An Examination of a Dental School's Holistic Preadmission Criteria as a Predictor of Student Performance

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ABSTRACT

The demanding dental curriculum and competitive nature of admission make it crucial for dental schools to apply strict preadmission criteria in order for them to select the best candidates. The objectives of this study are to evaluate the ability of preadmission criteria used (cumulative grade point average [CGPA], emotional intelligence [EI] test and semi-structured interview) in predicting the in-programme performance regarding academic performance, perception of education environment and perceived stress for the Bachelor of Dental Surgery undergraduates and to determine the relationship between EI and perceived stress amongst these students. This longitudinal study was conducted in two parts. Part one was conducted as a retrospective review of preadmission criteria consisting of EI, CGPA and results of a structured interview, while the second part included a cross-sectional evaluation of the education environment using the Dundee Ready Education Environment (DREEM) questionnaire and evaluation of perceived stress using the Perceived Stress Scale (PSS). The sample included all students enrolled between the 2015/2016 and 2019/2020 academic year. Academic performances were collected and analysed, revealing a positive correlation between preadmission CGPA and academic performance for the dental public health course. An inverse correlation was found between interview performance and education environment experience, where higher interview results were associated with lower education environment experience. Additionally, a positive correlation was found between EI scores and academic performance in the Periodontology subject. The current preadmission criteria do not provide much insight into the predicted future performance and experience of students. The inclusion of other tools such as a programme-specific entrance test could be considered.

Keywords: Stress, Preadmission, Emotional intelligence, Dental undergraduates, DREEM, Academic score

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INTRODUCTION

Interprofessional education (IPE) is a programme designed to help students acquire dentistry is known as one of the most challenging and stressful programmes of studies (1–3). Admission to dental programmes is highly selective and competitive. A dental training programme aims to equip dental students with a wide range of academic and clinical competencies and, at the same time, enhance their interpersonal skills (4). Student selection criteria are vital to predict the candidates' performance in dental programmes. Its validity and reliability highlight the degree of predicting the applicant's performance during and after the undergraduate training (5).

In Malaysia, dentistry is a five-year programme which consists of 10 semesters. Dental students are required to sit for several professional examinations prior to graduation. While there may be some variations in terms of the implementation of the curriculum across Malaysia in general, however, the undergraduate dentistry programmes are subjected to a programme standard by the Malaysian Qualifications Agency and the Malaysian Dental Council (MDC).

In general, the first professional examination (PRO 1) is usually held in semester four (year 2). It comprises written and clinical examinations to assess the dental and medical knowledge of the students. The next professional examination (PRO 2) is held in semester eight (year 4). This examination assesses the students' clinical competency and knowledge. The third professional examination (PRO 3) in semester 10 (year 5) assesses the students' overall dental knowledge, which covers most of the clinical and theoretical aspects.

Over the years, the number of applicants to dental schools has steadily increased, highlighting the growing popularity of dentistry as a respected and highly sought-after programme. However, the availability of spots is limited due to the moratorium set by the MDC. Therefore, it is crucial for dental institutions to enforce suitable preadmission criteria to ensure the selection of the best candidates (5). Traditionally, admission to dental schools focuses on cognitive measures such as cumulative grade point average (CGPA), however, nowadays, most dental school admission committees have come to recognise the importance of noncognitive skills as well, such as communication, interpersonal and professional abilities. The preadmission criteria can be assessed through several tests, which include semi-structured interviews, motor hand skills evaluation, colour blindness assessment and personality evaluations or emotional intelligence (EI). Likewise, these tests have also been adopted as preadmission criteria by other programmes such as post-surgical residency training and orthopaedic surgery residency (6–7).

According to Salovey and Mayer (8), EI is a form of social intelligence that involves the ability to monitor one's own and others' feelings and emotions, discriminate among them, and use this information to guide one's thinking and action. They suggested that EI comprises five principal features:

a. Being aware of one's own emotions.

b. Being able to manage one's own emotions.

c. Being sensitive to the emotions of others.

d. Being able to respond to and negotiate with other people emotionally.

e. Being able to use one's own emotions to motivate oneself.

Recent studies have identified four factors addressing optimism or the ability for mood regulation, the ability to appraise emotions, the appropriate utilisation of emotions and social skills within the EI scale developed by Schutte et al. (9–12). EI can potentially serve as an important factor in improving patients' outcomes, especially among medical and dental students (13). Studies have found that higher levels of EI positively correlate with better academic performance (12, 14). EI brings new depth to the understanding and assessment of a person's general intelligence and provides important insights regarding what else is required for superior professional performance. In the work field, it is related to better stress coping, teamwork, leadership qualities, job satisfaction, fewer turnover intentions, less burnout, and better overall performance (15). Wagner et al. (16) also reported patient satisfaction was positively associated with physicians' EI. Since training in health sciences includes patient interaction, it is believed that students with higher EI are more likely to achieve positive patient outcomes (12).

EI is also important as it is a coping mechanism to counter stress. Numerous studies have indicated that stress is prevalent among dental undergraduates, with up to 72% of final-year dental students diagnosed with stress and pathological anxiety (12). Additionally, 36% of year 1 dental students were found to experience psychological distress and emotional fatigue, highlighting the importance of assessing stress levels to determine the student's ability to cope with the academic demands and environment. To this end, the perceived stress test, which is essential to be performed among dental undergraduates, may be able to measure the perception of stress and identify the ability of the students to cope with stress (12).

Another important aspect in measuring the success of a dental programme is the educational environment. It is this educational environment that facilitates students' professionalism and moral responsibilities, which in turn improves students' performance (5, 17). The educational environment also influences the health-care professional's punctuality, hard work and ethical responsibility. The measurement of the environment has received great attention within the healthcare professional's education, which explores the impact on educational outcomes. The most commonly used measurement for the educational environment in health professionals' programmes is the Dundee Ready Education Environment Measure (DREEM) (18–20).

The Faculty of Dentistry applies a comprehensive preadmission criterion, which includes a semi-structured interview based on several questions that encompass both general and specific dental knowledge, an evaluation of academic ability through their preadmission CGPA, an aptitude evaluation through EI test, a motivation evaluation by determining selection choice and hand skills. The semi-structured interviews are carried out by trained interviewers. In addition, the EI test is used as a preadmission assessment test to assess noncognitive skills, while the selection choice looks at where the candidate places dentistry as a course of choice. The combination of these assessments or tests aims to assist in the selection of holistic individuals in addition to their CGPA merits. Therefore, the cumulative scores for all preadmission tests (EI, semi-structured interview, CGPA and hand skill) determine the selection of the most eligible candidates for the dental programme.

Even though there are many studies investigating the relationship of EI and students' or physicians' performance, there is a lack of longitudinal studies looking into the preadmission selection criteria using a combination of several preadmission tests such as EI, semi-structured interviews, and motor hand skills tests in predicting the academic performance, stress level, and education environment perception among dental undergraduates. Hence, the objectives of this study are to evaluate the ability of preadmission criteria used (CGPA,

EI test and semi-structured interview), to predict the in-programme performance regarding academic performance, perception of education environment and perceived stress for the Bachelor of Dental Surgery undergraduates, and to determine the relationship between EI and perceived stress amongst these students.

METHODS

Study Design

This retrospective cohort study was conducted among undergraduate students at Universiti Teknologi MARA Sungai Buloh, Selangor between December 2018 and March 2020. The preadmission criteria consist of three components. The predictive variables were as follows: academic abilities (CGPA), EI test, and semi-structured interview). The criterion variables were the Professional Exam results, DREEM scores and Perceived Stress Scale (PSS) scores of dental students.

Instruments

The first part of this study involved a retrospective review of the preadmission criteria, which consisted of an EI score, CGPA score, and a structured interview score. Data on EI were collected using a scale developed by Schutte et al. (10), which has been validated for use with the dental student population previously for its predictive, construct and discriminant validities (12). The EI scale comprised of 33 items, measured on a 5-point Likert scale from 1 to 5 with a probable range of scores of 33 to 165 (12). Data on CGPA was based on students' CGPA from their matriculation. Interview data consisted of a structured interview questionnaire, which included 10 areas and a hand skills assessment that included either wire bending, origami, or soap carving. The total score for the interview component was 40, where every area had a minimum score of 0 and a maximum score of 4. The scoring was subjective as it reflected the opinion of the interviewers. However, the interviewers had been calibrated and trained in the course of running the interviews.

For part two, a self-completed questionnaire was disseminated to all participants at the end of lectures in semester 2.2, where a short briefing session explaining the purpose of the questionnaire and assurance that participation is voluntary was conducted. The participants were given 15 to 20 minutes to complete the questionnaire.

The questionnaire consisted of three parts: (a) sociodemographic section with data on students' ID, age, gender, year of study and information on whether dentistry course was the participants first choice at preadmission; (b) the DREEM questionnaire; and (c) the PSS. The DREEM is a 50-item questionnaire developed using a Delphi approach that included a varied group of international health educators. As such, the DREEM is deemed appropriate for evaluating a variety of health professional programmes and is not considered to be context- or culture-specific. Items were measured based on a five-point Likert scale: 0 is strongly disagree, 1 is disagree, 2 is neither agree nor disagree, 3 is agree, and 4 is strongly agree. Participants were required to respond to statements depicting a variety of education environment domains, such as academic atmospheres or teaching styles. Nine items were reverse-scored. The questionnaire was made up of five subscales: students' perception of teachers, students' perception of learning, self-perceptions, students' perception of atmosphere, students' academic and students' social self-perception (18). The PSS, which is the third section of the questionnaire, was measured using the Perceived Stress Scale-10

(PSS-10). The PSS-10, which is comprised of 10 items measured on a 5-point Likert scale from 0 to 4, measures the "degree to which situations in one's life are appraised as stressful" (12, 21). Participants' academic performance in their professional examination was also collected where applicable. This data was obtained from the academic unit. The results were coded, and values were assigned to ensure anonymity. Academic performance data included grades for subjects in each professional examination (Pro); Pro 1 (Basic Medical Sciences), Pro 2 (Oral Pathology and General Medicine and General Surgery), Pro 3 (Oral Medicine and Radiology, Paediatric Dentistry, Orthodontics and Dental Public Health) and Pro 4 (Periodontology).

Data Analysis

The data obtained was analysed using Statistical Package for Social Sciences (SPSS version 24.0). Independent *t*-test and ANOVA were conducted between sociodemographic variables of interest and predictive and criterion variables. The correlation between admission variables and the professional examination results, DREEM score and PSS-10 score, were examined using Pearson's correlation coefficient to determine the nature and strength of relationships among the variables of interest. The *p*-value was considered significant at < 0.05.

RESULTS

Response Rate and Demographic Distribution

A total of 393 undergraduate dental students were involved in this study (98% response rate). The majority of the students are female (82%) and entered dental school with a matriculation qualification (93%), while the rest had a diploma qualification. Most students (95%) indicated that dentistry was their first choice when completing the admission application form (Table 1).

Table 1: Sample characteristics and descriptive statistics

Demographic characteristics	%
Gender	
Male	71 (18.0)
Female	322 (82.0)
Entry qualification	
Matriculation	366 (93.0)
Diploma	27 (7.0)
Choice of entry	
First	372 (94.6)
Second	16 (4.1)
Third	5 (1.3)
Current year of study	
Year 1	82 (20.9)
Year 2	77 (19.6)
Year 3	74 (18.8)
Year 4	90 (22.9)
Year 5	70 (17.8)

Preadmission and Performance Indicator

Table 2 shows the mean scores for both preadmission and performance indicator variables for the whole sample. A mean score of an academic subject corresponds to an assigned grade, as indicated in Table 2. As an example, the grade for the Basic Medical Sciences is 6.05 = C+.

Table 2: Mean score and standard deviation for preadmission and performance indicator variables

Preadmission and performance indicator variables		Mean (N)	SD
Preadmission criteria	EI	141.87 (351)	10.97
	Interview score	36.18 (336)	3.06
	CGPA	3.91 (393)	0.118
Performance indicator	DREEM	126.54 (393)	11.34
	PSS	21.27 (392)	4.214
	General Medicine and General Surgery	4.17 (159)	1.29
	Oral Pathology	4.24 (159)	1.46
	Basic Medical Sciences	6.05 (232)	1.23
	Oral Medicine and Radiology	3.06 (70)	0.95
	Paediatric Dentistry	4.60 (70)	1.13
	Orthodontics	4.04 (70)	1.49
	Dental Public Health	4.43 (70)	1.43
	Periodontology	3.51 (70)	1.05

Note: For the mean scores for academic subjects, each score corresponds to an assigned grade as follows: 1 = A*, 2 = A+, 3 = A, 4 = B+, 5 = B, 6 = C+, 7 = C, 8 = D, 9 = E, 10 = F.

Meanwhile, Table 3 shows the mean scores for CGPA, PSS, EI and DREEM by batch of study. No significant difference was found between PSS and EI scores between batches. However, year 2 and year 3 students reported significantly higher DREEM scores compared to other years ($p < 0.001$). Year 1, year 2 and year 5 students reported significantly higher preadmission CGPA compared to the current year 3 ($p < 0.05$).

In terms of entry qualification, matriculation students reported significantly higher CGPA (mean diff = 0.102; $p = 0.003$) and EI scores (mean diff = 6.300; $p = 0.005$) compared to their diploma-qualified counterparts. No significant difference was found between the choice of entry regarding CGPA, PSS, EI and DREEM.

Table 3: Mean scores for CGPA, PSS, EI and DREEM by batch of study

Batch	N (%)	CGPA		EI		PSS		DREEM	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Year 1	82 (20.9)	3.94*	0.10	8.73	0.31	20.87	3.65	122.79	7.04
Year 2	77 (19.6)	3.92*	0.11	8.42	0.67	21.53	5.56	133.66**	13.46
Year 3	74 (18.8)	3.87	0.12	8.56	0.87	21.54	5.36	133.24**	12.85
Year 4	90 (22.9)	3.89	0.13	8.68	0.61	21.18	3.17	122.22	7.79
Year 5	70 (17.8)	3.92*	0.10	8.47	0.73	21.24	2.68	121.57	6.98

Note: Cumulative grade point average (CGPA), Perceived Stress Scale (PSS), Emotional intelligence (EI), Dundee Ready Education Environment (DREEM); *($p < 0.05$); **($p < 0.001$).

The correlation between preadmission criteria variables and performance indicator variables using the Pearson product-moment correlation coefficient is shown in Table 4. CGPA was only significantly correlated with performance in the Dental Public Health subject, while EI was significantly inversely correlated (weak relationship) with performance in the Periodontology subject. Interview scores were only significantly inversely correlated (weak relationship) with the DREEM score while PSS scores were also only significantly inversely correlated (weak relationship) with the DREEM score. Correlation between subject-based performance indicators shows a medium to large positive correlation between Basic Medical Sciences subjects and all other clinical subjects. All clinical subjects were also similarly positively correlated (moderate to strong relationship) to each other.

Table 4: Pearson product-moment correlations between preadmission criteria and performance indicators

	1	2	3	4	5	6	7	8	9	10	11	12
(1) CGPA												
(2) EI	0.02											
(3) INT	−0.02	0.05										
(4) PSS	−0.07	0.05	−0.05									
(5) DREEM	−0.04	−0.03	−0.13*	−0.26*								
(6) GMGS	0.08	−0.07	0.13	0.08	0.01							
(7) OP	−0.11	−0.02	0.09	0.08	0.06	0.71**						
(8) BMS	−0.05	−0.03	0.12	0.03	−0.03	0.49**	0.52**					
(9) OMOR	−0.20	−0.23	−0.14	−0.01	0.14	0.29*	0.29*	0.52**				
(10) PAEDS	−0.03	−0.12	−0.02	−0.13	0.10	0.14	0.14	0.34**	0.41**			
(11) ORTHO	−0.80	0.04	−0.08	−0.08	0.07	0.28*	0.28*	0.56**	0.57**	0.63**		
(12) DPH	−0.25*	0.14	−0.15	0.06	0.02	0.22	0.22	0.50**	0.59**	0.44**	0.52**	
(13) PERIO	−0.11	0.29*	−0.16	−0.06	0.06	0.22	0.21	0.50**	0.53**	0.36**	0.39**	0.53**

Notes: ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed); Cumulative grade point average (CGPA); Emotional intelligence (EI); Interview (INT); Perceived Stress Scale (PSS); Dundee Ready Education Environment (DREEM); General Medicine and General Surgery (GMGS); Oral Pathology (OP); Basic Medical Sciences (BMS); Oral Medicine and Oral Radiology (OMOR); Paediatric Dentistry (PAEDS); Orthodontics (ORTHO); Dental Public Health (DPH); Periodontology (PERIO).

DISCUSSION

This study aims to evaluate the ability of preadmission criteria used to predict the in-programme performance regarding academic performance, perception of the education environment and perceived stress.

The lack of a significant correlation between preadmission CGPA and any performance indicator, with the exception of the dental public health subject, is worrying as the preadmission CGPA is a strict preadmission criterion that has a minimum requirement of at least 90%. This means that students who do not score the required 90% are not even given the chance to fulfil the rest of the preadmission criteria to be considered for admission, when, in fact, the CGPA is not predictive of academic performance nor education environment experience and stress perception. This lack of correlation could be because the subjects that contribute to the CGPA are not directly related to the subjects in the undergraduate dental programme. The lack of correlation may also be attributed to the different styles of learning

at matriculation, diploma and degree programmes, where learning in the undergraduate dental programme is student-centred learning as opposed to more teacher-centred learning at the matriculation level. This finding backs the practice by some European countries whereby high school grade or matriculation CGPA is not used as a preadmission consideration (22).

Interestingly, the performance in Basic Medical Sciences subjects significantly positively correlated with performance in all other clinical-based subjects. This finding suggests that it may be worthwhile to look at the value of implementing a programme-specific preadmission test based on the Basic Medical Sciences curriculum, as studies show that the preadmission test is one of the main statistically predictive factors of academic performance during undergraduate medical programmes (23).

The goal of doing an interview is to assess additional information on candidates that would otherwise be challenging or unfeasible to obtain by other means, such as communication skills ability and self-presentation. The lack of correlation between semi-structured interview scores and academic performance and perception of education environment and perceived stress in this study may also suggest that the components being assessed during the interview may not be relevant in predicting the student's performances and experience.

The multiple mini-interview, an innovation of the traditional interview, has been proposed as an alternative method to assess the non-academic abilities and personality of a candidate. To date, this method has been considered to be acceptable and reliable. At the same time, psychometric tests can also be used to objectively measure personality, characteristics and abilities in lieu of an interview.

The interpretation of the results must take into consideration some of the limitations of this study. Firstly, the possibility of a type 2 error due to the limited number of students analysed. Even though the total sample size exceeded the minimum sample size required, the sample size for the evaluation of academic performance indicators varied across each subject as even though the grade of Basic Medical Sciences subjects was available among the years 2, 3, 4 and 5 students, the grade of clinical subjects such as Oral Medicine and Oral Radiology, Paediatric Dentistry, Orthodontics, Dental Public Health and Periodontology were only available for a small subset of the samples as more than half of the samples had not yet sat for these exams. The small sample size could account for the lack of statistical significance in the correlation analyses. At the same time, while academic performance and CGPA were objective indicators, EI, perceived stress and perception of the education environment were both subjective measures and, as such, may be influenced by reporting bias. Students may have felt that they had to answer the questionnaires in a certain way which may have influenced the results of the study. The evaluation and the scoring of the interviews were also subjective measures, and while training of the interviewers was done prior to the start of the interviews, no calibration of interviewers was done to assess the reliability of the scoring of the interviews.

CONCLUSION

This study concludes that the current preadmission criteria do not provide much insight for predicting the future performance of students. Hence, there is a need to further investigate and evaluate the preadmission criteria imposed. Furthermore, the inclusion of valid and reliable admission tools, such as a programme-specific preadmissions test or a personality psychometric test for a candidate's suitability could be considered to establish a robust and ideal candidate selection process.

ETHICAL APPROVAL

Ethical approval to conduct the study was obtained from the Research Ethics Committee (600-IRMI (5/1/6)), and permission to collect data was obtained from the Faculty of Dentistry, Universiti Teknologi MARA, Sungai Buloh, Selangor.

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