

# Evaluating Academic Performance Among CFS IIUM Biological and Medical Sciences Students Through Competency in Science Courses

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**Abstract:** *Academic achievement is a student's educational standing at the end of a certain study period, expressed in grades. Thus, understanding and predicting students' academic performance in the biological and medical sciences is essential for educational institutions to provide effective support and intervention. It is crucial because certain programs impose strict admission criteria such as CGPA, necessitating proactive measures to ensure students can fulfil these requirements. Determining the factors influencing students' CGPA can provide valuable insights for educators and policymakers to improve the quality of education and student outcomes. This paper aims to explore predictive modelling methods for forecasting CGPA among CFSIIUM biological and medical sciences students. The study utilizes competencies in foundational science courses, such as biology, chemistry, mathematics, and physics, based on exam scores as predictors for academic performance. Multiple linear regression was utilized to develop predictive modelling to determine which exam scores are the best indicators of a student's CGPA. According to the results, students' academic performance can be strongly predicted by biology, mathematics and physics. Therefore, academic advisors must consider these two courses as potential indicators for the intervention process.*

**Keywords:** Academic Performance, CGPA, Science Courses, Correlation, Multiple Regression

## 1. Introduction

Predicting academic performance is a goal of educational institutions, and it is crucial in fields such as biological sciences with competitive admission requirements. Research has shown that student's performance in core sciences courses is often a strong indicator of their overall academic's success. For example, studies have found a significant relationship between proficiency in mathematics and science subjects with student's cumulative grade point average (CGPA) (Alfan & Othman, 2005; Blackmore et al., 2020; Prapasuwannakul & Bussaban, 2019;

Prapasuwannakul & Bussaban, 2019). Such findings underscore the importance of identifying predictors among science courses in predicting academic achievement to support students more effectively. The problem this study seeks to address is the lack of detailed evidence on which specific science courses significantly influence CGPA outcomes among biological and medical sciences students. While science and mathematics play important roles in academic achievement, the relative contributions of these subjects such as biology and mathematics remain underexplored in this context.

Thus, a study was conducted at the Centre for Foundation Studies, International Islamic University Malaysia (CFSIIUM) to investigate the relationship between students' performance in science core courses of Biology, Chemistry, Mathematics, and Physics; and their cumulative grade point average (CGPA). The study focused on students enrolled in biological and medical sciences programs, including medicine, dentistry, pharmacy, allied health sciences and biological sciences. Correlation and multiple linear regression analysis are used in this study to find important indicators of academic performance, with a focus on Biology and Mathematics competency. Insights from this study can guide academic advisors in providing targeted support, thereby enhancing students' academic outcomes. This research is crucial for developing strategies to help students achieve their academic goals effectively.

This study aims to fill the gap by examining the relationship between students' competence in science courses with their overall academic achievement (CGPA) and identifying which courses are significant predictors of CGPA. Specifically, the following are the research objectives:

- i. To investigate the correlation between performance in Biology, Chemistry, Mathematics and Physics courses and the academic achievement (CGPA) of students enrolled in the biological.
- ii. To identify which science core courses can predict the academic achievement (CGPA) of students enrolled in the biological module.

## 2. Methodology

The research sample was Biological Sciences (N=59), Allied Health Sciences (N=73) and Pharmacy (N=51) students' academic history for semesters 1, 2 and 3 2022/2023 obtained through the Office of Deputy Dean of Academics and Internationalisation (ODDAI), CFSIIUM. The measure for the research were students' results for Biology 1, Biology 2, Chemistry 1, Chemistry 2, Mathematics 1, Statistics, Physics 1, Physics 2 and CGPA at the end of their studies. Data obtained were analysed using SPSS.

The first part of the analysis involves a correlation study examining the relationships between the results of the six courses and their correlation with the CGPA. The second part of the analysis focuses on a regression analysis to investigate how the scores in these courses can predict the CGPA. SPSS version 28 was used for correlation and multiple regression analysis.

### 3. Results and Discussions

**Table 1: Descriptive Statistics for Variables**

	N	Minimum	Maximum	Mean	Std. Deviation
Biology 1	183	51	95	72.33	8.083
Biology 2	183	58	96	74.27	8.205
Chemistry 1	183	50	95	78.21	7.872
Chemistry 2	183	56	97	80.69	7.719
Physics 1	183	53	95	76.11	8.391
Physics 2	183	61	96	80.89	6.684
Mathematics 1	183	53	96	81.33	8.062
Statistics	183	52	95	71.98	8.373
CGPA	183	3.26	4.00	3.6792	.20627

Descriptive statistics of academic variables for a sample of 183 students indicated Mathematics 1 had the highest mean score (81.33) with a standard deviation of 8.062. Chemistry 2 and Physics 2 also had high mean scores of 80.69 and 80.89, respectively, with Chemistry 2 having the widest score range (56-97). Biology 2 showed slight improvement over Biology 1 with mean scores of 74.27 and 72.33, respectively. Physics 1 displayed a mean score of 76.11, while Statistics had the lowest mean score of 71.98. The CGPA data revealed a tight range from 3.26 to 4.00 with a mean of 3.6792, suggesting overall satisfactory academic performance. The consistency in student performance was most notable in Physics 2, with the lowest standard deviation of 6.684.

**Table 2: Correlation between courses and CGPA**  
**Correlations**

		Biology 1	Biology 2	Chemistry 1	Chemistry 2	Physics 1	Physics 2	Mathematics 1	Statistics	CGPA
Biology 1	Pearson Correlation	--								
	N	183								
Biology 2	Pearson Correlation	.523**	--							
	Sig. (2-tailed)	<.001								
Chemistry 1	Pearson Correlation	.457**	.348**	--						
	Sig. (2-tailed)	<.001	<.001							
Chemistry 2	Pearson Correlation	.482**	.402**	.520**	--					
	Sig. (2-tailed)	<.001	<.001	<.001						
Physics 1	Pearson Correlation	.422**	.400**	.483**	.546**	--				
	Sig. (2-tailed)	<.001	<.001	<.001	<.001					
Physics 2	Pearson Correlation	.479**	.370**	.466**	.510**	.519**	--			
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001				
Mathematics 1	Pearson Correlation	.374**	.274**	.538**	.474**	.525**	.390**	--		
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	<.001			
Statistics	Pearson Correlation	.416**	.380**	.424**	.596**	.508**	.577**	.461**	--	
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	<.001	<.001		
CGPA	Pearson Correlation	.596**	.705**	.532**	.616**	.581**	.671**	.410**	.677**	--
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	
	N	183	183	183	183	183	183	183	183	183

\*\* Correlation is significant at the 0.01 level (2-tailed).

The analysis of Table 2 reveals that all courses have a statistically significant positive correlation with CGPA, with Biology 2 showing the highest correlation ( $r = .705$ ,  $n = 183$ ,  $p < .001$ ). This suggests that students who perform well in Biology 2 tend to have higher overall academic success. Similarly, strong correlations are observed for Chemistry 2, Physics 2, and Statistics ( $r > .616$ ,  $n = 183$ ,  $p < .001$ ), indicating that these subjects are also critical in determining CGPA. A strong positive correlation was also shown for Physics 1 ( $r = .581$ ,  $n = 183$ ,  $p < .001$ ) indicating that higher grades are associated with higher CGPA.

The moderate correlation of Mathematics 1 ( $r = .410$ ,  $n = 183$ ,  $p < .001$ ) with CGPA suggests that while important, it may not be as strong a predictor of overall academic performance as the other courses.

**Table 3: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.884 <sup>a</sup>	.781	.771	.09881

a. Predictors: (Constant), Statistics, Biology 2, Chemistry 1, Mathematics 1, Biology 1, Physics 1, Physics 2, Chemistry 2

**Table 4: ANOVA for the regression model**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.045	8	.756	77.399	<.001 <sup>b</sup>
	Residual	1.699	174	.010		
	Total	7.744	182			

a. Dependent Variable: CGPA

b. Predictors: (Constant), Statistics, Biology 2, Chemistry 1, Mathematics 1, Biology 1, Physics 1, Physics 2, Chemistry 2

**Table 5: The correlation coefficient between CGPA and the eight science core courses**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.367	.106		12.956	<.001		
	Biology 1	.002	.001	.074	1.592	.113	.577	1.732
	Biology 2	.010	.001	.401	9.230	<.001	.669	1.495
	Chemistry 1	.002	.001	.093	1.979	.049	.567	1.764
	Chemistry 2	.002	.001	.087	1.726	.086	.495	2.018
	Physics 1	.002	.001	.080	1.655	.100	.535	1.868
	Physics 2	.007	.001	.236	4.900	<.001	.542	1.846
	Mathematics 1	-.002	.001	-.073	-1.570	.118	.589	1.699
	Statistics	.006	.001	.259	5.214	<.001	.513	1.951

a. Dependent Variable: CGPA

The predictive value of the independent variables (Biology 1, Biology 2, Chemistry 1, Chemistry 2, Physics 1, Physics 2, Mathematics 1, and Statistics) about the student's academic progress, as determined by CGPA, was determined by a multiple regression analysis. It was noted that a significant ANOVA result for the model was presented in Table 4. The sample is confirmed to be representative of the population by the F-test, which reveals a large aggregate

contribution from all subjects:  $F(8,174) = 77.399$ ,  $p=0.000$ . The dependent variable was consistently predicted by the predictors, according to the ANOVA results. Table 5 presents a strong relationship between CGPA and eight independent factors, with a correlation coefficient of 0.884 as presented by Table 4. All the eight predictors, explain 78.1% of the variation in CGPA.

Based on Table 5, the model is presented as follows:

$$CGPA = 1.367 + 0.01(\text{Biology 2}) + 0.007(\text{Physics 2}) + 0.006(\text{Statistics}) + 0.002(\text{Chemistry 1})$$

Significant information about the relationship between academic achievement in particular topics and overall CGPA can be obtained from the multiple regression model. With a coefficient of 0.01 for Biology 2, it is noteworthy that this subject has the most impact and that gains in it are likely to result in CGPA increases that are apparent. This suggests that students would gain a great deal by concentrating on Biology 2 to improve their overall academic status. With a value of 0.007, Physics 2 equally has a significant effect on CGPA, albeit to a slightly lesser degree than Biology 2. With a value of 0.006, Statistics has a moderately substantial impact on the estimate of CGPA. For this reason, performing well in Physics 2 and Statistics is also essential for academic achievement. Chemistry I, on the other hand, has less of an impact on CGPA (0.002) for students who seek to improve their CGPA substantially. According to these results, to enhance overall academic performance, targeted academic support and resources should be given priority to Biology 2, Statistics, and Physics 2. Nevertheless, balanced support is still necessary for all areas of study.

#### 4. Conclusion

The findings of this study effectively address the research objectives and provide valuable insights into the relationship between students' performance in core sciences courses and their overall academic achievement (CGPA). The analysis revealed that all courses under investigation showed statistically significant positive correlations with CGPA with Biology 2 emerging as the strongest predictor. This suggests that students who excel in Biology 2 tend to achieve higher overall academic success. Similarly, the strong correlation for Statistics, Chemistry 2 and Physics 2 further emphasizes their importance in influencing CGPA outcomes.

In particular, the multiple regression analysis identified that all eight core science courses collectively explained 78.1% of the variation in CGPA. Among these, Biology 2 was the most significant predictor of CGPA, followed by Statistics and Physics 2. This information underscores the importance of prioritizing academic support in Biology 2, Statistics and Physics 2 for students aiming to improve their academic performance. Based on the model fit, these subjects can be used to predict CGPA.

Overall, the study provides valuable insights for academic advisors and institutions to develop targeted strategies that support students in achieving academic success. The finding suggests that a balanced approach to academic support particularly emphasis on Biology 2, Statistics and Physics 2 will help students reach their full academic potential. These insights can be valuable for educators and students alike in understanding the impact of individual course performance on overall academic achievement.

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