Effects of Demographic Factors on the Multiple Intelligences of Preclinical Dental Students at SEGi University, Malaysia

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ABSTRACT

Over the years, there has been an increased emphasis on the learner-centred, outcome-based, as well as patient-centred approach in dental education. These changes require dental students to acquire many hard and soft skills in order to fulfill their role as a health care professional. The Theory of Multiple Intelligences (MI) by Howard Gardner fits well in this changing face of dental education as it embraces a mixed blend of capabilities and skills that are unique to an individual, which are important in shaping the dentist of tomorrow. This cross-sectional study investigated the MI of preclinical dental students at a private university in Malaysia using the MI Inventory. The effects of various demographic factors on MI were also explored. Dental students demonstrated the highest mean score in the intrapersonal domain and the lowest, in the verbal/linguistic domain. Age, gender, race and family income were found to play a role in the MI of these students. Findings of this study gives of a better understanding of the strengths and weaknesses of preclinical dental students in terms of their MI. Demographic and individual differences in MI suggest that mixed modes of teaching and learning and the learner-centred approach are beneficial in dental education.

Keywords: - *Multiple intelligences, Dental education, Effects of demographic factors, Preclinical dental students*

1. INTRODUCTION

For the past two decades or so, dental education has shifted from the teacher-centred approach to the learner-centred approach. A good example of such an approach is the adoption of problem-based learning in many dental schools world-wide, which marks an important milestone in the evolution of dental education [1, 2]. Many dental schools today are also inclined to outcome-based education [3] in which the learners are trained to be an all-rounded healthcare professional equipped with the essential competencies of a good dentist.

The emphasis on early clinical exposure and the patient-centred approach [4] in clinical training implies that dental students need to develop good interpersonal, inter-professional skills and many other competences in preparation of their future practise [5]. As an important member of the health care system, dentists must be equipped with the soft and hard skills required in patient management. While the hard skills deal with the technical aspects of dental practice, the soft skills enable the dentist to communicate and interact with patients professionally. Therefore, the 21st century dental students are not only expected to acquire dental-related skills and knowledge, more importantly, they should also have communication skills, critical appraisal skills, good attitudes and behaviours to provide high standards of evidence-based oral health care [6].

The changing face and the newer approaches in dental education imply that learning in dental education requires a mixed blend of capacities, which makes the Theory of Multiple Intelligences proposed by Howard Gardner [7] highly relevant in dental education. Unlike the traditional concept that emphasizes a general intelligence, Gardner believes that an individual is smart in different ways as described by the nine MI domains, namely, the musical/rhythmic, logical/mathematical, interpersonal, bodily/kinaesthetic, verbal/ linguistic, intrapersonal, visual/spatial, naturalist and existential intelligences [8].

Intelligence testing has a long history, which can be dated back to Alfred Binet and Theodore Simon's first practical intelligence test [9]. On the other hand, Charles Spearman first described general intelligence as the 'g' factor [10], which is responsible for the overall performance on cognitive ability tests. Gardner's MI Theory differs greatly from the traditional intelligence concept for he believes that it is not how smart a person is that matters, but how a person is smart in his or her own ways. However, Gardner's theory was not the first and only that emphasises on multiple intelligences. Examples of other theories on multiple intelligences include Thurstone's Theory of Primacy Mental Abilities [11], Guilford's Structure of Intellect Theory [12], as well as Sternberg's Triarchic Theory of Intelligence [13].

To date, there have been several sporadic reports on the MI of students studying dentistry or dental-related courses [14-17]. However, more research is necessary to establish the relationship between various demographic factors and MI. Therefore, this cross-sectional study aimed to investigate the MI of preclinical dental students at a private university (SEGi University) in Malaysia and to determine the effects of age, gender, race and income on the MI among these students.

2. METHODOLOGY
2.1 Participants

This was a cross-sectional study conducted on preclinical (Year 1 and Year 2) dental students who were enrolled in the Bachelor of Dental Science program of SEGi University. Convenient sampling was used to recruit the participants. A total of 83 students participated in the study with a response rate of 83%.

2.2 Instrument

The Multiple Intelligences Inventory (Copyright 1999-2017 Walter McKenzie) was used in this study. The questionnaire consists of nine sections with ten questions per section. The participants scored one mark for each question that was applicable to them. The score for each section was then added up and multiplied by ten. Therefore, the score for each section ranged from 0 to 100. A sample item for each section of the MI inventory is given in Table 1.

Table -1: Sample items in the MI Inventory

Section	MI domain	Sample item
1	Naturalist	I enjoy studying biology, botany and/or zoology
2	Musical/ rhythmic	I remember things by putting them in a rhyme
3	Logical/ mathematical	Step-by-step directions are a big help
4	Existential	Relaxation and meditation exercises are rewarding to me
5	Interpersonal	I value relationships more than ideas or accomplishments
6	Kinesthetic	I use gestures and non-verbal cues when I communicate
7	Verbal/linguistic	Word puzzles like crosswords or jumbles are enjoyable
8	Intrapersonal	I need to know why I should do something before I agree to do it
9	Visual/ spatial	Charts, graphs and tables help me interpret data

2.3 Ethics, approval and consent

Approval from the Research and Ethics Committee of SEGi University and the Dean of Faculty of Dentistry, SEGi University was obtained before the study was conducted. The participation in this study was voluntary and a written consent was obtained from the participants prior to attempting the questionnaire.

2.4 Data analysis

Statistical analysis was carried out using the Statistical Package for Social Sciences (SPSS) version 22. The relationship between age and MI was determined using the Pearson's correlation. For the demographic factors gender, race and family income, due to a low sample size ($n < 30$) in one or more of the subgroups, non-parametric tests (Mann-Whitney U or Kruskal-Wallis H test) were used. A p value of < 0.05 was considered significant.

3. RESULTS

3.1 Demographic data

The minimum age of the students was 19 years and the maximum age was 24 years. The mean age was 20.72 years (*SD*= 0.92). Other demographic data of the participants is summarised in Table 2.

Table -2: Demographic data of the participants

Demographic factor		Frequency
Gender	Male	25 (30.1%)
	Female	58 (69.9%)
Race	Malay	20 (24.1%)
	Chinese	55 (66.3%)
	Indian	8 (9.6%)
Monthly family income	Lower income group	59 (71.1%)
	Higher income group	17 (20.5%)
	Unspecified	7 (8.4%)

3.2 Mean MI domain scores of dental students

The mean MI domain scores of dental students and their standard deviations are shown in Table 3. In general, the intrapersonal domain had the highest mean score (*M*=73.61, *SD*=20.04) whereas the verbal/ linguistic domain had the lowest mean score (*M*=42.41, *SD*=19.91).

Table -3: Mean MI domain scores of dental students

MI domain	Mean	Std. Deviation
Naturalist	45.42	19.15
Musical/ rhythmic	51.33	19.43
Logical/ mathematical	56.14	21.06
Existential	63.86	21.00
Interpersonal	45.66	23.17
Kinesthetic	66.63	20.02
Verbal/Linguistic	42.41	19.91
Intrapersonal	73.61	20.04
Visual/spatial	61.08	20.95

3.3 Role of age in MI

Age was found to be weakly, positively and significantly correlated with the logical/ mathematical (*M*=56.14, *SD*=21.06; *r*=0.24, *p*=0.032) and verbal/linguistic (*M*=42.41, *SD*=19.91; *r*=0.23, *p*=0.041) domains (Table 4).

Table -4: Correlation between age and MI domain scores

Pearson's correlation	Logical/ mathematical	Verbal/Linguistic
r value	0.24	0.23
p value	0.032	0.041

*Only MI domains with significant correlation with age are shown.

3.4 Role of gender in MI

As one of the subgroups had a low sample size (n < 30), the non-parametric Mann- Whitney U test was used instead of the t-test. Among the nine MI domains, only the visual/spatial domain showed a statistical significant difference between male (*Mdn*=50) and female (*Mdn*=60) students (*U*=516.00, *Z*=-2.099; *p* =0.036) (Table 5).

Table -5: Comparing gender difference in MI using the Mann-Whitney U test

MI domain	Gender	Mean Rank	Sum of Ranks	Median	U	Z	*p* value
Visual/ spatial	Male	33.64	841.00	50	516.00	-2.099	0.036
	Female	45.60	2645.00	60			

*Only the MI domain with a significant gender difference is shown.

3.5 Role of race in MI

The non-parametric Kruskal-Wallis H test (instead of ANOVA) was used to compare racial differences in MI due to a low sample size in two of the racial subgroups (*n* < 30) in this study. A significant racial difference in MI was observed in the interpersonal domain, $X^2(2) = 8.417$, *p*=0.014, with a mean rank score of 40.43 for Malay students, 39.18 for Chinese students and 65.31 for Indian students. The verbal/ linguistic domain also demonstrated a significant racial difference $X^2(2) = 8.298$, *p*=0.016, with a mean rank scores of 39.30 for Malay students, 39.64 for Chinese students and 65.00 for Indian students (Table 6).

Table -6: Comparing racial differences in MI using the Kruskal Wallis H test

MI domain	Race	Mean Rank	Chi square	df	*p* value
Interpersonal	Malay	40.43	8.417	2	0.014
	Chinese	39.18			
	Indian	65.31			
Verbal/linguistic	Malay	39.30	8.298	2	0.016
	Chinese	39.64			
	Indian	65.00			

*Only the MI domains with significant racial differences are shown.

3.6 Role of family income in MI

The students were divided into two main income groups, i.e. those with a higher monthly family income (> RM 10,000) and those with a lower monthly family income (≤ RM 10,000). Due to a low sample size in one of the family income subgroups (*n* < 30), the non-parametric Mann-Whitney U test was used rather than the t-test. A significant difference was observed between those from the lower income group (*Mdn*=50) and those from the higher income group (*Mdn*=30) in the interpersonal domain (*U*=310.50, *Z*=-2.403; *p*=0.016).

Table -7: Comparing differences in MI according to family income using the Mann-Whitney U test

MI domain	Income group	Mean Rank	Sum of Ranks	Median	U	Z	*p* value
Interpersonal	Lower income group	41.74	2462.50	50	310.50	-2.403	0.016
	Higher income group	27.26	463.50	30			

*only the MI domain with a significant difference according to family income is shown.

4. DISCUSSION

Preclinical dental students in this study had the highest mean score in the intrapersonal domain (*M*=73.61, *SD*= 20.04) and the lowest score in the verbal/ linguistic domain (*M*=42.41, *SD*=19.91). The other domains had a mean score between 40 and 70. This finding coincides with that from another study, which reported the intrapersonal and interpersonal intelligences being more prevalent among Mexican dental students [16]. However, this finding contradicted one study carried out on Korean students majoring in dental hygiene, who had the highest score in

interpersonal intelligence and the lowest in naturalist intelligence [17]. These differences suggest that the MI of students may vary due to different settings of the university.

Age was found to play a role in MI among dental students. There was a weak but significant and positive correlation between age and the logical/ mathematical (r=0.24, p=0.032) and verbal/linguistic (r=0.23, p=0.041) intelligences in this study. This coincides with previous studies which suggest that intelligence changes over one's lifespan and that age has a differential effect on different intellectual capabilities [18, 19]. However, it is worth mentioning that the age of the students ranged from 19 to 24 in this study. A wider age gap may be more useful in determining the effects of age on MI. On the other, a statistical significant gender difference was observed in the visual/ spatial domain with the females scoring higher than the male students (p=0.017). Gender differences in MI have been commonly reported in previous studies [20-22].

In addition, statistical significant racial differences were observed in the interpersonal (p=0.014) and verbal/linguistic (p=0.016) domains. Racial differences in MI observed in this study fit well into the MI Theory as one of the major emphases of the MI Theory is a person's environs. As different cultures value different domains in varying degrees, how one's intelligences develop, and to what extent they are mobilised are therefore, inevitably affected by one's culture. Since the publication of his book "Frames of Mind" [7], Gardner has placed increasing emphasis on one's culture and the inseparability of intellect from one's cultural setting [23].

Besides, age, gender and race, the family income of the students also had a significant effect on MI. A statistical significant difference was observed in the interpersonal domain (p=0.016). Interpersonal intelligence may be defined as one's ability of working with, understanding, leading and organising others [24]. A person who is good in this domain communicates effectively and empathizes easily with others. Not many studies investigated the relationship between socioeconomic status and MI. In one study conducted on children, however, significant socioeconomic differences were observed in the musical and intrapersonal domains [25].

5. CONCLUSIONS

It can be concluded that preclinical dental students scored the highest in the intrapersonal intelligence and the lowest in the verbal/linguistic intelligence. Age, gender, race and family income all played a role in the MI of these students to a varying extent. These findings imply that mixed modes of teaching and learning are beneficial in dental education as this approach embraces individual differences and the learner-centred approach. As this study was limited by a small sample size and it only included the preclinical students, future research should include a bigger sample size, students from all levels of study and students from different universities to give a better representation of the MI of dental students in Malaysia.

6. ACKNOWLEDGEMENTS

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