**Educational environments in Asian medical schools: A cross-national comparison between Malaysia, Singapore and China.**

**Abstract**

Introduction: Perceptions of the educational environment represent an important source of information on medical students’ learning experience. Understanding and addressing these perceptions can help inform initiatives designed to improve the learning experience and educational outcomes, while comparison of student perceptions across medical schools can provide an added perspective. The aim of the study was to compare the educational environments of three Asian medical schools: Royal College of Surgeons in Ireland and University College Dublin Malaysia Campus, Yong Loo Lin School of Medicine, Singapore and Xiangya School of Medicine, China.

Methods: Medical students in the clinical years (*N*=1063) participated in a cross-sectional study using the Dundee Ready Educational Environment Measure (DREEM). Data was analyzed using SPSS version 22.

Results: There were significant differences between the three medical schools in the total DREEM scores (F [2, 1059] =38.29, *p*<.001), but all were in the category “more positive than negative” (mean score 135.42, range 128.97-142.44). Highest DREEM scores were noted in year 5 at RUMC (139.79±79), year 3 at YLL (145.93±14.52) and year 4 at XSM (138.56±18.91). Variations in total and subscale DREEM scores were also found between clinical years in each medical school.

Discussion: Total DREEM scores at the three medical schools are similar to those reported from other undergraduate settings. However, significant variations occurred in perceptions of the educational environment, as students progressed through the clinical years. Greater attention to the learning environment and the curriculum may improve students’ educational experience.

**Keywords:** Educational environment, DREEM, Medical schools, Cross-national

**Introduction**

As the theoretical understanding of medical education begins to place a greater emphasis on the agency of the learner, student perceptions of the educational environment (EE) have become an important focus of research (Mann, 2011). As defined by the General Medical Council (Marchant, 2013), EE at its simplest, refers to the physical surroundings within which learning takes place. More holistic definitions encompass the broader elements of educational culture, ethos, and climate that affect all aspects of learning. The EE has been shown to exert a strong influence on the effectiveness of an educational program (Glen. 2001), while student perceptions of EE are now used as a basis for initiatives designed to optimize the learning experience (Roff andMcAleer, 2001). There is also growing interest in exploring how EE is affected by student diversity, gender influences and changes in student expectations at different stages along the educational pathway (Roff and McAleer, 2001).

As medical education has become increasingly globalized, international comparison of medical schools with varying characteristics provides an opportunity to enrich the understanding of factors influencing the quality of EE (Roff *et al*. 2001; Al-Hazimi *et al*., 2004). Medical education in Asia, in particular South East Asia, has undergone remarkable expansion in recent years, mainly as a consequence of rapid economic development that has occurred within many countries in the region (Majumder *et al*. 2004; Amin *et al*. 2005). Associated with this phenomenon has been the realignment of curricula and learning processes that reflect altered student needs and expectations. A further influence has been the global trend towards homogenization and standardization, the latter associated with the increasing influence of western, arguably neocolonial, pedagogies (Majumder *et al*. 2004; Amin *et al*. 2005).

Particular challenges have been described in attempting to transition from a traditional educator-centered approach, in Asian medical educational settings, towards one with a greater focus on the learner (Khoo. 2003). However, challenges notwithstanding, responding to the imperative for rapid transformation in this area provides opportunities for greater experimentation and innovation in curriculum content and teaching (Amin *et al*. 2005; Khoo. 2003).

Several international studies have used the Dundee Ready Education Environment Measure (DREEM), in healthcare educational settings, for comparative purposes (Roff *et al*. 2001). Relatively lower DREEM scores, which indicate negative perceptions of the EE, have been found more frequently among undergraduates in Asian than in western medical schools, leading some authors to conclude that this may be linked to a greater emphasis on knowledge acquisition (Al-Hazimi *et al*. 2004; Khoo. 2003). While there is some research on national comparisons of the EE in Asian medical schools, no studies, to date, have attempted cross-national comparison within the region (Abraham *et al*. 2008; Al-Naggar *et al*. 2014).

The aim of the present study was to examine and compare the EE of three Asian undergraduate medical schools- the Royal College of Surgeons in Ireland and University College Dublin Malaysia Campus (RUMC), Malaysia, Yong Loo Lin School of Medicine (YLL) at the National University of Singapore, Singapore; and Xiangya School of Medicine (XSM), Central South University, China.

**Method**

**Settings**

The Royal College of Surgeons in Ireland and University College Dublin Malaysia Campus (RUMC) is a private medical college, jointly operated by the Royal College of Surgeons in Ireland (RCSI) and University College Dublin (UCD). Almost all RUMC undergraduates are Malaysians who undertake the first two and a half years of their course, in pre-clinical subjects, at either RCSI or UCD, in Dublin, Ireland. They then return to the RUMC campus in Penang, Malaysia, where they complete their clinical training at government hospitals and clinics, rotating through placements in a range of specialties.

Yong Loo Lin School of Medicine (YLL) is a medical school in Singapore within a public university, at which two years of pre-clinical study, and a subsequent three years of clinical training, are undertaken at the National University Hospital and other local hospitals. In year three, undergraduates begin core clinical rotations and, in their fourth year, rotate through sub-specialty placements. In the final year, students enter an internship program, in preparation for a more independent clinical role upon graduation.

Xiangya School of Medicine (XSM) was established by the Yale–China Association of Yale University and is China's first Sino–foreign school of medicine. Undergraduates spend two preclinical years at XSM and, in the subsequent two and a half years, rotate through core clinical attachments at Xiangya Hospital. The final year is a clinical internship program that is similar to that of YLL.

**Subjects, Recruitment and Data Collection**

Undergraduate students registered in clinical years of their course at the three study sites were invited to participate. Those who consented completed a questionnaire which included information on age, gender and academic year of study and then completed the DREEM questionnaire. The authors received ethical approval from the authorized ethical body for their respective institutions.

All three medical schools administered the DREEM questionnaire to participants at the same point in time, when students had completed their clinical rotations. The English version of the DREEM was used in Malaysia and Singapore, while in China, a validated Chinese version was administered (Wang *et al*. 2009). Response rates were as follows: 90% (*N*=230), at PMC; 89% (*N*=402) at YLL, and 93% (*N*=431) at XSM.

**Instrument**

The DREEM is a validated instrument for gathering information on EE and was developed by an international panel of 80 medical educators in Dundee (Roff *et al*. 1997; Roff. 2005). It is intended to be a culture-free and universal inventory, offering a consistent method for global comparison between medical schools (Roff *et al*. 2001). It comprises a 50-item inventory, with each item rated on a five-point Likert-type scale, ranging from “strongly disagree” to “strongly agree”. Higher scores indicate greater satisfaction with the environment. Total scores are categorized as: 0–50: “very poor”, 51–100: “plenty of problems”, 101–150: “more positive than negative”, and 151–200: “excellent”.

The DREEM can also be interpreted through five subscales: (1) Students' Perceptions of Learning (SPL) (12 items; maximum score = 48), (2) Students' Perceptions of Teachers (SPT) (11 items; maximum score = 44), (3) Students' Academic Self-Perceptions (SASP) (eight items; maximum score = 32), (4) Students' Perceptions of Atmosphere (SPA) (12 items; maximum score = 48), (5) Students' Social Self-Perceptions (SSSP) (seven items; maximum score = 28). Higher scores in these subscales indicate greater satisfaction with a particular aspect of the educational environment.

**Data Analysis**

Analyses were conducted with IBM SPSS version 24 (Chicago, IL), with significance set at .05. Parametric and non-parametric analyses were employed where necessary. Analyses also controlled for confounders such as gender. Cronbach’s alphas for DREEM total and subscale scores were deemed acceptable.

Univariate analyses provided means and standard deviations of total DREEM scores, as well as scores for the individual subscales. Bivariate analyses (one-way analyses of variance [ANOVAs], Kruskal Wallis, and Wilcoxon-Mann-Whitney *U* tests) investigated differences in the DREEM total and subscale scores across the three study sites. Further analysis addressed variation in DREEM scores between the different years for each medical school. All analyses that involved multiple comparisons were Bonferroni-corrected.

**Results**

**Demography**

The proportion of female to male participants was approximately equal at YLL, while there was a large female majority at RUMC and XSM (Table 1). In meeting the objective of a cross-national examination of the educational environment, the influence of gender was not examined, but was controlled for in the subsequent comparative analyses. Nearly all participants were in the 21-30 year age range.

**Cross-national Comparison of DREEM Scores**

While there were significant differences in total DREEM scores between all schools (one-way ANCOVA; *F* [2, 1059] = 38.29, *p* < .001, post-hoc Bonferroni-corrected pairwise comparisons *p* < .001), total mean DREEM scores for RUMC (128.97/200), YLL (142.44/200) and XSM (134.85/200) were all within the “more positive than negative” category (Table 2).

There were also significant differences in DREEM subscale scores across the three institutions, with YLL students scoring their EE more positively (one-way MANCOVA; Wilk’s Lamba = .69, *F* = 42.83, *p* < .001) (Table 2). However all of the individual DREEM subscale scores for each institution were still within the ‘more positive than negative’ category.

**Between-year analyses of DREEM Scores within Medical Schools**

1. **Malaysia/RUMC**

Significantly higher DREEM scores were found among year 5 students (mean = 139.8 ± 20.13) than year 4 students (mean = 120.2 ± 19.8) (t [228] = 7.398, p < .001). These differences were consistent across all five DREEM subscales (*p* < .001), indicating that year 5 students had more positive perceptions of the learning environment than those in year 4 (one-way MANCOVA; Wilk’s Lamba = .72, *F* = 17.37, *p* < .001; all post-hoc Bonferroni-corrected pairwise comparisons *p* < .001).

1. **Singapore/YLL**

There were significant differences in the DREEM scores between students in years 3, 4, and 5 (χ2 = 20.48, *p* < .001) at YLL. Final year students rated EE as significantly lower (mean =138.14 ± 15.61) than year 3 students (mean=145.93 ± 14.52) and year 4 students (mean=143.40 ± 16.94).

A similar trend was noted in the DREEM subscale scores, specifically in perceptions of teachers and the atmosphere, as well as their academic and social self-perceptions (*U*s = 5823.50–8528.50, *p*s < .01, *r*s =.18–.30). There were no significant differences in DREEM subscale scores between students in third and fourth years (*U*s = 7025.50–7739.50, *p*s > .99), and no significant differences noted in students’ perceptions of their learning across all years (χ2 = 6.75, *p* = .18).

1. **China/XSM**

At XSM there were significant differences in DREEM total scores between the different years, having controlled for gender (one-way ANOVA; *F* [2,430] = 7.13, *p* = .001). In contrast to year 4 students at YLL, year 4 students at XSM rated the EE higher (mean = 138.56 ± 18.9) than year 3 (mean = 130.46 ± 20.97) and year 5 students (mean 134.13± 19.07).

Further analyses revealed that higher EE ratings by year 4 students at XSM translated to higher subscales scores in perceptions of learning. At XSM, there were no significant differences across the years in the academic and social self-perception subscales (*p*s > .07).

**Discussion**

The overall finding that student-rated quality of the educational environment is “more positive than negative” in the three Asian medical schools is consistent with findings from a majority of studies in other medical schools in Asia and the west (Abraham *et al.* 2008; Al-Naggar *et al*. 2014; Varma *et al*. 2005).

Additionally, our findings are consistent with previous research, insofar as scores within the five DREEM domains across the three study sites followed a similar pattern to the total DREEM scores (Abraham *et al*. 2008; Al-Naggar *et al*. 2014). This similarity in the pattern of total DREEM and subscale scores has prompted questions regarding the validity of the five separate domains, suggesting that students may actually form a global perception of EE in their respective institution, which is then reflected in both the total and subscale scores (Abraham et al 2008; Al-Naggar et al., 2014). Our findings support this contention.

**Cross-national Comparisons in EE**

While the results seem to suggest that YLL students rated EE higher, compared to their peers at RUMC and XSM, the value of direct comparison of total DREEM scores in the three participating institutions may be limited. As described under Methods, the three medical schools differ in that RUMC is a private medical college, YLL is a public medical school and XSM is one of the earliest Sino-foreign medical schools in China. The curriculum content at the same stage of the course was not directly comparable. Therefore, comparing the mean score in non-equivalent samples may not adequately reflect the holistic rating of the EE. Furthermore, the difference between the cohort sizes and faculty-to-student ratio can influence EE ratings. Moreover, students in the three institutions may have varied in their educational expectations, and in the extent to which they were likely to criticize the quality of teaching, or other aspects of the learning environment.

It has been previously suggested that Asian students, in general, may be socialized to accept traditional teacher-imparted knowledge to a greater extent than their western counterparts (Khoo. 2003). However, such expectations and behaviors may not be present to the same extent in all Asian countries, or may be altered by exposure to western learning environments, as occurred with Malaysian students, all of whom had attended Dublin universities for the first two and a half years of their course (Ahn. 1999).

With such inherent problems in the direct comparison of DREEM scores across the three study sites, the most salient findings were the between-year variations in EE within each of the three medical schools. For example, while the total YLL DREEM score (142.44/200) was considerably higher than at RUMC (128.99/200), year 5 YLL students had a DREEM score (138.14/200) just minimally lower than year 5 RUMC students (139.79/200). This suggests that the value of comparison of total DREEM scores between medical schools may be limited, as it tends to mask between-year differences within each individual setting. While our study did not directly address this issue, several explanations are possible for the between-year differences in DREEM scores.

**Periods of Transition and Stress**

One possible explanation for between-year differences in DREEM scores relates to the challenges students face in transitioning from one stage of their course to the next. At RUMC, students undertake their preclinical studies at either RCSI or UCD, in Dublin Ireland, before returning to the RUMC campus in Malaysia, to complete clinical rotations. Regularly compiled end-of-year surveys, separate from the present study, have found that students experience less pressure from learning activities in Dublin, and found the Irish faculty less authoritarian in their attitude and style than counterparts at RUMC. The considerable personal and cultural adjustments associated with this transition may explain the relatively lower EE ratings in the year following this move; nonetheless, with adaptation to the new environment, DREEM scores improve by the final year.

At YLL, the introduction of the student internship program in the final year is recognized as more challenging than the first two clinical years, where clinical knowledge and some skills acquisition is the focus. Year 5 involves new and demanding roles in teamwork and some responsibility for patient care. The daunting reality of the challenges to be faced upon graduation may come into sharper focus and this may be reflected in more negative academic self-perceptions and perceptions of the learning atmosphere.

However at XSM, students in their final two clinical years had a more positive perception of EE than those in their first clinical year, which could be attributed to positive clinical learning experiences in hospital settings.

Changes in student perceptions of EE, during the transition from preclinical to clinical years, have been previously demonstrated (Aghamolaei and Fazel. 2010; Pai *et al*. 2014). In addition, self-rated stress amongst medical students has been found to be negatively correlated with DREEM scores (Enns *et al*. 2016). It is reasonable to conclude, therefore, that the significant between-year variations across the three medical schools may be attributed to increased levels of stress that students experience during challenging transitions within each institution, and the associated negative impact upon global perceptions of the educational environment.

In the absence of the use of an objective measure of student stress in the present study, the potential impact of stress finds support from the degree of commonality with regard to the five lowest-scored DREEM items across the three settings. Endorsement of these low-scored items points toward the influence of subjective distress and a questioning of students’ personal adequacy, rather than that of perceived problems in the external learning environment. This negative self-appraisal is conveyed in students’ endorsement of such statements as: *“I am able to memorize all I need”*, *“Learning strategies which worked for me before continue to work for me”* and *“Enjoyment outweighs the stress of studying medicine”.*

The issue of student stress during periods of transition may also relate to medical students’ level of preparedness for future clinical practice. This has been identified as an area of concern in several studies and interventions that might be helpful to students in adjusting to the demands of clinical work have been recommended (Radcliffe and Lester. 2003; Thompson *et al*. 2016). The pattern of our findings, most notably at RUMC and YLL, suggests that low DREEM scores, in the years in which students are adjusting to the clinical environment, may reflect their perception of being insufficiently prepared. Previous studies have suggested that a hybrid curriculum, which includes problem-based learning, structured clinical teaching with specific curricular objectives, as well as mentoring of senior students by faculty and peers, may improve the learning environment and the level of preparedness for future clinical practice (Al-Hazimi *et al*. 2004; Khoo. 2003).

**EE in an Asian Context**

Previous studies have suggested that students rate EE less positively in medical schools employing traditional, authoritarian, teacher-centered approaches, as opposed to those that have introduced student-centered, problem-based and self-directed learning opportunities (Zawawi and Elzubeir. 2012; Edgren *et al*. 2010). Our study found no evidence of this association; none of the three medical schools involved had introduced problem-based learning as a defining or prominent feature of their curricula, yet the total DREEM scores in all three settings were above 120. Our findings, in this regard, suggest that a largely positive EE is achievable in a context of a balanced curriculum that includes both modern and traditional elements.

Preliminary analyses also suggested an association between student gender and perceptions of the educational environment at XSM but not at RUMC or YLL. While this was not explored in the present study, where gender was controlled for in all analyses, female students in China recorded higher DREEM scores than their male classmates. Results from other studies are variable in this regard, with a few showing no relationship (Abraham *et al*. 2008), while others reported similar findings, as in China (Al-Naggar *et al*. 2014), and still others reported lower DREEM scores among female students (Al-Hazimi *et al*. 2004). While it is reported that men and women exhibit different learning styles (Philbin. 1995),our preliminary indications of higher EE ratings among female Chinese students is of interest and warrants exploration of gender differences in future studies.

Despite the widespread use of the DREEM internationally, there may also exist linguistic and cultural differences that impede direct comparison. However, the DREEM inventory is the only instrument validated for international comparison, and it takes the cultural context into account (Roff *et al*. 2001).

**Curricular changes within each institution**

Several changes have been introduced following this study. RUMC lengthened the orientation program for returning students from Dublin to a week and introduced basic clinical skills and clinical examination to prepare them for clinical work. Workshops on stress management techniques, time management, learning skills and the transition to the Malaysian healthcare system have been delivered by in-house clinical psychologists.

Similarly, YLL’s initiatives to better prepare students for their clinical years included: (1) a two-week patient-based program in the preclinical year, where students observe doctor–patient interactions in clinics, followed by discussion with tutors; (2) collaborative, case-based learning, where both pre-clinical and clinical teachers review problem-based cases with students; (3) an expanded clinical foundation skills course in the second preclinical year, and (4) a longitudinal patient experience program where students work in small teams and conduct supervised home-visits to follow-up with a patient in the community over a year-long period.

Changes in the clinical years at YLL include embedding all clinical students from their first clinical year in ward teams, with access to computerized medical records and being allowed to enter their findings into care plans after discussion with, and vetting by, their supervisor.

Finally, at XSM, there is now greater emphasis on obtaining better qualified faculty members, and on improving and innovating teaching methods. Medical students now have patient contact at an earlier stage, which benefits both theoretical knowledge and clinical skills.

**Limitations**

The variation in the characteristics of the three medical schools, as described, may appear to limit the value of direct comparisons of total DREEM scores. Nonetheless, our study provided the opportunity to compare the across private and public medical schools. Also, while the educational environment of medical schools is unlikely to be homogenous, the DREEM remains the best available instrument for international comparison. Finally a qualitative component, which was not within the scope of this research, could have helped elucidate the specific nature of students’ challenges.

In conclusion, this study provided an opportunity for cross-national collaboration in achieving a better understanding of the educational environment, within and between the three participating medical schools. More importantly, it provided valuable information that served as an impetus to introduce necessary changes, in order to enhance the quality of our students’ learning experience.

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