A Study on the Factors that Impact on the Academic Performance of the Computer Science and the Information Technology Students in University of Malaya

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ABSTRACT

This study aimed to investigate the factors that could affect the academic performance, based on Cumulative Grade Point Average (CGPA), of the Computer Science and the Information Technology undergraduates at the Faculty of Computer Science & Information Technology (FCSIT), University of Malaya. Factors investigated included whether the students were staying on-campus or off- campus, their English proficiency, interest in the respective major, prior programming knowledge and the percentage of coursework done by oneself. Data for the study were collected, using a questionnaire survey. Analysis of data was done using Statistical Package for Social Sciences (SPSS). To investigate the relationship between categorical variables, cross-tabulation was used. The study reveals that the undergraduates who stay off-campus generally perform better than those who stay on-campus; higher proficiency of English contributes to better academic results but does not guarantee excellent results; the Computer Science undergraduates perform better overall than the Information Technology undergraduates; interest in the respective major; prior programming knowledge and completing coursework totally by oneself do not necessarily lead to better academic performance.

Key words: Factors, Performance, Computer Science, Information Technology, Undergraduates, Survey, SPSS

INTRODUCTION

The Faculty of Computer Science & Information Technology (FCSIT), University of Malaya, enrolled the first batch of Bachelor of Computer Science undergraduates in 1990 (University of Malaya, 2002). The Bachelor of Computer Science programme equips its undergraduates with the knowledge and skills of the different aspects of computing which include computer hardware, computer networking technology, intelligent systems, information systems, Internet as well as software development and maintenance (University of Malaya, 2003). Six years later, in 1996, the Bachelor of Information Technology programme was introduced. This new programme focuses on providing its students with the skill and knowledge of computer technologies and their applications in different fields such as multimedia, management, e-commerce, web programming and information science.

Ever since the inception of the two programmes, the academic performance of the undergraduates has always been of utmost concern to the faculty, the students, their parents and the public, in general. Thus, this study was aimed to investigate some of the factors that could affect the academic performance of the Computer Science and the Information Technology undergraduates. The factors investigated included staying on-campus or off-campus, English proficiency, interest in the respective major, prior programming knowledge as well as the percentage of coursework done by a student himself/herself. The Cumulative Grade Point Average (CGPA) was used as a measure of academic performance. A CGPA <=3.00 is regarded as poor performance, CGPA between 3.01 - 3.69 is regarded as fairly good performance and CGPA >=3.70 is regarded as good performance.

METHODOLOGY

This study employed the questionnaire survey as the investigation technique. A survey is a retrospective study of a situation and is done to explore relationships and outcomes (Fenton and Pfleeger, 1997). Thus, it is appropriate for this study because the investigation of the relationships between certain factors and the performance of the undergraduates can only be done based on the latter's past performance.

Questionnaires were distributed at random to 300 undergraduates of FCSIT. It was not feasible to include the entire population of 1,738 undergraduates in this study as only five people were assigned to conduct the survey within two weeks. At the confidence level of 95%, this sample size will lead to confidence intervals of 5.15 (Creative Research Systems, 2003). In other words, it is 95% sure that the true percentage of the population is between ± 5.15 of the actual result.

The data collected were analyzed, using Statistical Package for Social Sciences (SPSS) version 12.0.1. To ensure meaningful inferences, the type of the data was used to determine the suitable analysis techniques to be applied. As the data is of categorical type, cross-tabulation was used to show the relationship between two categorical variables (nominal and ordinal). Also, the relationship observed has to be tested to determine whether it is significant or not. This was done by using the Pearson Chi-square test which is appropriate for almost any kind of data. Chi-square tests the hypothesis that the row and column variables are independent and the significance value (Asymptotic Significance) contains the required information (SPSS Inc, 1999). The lower the significance value, the less likely it is that the two variables are independent (unrelated). Somers'd, Kendall's tau-b, Kendall's tau-c and Gamma were also used to determine the association between two variables that are of ordinal type. If the approximate significance values of each measure are less than 0.050, it can be concluded that there is a statistically significant relationship between the variables (SPSS Inc, 1999).

Analysis of survey outcomes

This section looks at the sample population and discusses the analysis of the students' performance with respect to factors such as whether they are staying on-campus or off-campus, their English proficiency, interest in the respective major, prior programming knowledge and the percentage of coursework done by oneself.

Sample Population

The questionnaires were distributed at random to the undergraduates from the 1997/1998 to 2003/2004 intakes. Of the 300 students, 108 (36.0%) students are male and 180 (60.0%) students are female (Figure 1). The gender of 12 students (4.0%) was not indicated in the questionnaires.
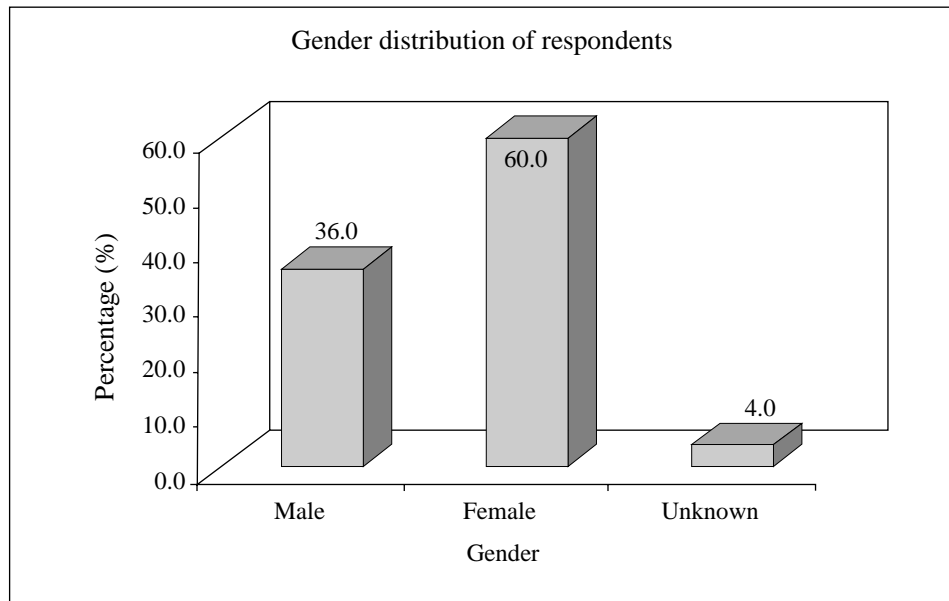

Figure 1. Gender distribution of respondents.

Staying on-campus or off-campus and academic performance

Figure 2 shows graphically the academic performance of the students staying on-campus and off-campus. Of the 300 students surveyed, only 275 students indicated whether they are staying on-campus or off-campus. Of these 275 students, 117 (42.5%) students are staying in the university hostels and 158 (57.5%) students are staying off-campus. For those students who are staying on-campus, 61 (52.1%) obtained CGPA <= 3.00, 49 (41.9%) students obtained CGPA between 3.01 - 3.69, and 7 (6.0%) obtained CGPA of 3.70 and above. Of those who are staying off-campus, 58 (36.7%) students obtained CGPA <= 3.00, 84 (53.2%) obtained CGPA between 3.01 - 3.69, and 16 (10.1%) obtained CGPA of 3.70 and above.
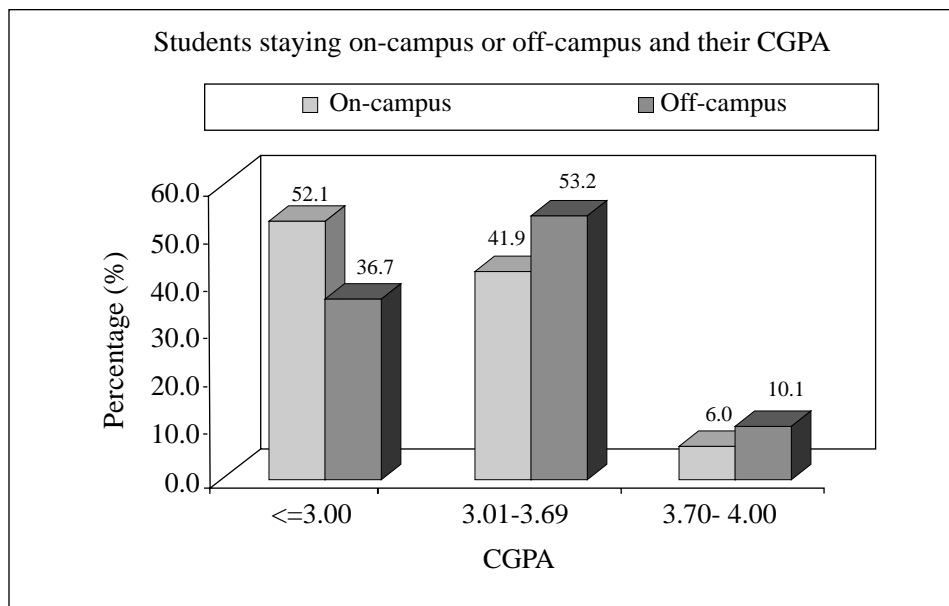
Figure 2. Students staying on-campus or off-campus and their CGPA.

It is obvious that most of the students who are staying on-campus (52.1%) obtained CGPA <= 3.00, whereas most of the students who are staying off-campus (53.2%) obtained better results, with CGPA between 3.01 - 3.69. In other words, the academic performance of students staying off-campus is better than those who are staying on-campus. This could be due to the fact that the students who are staying on-campus are required to participate actively in the hostels' activities and thus, they spent less time in their studies.

To investigate whether staying on-campus or off-campus truly impacts on the performance (CGPA) of the students, the Pearson Chi-square test was used to test the relationship. Asymptotic Significance (2-sided) gives 0.033 (Table 1). This value is less than 0.050 indicating that the two variables, staying on-campus or off-campus, and CGPA, are indeed related (SPSS Inc, 1999), implying that staying on-campus or off-campus does affect the performance of the students.

Staying on-campus is cheaper than staying off-campus. However, students need to participate actively in the hostel's activities to ensure that they get a place in the hostel in the following year. As this has significant impact on the students' performance, the hostel's activities must be reviewed to ensure that the activities are beneficial to the students but do not occupy too much of the students' study time. In this analysis, the percentage and not count was used in the statistical test as there is a variation in the marginal totals in the number of students staying on-campus (117) and those staying off-campus (158) (SPSS Inc, 1999).

Table 1. Chi-Square test for students staying on-campus or off-campus and CGPA.

	Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	6.847 (a)	2	0.033

(a) 0 cells (0.0%) have expected count less than 5. The minimum expected count is 9.79.

English proficiency and academic performance

The Ministry of Education (MOE), Malaysia, is aware of the lack of English proficiency among the local graduates, especially in interpersonal communication. The Ministry has encouraged all universities to use English also as a medium of instruction beside the national language (Malay) [Malaysia, Ministry of International Trade and Industry, 2002]. As far back as 1995, MOE had allowed public universities to use English as the medium of instruction for certain Science and Technology courses. It was envisaged that for Malaysia to become a developed nation by 2020, English has an important role to play, and thus, it should be mastered and used more widely (Zainal Abidin Abdul Wahid, 2001). Besides, with better proficiency in English, an individual stands a better chance to secure a job (Mahathir Bin Mohamad, 2002). During the tabling of the 2003 National Budget, the Government announced its decision to implement the teaching of Science and Mathematics in schools using English, and allocated nearly RM* 5 billion for a period of seven years, starting from 2002 until 2008 for that purpose (Malaysia, Ministry of Finance, 2002).

In line with that, FCSIT has since then been gradually using English to teach the computing courses. Hence, it would be interesting to investigate whether English proficiency impacts on the performance of the students since this came about in academic year 2002/03.

In this study, students' proficiency in English is based on their results in the Malaysian University English Test (MUET). Of the 263 students who took MUET, 12 (4.0%) students obtained band 2, 76 (25.3%) obtained band 3, 107 (35.7%) obtained band 4, 59 (19.7%) obtained band 5, and the remaining 9 (3.0%) students obtained band 6 (Table 2). This shows that the majority of the students surveyed achieved band 4, indicating average level of proficiency in English.

Table 2. Students' MUET results.

Band	Frequency	Percent (%)
2	12	4.0
3	76	25.3
4	107	35.7
5	59	19.7
6	9	3.0
Total	263	87.7
No Response	37	12.3
Total	300	100.0

Figure 3 illustrates graphically the relationship between students' proficiency in English and their academic performance. It is obvious that the majority of the students with band 2 (66.7%) and band 3 (70.3%) obtained CGPA <= 3.00. In addition, 33.3% and 29.7%

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*1 US$ = 4 RM (approx.)

of the band 2 and band 3 students respectively, obtained CGPA between 3.01 - 3.69. No students in band 2 and band 3 obtained CGPA of 3.70 and above. Hence, English proficiency does have an impact on the performance (CGPA) of the students.
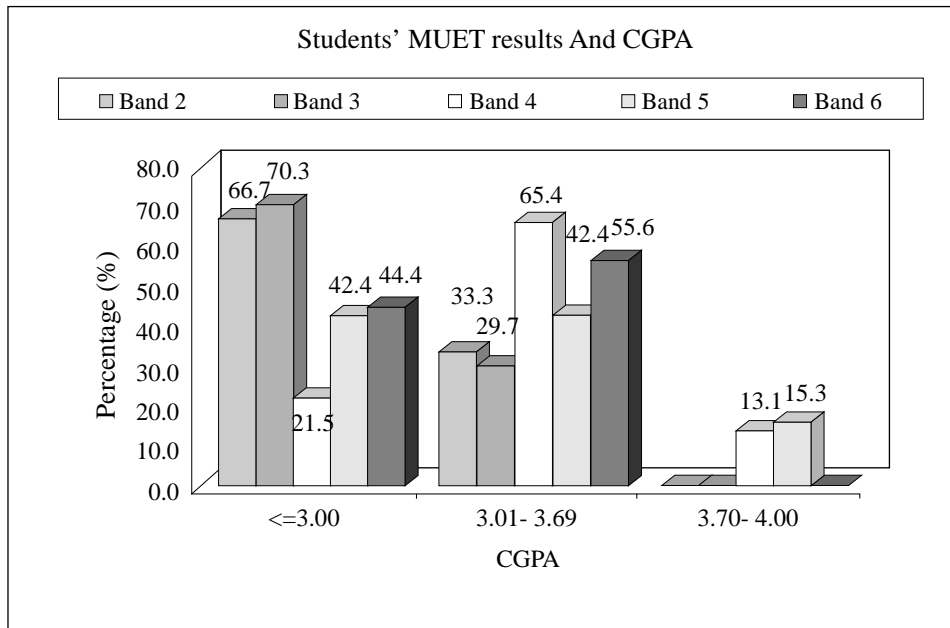

Figure 3. Students' MUET results and CGPA.

What about those students who scored band 4 for their MUET? For this group, 21.5% of them obtained CGPA <= 3.00, 65.4% of them obtained CGPA between 3.01 - 3.69 and 13.1% of them obtained CGPA of 3.70 and above. For those students with band 5, 42.4% of them achieved CGPA <= 3.00 and CGPA between 3.01 - 3.69, respectively. The remaining 15.3% of band 5 students achieved CGPA 3.70 and above. Lastly, for those students with high proficiency in English, that is, those with band 6 for their MUET, 44.4% of them obtained CGPA <= 3.00, 55.6% of them obtained CGPA between 3.01 - 3.69 and none of them managed to obtain CGPA 3.70 and above.

Since both the variables are ordinal, the directional and symmetric measures of Somers' d, Kendall's tau-b, Kendall's tau-c and Gamma were used to determine the association between proficiency in English and academic performance (CGPA). The approximate significance value of each measure is 0.000 (Table 3 and Table 4). Since this is less than 0.050 (SPSS Inc, 1999), it can be concluded that there is a statistically significant relationship between proficiency in English and CGPA. The value of each measure is more than 0.150 (shown by the darken cells in Table 3 and Table 4), indicating a significant relationship (SPSS Inc, 1999). Besides, Spearman's rho when calculated gives the value of 0.252 (Table 5), indicating a positive but weak correlation [SPSS Inc, 1999] between English proficiency and CGPA.

Table 3. Directional measures for English proficiency and CGPA.

			Value	Asymp. Std. Error (a)	Approx. T (b)	Approx. Sig.
Ordinal by Ordinal	Somers' d	Symmetric	.240	.054	4.385	.000
		English Proficiency (MUET) Dependent	.266	.060	4.385	.000
		CGPA Dependent	.219	.050	4.385	.000

a Not assuming the null hypothesis.
b Using the asymptotic standard error assuming the null hypothesis.

Table 4. Symmetric measures for English proficiency and CGPA.

		Value	Asymp. Std. Error (a)	Approx. T (b)	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	.242	.055	4.385	.000
	Kendall's tau-c	.229	.052	4.385	.000
	Gamma	.362	.079	4.385	.000
	Spearman Correlation	.266	.061	4.444	.000(c)
N of Valid Cases		261			

a Not assuming the null hypothesis.
b Using the asymptotic standard error assuming the null hypothesis.
c Based on normal approximation.

Table 5. Correlations between English proficiency and CGPA.

			CGPA	English Proficiency (MUET)
Correlation Coefficient	Spearman's rho	CGPA	1.000	.252(**)
		English Proficiency	.252(**)	1.000
Sig. (2-tailed)	Spearman's rho	CGPA	.000	.000
		English Proficiency	.000	.000
N	Spearman's rho	CGPA	296	261
		English Proficiency	261	263

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

This analysis shows that generally, high proficiency in English does contribute to better academic performance. However, none of the 9 students in the survey with high proficiency in English (band 6 for MUET) obtained CGPA of 3.70 and above. This can be explained that good English proficiency generally does contribute to better academic

performance, but does not guarantee the achievement of CGPA of 3.70 and above, as it is obvious that in a technical discipline such as computing or information technology, other factors also influence a student's overall performance.

Interest in the respective major

Of the students surveyed, 240 (81.6%) students find their major or area of specialization, interesting. Applying the Pearson Chi-square test, Asymptotic Significance gives 0.003 (Table 6) indicating that there is indeed some relationship between interest in the respective major and CGPA.

Table 6. Chi-square test for interest in the respective major and CGPA.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.731 (a)	2	0.033

(a) 1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.22

As shown in Figure 4, 51.7% of the students who find their major interesting obtained CGPA <= 3.00. On the other hand, 63.0% of those who do not find their major interesting obtained CGPA between 3.01-3.69. Moreover, the percentage of students who do not find their major interesting (11.1%) but obtained CGPA between 3.70 - 4.00 outnumbered those who find their major interesting (7.1%). This contradicts the common belief that the students would perform better if they find their majors interesting. What could have contributed to this? Is the major too difficult or is it because the students did not put in sufficient effort in their studies? The data was further analysed using "Major" as the layer variable for the cross-tabulation with "interest in the respective major" and "CGPA". The Chi-square test indicates that the relationship between "interest in the respective major" and "CGPA" is not the same across the different majors.
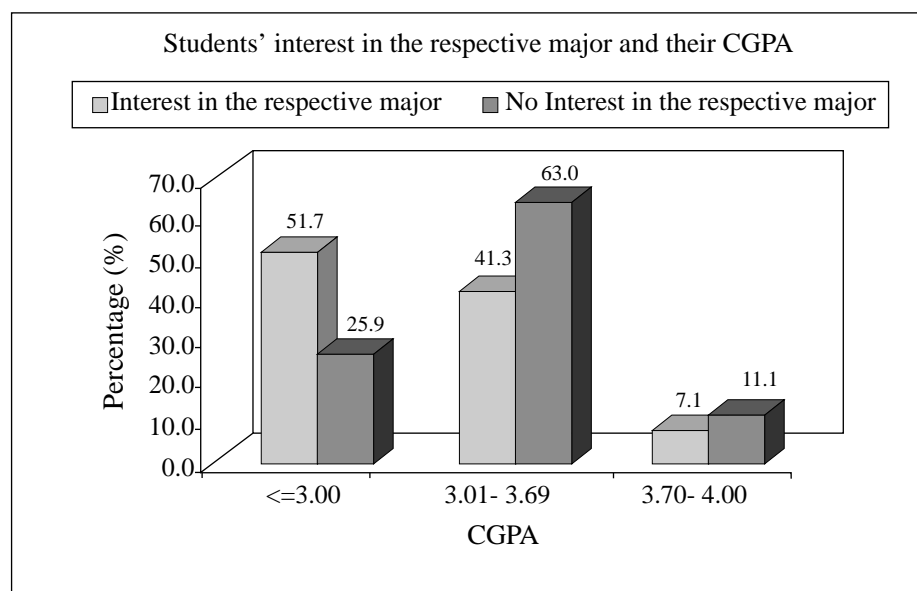

Figure 4. Students' interest in the respective major and their CGPA.

It is generally believed that when a student is interested in the major, he will probably do well in that major. In this study, it is surprising to find the reverse is true among the Computer Science students in FSCIT. Figure 5 shows the "interest in the respective major" and performance (CGPA) of the students according to their majors for the Computer Science programme. The majority of the students who major in Artificial Intelligence (AI) (56.3%) and Software Engineering (SE) (50.0%) and find their major interesting, obtained CGPA between 3.01 - 3.69. However, for students who major in Management Information System (MIS) (60.0%) and Computer Networking and Systems (CNS) (52.1%), majority of them who find their major interesting obtained CGPA <= 3.00.

On the other hand, students (from all the four majors) who do not find their majors interesting, the majority of them obtained fairly high CGPA of between 3.01 - 3.69. This is most evident for students majoring in AI (100%). This could probably be due to the fact that students are willing to accept the major even though they were not offered the major of their interest (choice), have positive attitude, and worked as hard to excel in their studies. Also, as there are fewer number of students (according to the Annual Report 2003 of FCSIT) who major in AI (with the highest number of 67 students in 2000/01 intake) as compared to the other three majors (with the number of students ranging from 60 to 166 students) (University of Malaya, 2003b), the students who major in AI received better and closer supervision and guidance than the students from the other three majors.
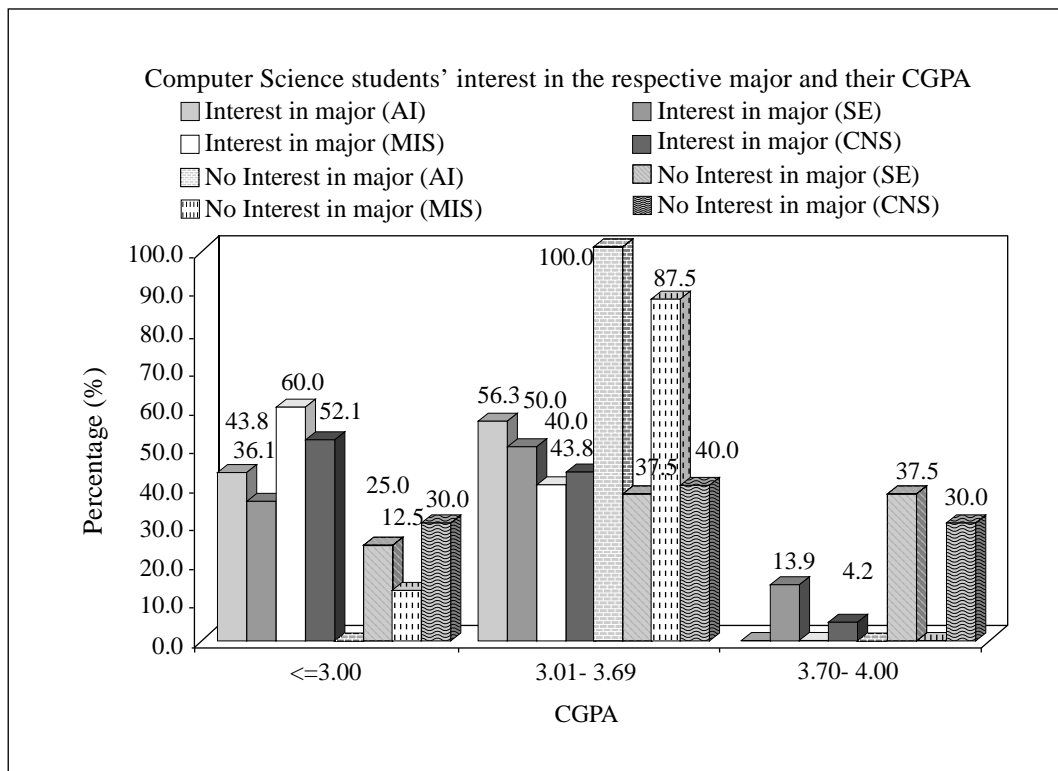

Figure 5. Computer Science students' interest in the respective major and their CGPA.

Figure 6 depicts the students' "interest in the respective major" and their performance (CGPA) according to their majors for Information Technology programme. For those who find interest in their majors, the majority obtained CGPA <=3.00, implying that interest in the respective major does not guarantee good results.

It is interesting to note that 100% of the students who major in Multimedia but do not find their major interesting obtained poor results with CGPA <= 3.00. However, for those students who major in Information Science, 100% of them obtained CGPA between 3.01-3.69 regardless of their interest in the major.
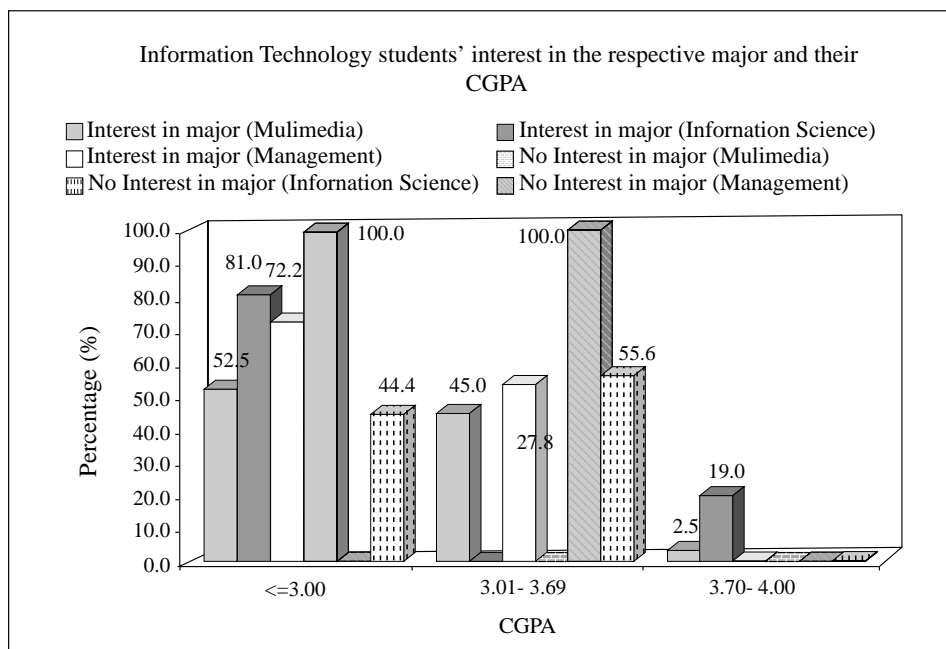

Figure 6. Information Technology students' interest in the respective major and their CGPA.

Performance of students according to majors

Figure 7 shows the performance of the students (CGPA) according to the majors of both the Computer Science and the Information Technology programmes. The percentages of students who obtained ùpoorû results with CGPA <= 3.00, from all the four majors of the Computer Science programme are lower than all the three majors from the Information Technology programme. This is evident from the 31.8%, 35.0%, 39.5% and 48.3% of students who major in AI, SE, MIS and CNS, respectively, compared to 55.8%, 63.0% and 73.9% of students who major in Multimedia, Management and Information Science, respectively.

As shown in Figure 7, the majority of the Computer Science students who major in AI (68.2%), SE (48.8%) and MIS (60.5%) obtained CGPA of between 3.01 - 3.69. For those Computer Science students who major in CNS networking, the majority of them (48.3%) obtained CGPA <= 3.00. On the other hand, the majority of the students from all the three majors of the Information Technology programme obtained CGPA <= 3.00.

It is obvious that the Computer Science students performed better than the Information Technology students, specifically, those students who major in Information Science and Management. This could be due to the course structure of the Information Science and Management majors. Besides, the 48 credit hours or 44.4% of the core faculty courses which focus on computing, the students in these two majors are required to complete 30 credit hours or 27% of core departmental courses which focus on information science and management aspects, respectively (University of Malaya, 2003). This could possibly explain the poor performance as the students are required to cope with two different foci in their studies.
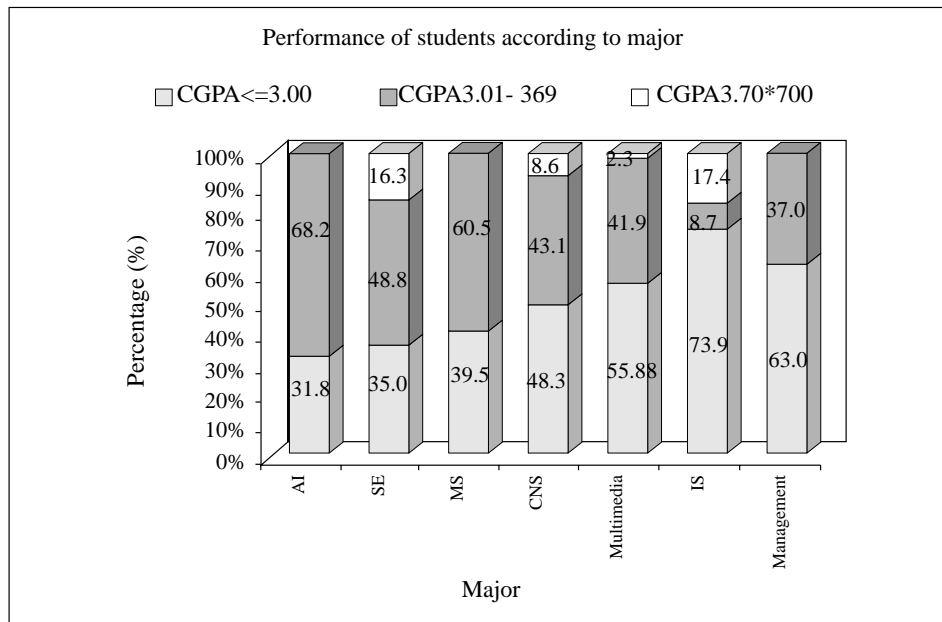

Figure 7. Performance of students according to major.

Prior programming knowledge

As programming courses are compulsory in both the Computer Science and the Information Technology pragrammes, one of the main investigations in this study is whether students, having prior programming knowledge, would perform better in their studies. Figure 8 shows graphically that 58.6% of the students who have prior programming knowledge obtained CGPA <= 3.00. However, 47.8% of those who do not have prior programming knowledge obtained better CGPA of between 3.01 - 3.69. Moreover, 9.3% of the students who do not have prior programming knowledge excelled academically with CGPA of between 3.70 - 4.00. Again, the Pearson Chi-square test was applied and Asymptotic Significance (2-sided) gives 0.036 (Table 7) indicating that the relationship is significant.

The analysis shows that having prior programming knowledge does not guarantee good performance. This is because programming courses contribute to 24 - 27 credit hours (22.2% - 25%) only, depending on the major, of the total credit hours required in both programmes (University of Malaya, 2003). Hence, students without prior programming knowledge could also excel in their studies. This is reflected by 9.3% of the students who obtained CGPA of

3.70 and above but do not have prior programming knowledge, and exceeded the 2.9% of students who have prior programming knowledge.
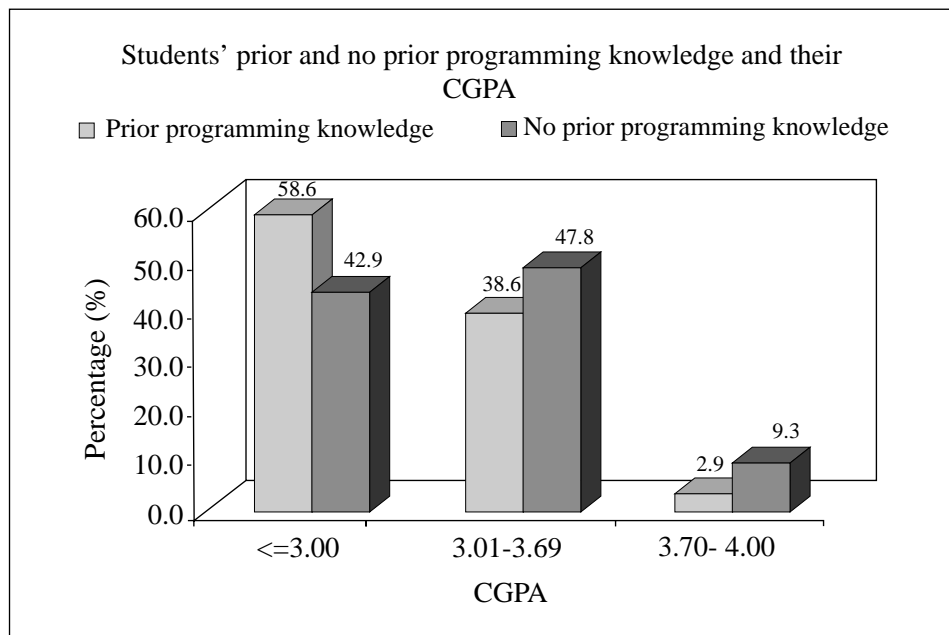

Figure 8. Students' prior and no prior programming knowledge and their CGPA.

Table 7. Chi-square test for prior programming knowledge and CGPA.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.652 (a)	2	0.036

(a) 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.44.

Percentage of coursework done by oneself

It is common to receive complaints about students who submit courseworks (which include assignments, exercises, tutorials and projects) which were not done entirely by the students themselves. The students might have obtained help from their course mates, seniors, personal tutors and friends to complete the coursework. Thus, one interesting aspect of this study is to find out the percentage of courseworks that each student completes on his/her own, and how this relates to academic performance.

Of the 296 students surveyed, 34 (11.5%), 162 (54.7%), 82 (27.7%) and 18 (6.1%) students indicated that they completed less than 50%, 50%-80%, 81%-99% and 100% of the courseworks on their own, respectively (Table 8).

Table 8. Percentage of coursework done by oneself.

Percentage of coursework	Frequency	Percent (%)
< 50%	34	11.5
50% - 80%	162	54.7
81% - 99%	82	27.7
100%	18	6.1
Total	296	100.0

As shown in Figure 9, 27.8% of those who did their coursework entirely (100%) on their own obtained CGPA of between 3.70 - 4.00. However, 50% of them obtained CGPA <= 3.00 suggesting that doing coursework on their own without getting advice or feedback from the lecturers or having their works proofread by a friend, could result in unsatisfactory performance.

On the other hand, students who sought help from others when doing their coursework might find it disadvantageous to their academic performance. Hence, those who did less than 50% and those who did 50% - 80% of the coursework on their own, the majority obtained CGPA <= 3.00. Those who did 81% - 99% of the coursework themselves performed better as indicated by a majority (65.9%) who obtained CGPA of between 3.01-3.69. In a nutshell, doing most of the coursework by oneself enables the students to achieve better results.
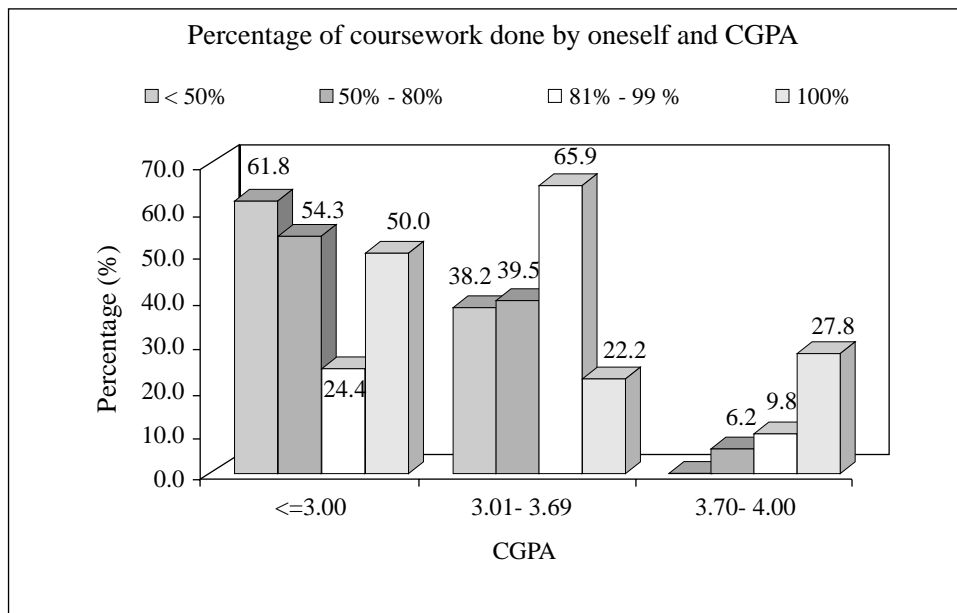

Figure 9. Percentage of coursework done by oneself and CGPA.

The significance of the above relationship between the percentage of coursework done by oneself and CGPA is supported by the approximate significance of 0.000 for Somers' d, Kendall's tau-b, Kendall's tau-c and Gamma (Table 9 and Table 10). There is a positive but weak correlation between the percentage of coursework done by oneself and CGPA as evidenced by a positive value (0.218) of the Spearman's rho value (Table 11).

Table 9. Directional measures for percentage of coursework done by oneself and CGPA.

			Value	Asymp. Std. Error (a)	Approx. T (b)	Approx. Sig.
Ordinal by Ordinal	Somers' d	Symmetric	.234	.052	4.469	.000
		Percentage of coursework done by oneself. Dependent	.242	.053	4.469	.000
		CGPA Dependent	.227	.051	4.469	.000

a Not assuming the null hypothesis.
b Using the asymptotic standard error assuming the null hypothesis.

Table 10. Symmetric measures for percentage of coursework done by oneself and CGPA.

		Value	Asymp. Std. Error (a)	Approx. T (b)	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	.235	.052	4.469	.000
	Kendall's tau-c	.207	.046	4.469	.000
	Gamma	.384	.080	4.469	.000
	Spearman Correlation	.254	.056	4.499	.000(c)
N of Valid Cases		261	296		

a Not assuming the null hypothesis.
b Using the asymptotic standard error assuming the null hypothesis.
c Based on normal approximation.

Table 11. Correlations between percentage of coursework done by oneself and CGPA.

			CGPA	Percentage of coursework done by oneself
Correlation Coefficient	Spearman's rho	CGPA	1.000	.218(**)
		Percentage of coursework done by oneself	.218(**)	1.000
Sig. (2-tailed)	Spearman's rho	CGPA	.000	.000
		Percentage of coursework done by oneself	.000	.00
N	Spearman's rho	CGPA	300	300
		Percentage of coursework done by oneself	300	300

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

CONCLUSIONS

This study reveals interesting relationships among several factors and the academic performance (CGPA) of the Computer Science and the Information Technology students at FCSIT, University of Malaya. Factors investigated include whether students are staying on-campus or off-campus, their English proficiency, interest in the respective major, prior programming knowledge and the percentage of coursework done by oneself. Generally, students who are staying off-campus perform better than those who are staying on-campus; higher proficiency in English contributes to better CGPA but does not guarantee that the students would excel; the Computer Science students perform better overall than the Information Technology students; interest in the respective major; prior programming knowledge and completing coursework totally by oneself do not necessarily lead to better academic performance.

The findings from the study show that the factors investigated could affect the academic performance of the students. It must be cautioned, however, that the findings are not authoritative because the students' academic performance could also depend on many other factors such as the students' level of intelligence, the teaching approach and so on. Another important point to note is that the results from this study pertain specifically to the pool of undergraduates surveyed at FCSIT only. It cannot be assumed that the findings are generally true for other groups of undergraduates of the same programmes at FCSIT or other programmes offered by other faculties in the University of Malaya.

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