



## The Capability of Students towards Mathematics Using Student's Feedback

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### Authors' contributions

This work was carried out in collaboration among all authors. Author MM designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors MW and SA managed the analyses of the study. Authors SKB, OA and FA managed the literature searches. All authors read and approved the final manuscript.

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## Abstract

The attitude of students towards mathematics is most important factor especially for the engineers in their practical observation relating to the understanding of particular problems in their field. To analyze this reservation, the study is conducted using students' feedback towards the performance of students in Calculus and Differential Equation subjects. During the analysis, a case study of 17A and 17B batches of 1<sup>st</sup> and 2<sup>nd</sup> semesters are selected. The marks of the Mathematics subjects namely Applied Mathematics-I (Calculus) and Applied Mathematics-II (Differential Equation) is collected from the students individually using university students portal and the results is calculated by using Statistical Package for Social Sciences (SPSS v.16) which shows the overall students' perception towards the mathematics subjects. The results imply that there is no significant relationship between the marks of calculus and differential equation. Furthermore, the null hypothesis is rejected for the disciplines such as Civil, Mechanical, Electrical, Mechatronics and Textile of 17A and Civil, Mechanical and Electrical of 17B Batch. Although the null hypothesis is accepted only for the Electronics department of 17A and Mechatronics, Electronics and Textile of 17B Batch. It is recommended that the teachers must put efforts on the students for the understanding of Mathematics concepts and improve their attitude towards it, so that they can perform better in their future practical life.

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## 1 Introduction

Mathematics is considered mandatory through the world in modern education system and a basic core subject for Engineering, science and technology. Indus University admission criteria is also based on the principle requirements that is student should graduate intermediate education in Pre-Engineering and General Science group except for the admission in Department of Physical Therapy and Fashion Design / Interior Design, where the students of arts and pre-medical groups are also acceptable. In this regard Mathematics as a subject plays a vital role in different education levels as well as in all aspects of human life. Mathematics is seem as the basic principle tool for the scientific and technical knowledge by the society that play an important role in socio-economic development of a nation-state. Thus, this subject should not be considered for granted because it has a giant part for the development of our society.

Agreeing to the University of Cape Coast (U.C.C) Chief examiner statement, the bad execution in the 2013-14 academic year starting semester examination for Colleges of Education in Ghana was in Mathematics. The reports elucidate that the performance of candidates in Mathematics paper who got D or  $D^+$  in their final examination and 1/5th of students were failed in that subject [1,2]. In understanding of mathematics, the student's performance is controlled by so many factors, such as teaching techniques, environment of classroom, enrolment of students, assessment conditions and motivation, which are some of the constraints that have significant impacts on students learning towards the approach of mathematics [3]. Furthermore, there is a recent turn down of admission in higher education courses of mathematics, sciences and engineering observed in South Africa that shows undesirable views of mathematics and frequently cited as contributed parameters [4]. These elements must be intensively focused during the studies of the students to improve the decreasing interest rate in mathematics by the students. Despite of the advance teaching practices enacted nowadays, the functioning of the students in Mathematics remains low and alarming [5]. It can only be improved by the focusing on the factors such as, the lecture method of instruction which turns the learner into passive participants in the learning process [6]. The studies suggest that there is a strong progressive affiliations among the performance and the perception builds such as belief in oneself, schooling and learning support material, interest in mathematics, myths and belief about mathematics [7]. It is also asserted that, adverse perceptions and myths of mathematics are common between the students that, observed in the developed countries [8-10].

In Indus University, Karachi, the department of Sciences and Technologies offered distinct subjects of mathematics such as, Applied Mathematics-I (Calculus), Applied Mathematics-II (Differential Equation), Linear Algebra, Numerical Methods, Probability and Statistics etc.; to the enrolment of students in all disciplines from start to a sixth semester. In Sciences & Technologies, the subjects of Applied Mathematics-I (Calculus) and Applied Mathematics-II (Differential Equation) plays a key role. In this esteem, the execution of the students in these subjects were examined through statistical tools; variance, regression and coefficient of correlation. The knowledge of these subjects helps the students to get good results in later mathematical courses of third, fourth, fifth and sixth semesters. It also helps them in different subjects of engineering such as Fluid Mechanics, Dynamics, Thermodynamics and Automation Engineering etc.

## 2 Materials and Methods

This study represents the expressive capability of students in mathematics courses for the first and second semester of Bachelor of Science department of Indus University, Karachi, namely Civil, Textile, Mechanical, Mechatronics, Electrical and Electronics departments. The data include the hundred students of both first and second semester. I have gathered the data through Indus University Examination Department on behalf of controller of examination. The data was concluded of students obtained marks in individual subjects entitled Applied Mathematics I (Calculus) and Applied Mathematics II (Differential Equation). The outcomes is considered by using Statistical Package for Social Sciences (SPSS v.16).

Student feedback is used as an instrument for this study and data extract through it was investigated using descriptive statistics such as average, median, standard deviation and variance, t-test, the simple regression model and coefficient of the correlation were analyzed. The student feedback was obtained by the student-teacher interaction and also verified by the student's login portal. The student's results of subjects, namely Applied Mathematics I (Calculus) and Applied Mathematics II (Differential Equation) is assessed to observe the learning attitude towards the mathematics.

To test the significance of the result, Null Hypothesis is set with 95% confidence interval. The hypothesis is:

$H_0$ : There is a significance relationship between the results.

$H_1$ : There is no significance relationship between the results.

### 3 Results and Discussion

(Table 1.1 – 1.4) shows that the descriptive statistics of Applied Mathematics-I (Calculus) and Applied Mathematics-II (Differential Equation) of both Batch 17A & 17B with Mean, Standard Error of Mean, Median, Mode, Standard Deviation, Variance, Skewness, Standard Error of Skewness, Kurtosis, Standard Error of Kurtosis, Range, Minimum Value, Maximum Value and Sum of the marks of students for the six disciplines with its first and second semesters' mathematics subjects.

Table 1.1, illustrates that the minimum average for Calculus Subject is 93.09 with standard deviation of 31.903 for the Bachelor of Science in Mechanical, while the maximum average is 104.68 with standard deviation of 14.066 for the Bachelor of Science in Electrical department. This shows that the Electrical department student's marks of Batch 17A are less variant than the other departments.

Table 1.2, represents that the minimum average for Differential Equation is 89.43 with standard deviation of 33.722 for the Bachelor of Science in the Mechanical, whereas the maximum average is 109.21 with standard deviation of 20.170 for the Bachelor of Science in Civil department. This shows that the civil department students' marks of Batch 17A are more reliable than the other departments.

Table 1.3, displays that the minimum mean for Calculus subject is 92.62 with standard deviation of 8.518 for the Bachelor of Science in Mechatronics, on the other hand the maximum mean is 119.33 with standard deviation of 8.430 for the Bachelor of Science in the Electronics department. This proves that the electronics department students' marks of Batch 17B are more reliable than the other departments.

Note that the equation is centered using a center tab stop. Be sure that the symbols in your equation.

Table 1.4, shows that the minimum mean of Differential Equation is 91.75 with standard deviation of 18.071 for Bachelor of Science in Textile, although the maximum mean is 129.50 with standard deviation of 13.561 for Bachelor of Science in Electronics department. This describes that the Electronics student's marks of Batch 17B are more reliable than the remaining department's student's marks.

Table 2, indicates that the critical values of  $r$  and Pearson's  $r$  correlation with remarks by means of results of Applied Mathematics-I (Calculus) and Applied Mathematics-II (Differential Equation) of students studying in 1<sup>st</sup> and 2<sup>nd</sup> semester. However the batch 17A has a strong evidence of Pearson correlation between the marks of both subjects of Civil, Mechanical, Electrical, Mechatronics and Textile departments and only medium correlation found in the Electronics department. This shows that Electronics department student's marks have some variation regarding assessment or any other reason such as the data collection, same marks of the students and low ratio of passing students. In 17B batch, there is strong relationship between the marks of calculus and differential equation in the Civil, Electrical and Electronics departments, medium correlation in the Mechanical department and small correlation in the Mechatronics and Textile department. So, this is conclude that Mechatronics and Textile department students' marks for both subjects have not uniqueness to each other or you can say that, there is a variation in the marks of Calculus and Differential Equation in these departments.

Table 3, shows that the t-test between the marks of Calculus and Differential Equation in the six departments for the batch 17A and it is true that there is no significance relationship between the results of Civil, Mechanical, Electrical, Mechatronics and Textile department. The null hypothesis is accepted for the Electronics department, which reveals that there is significance relationship between the results. So, the marks of differential equation is dependent on the marks of calculus for Electronics department students only. This table also disclosed that there is no significance relationship between the marks of Calculus and Differential Equation for the 17B batch in Civil, Mechanical and Electrical departments. Whereas the significance relationship found between the marks of Calculus and Differential Equation for the Electronics, Mechatronics and Textile departments.

**Table 1.1 Descriptive statistics of students of applied mathematics-I (Calculus) (First Semester) (Batch-17A)**

	Civil	Mechanical	Electrical	Electronics	Mechatronics	Textile
<b>N Valid</b>	29	23	28	12	19	12
<b>Mean</b>	101.90	93.09	104.68	95.75	103.05	103.50
<b>Median</b>	103.00	97.00	102.50	97.00	104.00	102.00
<b>Mode</b>	97 <sup>a</sup>	94 <sup>a</sup>	96	96	90	90 <sup>a</sup>
<b>Std. Deviation</b>	13.213	31.906	14.066	21.304	13.074	9.415
<b>Variance</b>	174.596	1017.992	197.856	453.841	170.942	88.636
<b>Skewness</b>	-2.396	-2.283	.310	-1.567	.512	.208
<b>Std. Error of Skewness</b>	.434	.481	.441	.637	.524	.637
<b>Kurtosis</b>	11.819	5.454	-1.301	4.902	-.556	-.670
<b>Std. Error of Kurtosis</b>	.845	.935	.858	1.232	1.014	1.232

**Table 1.2 Descriptive statistics of students of applied mathematics-II (Differential Equation) (Second Semester) (Batch-17A)**

	Civil	Mechanical	Electrical	Electronics	Mechatronics	Textile
<b>N Valid</b>	29	23	28	12	19	12
<b>Mean</b>	109.21	89.43	95.46	92.75	103.79	99.83
<b>Median</b>	115.00	96.00	96.00	90.00	101.00	90.00
<b>Mode</b>	115	78 <sup>a</sup>	96	78 <sup>a</sup>	86 <sup>a</sup>	90
<b>Std. Deviation</b>	20.170	33.722	18.191	22.259	20.332	18.654
<b>Variance</b>	406.813	1137.166	330.925	495.477	413.398	347.970
<b>Skewness</b>	-.418	-1.159	.652	1.179	.245	1.965
<b>Std. Error of Skewness</b>	.434	.481	.441	.637	.524	.637
<b>Kurtosis</b>	1.230	1.224	-.301	1.184	-.328	2.564
<b>Std. Error of Kurtosis</b>	.845	.935	.858	1.232	1.014	1.232

**Table 1.3 Descriptive statistics of students of applied mathematics-I (Calculus) (First Semester) (Batch-17B)**

	Civil	Mechanical	Electrical	Electronics	Mechatronics	Textile
<b>N Valid</b>	15	37	20	6	8	12
<b>Mean</b>	111.80	115.16	104.70	119.33	92.62	96.92
<b>Median</b>	115.00	117.00	103.00	117.50	89.50	103.00
<b>Mode</b>	107 <sup>a</sup>	118	102	114	83 <sup>a</sup>	97 <sup>a</sup>
<b>Std. Deviation</b>	10.825	13.510	6.359	8.430	8.518	33.321
<b>Variance</b>	117.171	182.529	40.432	71.067	72.554	1.110E3
<b>Skewness</b>	-2.012	-2.241	.574	.772	.763	-2.470
<b>Std. Error of Skewness</b>	.580	.388	.512	.845	.752	.637
<b>Kurtosis</b>	5.918	9.818	-.343	-.072	-.953	7.523
<b>Std. Error of Kurtosis</b>	1.121	.759	.992	1.741	1.481	1.232

**Table 1.4. Descriptive statistics of students of applied mathematics-II (Differential Equation) (Second Semester) (Batch-17B)**

	Civil	Mechanical	Electrical	Electronics	Mechatronics	Textile
<b>N Valid</b>	15	37	20	6	8	12
<b>Mean</b>	110.40	103.43	116.35	129.50	123.25	91.75
<b>Median</b>	107.00	109.00	112.00	130.50	124.00	83.50
<b>Mode</b>	107	75	96 <sup>a</sup>	115	108 <sup>a</sup>	78
<b>Std. Deviation</b>	11.469	32.625	17.774	13.561	7.778	18.071
<b>Variance</b>	131.543	1064.419	315.924	183.900	60.500	326.568
<b>Skewness</b>	.507	-.770	.243	.231	-.975	1.026
<b>Std. Error of Skewness</b>	.580	.388	.512	.845	.752	.637
<b>Kurtosis</b>	-.346	1.024	-1.478	-1.316	1.143	-.298
<b>Std. Error of Kurtosis</b>	1.121	.759	.992	1.741	1.481	1.232

**Table 2. Pearson correlation**

Department	Batch	Number of Students	Pearson Correlation	t-statistic	Remarks
Civil	17A	29	0.781	6.491	Strong Correlation
	17B	15	0.602	2.718	Strong Correlation
Mechanical	17A	23	0.562	3.115	Strong Correlation
	17B	37	0.483	3.259	Medium Correlation
Electrical	17A	28	0.638	4.230	Strong Correlation
	17B	20	0.747	4.767	Strong Correlation
Electronics	17A	12	0.403	1.393	Medium Correlation
	17B	06	0.604	1.514	Strong Correlation
Mechatronics	17A	19	0.565	2.824	Strong Correlation
	17B	08	0.243	0.614	Small Correlation
Textile	17A	12	0.671	2.861	Strong Correlation
	17B	12	0.223	0.724	Small Correlation

**Table 3. T-test with their regression lines**

Department	Batch	Regression Line	Slope (B)	Standard Error of Slope	t-statistic	Hypothesis ( $t = \pm 1.96$ )
Civil	17A	1.192x-12.218	1.192	0.184	6.491	REJECT
	17B	0.638x+39.097	0.638	0.235	2.718	REJECT
Mechanical	17A	0.594x+34.129	0.594	0.191	3.115	REJECT
	17B	1.165x-30.752	1.165	0.358	3.259	REJECT
Electrical	17A	0.826x+9.027	0.826	0.195	4.230	REJECT
	17B	2.088x-102.277	2.088	0.438	4.767	REJECT
Electronics	17A	0.421x+52.429	0.421	0.302	1.393	ACCEPT
	17B	0.971x+13.637	0.971	0.641	1.514	ACCEPT
Mechatronics	17A	0.879x+13.220	0.879	0.311	2.824	REJECT
	17B	0.222x+102.687	0.222	0.362	0.614	ACCEPT
Textile	17A	1.329x-37.742	1.329	0.465	2.861	REJECT
	17B	0.121x+80.023	0.121	0.167	0.724	ACCEPT

## 4 Conclusion

From the above mentioned studies, it is concluded that there is no significance relationship between the results of Applied Mathematics-I (Calculus) and Applied Mathematics-II (Differential Equation) for the students of Civil, Mechanical, Electrical, Mechatronics and Textile departments. Hence the null hypothesis is rejected for the mentioned departments of 17A Batch and it is also rejected for the Civil, Mechanical and

Electrical departments of 17B Batch. On the other hand, the null hypothesis is accepted for the Electronics department of Batch 17A and same is accepted for Electronics, Mechatronics and Textile departments of 17B Batch. It is also concluded that the mean marks of Applied Mathematics-II (Differential Equation) are greater than the Applied Mathematics-I (Calculus), although the trend of the regression lines is decreasing. From the above study, it is recommended that the perception of the students in these two subjects is independent of their departments. However, the progress of students towards these two subjects of mathematics is essential to get better performance in engineering subjects and that can be improved by adopting best recommended teaching method to understand the concepts of the mathematics subjects.

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## Competing Interests

Authors have declared that no competing interests exist.

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