.39166	9.567632	0.06200628	6.206067
27	27	79.70398	0.2344556	63.39502	9.602971	0.06231299	6.231542
28	28	79.71337	0.2342956	63.37481	9.600848	0.06278388	6.253704

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Table 48 demonstrate the final selected factors of
backward selection method and its coefficients

Table 48: Coefficient of the final backward model
of Math Test-Score of 9th Students in original survey

(Intercept)	121.98616120	ATTITUDE_ENG.9	0.11099561
CLASSMATERELATION.9	-0.07754025	STUDYINTEREST_MATH.9	0.10217889
CAMPUS_CONDITION.9	-0.14748403	SATISIFACTION_LEARNING_MATH.9	0.26080136
THR_MATH_NEW.9	0.06592582	PISA_12_ST81_ENG.9	0.13565099
SATISIFACTION_LEARNING_ENG.9	-0.07944674	HOMEWOK_CORR_ENG.9	-0.10323092
MATH_ENG_STRESS.9	0.03736845	MANNERS.9	-0.22820089
SOCIAL_MORALS.9	0.22058516	SENSE_HONOR.9	0.15573265
HARD_WORK.9	-0.10888006	SOLIDARITY_FRIENDSHIP.9	0.20032634
MORAL_DUTY.9	-0.22218912	THRIFTY.9	0.05902557
MP_ADD.9	-0.06040098	GRA_GEOMETRY.9	0.30984425
SELF_PROTECTION.9	0.19963737		

Table 49 shows the results of forward and cross-validation selection to the survey data build Linear Regression for predicting Math and Test-Score of 9th students. It seems that 17variables are the best model of smallest RMSE (80.24146) .

Table 49: Results of forward model of Math Test-Score of 9th Students in original data

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	83.68883	0.1410390	66.06677	6.072097	0.06515394	4.153679
2	2	81.11783	0.1936945	63.69847	5.801220	0.09445499	4.057824
3	3	81.74043	0.1841224	64.56161	6.570136	0.12173076	4.501733
4	4	82.33877	0.1771090	65.32474	6.322166	0.11795343	4.549133
5	5	83.41420	0.1692773	66.11531	6.590467	0.12052943	5.138754
6	6	83.70680	0.1663289	66.35870	5.969662	0.11569027	5.533882
7	7	83.62639	0.1712410	66.24893	6.532710	0.12035323	5.847540
8	8	83.60590	0.1732046	66.02055	6.229065	0.11785596	5.415908
9	9	83.40517	0.1755768	65.87172	6.074337	0.11989031	5.241170
10	10	83.43834	0.1776009	66.06664	6.299636	0.12308465	4.996483
11	11	83.06333	0.1857861	65.78825	6.495576	0.11740290	5.032086
12	12	83.17842	0.1847853	65.99460	5.687279	0.11490007	4.049094
13	13	82.81404	0.1914574	65.88326	5.680831	0.11406221	3.916134
14	14	82.33670	0.1992307	65.16464	6.105052	0.12421410	4.218572

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15	15	81.28650	0.2135465	64.41304	6.286224	0.12285718	4.049777
16	16	80.62505	0.2242298	63.78936	6.535509	0.12284847	4.075343
17	17	80.24146	0.2325505	63.25677	5.805684	0.12199358	3.993002
18	18	80.31578	0.2323121	63.35529	6.038716	0.12232463	4.372584
19	19	80.44770	0.2303859	63.40173	6.144105	0.12307157	4.445353
20	20	80.82128	0.2249847	63.66720	6.132859	0.11932998	4.593985
21	21	80.64740	0.2292197	63.38965	6.457038	0.12554999	4.935972
22	22	80.62368	0.2296273	63.24021	6.401337	0.12524448	4.855984
23	23	80.77107	0.2275671	63.35758	6.270179	0.12308477	4.696474
24	24	80.79851	0.2264321	63.31802	6.274922	0.12152687	4.647715
25	25	80.87685	0.2259323	63.37706	6.349139	0.12249256	4.688714
26	26	80.88223	0.2253773	63.33383	6.306214	0.12146001	4.642985
27	27	80.88171	0.2248037	63.36470	6.226111	0.12087092	4.561523
28	28	80.88289	0.2249481	63.38148	6.240615	0.12086875	4.588834

Table 50 demonstrate the final selected factors of forward selection method and its coefficients

Table 50: Coefficient of the final forward model of Math Test-Score of 9th Students in original survey

(Intercept)	ATTITUDE_ENG.9
100.93541036	0.10772280
CLASSMATERELATION.9	STUDYINTEREST_MATH.9
-0.07788717	0.11337173
CAMPUS_CONDITION.9	SATISIFACTION_LEARNING_MATH.9
-0.14864615	0.25904618
THR_MATH_NEW.9	PISA_12_ST81_ENG.9
0.06233785	0.14396538
SATISIFACTION_LEARNING_ENG.9	HOMEWOK_CORR_ENG.9
-0.07608592	-0.10373583
MANNERS.9	SOCIAL_MORALS.9
-0.22420399	0.24380281
SENSE_HONOR.9	HARD_WORK.9
0.15174848	-0.09777944
SOLIDARITY_FRIENDSHIP.9	MORAL_DUTY.9
0.20285936	-0.19502701
GRA_GEOMETRY.9	SELF_PROTECTION.9
0.30641084	0.20547794

Table 51 shows the results of stepwise and cross-validation selection to the survey data build Linear Regression for predicting Math and Test-Score of 9th students. It seems that 20 variables are the best model of smallest RMSE (78.32629).

Table 51: Results of stepwise model of Math Test-Score of 9th Students in original data

	nvmax	RMSE	Rsquared	MAE	RMSESD	RsquaredSD	MAESD
1	1	83.18267	0.1456005	66.05101	11.578704	0.07526664	8.400353
2	2	80.69206	0.2014067	63.78137	11.311542	0.08687302	8.272363
3	3	80.31356	0.2051515	63.88456	10.587982	0.07939790	7.564386

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4	4	82.62786	0.1608288	65.44092	9.481435	0.08977031	6.543070
5	5	82.07441	0.1722701	64.94859	9.504673	0.06870934	6.712453
6	6	82.14888	0.1753129	65.31744	10.156067	0.06897840	6.539609
7	7	81.39503	0.1873140	64.36313	10.165821	0.07481373	6.660352
8	8	82.86046	0.1589582	65.23805	10.603155	0.08101522	6.928109
9	9	81.20002	0.1912525	64.27774	9.510666	0.07116456	6.085045
10	10	82.03043	0.1793196	65.26605	11.632707	0.08874771	8.476239
11	11	81.65800	0.1785809	64.92924	11.005737	0.09129652	7.848896
12	12	80.94448	0.1971828	64.54962	9.670427	0.08999739	6.473696
13	13	80.89273	0.1918724	64.47804	11.024049	0.08799994	7.344878
14	14	82.77950	0.1635994	65.97759	10.875218	0.09116375	7.867743
15	15	79.68167	0.2183915	63.52298	9.848480	0.09999194	6.977942
16	16	79.65668	0.2177780	63.96311	11.582847	0.08949741	8.578256
17	17	79.92031	0.2100982	63.83777	8.235025	0.09015512	6.174151
18	18	80.97492	0.1948102	64.05846	10.514800	0.08616007	7.007165
19	19	78.62083	0.2393051	62.45618	9.702374	0.08982235	6.954764
20	20	78.32629	0.2393651	62.34105	9.285557	0.07438920	6.382198
21	21	81.08406	0.1928246	64.04848	12.153271	0.09332677	8.174280
22	22	80.63803	0.2048532	64.26692	10.014911	0.08467864	7.137687
23	23	80.92734	0.1967626	64.18358	11.221932	0.07453210	7.643489
24	24	79.67527	0.2211394	63.31123	10.780631	0.08248775	7.576999
25	25	79.69403	0.2171569	63.69690	9.705746	0.08271603	7.023458
26	26	80.90377	0.1993865	63.83857	10.764084	0.09271648	7.749028
27	27	79.12114	0.2261228	62.62440	10.854673	0.08525102	7.622616
28	28	79.30915	0.2271488	63.00905	9.860713	0.08344245	7.029540

Table 52 demonstrate the final selected factors of

stepwise selection method and its coefficients

Table 52: Coefficient of the final stepwise model of

Math Test-Score of 9th Students in original survey

(Intercept)	ATTITUDE_ENG.9	
121.98616120	0.11099561	
CLASSMATERELATION.9	STUDYINTEREST_MATH.9	
-0.07754025	0.10217889	
CAMPUS_CONDITION.9	SATISIFACTION_LEARNING_MATH.9	
-0.14748403	0.26080136	
THR_MATH_NEW.9	PISA_12_ST81_ENG.9	
0.06592582	0.13565099	
SATISIFACTION_LEARNING_ENG.9	HOMEWOK_CORR_ENG.9	
-0.07944674	-0.10323092	
MATH_ENG_STRESS.9	MANNERS.9	
0.03736845	-0.22820089	
SOCIAL_MORALS.9	SENSE_HONOR.9	
0.22058516	0.15573265	
HARD_WORK.9	SOLIDARITY_FRIENDSHIP.9	
-0.10888006	0.20032634	
MORAL_DUTY.9	THRIFTY.9	
-0.22218912	0.05902557	
MP_ADD.9	GRA_GEOMETRY.9	
-0.06040098	0.30984425	
SELF_PROTECTION.9		
0.19963737		

In conclusion, we choose the final stepwise model which has the smallest RMSE (78.32629). The factors contained in this

model are ATTITUDE_ENG.9 CLASSMATERELATION.9 STUDYINTEREST_MATH.9 CAMPUS_CONDITION.9 SATISIFACTION_LEARNING_MATH.9 THR_MATH_NEW.9 PISA_12_ST81_ENG.9 SATISIFACTION_LEARNING_ENG.9 HOMEWOK_CORR_ENG.9 MANNERS.9 SOCIAL_MORALS.9 SENSE_HONOR.9 HARD_WORK.9

4. Conclusion

In the analysis of PC component, we get a model of PC1, PC3, PC5, PC10, PC12 to predict English test score of 5th students while in the analysis of the original survey data we get a model of

ATTITUDE_ENG.5, INTEREST_ENG.5,
HOMEWOK_CORR_MATH,
SATISIFACTION_LEARNING_ENG.5,
STUDYINTEREST_MATH.5, to predict which is
consistent with the PC component (both has 5
variables in final model)

For the prediction of Math score of 5th students, the PC analysis preform a model of PC1, PC5, PC9, PC11.

while the model of the original survey analysis is

ATTITUDE_ENG.5 THR_ENG_NEW.5
HOMEWOK_CORR_MATH
HOMEWOK_CORR_ENG.5
MATH_ENG_STRESS_5 SOCIAL_MORALS.5

which is more complicated than the model got in the PC analysis.

For the prediction of English score of 9th students,

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the PC analysis perform a model of PC1, PC2, PC4,
PC5, PC13, PC14 while the model of the original
survey analysis is ATTITUDE_ENG.9,
INTEREST_ENG.9, CLASSMATERELATION.9,
CAMPUS_CONDITION.9

STUDYATTITUDE_MATH_9

SATISIFACTION_LEARNING_MATH.9

THR_MATH_NEW.9 PISA_12_ST81_ENG.9

SATISIFACTION_LEARNING_ENG.9

STRATEGE_ENG.9

HOMEWOK_CORR_ENG.9

STEP_CLASSMATERELATION.9

MATH_ENG_STRESS_9 MANNERS.9

SOCIAL_MORALS.9 SENSE_HONOR.9

HARD_WORK.9

SOLIDARITY_FRIENDSHIP.9

MORAL_DUTY.9

GRA_GEOMETRY.9

SELF_PROTECTION.9

Which is more complicated.

For the prediction of the Math score of 9th students,
the model of the PC analysis is PC1, PC2, PC3, PC4,
PC5, PC7, PC10, PC13, PC14, PC15 while the
variable in the original data analysis model are
ATTITUDE_ENG.9 CLASSMATERELATION.9

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STUDYINTEREST_MATH.9

CAMPUS_CONDITION.9

SATISIFACTION_LEARNING_MATH.9

THR_MATH_NEW.9

PISA_12_ST81_ENG.9

SATISIFACTION_LEARNING_ENG.9

HOMEWOK_CORR_ENG.9

MANNERS.9 SOCIAL_MORALS.9

SENSE_HONOR.9 HARD_WORK.9

SOLIDARITY_FRIENDSHIP.9

MORAL_DUTY.9

GRA_GEOMETRY.9

SELF_PROTECTION.9.

Which is more complicated.