**ORIGINAL ARTICLE**

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# Perception of Face-To-Face and Virtual Educational Environment During COVID-19 Pandemic: Medical Undergraduates' Experiences in Northern Borneo

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## ABSTRACT

Positive educational environments foster comfort, well-being, academic achievement and collaboration among students, teachers and organisations, supporting the production of quality graduates. Consequently, educational organisations must evaluate their educational environments. This study explores the conditions of the physical and virtual educational environment at Universiti Malaysia Sabah (UMS). A cross-sectional study involving 456 medical students from year one to year five at Faculty of Medicine and Health Sciences (FMHS), UMS was conducted. Students' perceptions of their educational environment were assessed using the shortened Dundee Ready Education Environment Measure (DREEM-17) and Online Student Connectedness Survey (OSCS-25) questionnaires. Quantitative analysis was performed using Statistical Package for Social Sciences (SPSS) version 28. Ethical clearance was obtained from the Human Research Ethics Committee at UMS. In total, 329 out of 456 medical students completed the questionnaires (72.1%) in this study. Students' perceptions of the physical educational environment were mainly positive, with a mean score of 2.93 (Standard Deviation (SD) = 0.76), while their perceptions of online connectedness in virtual learning were moderate, with a mean score of 2.60 (SD = 0.79). There was no significant difference in students' perceptions of physical and virtual educational environments based on sex, but there was a notable difference between pre-clinical and clinical year students, with the latter having less favourable perceptions of virtual education. The preference for physical or blended learning over fully online learning was evident. The low level of perceived support for students' well-being suggests a need for improvement in support systems in FMHS, UMS.

*Keywords*: *educational environment, virtual, face to face, Covid-19, students' perceptions, medical education*

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## INTRODUCTION

The educational environment, sometimes referred to as the educational climate or learning environment, is a multifaceted structure encompassing individual development, social interactions with physical and virtual surroundings and curricular design within institutions (1, 2). Research on the educational environment has transitioned from the use of qualitative methods to quantitative approaches. Genn highlighted the broad scope of factors influencing education, presenting a framework categorising them into faculty, students, administration and physical features (3). In 2012, Schonrock-Adema and team incorporating Moos' 1974 domains of personal development, relationships and system maintenance into a theoretical framework for assessing the quality of medical education (4). All these frameworks contribute to understanding and improving the educational experience within institutions.

While researchers generally accept these frameworks and utilise them as a conceptual background in educational environment research, Gruppen and colleagues proposed a conceptual framework for an educational environment that adapted Miller's levels of living systems (Figure 1) (5). In addition to focusing on social interactions, as in the framework of Schonrock-Adema et al. (4), it also emphasises the need to consider intraindividual psychological characteristics as well as physical spaces and virtual environments. This framework consists of two primary dimensions: a psychosocial dimension and a socio-material dimension (5). The psychosocial dimension encompasses the key elements of social interactions discussed in the frameworks of Moos and Schonrock-Adema mentioned above. There are at least three levels in the living systems hierarchy that shown in Figure 1 of the psychosocial dimension: personal, social or group and organisational levels. For this study, we adopted this framework as a background to investigate the relationship between different educational environments (Figure 2).
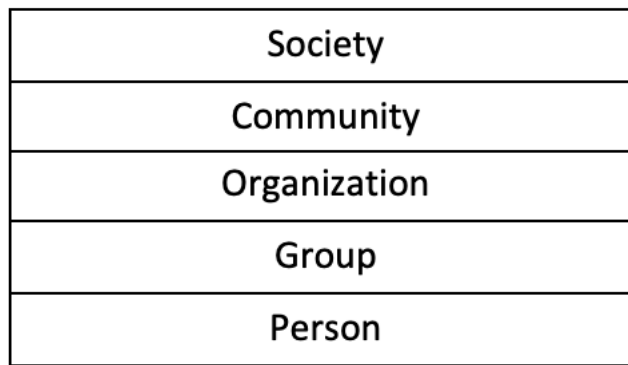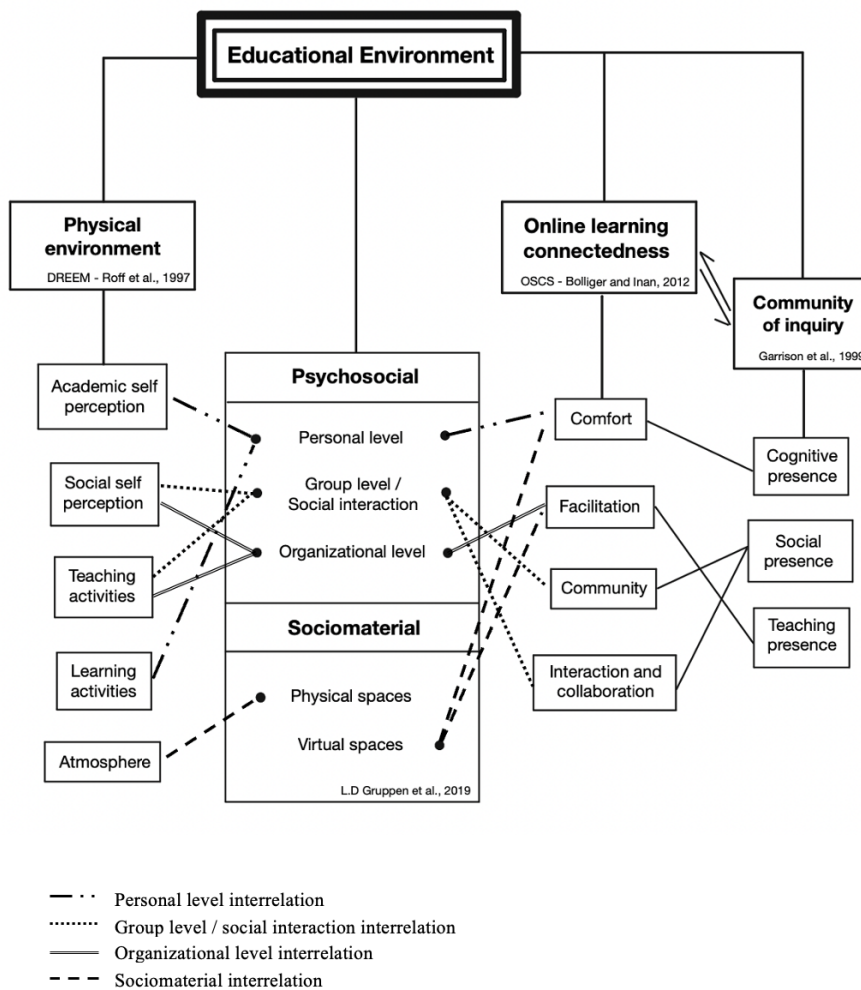
Figure 1: Level s of living



Figure 2: Conceptual framework

In early 2020, the Covid-19 pandemic disrupted education worldwide, affecting over a billion students. Medical education shifted to emergency remote teaching (ERT), replacing face-to-face classes with online learning. While a meta-analysis by Pei and Wu indicated that online learning was as effective as offline learning (6), other factors influencing the online learning environment should also be considered. Here, we focus on engagement or connectedness, which we can assess based on learners' perceptions (7). Connectedness or engagement in online courses involves interaction among students, teachers and faculty to help achieve online learning objectives. It is among the best predictors of students' satisfaction with online learning, along with internet self-efficacy and self-regulated learning ability (8).

Understanding the educational environment is vital for effectively managing learning, development and change within the health professions (1, 9). A positive educational environment is known to improve student satisfaction, well-being, academic success and collaboration among teachers, students and organisations (10). Given these effects, it is crucial for organisations to evaluate their educational environments. However, due to the advancement of technology, not only face-to-face teaching and learning but also virtual educational environments must be examined, as more teaching, including medical education, is being performed online.

Figure 2 illustrates the possible connections between the domains of instruments measuring the physical educational environment, including the Dundee Ready Education Environment Measure (DREEM) (11) and Online Student Connectedness Survey (OSCS) (12), in line with Gruppen et al.'s theoretical framework of the educational environment. At the personal level, DREEM's academic self-perception and learning activities, along with OSCS's comfort domain, relate to learners' personal and professional growth. On the group level, DREEM's social self-perception and teaching activities, coupled with OSCS's community and interaction and collaboration domains, capture social interactions among students, peers and educators. The organisational dimension includes DREEM's

social self-perception and teaching activities, similar to the group level, along with OSCS's facilitation domain, suggesting that organisational policies guide student–educator interactions. Finally, the socio-material dimension encompasses physical and virtual educational spaces, with DREEM and OSCS each measuring distinct spaces without interrelation, offering unique interpretations.

This study aims to assess the educational environment at Universiti Malaysia Sabah (UMS) from students' perspectives, including both physical and virtual aspects. It will explore how UMS medical students' perceptions of the educational environment relate to their phase of study, sex and academic performance as well as examining the correlation between face-to-face and virtual learning environments during the Covid-19 pandemic within the Faculty of Medicine and Health Sciences at UMS.

## METHODOLOGY

### Study design and participants

A cross-sectional study was conducted involving all medical students from year one to year five in the 2020/2021 semester at the Faculty of Medicine and Health Sciences, UMS (FMHS, UMS). The study population included 456 medical students. Stratified random sampling was used, where samples were divided according to their year of study. Thus, each year of study from year one to year five included a relatively equal number of samples. Then, using random sampling, at least 77 students from each year were selected with the help of batch leaders.

All participants were asked to answer a questionnaire that included (i) questions related to their demographic characteristics, (ii) 17 questions on their perceptions of face-to-face educational environments and (iii) 25 questions on their perceptions of the virtual educational environment. The questionnaire was distributed to the participants using a Google form survey through the WhatsApp application with the help of batch leaders. The students were informed to carefully follow the instructions provided in the questionnaire and that consent would be required prior to participation. They were also informed that their participation in the study would be anonymous, entirely voluntary and would have no bearing on their academic progress. Ethical approval for the study was received from the Human Research Ethics Committee of UMS (ethical approval code: JKEtika 3/21 (2)).

**Instrument**

Two research tools were obtained from an open access inventory and used for data collection in this study. The shortened version of the 17-item Dundee Ready Education Environment Measure (DREEM-17) and the Online Student Connectedness Survey (OSCS) were used to assess the physical educational environment and students' connectedness in the virtual educational environment, respectively (11, 12). Both instruments are written in the English language. There were no concerns regarding participant comprehension, as all participants were undergraduate students proficient in the use of the English language.

In this study, the physical educational environment was assessed using DREEM-17. DREEM is globally recognised as a valuable tool for evaluating the strengths and weaknesses of educational environments in various institutions (13). Originally consisting of 50 items, DREEM has been translated into multiple languages, including Malay (14). However, a study by Yusoff in 2012 found that the original 50-item version did not support the five-factor structure of the original DREEM among Malaysian medical students, leading to the development of a shortened 17-item version (11). This abbreviated version demonstrated adequate goodness of fit and reliability, comparable to the

original DREEM (Table 1), which also includes score interpretation based on items, domains and total score (15, 16). Since DREEM-17 has been shown to be as valid and reliable as the original DREEM-50, the researcher opted to employ this shortened version in this study. The combination of DREEM-17 with other instruments in this study ensured a balanced number of questions for participants to respond to.

Table 1: Shortened DREEM with 17-items and its score interpretation

| Domain | Statement | Score Interpretation According to Domain |
|---|---|---|
| Students' Perception of Learning (SPoL) | 1. The teaching is well-focused<br>2. The teaching helps to develop my confidence<br>3. The teaching time is put to good use | 0 – 1.0: Very poor<br><br>1.01 – 2.0: Teaching is viewed negatively<br><br>2.01 – 3.0: A more positive approach<br><br>3.01 – 4.0: Teaching highly thought of |
| Students' Perception of Teaching (SPoT) | 4. The teachers adopt a patient-centred approach to consulting<br>5. The teachers give clear examples<br>6. The teachers are well-prepared for their teaching sessions | 0 – 1.0: Abysmal<br><br>1.01 – 2.0: In need of some retraining<br><br>2.01 – 3.0: Moving in the right direction<br><br>3.01 – 4.0: Model teachers |
| Students' Academic Self-Perception (SASP) | 7. Last year's work has been a good preparation for this year's work<br>8. My problem-solving skills are being well developed here<br>9. Much of what I have to learn seems relevant to a career in healthcare | 0 – 1.0: Feeling of total failure<br><br>1.01 – 2.0: Many negative aspects<br><br>2.01 – 3.0: Feeling more on the positive side<br><br>3.01 – 4.0 Confident |
| Students' Perception of Atmosphere (SPoA) | 10. There are opportunities for me to develop my interpersonal skills<br>11. I feel comfortable in class socially<br>12. The enjoyment outweighs the stress of the course<br>13. The atmosphere motivates me as a learner<br>14. I feel able to ask the questions I want | 0 – 1.0: A terrible environment<br><br>1.01 – 2.0: There are many issues that need changing<br><br>2.01 – 3.0: A more positive atmosphere<br><br>3.01 – 4.0: A good feeling overall |
| Students' Social Self-Perception (SSSP) | 15. There is a good support system for students who get stressed<br>16. My social life is good<br>17. My accommodation is pleasant | 0 – 1.0: Miserable<br><br>1.01 – 2.0: Not a nice place<br><br>2.01 – 3.0: Not too bad |

| | | 3.01 – 4.0: Very good socially |
|---|---|---|
| **Section** | | **Interpretation** |
| **Total DREEM Score (Mean)** | | |
| 0 – 1.0 | | Very poor |
| 1.01 – 2.0 | | Plenty of problems |
| 2.01 – 3.0 | | More positive than negative |
| 3.01 – 4.0 | | Excellent |
| **DREEM Score According To Items** | | |
| Mean Score ≤ 2.0 | | Need particular attention |
| Mean Score 2.01-3.0 | | Have room for improvement |
| Mean Score > 3.0 | | Strong area |

OSCS (12) was used to measure students' connectedness during online learning sessions as a factor influencing online learning. It consists of 25 Likert-type scale questions and has four scales: community, comfort, facilitation and interaction, and collaboration. The validity and reliability of the instrument has been confirmed. Items are answered using a five-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Interpretation of OSCS domain scores and overall scores were determined as mean score, with a minimum score of '0' and a maximum score of '4'. A score of 2.01 and above indicates moderate connectedness.

**Data analysis**

The data were analysed using Statistical Package for Social Sciences (SPSS) version 28. A 95% confidence interval margin of error ($\alpha=0.05$) was set. Assumptions for each statistical test were checked. Demographic variables were reported as frequencies and percentages, while the DREEM and OSCS attributes were reported as means and standard deviations. An independent t-test was used to examine mean score differences in DREEM and OSCS subscales based on sex. The same test was used to compare OSCS scores across study phases. Due to unmet assumptions, a Mann–Whitney test was used to compare DREEM scores between study phases. The Pearson correlation coefficient was used to assess the correlation between DREEM and OSCS scores. The interpretation of the correlation

coefficient (r) followed the conventional approach, with the ranges defined as follows: r = 0.00–0.10 was considered to indicate 'negligible correlation'; r = 0.10–0.39 indicated 'weak correlation'; r = 0.40–0.69 indicated 'moderate correlation'; r = 0.70–0.89 indicated 'strong correlation'; and r = 0.90–1.00 indicated 'very strong correlation' (17).

**RESULTS**

In total, 456 UMS medical students were recruited, and 72.1% (n=329) participated in the study. The majority of the respondents were female and were in their clinical year. Demographic data are presented in Table 2.

Table 2: Demographic data of participants

| Variables | | n (%) | Total (%) |
|---|---|---|---|
| Sex | Male | 86 (26.2) | 329 (100) |
| | Female | 243 (73.8) | |
| Academic Achievement | Higher achiever (CGPA ≥ 3.0) | 327 (99.4) | 329 (100) |
| | Lower achiever (CGPA < 3.0) | 2 (0.6) | |
| Phase of Study | Pre-Clinical (Year 1 & 2) | 131 (39.8) | 329 (100) |
| | Clinical (Year 3, 4 & 5) | 198 (60.2) | |

CGPA – Cumulative Grade Point Average

**Medical students' perceptions of the physical educational environment at UMS**

Table 3 reflects the students' perceptions of the physical educational environment they experienced during the Covid-19 pandemic. Overall, their perceptions of the physical educational environment were more positive than negative, with a mean score of 2.93 (SD = 0.76). Teaching activities received the highest mean score of 3.20 (SD = 0.63), indicating 'model teachers', while social self-perceptions scored the lowest, with a mean score of 2.58 (SD = 0.91), indicating 'not too bad'. Scores for other domains were also within the average range, reflecting a positive atmosphere, learning approach and confidence in academic self-perception.

All items in each domain had above-average mean scores. The lowest scores were for the items regarding students' perception of the atmosphere domain ('the enjoyment outweighs the stress of the course'), with a mean score of 2.38 (SD = 1.17), and students' social self-perception domain (support system for students who are stressed), with a mean score of 2.39 (SD = 1.17). In contrast, the highest mean score of 3.35 (SD = 0.69) was found for students' perception of the teaching domain, indicating that teachers are well prepared for their teaching sessions. In summary, the majority of the items fell into the 'room for improvement' category, while seven out of 17 items were considered strong and not requiring particular attention.

Table 3: Mean score of DREEM by medical students of UMS

| No | Domain | Items | Mean (SD) | |
|----|--------|-------|-------------|---------|
| | | | **DREEM score** | **Overall** |
| 1 | Students' | ***The teaching is well-focused | 3.05 (0.82) | 3.00 (0.77) |

| | | | | |
|---|---|---|---|---|
| | perceptions of learning (SPL) | **The teaching helps to develop my confidence | 2.90 (0.96) | |
| | | ***The teaching time is put to good use | 3.11 (0.87) | |
| 2 | Students' perceptions of teaching (SPT) | ***The teachers adopt a patient-centred approach in consulting | 3.12 (0.83) | 3.20 (0.63) |
| | | ***The teachers give clear examples | 3.19 (0.76) | |
| | | ***The teachers are well-prepared for their teaching sessions | 3.35 (0.69) | |
| 3 | Students' academic self-perceptions (SASP) | **Last year's work has been a good preparation for this year's work | 2.80 (0.95) | 3.03 (0.70) |
| | | **My problem-solving skills are being well developed here | 2.93 (0.87) | |
| | | ***Much of what I have to learn seems relevant to a career in healthcare | 3.34 (0.79) | |
| 4 | Students' perceptions of atmosphere (SPA) | ***There are opportunities for me to develop my interpersonal skills | 3.08 (0.94) | 2.84 (0.78) |
| | | **I feel comfortable in class socially | 3.00 (0.93) | |
| | | **The enjoyment outweighs the stress of the course | 2.38 (1.17) | |
| | | **The atmosphere motivates me as a learner | 2.85 (1.07) | |
| | | **I feel able to ask the questions I want | 2.93 (0.94) | |
| 5 | Students' social self-perceptions (SSSP) | **There is a good support system for students who get stressed | 2.39 (1.17) | 2.58 (0.91) |
| | | **My social life is good | 2.66 (1.12) | |
| | | **My accommodation is pleasant | 2.69 (1.11) | |
| **Total DREEM score** | | | | **2.93 (0.76)** |

SD – Standard deviation

Minimum score = 0 ; Maximum score = 4

| | | |
|---|---|---|
| * | ≤ 2.0 | Need particular attention |
| ** | 2.01 - 3.0 | Room for improvement |
| *** | > 3.0 | Strong areas |

Domain 1:
Domain 2:

| | |
|---|---|
| 0 – 1.0 | Very poor |
| 1.01 – 2.0 | Teaching is viewed negatively |
| 2.01 – 3.0 | A more positive approach |
| 3.01 – 4.0 | Teaching highly thought of |

| | |
|---|---|
| 0 – 1.0 | Abysmal |
| 1.01 – 2.0 | In need of some retraining |
| 2.01 – 3.0 | Moving in the right direction |
| 3.01 – 4.0 | Model teachers |

Domain 3:
Domain 4:

| | |
|---|---|
| 0 – 1.0 | Feeling of total failure |
| 1.01 – 2.0 | Many negative aspects |
| 2.01 – 3.0 | Feeling more on the positive side |
| 3.01 – 4.0 | Confident |

| | |
|---|---|
| 0 – 1.0 | A terrible environment |
| 1.01 – 2.0 | There are many issues that need changing |
| 2.01 – 3.0 | A more positive atmosphere |
| 3.01 – 4.0 | A good feeling overall |

Domain 5:

| | |
|---|---|
| 0 – 1.0 | Miserable |
| 1.01 – 2.0 | Not a nice place |
| 2.01 – 3.0 | Not too bad |
| 3.01 – 4.0 | Very good socially |

**Medical students' perceptions of the connectedness in online learning at FMHS, UMS**

In general, as illustrated in Table 4, students' perceptions of online connectedness were moderate, with a mean score of 2.63 (SD = 0.78), whereas the lowest perception was for the community domain, with a mean score of 2.05 (SD = 0.89), just slightly above average. The most favourable perception was for the interaction and collaboration domain, with a mean score of 2.99 (SD = 0.73).

In more details, all OSCS items had above-average mean scores, except for 3 items – 'I feel emotionally attached to other students in my online courses', 'my peers have gotten to know me quite well in my online courses' and 'I feel that students in my online courses depend on me' – which had mean scores of 1.82 (SD = 1.17), 1.95 (SD = 1.13) and 1.70 (SD = 1.13) respectively. All three of these items are from the community domain. The highest mean score of 3.18 (SD = 0.81) was for students' perception of facilitation during virtual sessions, indicating that instructors participate in online discussions.

Table 4: Mean score of OSCS by medical students of UMS

| No. | Domain | Items | Mean | SD | Overall Mean (SD) |
|---|---|---|---|---|---|
| 1 | Comfort | I feel comfortable in the online learning environment provided by my program. | 2.47 | 1.08 | 2.63 (0.78) |
| 2 | | I feel my instructors have created a safe online environment in which I can freely express myself. | 2.66 | 0.94 | |
| 3 | | I feel comfortable asking other students in online courses for help. | 2.82 | 1.06 | |
| 4 | | I feel comfortable expressing my opinions and feelings in online courses. | 2.38 | 1.07 | |

| | | | | | |
|---|---|---|---|---|---|
| 5 | | I feel comfortable introducing myself in online courses. | 2.65 | 1.06 | |
| 6 | | If I need to, I will ask for help from my classmates | 3.18 | 0.88 | |
| 7 | | I have no difficulties with expressing my thoughts in my online courses | 2.33 | 1.03 | |
| 8 | | I can effectively communicate in online courses. | 2.40 | 1.04 | |
| 9 | Community | I have gotten to know some of the faculty members and classmates well | 2.46 | 1.19 | |
| 10 | | I feel emotionally attached to other students in my online courses. | 1.82 | 1.17 | |
| 11 | | I can easily make acquaintances in my online courses. | 2.11 | 1.11 | |
| 12 | | I spend a lot of time with my online course peers. | 2.11 | 1.22 | 2.05 (0.89) |
| 13 | | My peers have gotten to know me quite well in my online courses | 1.95 | 1.13 | |
| 14 | | I feel that students in my online courses depend on me. | 1.70 | 1.13 | |
| 15 | Facilitation | Instructors promote collaboration between students in my online courses. | 2.52 | 1.04 | |
| 16 | | Instructors integrate collaboration tools (e.g., chat rooms, wikis, and group areas) into online course activities | 2.65 | 1.03 | |
| 17 | | My online instructors are responsive to my questions. | 3.14 | 0.85 | 2.85 (0.73) |
| 18 | | I receive frequent feedback from my online instructors. | 2.43 | 1.04 | |
| 19 | | My instructors participate in online discussions. | 3.18 | 0.81 | |
| 20 | | In my online courses, instructors promote interaction between learners. | 3.02 | 0.91 | |
| 21 | Interaction and Collaboration | I work with others in my online courses | 3.05 | 0.89 | 2.99 (0.73) |
| 22 | | I relate my work to others' work in my online courses | 2.74 | 0.97 | |

| 23 | | I share information with other students in my online courses. | 3.07 | 0.89 | |
| 24 | | I discuss my ideas with other students in my online courses. | 2.97 | 0.92 | |
| 25 | | I collaborate with other students in my online courses. | 2.98 | 0.87 | |
| **Total OSCS score** | | | | | **2.63 (0.78)** |

SD – Standard deviation

Minimum score = 0 ; Maximum score = 4

## Students' perceptions of the physical and virtual educational environment and associated factors

Regarding factors associated with students' perceptions of the physical educational environment, there were no significant differences in students' perceptions of the physical educational environment based on sex or study phase (p = 0.245 and p = 0.718, respectively, 95% confidence interval). In terms of the virtual educational environment, there was a significant difference based on the phase of study. Pre-clinical medical students had a higher perception of online connectedness compared to students in clinical rotation (p < 0.05, 95% of confidence interval). Meanwhile, there were no significant differences between male and female medical students in their perceptions of virtual learning (p = 0.329), similar to the physical educational environment.

**Comparison and correlation between physical and virtual educational environments**

In this study, a moderate, significant correlation was found between DREEM scores, measuring the physical environment, and OSCS scores, measuring online connectedness in the virtual environment (r = 0.496, p < 0.05). Students' perceptions of the physical and virtual educational environments were

compared in terms of the psychosocial dimension of the educational environment framework (5), as depicted in Table 5 and Figure 3 for the correlation.

Table 5: Comparison between domains in different levels of psychosocial dimension

| Psychosocial Dimension | DREEM Score, Mean (SD) | | OSCS Score, Mean (SD) | |
|---|---|---|---|---|
| Personal level | Academic self-perception | 3.03 (0.70) | Comfort | 2.63 (0.78) |
| | Learning activities | 3.00 (0.77) | | |
| Group level | Social self-perception | 2.58 (0.91) | Community | 2.05 (0.89) |
| | Teaching activities | 3.20 (0.63) | Interaction and collaboration | 2.99 (0.73) |
| Organizational level | Social self-perception | 2.58 (0.91) | Facilitation | 2.85 (0.73) |
| | Teaching activities | 3.20 (0.63) | | |

On the personal level, all scores were above average, with OSCS comfort domain items receiving lower scores than those regarding perception of the physical environment. A further statistical test revealed a significant positive moderate correlation between OSCS comfort domain scores and DREEM academic self-perception scores ($r = 0.464$, $p < 0.001$) and DREEM learning activities scores ($r = 0.405$, $p < 0.001$). These results support the interrelation of domains in both physical and virtual educational environments at the psychosocial-personal level.

In the group-level dimension, all domain scores were above average. However, the score for the community domain, which mainly reflects social interactions among students during virtual learning, was among the lowest scores. Further analysis of the data revealed a moderate positive correlation between OSCS community and DREEM social self-perception scores ($r = 0.405$). For other domains, OSCS interaction and collaboration scores were weakly correlated with DREEM social self-perception scores ($r = 0.265$). Similarly, the OSCS community and DREEM teaching activities domains as well as the OSCS interaction and collaboration and DREEM teaching activities scores exhibited weak positive correlations ($r = 0.227$ and $r = 0.323$, respectively).

Comparing the domains at the psychosocial-organisational level, it can be seen that OSCS facilitation scored lower than DREEM teaching activities, indicating that students had more favourable perceptions of teachers' roles during physical teaching and learning sessions compared to virtual sessions. Nevertheless, students assigned lower DREEM social self-perception scores, which may reflect support received from the organisational level, as shown in Table 5. Similar to other dimensions, there were also significant, positively moderate correlations between all domains in the psychosocial-organisational level dimension.

## DISCUSSION

The objective of this research was to gain insight into the educational environment at FMHS, UMS, as perceived by undergraduate students. The results were utilised to identify both the positive aspects and areas for improvement in the institution's educational environment.

### Students' perceptions of the physical educational environment at UMS

The total mean DREEM score indicates that medical students at FMHS, UMS had more positive than negative perceptions of their physical educational environment. This finding is in line with those of pre-pandemic studies (18-21). It also consistent with a systematic review showing that 80.6% of studies conducted worldwide reported DREEM scores within the range of 'more positive than negative' (22). This suggests that despite Covid-19 challenges, medical students at UMS are generally satisfied with the physical educational environment. The adaptability of the academic team and stakeholders, allowing flexible curriculum adjustments, likely contributes to this satisfaction (23).

The perception of teaching received the highest score. This is an encouraging result that signifies good teaching standards as well as students' adaptability to the teaching styles of lecturers. It also shows that medical students value interactive teaching and learning activities as part of the modern curriculum that is implemented at UMS. In the literature, this revised curriculum is associated with more positive perceptions of the educational environment among medical students compared to the traditional curriculum (24-26).

In the academic self-perception domain, the students expressed confidence in their academic abilities, including well-developed problem-solving skills relevant to their future healthcare careers. This aligns with the success of teaching methods like problem-based learning at FMHS, UMS. High academic

self-perception scores are correlated with good academic performance (27), as evidenced by the fact that 99.4% of the respondents achieved a Cumulative Grade Point Average (CGPA) >3.0 in this study.

Medical students viewed learning at FMHS, UMS as 'a more positive approach.' This positive perception of learning can be attributed to the integrated curriculum. However, there is room for improvement, particularly in terms of enhancing confidence levels, especially among first-year students, who typically exhibit lower confidence levels. Confidence tends to increase with advancing years of study, aided by proper assessment and feedback (28). Thus, effective assessment strategies coupled with constructive feedback sessions should be implemented.

Two domains scored the lowest compared to other domains: perceptions of the atmosphere and students' social self-perception. This was likely influenced by restrictions on social interactions during the Covid-19 pandemic. UMS regulations prohibited gatherings outside of students' rooms, except for classes that implemented physical distancing, impacting students' social perceptions. Particularly concerning is the low score for support systems for stressed students, linked to the item 'the enjoyment outweighs the stress of the course' in the atmosphere domain. This finding highlights the need to improve support for medical students at FMHS, UMS to enhance their well-being.

A systematic review revealed that medical students' mental health is negatively impacted by unsupportive educational environments (29). Medical students, including those at UMS, faced notable mental stress even prior to Covid-19 (30), and the pandemic exacerbated this situation. Indeed, recent studies have highlighted the significant impact of the pandemic on students' well-being (31), underscoring the need for sustained psychological and educational support. While support systems like a mentor–mentee programme have already been established at FMHS, UMS, their effectiveness requires further evaluation, as indicated by the findings of this study. Further research is warranted to qualitatively assess students' perceptions of the support system and identify areas for improvement.

**Students' perceptions of the virtual educational environment at UMS**

Overall, medical students perceived online connectedness during virtual teaching and learning activities at FMHS, UMS as moderate. This finding is in alignment with other research on online student connectedness (32, 33) and indicates that medical students adapted to the virtual learning activities in medical education during the Covid-19 pandemic.

In assessing perceptions of the virtual educational environment, students rated interaction and collaboration highest, whereas they gave lower scores to social interaction in the physical setting due to pandemic restrictions. Despite limited physical socialisation, the use of various online platforms clearly facilitated more effective communication. The advantage of knowing each other prior to the commencement of emergency virtual learning might have also contributed to the high scores for this domain of student connectedness in virtual learning.

In the facilitation domain of the virtual educational environment, medical students generally expressed satisfaction with their instructors' guidance during virtual sessions. However, a notable concern was raised regarding the perceived lack of feedback from online instructors. This may be related to medical educators' adaptation to sudden virtual teaching, which forced them to balance teaching with clinical responsibilities (34). Nonetheless, this presents an opportunity for improvement not only in virtual learning but also in physical or blended approaches, emphasising the crucial role of feedback in enhancing the educational environment (35).

Among the OSCS domains, the scores were lowest in the community domain, with half of its items rated below average. This suggests that the medical students in this study had a low sense of belonging to any specific group within their virtual educational environment. A low score in this domain has also observed in prior studies (32, 33). This lack of community connection may be attributed to the temporary nature of online learning during the pandemic, which limited opportunities for deeper interaction. Additionally, the brief interaction duration may have hindered the development

of personal relationships, hampering the establishment of social presence, as outlined in the Community of Inquiry (CoI) framework (36).

## Comparison and correlation between the physical educational environment and online student connectedness in the virtual educational environment

It is clear from the results that all domains in both DREEM and OSCS have a significant, weak to moderate positive correlation, indicating that there is an interrelation between physical and virtual educational environments based on the dimensions.

One notable finding in this study is the consistently lower scores for perceptions of online connectedness compared to scores for the physical educational environment. This suggests a preference among UMS medical students for traditional physical teaching over virtual learning. Despite evidence suggesting that online learning in medical education can be effective (37), there is a prevailing sentiment that full online learning is not yet suitable for medical education. While the pandemic prompted exploration of virtual learning opportunities, a blended learning approach appears more feasible in the short term, especially for clinical year students, who require hands-on experience with real patients in hospital settings, as supported by previous studies (23, 38).

To delve deeper, we compared and correlated the perceptions of physical and virtual educational environments based on the level of dimension in the psychosocial framework of the educational environment.

## Psychosocial – personal-level dimension

The personal level of the psychosocial dimension explores learners' personal and professional growth within the educational environment. As illustrated in Table 5, this dimension includes the DREEM domain of academic self-perception and learning activities and the OSCS domain of comfort. The

students' perceptions of comfort during online learning were above average but lower than those of the physical educational environment. This suggests that students may experience greater personal and professional growth in face-to-face sessions compared to virtual ones (39). Conversely, some studies have suggested that there is no disparity in professional development between face-to-face and virtual learning (40).

Successfully fostering personal and professional growth during online learning relies heavily on the objectives of and methods employed by instructors. However, it is widely acknowledged that learners primarily benefit from personal and professional development through indirect interactions in face-to-face sessions with teachers, peers and patients, as outlined in the hidden curriculum (2).

## Psychosocial – group-level dimension

The psychosocial group-level dimension incorporates the DREEM social self-perception and teaching activities domains as well as the OSCS interaction and collaboration and community domains. The low correlation between DREEM and OSCS in this dimension may stem from their distinct focuses on interaction. While DREEM assesses interactions among students, OSCS includes interactions between students, teachers and faculty within its community and interaction and collaboration domains. This disparity in scope likely accounts for the limited correlation observed between the two measures in this dimension.

While we observed the lack of a sense of belonging in the community domain in online learning, social interaction among students and teachers during face-to-face learning sessions also has room for improvement. This was particularly clear in the social self-perception domain, where the item 'there is a good support system for students who get stressed' received one of the lowest scores from the

medical students. This again highlights the importance of good psychological and educational support for medical students during the pandemic and especially in the post-pandemic period.

## Psychosocial – organisational-level dimension

In addition to the students themselves and the interactions between students, peers and teachers, interactions between students and the organisation also play a role in creating a good educational environment. It is the organisation's responsibility to provide the proper structure, guidance and support to enhance the learning experience (3).

The results of this study show a lower perception of online learning compared to face-to-face learning, particularly in facilitating teaching processes. Understandably, the sudden shift to online education in the face of the Covid-19 pandemic presented challenges for administrators in medical education. However, this experience prompted educators and administrators to adopt more innovative approaches, fostering meaningful and engaging learning activities for medical students. Indeed, this experience has enhanced readiness for future circumstances requiring distance learning. Today, educational organisations must prioritise enhancing their infrastructure to support hybrid and blended learning methods.

### Educational environment in relation to the respondents' phase of study and sex

There was no significant difference between the phase of study in the DREEM scores measuring the perception of the physical educational environment. This finding aligns with a study conducted at UniSZA (41) but contradicts the findings from a study at Taylor's University, in which the perception of the educational environment was more favourable among clinical students (21).

The perception of student connectedness in virtual learning differs significantly between pre-clinical and clinical year students. Specifically, pre-clinical students perceive better online connectedness

compared to clinical year students. This disparity is expected due to the nature of medical education during the clinical year, which involves more practical and hands-on experiences with actual patients in a hospital setting. It is a significant challenge to teach clinical year students with an actual patient via online learning. A previous study also highlighted the preferability of online learning for pre-clinical students (42).

No significant differences were found students' perceptions of the physical educational environment and online student connectedness in virtual learning based on the respondents' sex, consistent with prior research (21, 43, 44). However, a study at UniSZA showed that females perceived the physical educational environment more positively than males (41). Similarly, while some studies have suggested that female students are more connected online (45, 46), another indicated the opposite (32). Such discrepancies suggest that factors like learning outcomes, styles or sex bias in medical institutions may influence the impact of learners' sex on the educational environment (37, 47, 48). While no sex bias in medical education was observed at FMHS, UMS in this study, the influence of other factors like learning styles remains unexplored in this specific context.

**Practical implications of students' perceptions of the educational environment**

The findings of this study offer valuable insights for educators and policymakers in medical education. It is notable that despite facing hurdles like the Covid-19 pandemic, most medical students view their educational environment positively. This highlights the ability of both students and educational institutions to adapt to and surmount challenges. Below, we outline practical implications of the study, which provide actionable guidance for improving medical education practices.

### Teaching Methods

The highly favourable perception of teaching quality suggests that educators should continue to prioritise interactive teaching methods that engage students in the class physically or online session. This could involve further training for instructors in modern teaching techniques and technologies to enhance student learning experiences.

### Curriculum Development

The positive perception of the revised curriculum compared to traditional methods highlights the importance of ongoing curricular development efforts. Institutions should continue to review and update their curricula to align with modern educational approaches and meet the evolving needs of medical students. An understanding of students' preference for face-to-face sessions and the perceived limitations of virtual learning can guide the design of more effective educational environments. Educators can incorporate elements that promote personal and professional growth while ensuring that online platforms facilitate meaningful interactions.

### Support Systems

Given the challenges highlighted in the study, particularly regarding social interaction and organisational support, there is a need for institutions to prioritise students' psychological well-being. Providing adequate support systems, counselling services and mentorship programmes can help address stress and foster a sense of belonging within the learning community.

*Investing in Infrastructure*

Institutions should invest in improving infrastructure to support hybrid and blended learning methods. This includes ensuring access to reliable technology, enhancing online learning platforms and providing training for faculty to effectively utilise these tools.

*Promoting Innovation in Education*

The study underscores the importance of innovation in medical education, particularly in response to challenges like the Covid-19 pandemic. Institutions should encourage educators to explore innovative teaching methods and leverage technology to enhance learning experiences for students.

*Continuous Evaluation*

The findings emphasise the importance of continuous evaluation and improvement of the educational environment. Institutions should regularly collect feedback from students and faculty, assess the effectiveness of educational initiatives and make adjustments as needed to ensure a supportive and enriching educational environment for all students.

Overall, this study emphasises the importance of the ongoing commitment of medical education institutions to meet the diverse needs of their students while leveraging advancements in technology and pedagogy to create engaging and effective educational environments. By addressing the areas of improvement identified in the study, institutions can further enhance the quality of medical education and better support the well-being and success of their students.

## LIMITATIONS OF THE STUDY

There are a few limitations of the current study that must be considered. First, both questionnaires that were used are close-ended inventories, which have some inherent limitations in terms of exploring a specific problem in depth. Moreover, like many self-report measures, both questionnaires are susceptible to response bias, where respondents may provide answers that they believe are socially desirable or expected rather than reflecting their true perceptions of the educational environment. However, this issue can be mitigated by constructing an open-ended inventory through focus group discussions, especially focusing on weak items, and performing a qualitative analysis in further research.

The use of OSCS as an instrument in this study is also a limitation, as the instrument was validated in Turkey but has not yet been validated in Malaysia. Further research is needed to validate this instrument for use with Malaysian students.

Another limitation is the format that was used for collecting data on academic achievement, which were in categorical form, CGPA $\geq$ 3.0 or < 3.0, as we only received two samples for which CGPA < 3.0. Due to the insufficient number of samples, it was not possible to examine the association between the academic achievement of medical students at UMS and their perceptions of the educational environment.

## CONCLUSION

This study provides valuable insights into how medical students perceive their educational environment, both in physical and virtual settings. While students at FMHS, UMS generally have positive views of their educational environment in both realms, there is room for improvement, especially in light of the challenges posed by the Covid-19 pandemic. The observation that students

favour the physical environment over the virtual one suggests that adopting a blended learning approach may be more beneficial than fully online learning for medical education moving forward.

Furthermore, the study highlights areas in which the students rated UMS's well-being support system lower. It is imperative for the faculty to delve deeper into these findings and investigate the implementation of support systems to enhance student well-being, even in the post-pandemic period.

The findings of this study establish a baseline for FMHS, UMS, offering guidance for future initiatives. Regular assessments are essential to continuously gather feedback from students and stakeholders, enabling ongoing enhancements to the educational environment and the promotion of effective teaching and learning activities. By prioritising these efforts, UMS can cultivate well-rounded healthcare professionals equipped to serve the community effectively, ensuring sustained improvement and consistency in practice.

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