PREDICTORS OF ANATOMY AND PHYSIOLOGY ACHIEVEMENT AMONG DIPLOMA IN NURSING STUDENTS

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Abstract

This study aims to explore whether students' results in the Malaysian Certificate of Education (MCE) Examination particularly in Biology, Chemistry and English subjects can predict students' achievement in Anatomy & Physiology (A&P) course of the Diploma in Nursing students in Malaysia. The study involved 411 students studying in the Ministry of Health's training colleges who came from the science stream background in the high school. Students' background data comprising MCE Biology, Chemistry and English results, academic stream in high school, and students' ID were collected using a short questionnaire. Stepwise regression analysis was performed on the data. Even though result showed that MCE Biology, MCE Chemistry and MCE English seem to be significant predictors of A&P achievement, only MCE Biology was kept in the final model of stepwise regression. Thus, MCE Biology is the only significant predictor of A&P in this study. Further analysis and extrapolation of the A&P and Biology results suggest that candidates from the science stream in high school should obtain at least `B' grade in Biology in the MCE examination to get at least a pass in A&P.

Keywords *Achievement predictor, Nursing, Anatomy & Physiology, Biology, Chemistry, English.*

Abstrak

Kajian ini bertujuan untuk meneroka sama ada keputusan Sijil Pelajaran Malaysia (SPM) terutamanya dalam subjek Biologi, Kimia dan Bahasa Inggeris boleh meramalkan pencapaian pelajar dalam kurus Anatomi & Fisiologi (A&F) pelajar Diploma Kejururawatan di Malaysia. Kajian ini melibatkan 411 orang pelajar di kolej-kolej latihan Kementerian Kesihatan yang datang dari latarbelakang aliran sains di peringkat sekolah menengah atas. Data latar belakang pelajar yang terdiri daripada keputusan SPM Biologi, Kimia dan Bahasa Inggeris, aliran akademik di sekolah menengah, dan nombor pengenalan pelajar dipungut dengan menggunakan soal selidik yang ringkas. Analisis regrasi *stepwise* telah dijalankan ke atas data. Walaupun keputusan analisis menunjukkan bahawa SPM Biologi, SPM Kimia dan SPM Bahasa Inggeris seolah-olah menjadi peramal signifikan untuk pencapaian A&F, hanya SPM Biologi yang telah dikekalkan dalam model akhir regrasi *stepwise*. Oleh itu, peramal yang signifikan untuk A&F dalam kajian ini hanya SPM Biologi. Analisis dan ekstrapolasi selanjutnya terhadap keputusan A&F dan Biologi mencadangkan bahawa calon daripada

aliran sains di sekolah menengah perlu mendapatkan sekurang-kurangnya gred `B' dalam subjek Biologi SPM untuk mendapatkan sekurang-kurangnya lulus dalam A&F.

Kata kunci *Peramal pencapaian, kejururawatan, Anatomi & Fisiologi, Biologi, Kimia, Bahasa Inggeris.*

BACKGROUND AND RATIONALE

In line with the Government policy to ensure the people enjoy better health, Ministry of Health Malaysia (MOH) has set up several training institutions for health science in the field of Nursing (Board of Nursing, 2001). Until December 2012, MOH Malaysia has 16 training institutions (colleges) that offer Diploma in Nursing throughout the country. The Diploma in Nursing is a 3-year program that integrates theoretical and practical components.

Students enrolled in the Diploma of Nursing at the MOH are the candidates who have been selected by the Public Service Commission (PSC) based on several criteria. Candidates should be Malaysian citizens with ages between 17 and 25 years old and possess good results in the Malaysian Cerificate of Education (MCE) examination (Bahagian Pengurusan Latihan, 2010). In addition, candidates should pass the Aptitude Test (assessing interest and personality) and the interview conducted right after the test. This implies that candidates selected for the program can be considered as having interests as well as suitable personality and have the potential to succeed in the program.

However, even though students who enrolled in the training institutions of the MOH have been selected based on their academic qualifications, interests, personality traits deemed appropriate for the program, there are still failures in the program. During the presentation of the results of the Final Semester Examination for July-December 2012 session, the overall passing rate for Year 1 Semester I of the all the 16 colleges offering Diploma in Nursing program at the MOH Training Institutions was found to decline noticably (14%) compared to the previous sessions. The passing rate for for that cohort was only 82.5 percent. This was much lower than the previous three cohorts/ sessions (January-June 2011, July-December 2011 and January-June 2012), where the passing rates were 97.0%, 92.9% and 96.5% respectively. The result for the July-December 2012 session was the lowest even when compared to the following session (January-June 2013) where the overall passing rate was 92.0 percent.

With the overall passing rate at only 82.5 percent, the July-December session of 2012 result was below the expected minimum performance standard of 85 percent. Further analysis showed half of the colleges (8) have not reached the expected minimum standard of performance for MOH Training Institutions.

Review of the results of the July-December 2012 cohort showed that 308 of 309 (99.7%) students who failed that session were found to fail actually in the A&P course. In other words, their failure in program was due to failure in A&P course which major components were Biology and Chemistry. This also suggested that the

A&P course accounted for 17.4 percent (308 of 1769) of student attrition in that session. A quite similar observation was found in Columbus State University, U.S. A study conducted by Hughes (2011) found that university students who had to repeat courses in the Diploma in Biology program were mainly due to failure in Human Anatomy and Physiology course. During the spring semester in 2007 and 2008, 41 percent of the students had to repeat due to poor results (not obtaining grade C or better) in Human Anatomy and Physiology. This indicates that the subject of A&P is a difficult subject for many students.

Closer analysis of A&P assessment results showed that the failure in A&P was due to the students' poor achievement in the Final Semester Examination. Further analysis of the Final Semester Examination of multiple choice items (MCQ) and modified essay questions (MEQ) showed that the MCQ result was very poor (15.38% passes) compared to MEQ paper (89.88% passes). For majority of the students (88.3%), failure in A&P was due to failure in MCQ paper. Thus, MCQ was found to be the largest contributor to the failure in A&P. It was also found to affect the students' cumulative grade point averages (CGPA's) of students.

Mathiasen (1984) stated that test scores and high school achievement are the best predictors for success in college. Neill (2011) also found that academic skills acquired in the previous level such as high school can help facilitate course performance. In this study, the performance of MCE Biology and Chemistry were considered in predicting the Anatomy & Physiology (A&P) achievement among the Diploma in Nursing students due to their content relevance, and English was considered due to its the prominent use in A&P instruction.

About 76% of the students in the July-December 2012 cohort came from non-science background while the remaining 24% came from science background in the high school. Hishamuddin (2012) in his study found that science background students got better achievement in their diploma level course as compared to non-science students. However, detail examination of the Diploma in Nursing students' results also showed that 65% of science background students failed the A&P MCQ paper compared to 85% of non-science students. This is surprising because even students from science background with supposedly strong background knowledge failed the A&P MCQ paper. Science stream students typically took Chemistry and Biology which are closely related to A&P. Could it be because of their poor performance in those subjects in high school? All these are worth exploring to determine if performance in these school subjects influence A&P achievement. Separate analysis will be done in another study to examine if performance in core science predicts A&P achievement among non-science background students.

Review of related literature

Talbot (2013) found out the results from his study that Biology knowledge was important in areas related to A&P. Taylor (2004) from his research argued that there was a significant positive interaction between Biology courses and an average grade of the subjects of A&P. This means that knowledge in Biology is important factor in studying A&P.

Sundrud and Hueftle (2009) found that chemistry topics can be very intimidating for some students. Realizing that chemistry is a very important part of A&P, innovatively lecturers often use analogies to help students learn abstract materials and relating it to students' own experiences. To reinforce that chemistry is likely to be a predictive factor in the subject of A&P, Scanlon and Sanders (2011) stated that the anatomy of the human body itself is actually a solid structure that acts as a reservoir of various chemicals and chemical reactions. Before discussing more complex details about topics in A&P, they Scanlon and Sanders started with the easiest level related to the topic of organic chemistry and inorganic chemistry. Thus it can be seen here that basic knowledge of chemistry is important in the learning of A&P.

Apart from Biology and Chemistry, English proficiency is also considered very important in learning A&P because most of the terminologies used A&P are in English language. Low English proficiency may hinder students to succeed in the subject. English language proficiency among students in higher educational institutions is not only the problem of Malaysian students (Gobel, Siew, Sidhu, Oon & Chan, 2013). It is a global issues for a none English speaking countries such as Tanzania (Komba, Kafanabo, Njabili, & Kira, 2012), Iran (Sadeghi, Kashanian, Maleki & Haghdoost, 2013) and even in English speaking countries like Australia (Mann, Canny, Reser & Rajan, 2013).

The main reference books suggested for the A&P in the nursing colleges of MOH are also a books in English language such as 'Anatomy and Physiology in Health and Illness' along with other English and Malay Language books that contain a lot of medical terminologies in English language (Training and Management Division, 2009). Results from a study conducted by Talib, Su Luan, Azhar and Abdullah (2009) found that, proficiency in English is important for a student to excel in science-based subjects because most reference sources are in English and it also helps students to understand the various terminologies used. Sadeghi et al., (2013) in their research found that achievement of medical including nursing students directly increased by ability in scientific English (reading, writing and speaking). It is also an evidence that group of student with higher MCE English language grade believes more in their own ability to determine success in higher education (Gobel et al., 2013).

Siti Eshah (2012) in her study found that one third of school principals and science teachers interviewed agreed that scientific basic knowledge is an important factor that determines the performance in secondary science. The dependent variable in this study which is A&P subjects can also be categorized as science-based subjects. Therefore, some scientific basic knowledge especially from science stream students is very relevant to A&P. Taking this into consideration, non-science background students from high school might find A&P tougher than their counterparts from science stream.

A&P is a compulsory subject in most nursing programs (Bastable & Markowitz, 2012; Jun, Lee, Park, Chang & Kim, 2013). Johnston (2010) stated that, knowledge and skills such as physical assessment by nurses, is very demanding and it requires an understanding of functional human anatomy. With the increasing aging population and increasing number of patients with multiple pathologies, all health care providers, including nurses, need a good understanding of the complexities of anatomy and physiology. Therefore, the assessment results should reflect that knowledge in the

subject A&P has been adequately obtained by the students. The assessment structure for A&P subject in MOH colleges is presented in Table 1.

Table 1 Assessment structure for A&P subject

Examination	Mid Semester (30%)				Final Semester (70%)	
Domain	Theory (Cognitve)		Continous		Theory	
Paper	MCQ	SEQ	Coursework	Affective Domain	MCQ	MEQ
Percentage	5%	10%	10%	5%	40%	30%

All students pursuing Diploma in Nursing are required to undergo the Mid Semester and Final Semester Examinations (theory and practical) according to the course syllabi. However, for A&P subject, the examination structure mainly consists of the theory part, especially in the Final Semester Examination. This study focuses on the MCQ paper of the A&P Final Semester Examnination. The paper consists of 40 items. The instrument is a set of A&P questions for the Final Semester Examination in July-December 2012 session for the Diploma in Nursing program, MOH Training Institutions. It is used to estimate the ability of students in the A&P course which is compulsory in nursing. Therefore, there is a strong need to conduct a study to determine if there are differences in achievement between science and non-science background students and to identify some of the predictors of students' achievement in A&P MCQ paper.

Research question

i. Is there any significant difference in students' A&P achievement from science and non-science background?
ii. Can the MCE Biology, Chemistry, and Core Science and English results predict significantly A&P achievement among the Diploma in Nursing students in Malaysia?
iii. If yes, how much is the contribution of MCE Biology, Chemistry, and English results in predicting the variability of A&P results as reflected by the R^2?
iv. What are the minimum grades of MCE Biology, Chemistry, and English needed to get at least a 'pass' in A&P?

METHODOLOGY

The study population comprised of 1769 male and female students studying in 16 MOH Training Institutes. They were the first year students of the July-December 2012 cohort. Students from other semesters were not included as respondents because the A&P course is only offered in first semester of the Diploma in Nursing program. From the 1769 students, 431 were from science stream background while the majority (1338) were from non-science stream in their high school. However, not all students completed the background information section in the questionnaire. This study involved 411 science stream students and 1239 non-science stream students who were randomly chosen from those who completed the questionnaires. This sample size is

sufficient and greater than proposed by Krejcie & Morgan (1970) which suggested a sample size of 203 and 293 for science stream and no-science students respectively at 95 percent confidence level. Bigger sample size was chosen to reduce the standard error of measurement as stated by Button et al., (2013).

Prior to the study in November 2012, the researcher submitted an application to the Head of the Exams & Certification Unit, Training and Management Division, MOH to access the Nursing curriculum and A&P syllabus of A&P course. Subsequently the researcher submitted another application to access the examination questions and detail results of the students to the same division and permission was granted in December 2012.

Research Instruments

Two sets of instruments used in this study were questionnaire for students and the A&P MCQ paper.

a) Questionnaire

The instrument used to collect the background data in the study was a questionnaire administered to respondents in all 16 colleges involved. Background data comprising academic stream in high school, MCE subject grades (Biology, Chemistry and English) and students' ID were collected. Results in A&P subject in Final Semester Examination for Year 1 Semester I session for July-December 2012 were collected separately from the Examination Unit, Training and Management Division, MOH by researcher.

b) A&P MCQ Paper

The MCQ paper for A&P course was the test used for the Final Semester Examination in July-December 2012 session, Diploma in Nursing program of MOH Training Institutes, which consisted of 40 items. It was used to estimate the achievement of students in A&P which is a prerequisite knowledge in nursing. The items were first drafted by the lecturers at the individual college level. Next, the items were sent to the Training and Management Division, MOH, for review, editting and selection. Item review was done by a group of lecturers who are proficient in the subject. Only 120 best items were selected and assembled based on the test specification table.

Three sets of questions were then proposed, with each set containing 40 items. The decision on which set of questions to be used in the examination was finally made by the committee chaired by the Secretary (Director) of Training and Management Division, MOH. In the Final Semester Examination, all 16 colleges are received the same set of questions.

Data Analysis Procedure

Data for the study were analysed using independent samples t-test to determine there is any significant difference between science and non-science background students in their A&P MCQ achievement. In addition, stepwise regression analysis was performed to determine if students' performance in MCE Biology, Chemistry and English at high

school can predict achievement in the A&P MCQ, as well as to determine the extent to which these high school results predict the A&P MCQ achievement. Analysis was also done to estimate the minimum requirement of MCE Biology grade to get at least a 'pass' in the A&P MCQ. For analysis purposes, MCE grades obtained were converted to research scale according to year of MCE as shown in Appendix A.

RESULTS

Preliminary analysis showed that A&P MCQ scores were normally distributed and the means of Y fell on a straight line. This is shown in Figure 1. Levene's test for equality of variances showed a value of 0.377 ($p>0.05$) in Table 3. This means that there is no significant difference in the variances between the sub groups. Therefore, equal variance assumption is met. This also means that the variances between tested groups are homogenous. Since the normality, linearity and equal variance assumption are met, parametric analysis using independent samples t-test and regression analysis were performed on the data.

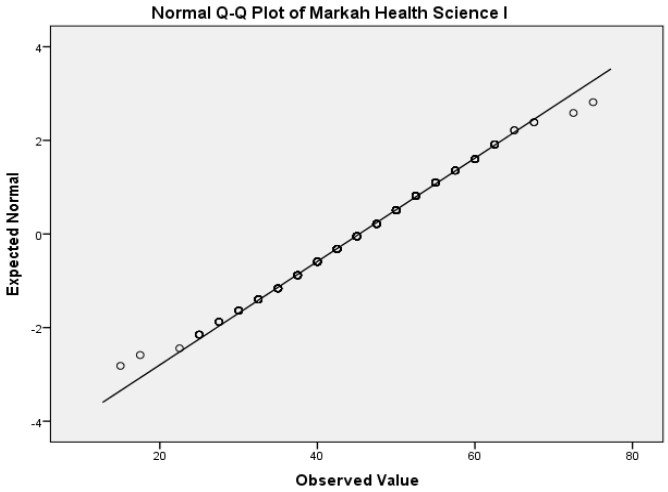

Figure 1 Normality plot of A&P marks

Differences in A&P MCQ Achievement between Science and Non-Science Background Students

Results in Table 2 showed that, on average science stream students obtained higher scores (μ=45.32; σ=9.06; n=411) in A&P MCQ as compared to the non-science stream students (μ=36.36; σ=8.60; n=1239) by 8.96 points. Separate analyses need to be conducted to the science and non-science students' data to explore further into the potential factors that predict their A&P MCQ scores. However, this study focuses only on the science students' data for the subsequent analyses due to the availability of data.

Table 2 Group statistic

	Academic Stream	N	Mean	Std. Deviation	Std. Error Mean
A&P Scores	Science	411	45.32	9.06	.45
	Non-Science	1239	36.36	8.60	.24

Results of independent samples t-test showed that there is a significant difference the mean scores of the science and non-science background groups. The P-value was 0.000 ($p<0.05$), suggesting that the null hypothesis (H_o) that stated no significant difference between the two groups to be rejected. Independent samples t-test results in Table 3 showed that science stream students performed significantly better ($p<0.05$; $t=18.07$; $df=1648$) than non-science stream students in the A&P MCQ.

Table 3 Independent samples t-test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
A&P MCQ Scores	Equal variances assumed	.780	.377	18.07	1648	.000	8.96	.496	7.99	9.93
	Equal variances not assumed			17.60	671.87	.000	8.96	.509	7.96	9.96

The Effects of MCE Biology, Chemistry and English on A&P Achievement

A correlation matrix in Table 4 shows the coefficient correlations between pairs of independent variables. All the independent variables appear to have a significantly moderate correlation with A&P MCQ scores. The MCE Biology and MCE Chemistry grades showed a correlation of 0.265 and 0.217 respectively, with MCE Biology showed the strongest relationship with A&P MCQ scores.

Table 4 Correlations matrix between variables

		A&P MCQ Scores	MCE Biology grade	MCE Chemistry grade	MCE English grade
Pearson Correlation	A&P MCQ scores	1.000	.265	.217	.166
	MCE Biology grade	.265	1.000	.114	.102
	MCE Chemistry grade	.217	.114	1.000	.100
	MCE English grade	.166	.102	.100	1.000
Sig. (1-tailed)	A&P MCQ scores	.	.000	.000	.000
	MCE Biology grade	.000	.	.010	.020
	MCE Chemistry grade	.000	.010	.	.022
	MCE English grade	.000	.020	.022	.
N	A&P MCQ scores	411	411	411	411
	MCE Biology grade	411	411	411	411
	MCE Chemistry grade	411	411	411	411
	MCE English grade	411	411	411	411

The Contribution of MCE Biology, Chemistry and English results in A&P achievement

To examine the relationship between the variables, a stepwise multiple regression analysis was performed on the data. A stepwise multiple regressions were conducted to determine the equation or model that best fits the data. The independent variables were entered one by one into the model with Biology being entered first, followed by Chemistry and English. The computed F value of 18.563 and the P-value < 0.05 (Appendix B) indicates that the independent variables in the model 3 have significant effects to the regression model (Table 5). This means that the independent variables have the ability to predict the variation in A&P MCQ scores.

Table 5 Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	39.059	1.207		32.354	.000
	MCE Biology Grade	1.503	.271	.265	5.549	.000
2	(Constant)	34.880	1.580		22.082	.000
	MCE Biology Grade	1.380	.268	.243	5.155	.000
	MCE Chemistry Grade	1.145	.286	.189	4.004	.000
3	(Constant)	31.876	1.935		16.473	.000
	MCE Biology Grade	1.316	.267	.232	4.929	.000
	MCE Chemistry Grade	1.078	.285	.178	3.781	.000
	MCE English Grade	.636	.240	.124	2.649	.008

a. Dependent Variable: A&P Scores

Stepwise regression analysis also showed that an adjusted R^2 value of 11.4 percent (Table 6). This means that variation in MCE Biology, MCE Chemistry and MCE English grades contribute 11.4 percent to the variation in A&P.

Table 6 Model summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.265[a]	.070	.068	8.74344	.070	30.796	1	409	.000
2	.324[b]	.105	.101	8.58703	.035	16.036	1	408	.000
3	.347[c]	.120	.114	8.52438	.015	7.019	1	407	.008

a. Predictors: (Constant), MCE Biology grade

b. Predictors: (Constant), MCE Biology grade, MCE Chemistry grade

c. Predictors: (Constant), MCE Biology grade, MCE Chemistry grade, MCE English grade

d. Dependent Variable: A&P Scores

Even though all the three independent variables namely MCE Biology, MCE Chemistry and MCE English were statistically significant in predicting A&P scores in the first round (variable to enter), the latter two were excluded from the model in the stepwise regression (Table 7). MCE Biology was found to be the only predictor variable of A&P MCQ in the final model and this variable predicts 6.8 percent of the variation in A&P MCQ scores. Therefore, based on results in Table 5 and Table 6, the regression model becomes:

$$\text{A\&P Scores} = \beta_0 + \beta_1 \text{Biology} + E, \text{ or}$$
$$\text{A\&P Scores} = 39.059 + 1.503(\text{Biology}) + E.$$

Table 7 Excluded variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	MCE Chemistry grade	.189[b]	4.004	.000	.194	.987
	MCE English grade	.140[b]	2.951	.003	.145	.990
2	MCE English grade	.124[c]	2.649	.008	.130	.982

a. Dependent Variable: A&P Scores

b. Predictors in the Model: (Constant), MCE Biology grade

c. Predictors in the Model: (Constant), MCE Biologi grade, MCE Chemistry grade

Estimate of Minimum Grade in MCE Biology to Pass A&P

According to (Ministry of Health, 2009), students should get a minimum score of 50 percent to pass a paper. Further analysis of the data found that, in order for student to get a `pass' in the A&P MCQ paper, he or she should get a minimum of `B' grade or `High Credit' in MCE Biology. Correlation pattern between MCE grades and means of A&P achievement is shown in Table 8 and graph is shown in Figure 2.

Table 8 Descriptives

MCE Biology Grade	A&P Scores Mean Statistic	Std. Error
*None	41.95	1.76
Pass	35.00	2.37
Upper Pass	42.16	1.15
Credit	44.95	.67
Upper Credit	45.08	.88
High Credit	51.05	1.24
Highest Credit	50.77	2.03
High/Highest Distinction	57.50	2.50

*None = students did not take MCE Biology

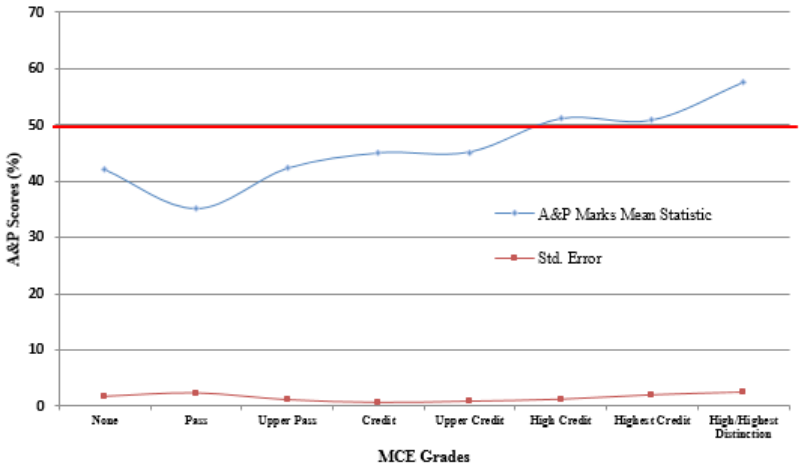

Figure 2 Correlation pattern between MCE Biology grades and means of A&P scores

DISCUSSION

Even though the A&P MCQ results were relatively poor as reflected by the means (μ=38.59; σ=9.53), science stream students (μ=45.32; σ=9.06) performed significantly better than non-science stream students (μ=36.36; σ=8.60) in A&P. This finding is in accordance with a research conducted by Siti Eshah (2012) who found that the scientific basic knowledge among the students is an important factor that determines later performance in science subjects. This is likely to suggest that the entry qualifications for Diploma in Nursing have to be reviewed and most probably priority should be given to candidates from science stream background. This is also congruents with Wolkowitz & Kelley (2010) findings from their study that suggested science knowledge should be a prominent academic area considered when admitting students into the nursing programme.

Result of stepwise regression analysis showed that MCE Biology has significant effects on A&P achievement. MCE Biology predicts 6.8 percent of the variation in A&P MCQ scores. This matches the results of recent research across different fields (Talbot, 2013; Scanlon & Sanders, 2011; Talib et al., 2009; Taylor, 2004) that showed knowledge in human biology field is closely related to A&P. Even though MCE Biology, MCE Chemistry and MCE English seem to be significant predictors of A&P, only MCE Biology was kept in the final model of the stepwise regression analysis. Thus, MCE Biology is the only significant predictor of A&P MCQ in this study. Another important finding revealed from this study is that students should obtain a miminum B grade in MCE Biology in order to pass A&P in the Diploma in Nursing and this should be taken into consideration in the selection of students into the program in the future.

CONCLUSION

From this study, students with high performance in A&P generally possess strong science ability, particularly in high school Biology subject. Knowledge in high school Biology was found to predict A&P scores and therefore should be considered in the selection of students for Diploma In Nursing. This is coherent with findings from other studies presented in this article. A striking finding was the minimum grade of MCE Biology required to pass A&P course among science stream students. Even though these results may not be conclusive and require more extensive studies, this can serve as an early indication that MOH may have to review its prerequisite admission policy of student admission.

However, this study has its limitations. The predictors of A&P achievement for non-science background students were not yet explored. Futhermore, MCE Biology results only explain about seven (7) percent of the variation in A&P scores. Therefore, the results need to be treated with caution and more comprehensive studies in this area need to be done before the new admission policies are formulated to ensure quality and equity in educational opportunities.

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Appendix A

Conversion MCE grades to reseach scale according to year of MCE

Previous MCE Grading		MCE Grading Application From Year 2009		Research Scale
Grades	Interpretation	Grades	Interpretation	
-	-	A+	Highest Distinction	9
1A	Distinction	A	High Distinction	
2A	Distinction	A-	Distinction	8
3B	Credit	B+	Highest Credit	7
4B	Credit	B	High Credit	6
5C	Credit	C+	Upper Credit	5
6C	Credit	C	Credit	4
7D	Pass	D	Pass Upper	3
8E	Pass	E	Pass	2
9G	Fail	G	Fail	1
Not Seating				0

Appendix B

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2354.258	1	2354.258	30.796	.000[b]
	Residual	31267.123	409	76.448		
	Total	33621.381	410			
2	Regression	3536.683	2	1768.341	23.982	.000[c]
	Residual	30084.698	408	73.737		
	Total	33621.381	410			
3	Regression	4046.731	3	1348.910	18.563	.000[d]
	Residual	29574.650	407	72.665		
	Total	33621.381	410			

a. Dependent Variable: A&P Scores

b. Predictors: (Constant), Gred SPM Biologi

c. Predictors: (Constant), Gred SPM Biologi, Gred SPM Kimia

d. Predictors: (Constant), Gred SPM Biologi, Gred SPM Kimia, Gred SPM Bahasa Inggeris