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Examining the perception of undergraduate health professional students of their learning environment, learning experience and professional identity development: a mixed-methods study

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Background The quality of the learning environment significantly impacts student engagement and professional identity formation in health professions education. Despite global recognition of its importance, research on student perceptions of learning environments across different health education programs is scarce. This study aimed to explore how health professional students perceive their learning environment and its influence on their professional identity development.

Methods An explanatory mixed-methods approach was employed. In the quantitative phase, the Dundee Ready Education Environment Measure [Minimum–Maximum possible scores = 0–200] and Macleod Clark Professional Identity Scale [Minimum–Maximum possible scores = 1–45] were administered to Qatar University-Health students (*N* = 908), with a minimum required sample size of 271 students. Data were analyzed using SPSS, including descriptive statistics and inferential analysis. In the qualitative phase, seven focus groups (FGs) were conducted online via Microsoft Teams. FGs were guided by a topic guide developed from the quantitative results and the framework proposed by Gruppen et al. (Acad Med 94:969-74, 2019), transcribed verbatim, and thematically analyzed using NVIVO®.

Results The questionnaire response rate was 57.8% (525 responses out of 908), with a usability rate of 74.3% (390 responses out of 525) after excluding students who only completed the demographic section. The study indicated a "more positive than negative" perception of the learning environment (Median [IQR] = 132 [116–174], Minimum–Maximum obtained scores = 43–185), and a "good" perception of their professional identity (Median [IQR] = 24 [22–27], Minimum–Maximum obtained scores = 3–36). Qualitative data confirmed that the learning environment was supportive in developing competence, interpersonal skills, and professional identity, though opinions on emotional support adequacy were mixed. Key attributes of an ideal learning environment included mentorship programs, a reward system, and measures to address fatigue and boredom.

Conclusions The learning environment at QU-Health was effective in developing competence and interpersonal skills. Students' perceptions of their learning environment positively correlated with their professional identity. Ideal

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environments should include mentorship programs, a reward system, and strategies to address fatigue and boredom, emphasizing the need for ongoing improvements in learning environments to enhance student satisfaction, professional identity development, and high-quality patient care.

Keywords Learning Environment, Professional Identity, Healthcare Professions Education, DREEM, MCPIS-9, Gruppen et al. Framework

Background

The learning environment is fundamental to higher education and has a profound impact on student outcomes. As conceptualized by Gruppen et al. [1], it comprises a complex interplay of physical, social, and virtual factors that shape student engagement, perception, and overall development. Over the last decade, there has been a growing global emphasis on the quality of the learning environment in higher education [2–4]. This focus stems from the recognition that a well-designed learning environment that includes good facilities, effective teaching methods, strong social interactions, and adherence to cultural and administrative standards can greatly improve student development [2, 5–7]. Learning environments impact not only knowledge acquisition and skill development but also value formation and the cultivation of professional attitudes [5].

Professional identity is defined as the "attitudes, values, knowledge, beliefs, and skills shared with others within a professional group" [8]. The existing research identified a significant positive association between the development of professional identity and the quality of the learning environment, and this association is characterized by being multifaceted and dynamic [9]. According to Hendelman and Byszewski [10] a supportive learning environment, characterized by positive role models, effective feedback mechanisms, and opportunities for reflective practice, fosters the development of a strong professional identity among medical students. Similarly, Jarvis-Selinger et al. [11] argue that a nurturing learning environment facilitates the socialization process which enables students to adopt and integrate the professional behaviors and attitudes expected in their field. Furthermore, Sarraf-Yazdi et al. [12] highlighted that professional identity formation is a continuous and multifactorial process involving the interplay of individual values, beliefs, and environmental factors. This dynamic process is shaped by both clinical and non-clinical experiences within the learning environment [12].

Various learning theories, such as the Communities of Practice (CoP) theory [13], emphasize the link between learning environments and learning outcomes, including professional identity development. The CoP theory describes communities of professionals with a shared knowledge interest who learn through regular interaction [13, 14]. Within the CoP, students transition from being peripheral observers to central members [15]. Therefore, the CoP theory suggests that a positive learning environment is crucial for fostering learning, professional identity formation, and a sense of community [16].

Undoubtedly, health professional education programs (e.g., Medicine, Dental Medicine, Pharmacy, and Health Sciences) play a vital role not only in shaping the knowledge, expertise, and abilities of health professional students but also in equipping them with the necessary competencies for implementing healthcare initiatives and strategies and responding to evolving healthcare demands [17]. Within the field of health professions education, international organizations like the United Nations Educational, Scientific, and Cultural Organization (UNESCO), European Union (EU), American Council on Education (ACE), and World Federation for Medical Education (WFME) have emphasized the importance of high-quality learning environments in fostering the development of future healthcare professionals and called for considerations of the enhancement of the quality of the learning environment of health profession education programs [18, 19]. These environments are pivotal for nurturing both the academic and professional growth necessary to navigate an increasingly globalized healthcare landscape [18, 19].

Professional identity development is integral to health professions education which evolves continuously from early university years until later stages of the professional life as a healthcare practitioner [20, 21]. This ongoing development helps students establish clear professional roles and boundaries, thereby reducing role ambiguity within multidisciplinary teams [9]. It is expected that as students advance in their professional education, their perception of the quality of the learning environment changes, which influences their learning experiences, the development of their professional identity, and their sense of community [22]. Cruess et al. [23] asserted that medical schools foster professional identity through impactful learning experiences, effective role models, clear curricula, and assessments. A well-designed learning environment that incorporates these elements supports medical students' socialization and professional identity formation through structured learning, reflective

practices, and constructive feedback in both preclinical and clinical stages [23].

Despite the recognized importance of the quality of learning environments and their influence on student-related outcomes, this topic has been overlooked regionally and globally [24–30]. There is a significant knowledge gap in understanding how different components of the learning environment specifically contribute to professional identity formation. Most existing studies focus on general educational outcomes without exploring the detailed ways in which the learning environment shapes professional attitudes, values, and identity. Moreover, there is a global scarcity of research exploring how students' perceptions of the quality of the learning environment and professional identity vary across various health profession education programs at different stages of their undergraduate education. This lack of comparative studies makes it challenging to identify best practices that can be adapted across different educational contexts. Furthermore, most research tends to focus on single-discipline studies, neglecting the interdisciplinary nature of modern healthcare education, which is essential for preparing students for collaborative practice in real-world healthcare settings. Considering the complex and demanding nature of health profession education programs and the increased emphasis on the quality of learning environments by accreditation bodies, examining the perceived quality of the educational learning environment by students is crucial [19]. Understanding students' perspectives can provide valuable insights into areas needing improvement and highlight successful strategies that enhance both learning environment and experiences and professional identity development.

This research addresses this gap by focusing on the interdisciplinary health profession education programs to understand the impact of the learning environment on the development of the professional identity of students and its overall influence on their learning experiences. The objectives of this study are to 1) examine the perception of health professional students of the quality of their learning environment and their professional identity, 2) identify the association between health professional students' perception of the quality of their learning environment and the development of their professional identity, and 3) explore the expectations of health professional students of the ideal educational learning environment. This research is essential in providing insights to inform educational practices globally to develop strategies to enhance the quality of health profession education.

Methods

Study setting and design

This study was conducted at Qatar University Health (QU Health) Cluster which is an interdisciplinary health profession education program that was introduced as the national provider of higher education in health and medicine in the state of Qatar. QU Health incorporates five colleges: Health Sciences (CHS), Pharmacy (CPH), Medicine (CMED), Dental Medicine (CDEM) and Nursing (CNUR) [31]. QU Health is dedicated to advancing inter-professional education (IPE) through its comprehensive interdisciplinary programs. By integrating IPE principles into the curriculum and fostering collaboration across various healthcare disciplines, the cluster prepares students to become skilled and collaborative professionals. Its holistic approach to teaching, research, and community engagement not only enhances the educational experience but also addresses local and regional healthcare challenges, thereby making a significant contribution to the advancement of population health in Qatar [32]. This study was conducted from November 2022 to July 2023. An explanatory sequential mixed methods triangulation approach was used for an in-depth exploration and validation of the quantitative results qualitatively [33, 34]. Ethical approval for the study was obtained from the Qatar University Institutional Review Board (approval number: QU-IRB 1734-EA/22).

For the quantitative phase, a questionnaire was administered via SurveyMonkey® incorporating two previously validated questionnaires: the Dundee Ready Educational Environment Measure (DREEM), developed by Roff et al. in 1997 [35], and the Macleod Clark Professional Identity Scale-9 (MCPIS-9), developed by Adam et al. in 2006 [8]. Integrating DREEM and MCPIS-9 into a single questionnaire was undertaken to facilitate a comprehensive evaluation of two distinct yet complementary dimensions—namely, the educational environment and professional identity—that collectively influence the learning experience and outcomes of students, as no single instrument effectively assesses both aspects simultaneously [36]. The survey comprised three sections—Section A: sociodemographic characteristics, Section B: the DREEM scoring scale for assessing the quality of the learning environment, and Section C: the MCPIS-9 scoring scale for assessing professional identity. For the qualitative phase, seven focus groups (FGs) were arranged with a sample of QU-Health students. The qualitative and quantitative data obtained were integrated at the interpretation and reporting level using a narrative, contiguous approach [37, 38].

Quantitative phase

Population and sampling

The total population sampling approach in which all undergraduate QU-Health students who had declared their majors (i.e., the primary field of study that an undergraduate student has chosen during their academic program) at the time of conducting the study in any of the four health colleges under QU-Health ($N=908$), namely, CPH, CMED, CDEM, and CHS, such as Human Nutrition (Nut), Biomedical Science (Biomed), Public Health (PH), and Physiotherapy (PS), were invited to participate in the study. Nursing students were excluded from this study because the college was just established in 2022; therefore, students were in their general year and had yet to declare their majors at the time of the study. The minimum sample size required for the study was determined to be 271 students based on a margin error of 5%, a confidence level of 95%, and a response distribution of 50%.

Data collection

Data was collected in a cross-sectional design. After obtaining the approval of the head of each department, contact information for eligible students was extracted from the QU-Health student databases for each college, and invitations were sent via email. The distribution of these invitations was done by the administrators of the respective colleges. The invitation included a link to a self-administered questionnaire on SurveyMonkey® (Survey Monkey Inc., San Mateo, California, USA), along with informed consent information. All 908 students were informed about the study's purpose, data collection process, anonymity and confidentiality assurance, and the voluntary nature of participation. The participants were sent regular reminders to complete the survey to increase the response rate.

A focused literature review identified the DREEM as the most suitable validated tool for this study. The DREEM is considered the gold standard for assessing undergraduate students' perceptions of their learning environment [35]. Its validity and reliability have been consistently demonstrated across various settings (i.e., clinical and non-clinical) and health professions (e.g., nursing, medicine, dentistry, and pharmacy), in multiple countries worldwide, including the Gulf Cooperation Council countries [24, 35, 39–42]. The DREEM is a 50-item inventory divided into 5 subscales and developed to measure the academic climate of educational institutions using a five-point Likert scale from 0 "strongly disagree" to 4 "strongly agree". The total score ranges from 0 to 200, with higher scores reflecting better perceptions of the learning environment [35, 39, 43]. The interpretation includes very poor (0–50), plenty of problems (51–100), more positive than negative (101–151), and excellent (151–200).

The first subscale, Perception to Learning (SpoL), with 12 items scoring 0–48. Interpretation includes very poor (0–12), teaching is viewed negatively (13–24), a more positive approach (25–36), and teaching is highly thought of (37–48). The second domain, Perception to Teachers (SpoT), with 11 items scoring 0–44. Interpretation includes abysmal (0–11), in need of some retraining (12–22), moving in the right direction (23–33), and model teachers (34–44). The third domain, academic self-perception (SASP), with 8 items scoring 0–32. Interpretation includes a feeling of total failure (0–8), many negative aspects (9–16), feeling more on the positive side (17–24), and confident (25–32). The fourth domain, Perception of the atmosphere (SPoA), with 12 items scoring 0–48. Interpretation includes a terrible environment (0–12); many issues need to be changed (13–24), a more positive atmosphere (25–36), and a good feeling overall (37–48). Lastly, the fifth domain, social self-perception (SSSP), with 7 items scoring 0–28. Interpretation includes Miserable (0–7), Not a nice place (8–14), Not very bad (15–21), and very good socially (22–28).

Several tools have been developed to explore professional identity in health professions [44], but there is limited research on their psychometric qualities [45]. The MCPIS-9 is notable for its robust psychometric validation and was chosen for this study due to its effectiveness in a multidisciplinary context as opposed to other questionnaires that were initially developed for the nursing profession [8, 46, 47]. MCPIS-9 is a validated 9-item instrument, which uses a 5-point Likert response scale, with scores ranging from 1 "strongly disagree" to 5 "strongly agree". Previous studies that utilized the MCPIS-9 had no universal guidance for interpreting the MCPIS-9 score; however, the higher the score, the stronger the sense of professional identity [46, 48].

Data analysis

The quantitative data were analyzed using SPSS software (IBM SPSS Statistics for Windows, version 27.0; IBM Corp., Armonk, NY, USA). The original developers of the DREEM inventory identified nine negative items: items 11, 12, 19, 20, 21, 23, 42, 43, and 46 – these items were reverse-coded. Additionally, in the MCPIS-9 tool, the original developers identified three negative items: items 3, 4, and 5. Descriptive and inferential analyses were also conducted. Descriptive statistics including number (frequencies [%]), mean ± SD, and median (IQR), were used to summarize the demographics and responses to the DREEM and MCPIS-9 scoring scales. In the inferential analysis, to test for significant differences between demographic subgroups in the DREEM and MCPIS-9 scores, Kruskal–Wallis tests were used for variables with more

than two categories, and Mann–Whitney U-tests were used for variables with two categories. Spearman's rank correlation analysis was used to investigate the association between perceived learning environment and professional identity development. The level of statistical significance was set a priori at $p < 0.05$. The internal consistency of the DREEM and MCPIS-9 tools was tested against the acceptable Cronbach's alpha value of 0.7.

Qualitative phase

Population and sampling

A purposive sampling approach was employed to select students who were most likely to provide valuable insights to gain a deeper understanding of the topic. The inclusion criteria required that participants should have declared their major in one of the following programs: CPH, CMED, CDEM, CHS: Nut, Biomed, PS, and PH. This selection criterion aimed to ensure that participants had sufficient knowledge and experience related to their chosen fields of study within QU-Health. Students were included if they were available and willing to share their experiences and thoughts. Students who did not meet these criteria were excluded from participation. To ensure a representative sample, seven FGs were conducted, one with each health professional education program. After obtaining the approval of the head of each department, participants were recruited by contacting the class representative of each professional year to ask for volunteers to join and provide their insights. Each FG involved students from different professional years to ensure a diverse representation of experiences and perspectives.

Data collection

The topic guide (Supplementary Material 1) was developed and conceptualized based on the research objectives, selected results from the quantitative phase, and the Gruppen et. al. framework [1]. FGs were conducted online using Microsoft Teams® through synchronous meetings. Before initiating the FGs, participants were informed of their rights and returned signed consent forms to the researchers. FGs were facilitated by two research assistants (AA and OY), each facilitating separate sessions. The facilitators, who had prior experience with conducting FGs and who were former pharmacy students from the CPH, were familiar with some of the participants, and hence were able to encourage open discussion, making it easier for students to share their perceptions of the learning environment within the QU Health Cluster. Participants engaged in concurrent discussions were encouraged to use the "raise hand" feature on Microsoft Teams to mimic face-to-face interactions. Each FG lasted 45–60 min, was conducted in English, and was recorded and transcribed verbatim and double-checked for accuracy. After the seventh FG, the researchers were confident that a saturation point had been reached where no new ideas emerged, and any further data collection through FGs was unnecessary. Peer and supervisory audits were conducted throughout the research process.

Data analysis

The NVIVO® software (version 12) was utilized to perform a thematic analysis incorporating both deductive and inductive approaches. The deductive approach involved organizing the data into pre-determined categories based on the Gruppen et al. framework, which outlines key components of the learning environment. This framework enabled a systematic analysis of how each component of the learning environment contributes to students' professional development and highlighted areas for potential improvement. Concurrently, the inductive approach was applied to explore students' perceptions of an ideal learning environment, facilitating the emergence of new themes and insights directly from the data, independent of pre-existing categories. This dual approach provided a comprehensive understanding of the data by validating the existing theory while also exploring new findings [49]. Two coders were involved in coding the transcripts (AA and BM) and in cases of disagreements between researchers, consensus was achieved through discussion.

Results

Quantitative phase

The response rate was 57.8% (525 responses out of 908), while the usability rate was 74.3% (390 responses out of 525) after excluding students who only completed the demographic section. The demographic and professional characteristics of the participants are presented in Table 1. The majority were Qataris (37.0% [$n = 142$]), females (85.1% [$n = 332$]), and of the age group of 21–23 years (51.7% [$n = 201$]). The students were predominantly studying at the CHS (36.9%[$n = 144$]), in their second professional year (37.4% [$n = 146$]), and had yet to be exposed to experiential learning, that is, clinical rotations (70.2% [$n = 273$]).

Perceptions of students of their learning environment

The overall median DREEM score for study participants indicated that QU Health students perceive their learning environment to be "more positive than negative" (132 [IQR = 116–174]). The reliability analysis for this sample of participants indicated a Cronbach's alpha for the total DREEM score of 0.94, and Cronbach's alpha

Table 1 Demographic and professional characteristics of the health professional students ($N = 390$)

Characteristic	Frequency n [%]
Gender	***n* = 390**
Male	58 [14.9]
Female	332 [85.1]
Age (years)	***n* = 389**
18 – 20	170 [43.7]
21 – 23	201 [51.7]
24 – 26	17 [4.4]
27 – 29	1 [0.3]
Nationality	***n* = 384**
Qatari	142 [37.0]
Egyptian	51 [13.3]
Jordanian	34 [8.9]
Syrian	23 [6.0]
Pakistani	20 [5.2]
Palestinian	14 [3.6]
Yemeni	11 [2.9]
Bangladeshi	9 [2.3]
Other	80 [20.8]
Place of high school completion	***n* = 389**
Inside Qatar	376 [96.7]
Outside Qatar	13 [3.3]
College	***n* = 390**
Medicine	92 [23.6]
Dental Medicine	44 [11.3]
Pharmacy	110 [28.2]
Health Sciences	144 [36.9]
Program	***n* = 390**
Medicine	91 [23.3]
Dental Medicine	44 [11.3]
Pharmacy	111 [28.5]
Physiotherapy	49 [12.6]
Biomedical Sciences	46 [11.8]
Human Nutrition	40 [10.3]
Public health	9 [2.3]
Current program as the first option	***n* = 390**
Yes	213 [54.6]
No	163 [41.8]
I do not know	7 [1.8]
I prefer not to answer	7 [1.8]
Current professional year[a]	***n* = 390**
1	65 [16.7]
2	146 [37.4]
3	88 [22.6]
4	66 [16.9]
5	21 [5.4]
6	4 [1.0]
Started undergraduate clinical rotations/training?	***n* = 389**
Yes	116 [29.8]
No	273 [70.2]
Relatives studying/studied the same profession?	***n* = 374**
Yes	133 [34.1]
No	241 [61.8]
Time spent in self-studying per week (hours)	***n* = 390**
0–5	91 [23.3]
6–10	123 [31.5]
11–15	90 [23.1]
> 16	86 [22.1]

[a] Current professional year represents the academic year of studying one's chosen profession following the declaration of their major

scores for each domain of the DREEM tool, SPoL, SPoT, SASP, SPoA, and SSSP of 0.85, 0.74, 0.81, 0.85, and 0.65, respectively.

Individual item responses representing each domain of the DREEM tool are presented in Table 2. For Domain I, QU Health students perceived the teaching approach in QU Health to be "more positive" (32 [IQR = 27–36]). Numerous participants agreed that the teaching was well-focused (70.7% [$n = 274$]), student-focused (66.1% [$n = 254$]) and aimed to develop the competencies of students (72.0% [$n = 278$]). The analysis of students' perceptions related to Domain II revealed that faculty members were perceived to be "moving in the right direction" (30 [IQR = 26–34]). Most students agreed that faculty members were knowledgeable (90.7%[$n = 345$]) and provided students with clear examples and constructive feedback (77.6% [$n = 294$] and 63.8% [$n = 224$], respectively. Furthermore, the analysis of Domain III demonstrated that QU Health students were shown to have a "positive academic self-perception" (22 [IQR = 19–25]). In this regard, most students believed that they were developing their problem-solving skills (78% [$n = 292$]) and that what they learned was relevant to their professional careers (76% [$n = 288$]). Furthermore, approximately 80% ($n = 306$) of students agreed that they had learned empathy in their profession. For Domain IV, students perceived the atmosphere of their learning environment to be "more positive" (32 [IQR = 14–19]). A substantial number of students asserted that there were opportunities for them to develop interpersonal skills (77.7% [$n = 293$]), and that the atmosphere motivated them as learners (63.0% [$n = 235$]). Approximately one-third of students believed that the enjoyment did not outweigh the stress of studying (32.3% [$n = 174$]). Finally, analysis of Domain V indicates that students' social self-perception was "not very bad" (17 [IQR = 27–36]). Most students agreed

Table 2 Health Professional Students' Responses to Dundee Ready Education Environment Measure (DREEM) and Macleod Clark Professional Identity (MCPIS-9) scoring scales

Domain/item	Strongly disagree n (%)	Disagree n (%)	Unsure n (%)	Agree n (%)	Strongly Agree n (%)	Mean (± SD)	Median (IQR)	Missing n (%)
Dundee Ready Education Environment Measure (DREEM)								
Domain I: Perception to learning								
I am encouraged to participate in class	18 (4.6)	44 (11.3)	64 (16.5)	182 (46.8)	81 (20.8)	2.70 (1.03)	3 (2–3)	1 (0.3)
The teaching is sufficiently concerned to develop my confidence	16 (4.1)	35 (9.0)	74 (19.1)	192 (49.5)	71 (18.3)	2.71 (1.00)	3 (2–4)	2 (0.5)
The teaching encourages me to be an active learner	11 (2.8)	30 (7.8)	63 (16.4)	180 (46.6)	102 (26.4)	2.85 (0.99)	3 (2–4)	4 (1.0)
The teaching is well focused	11 (2.8)	32 (8.2)	71 (18.3)	207 (53.4)	67 (17.3)	2.78 (0.91)	3 (2–3)	2 (0.5)
The teaching is sufficiently concerned to develop my competence	14 (3.6)	33 (8.6)	61 (15.8)	202 (52.3)	76 (19.7)	2.78 (0.98)	3 (2–3)	4 (1.0)
I am clear about the learning objectives of the course	13 (3.4)	21 (5.5)	51 (13.2)	188 (48.8)	112 (29.1)	2.99 (0.92)	3 (3–4)	5 (1.3)
The teaching is often stimulating	11 (2.9)	48 (12.5)	79 (20.5)	198 (51.4)	49 (12.7)	2.61 (0.95)	3 (2–3)	5 (1.3)
The teaching time is put to good use	21 (5.4)	39 (10.1)	62 (16.1)	194 (50.3)	70 (18.1)	2.67 (1.04)	3 (2–3)	4 (1.0)
The teaching is student centered	16 (4.2)	38 (9.9)	76 (19.8)	192 (50.0)	62 (16.1)	2.67 (0.99)	3 (2–3)	5 (1.5)
Long-term learning is emphasized over-short term	14 (3.6)	39 (10.1)	103 (26.7)	157 (40.7)	73 (18.9)	2.64 (1.02)	3 (2–3)	4 (1.0)
The teaching is too teacher-centered[a]	27 (7.0)	135 (35.0)	110 (28.6)	87 (22.6)	26 (6.8)	2.17 (1.05)	2 (1–3)	5 (1.3)
The teaching over-emphasizes factual learning[a]	9 (2.4)	44 (11.5)	165 (43.3)	132 (34.6)	31 (8.2)	1.66 (0.90)	2 (2–1)	9 (2.3)
Domain II: Perception to teachers								
The teachers are good at providing feedback to students	26 (6.8)	46 (12.1)	66 (17.3)	182 (47.8)	61 (16.0)	2.59 (1.09)	3 (2–3)	9 (2.3)
The teachers have good communications skills with patients	8 (2.1)	13 (3.4)	84 (22.2)	201 (53.0)	73 (19.3)	2.89 (0.79)	3 (3–3)	11 (2.8)
The teachers are knowledgeable	4 (1.1)	12 (3.2)	19 (5.0)	194 (51.0)	151 (39.7)	3.28 (0.75)	3 (3–4)	10 (2.6)
The teachers give clear examples	7 (1.8)	26 (6.9)	52 (13.7)	193 (50.9)	101 (26.7)	2.96 (0.89)	3 (3–4)	11 (2.8)
The teachers are well prepared for their classes	6 (1.6)	18 (4.7)	35 (9.2)	194 (50.9)	128 (33.6)	3.13 (0.59)	3 (3–4)	9 (2.3)
The teachers provide constructive criticism here	7 (1.8)	39 (10.3)	109 (28.8)	171 (45.1)	53 (14.0)	2.61 (0.92)	3 (2–3)	11 (2.8)
The teachers ridicule the students[a]	84 (22.3)	94 (24.9)	124 (32.9)	54 (14.3)	21 (5.6)	2.48 (1.14)	2 (2–3)	13 (3.3)
The teachers get angry in class[a]	107 (28.2)	153 (40.4)	53 (39.2)	50 (13.2)	16 (4.2)	2.74 (1.12)	3 (2–4)	11 (2.8)
The teachers are authoritarian[a]	50 (13.3)	84 (22.3)	138 (36.6)	82 (21.7)	23 (6.1)	2.18 (1.09)	2 (1–3)	13 (3.3)
The teachers are patient with patients	7 (1.8)	21 (5.6)	145 (38.6)	156 (41.5)	47 (12.5)	2.59 (0.83)	3 (2–3)	14 (3.6)
The students irritate the teachers[a]	76 (20.2)	136 (36.1)	101 (26.8)	12 (3.2)	52 (13.8)	2.57 (1.05)	3 (2–3)	13 (3.3)
Domain III: Academic self-perception								
I am able to memorize all i need	33 (8.7)	115 (30.6)	60 (16.0)	136 (36.2)	32 (8.5)	2.08 (1.18)	2 (1–3)	14 (3.6)

Table 2 (continued)

Domain/item	Strongly disagree n (%)	Disagree n (%)	Unsure n (%)	Agree n (%)	Strongly Agree n (%)	Mean (± SD)	Median (IQR)	Missing n (%)
Much of what I have to learn seems relevant to a career of my profession	12 (3.2)	33 (8.8)	43 (11.4)	193 (51.3)	95 (25.3)	2.92 (0.96)	3 (3–4)	14 (3.6)
I feel i am being well prepared for my profession	8 (2.1)	37 (9.8)	79 (21.0)	181 (48.1)	71 (18.9)	2.74 (0.93)	3 (2–3)	14 (3.6)
Last year's work has been a good preparation for this year's work	10 (2.7)	39 (10.4)	77 (20.5)	179 (47.5)	71 (18.9)	2.72 (0.98)	3 (2–3)	14 (3.6)
My problem-solving skills are being well developed here	8 (2.1)	15 (4.0)	60 (16.0)	212 (56.5)	80 (21.4)	2.95 (0.82)	3 (3–3)	15 (3.8)
I am confident about passing this year	8 (2.1)	11 (2.9)	53 (14.1)	186 (49.7)	117 (31.2)	3.10 (0.83)	3 (3–4)	15 (3.8)
I have learned a lot about empathy in my profession	7 (1.9)	14 (3.7)	49 (13.0)	190 (50.5)	116 (30.9)	3.07 (0.83)	3 (3–4)	14 (3.6)
Learning strategies which worked for me before continue to work for me now	27 (7.2)	85 (22.7)	66 (17.6)	143 (38.1)	54 (14.4)	2.31 (1.18)	3 (1–3)	15 (3.8)
Domain IV: Perception of the atmosphere								
The atmosphere is relaxed during lectures	13 (3.4)	39 (10.3)	49 (13.0)	216 (57.4)	60 (15.9)	2.72 (0.95)	3 (2–3)	13 (3.3)
I feel able to ask the questions i want	14 (3.7)	41 (10.9)	55 (14.6)	182 (48.4)	84 (22.4)	2.77 (1.02)	3 (2–3)	14 (3.6)
I feel comfortable in class socially	16 (4.2)	42 (11.1)	53 (14.1)	167 (44.3)	99 (26.3)	2.77 (1.06)	3 (2–4)	13 (3.3)
There are opportunities for me to develop interpersonal skills	12 (3.2)	19 (5.0)	53 (14.1)	213 (56.5)	80 (21.2)	3.01 (0.87)	3 (3–3)	13 (3.3)
The atmosphere is relaxed during seminars/tutorials	9 (2.4)	23 (6.1)	53 (14.1)	214 (56.8)	78 (20.6)	2.89 (0.87)	3 (3–3)	13 (3.3)
The enjoyment outweighs the stress of studying for my profession	48 (12.8)	73 (19.5)	79 (21.1)	125 (33.4)	49 (13.2)	2.09 (1.25)	2 (1–3)	16 (4.1)
The atmosphere motivates me as a learner	18 (4.8)	50 (13.3)	72 (19.2)	177 (47.2)	58 (15.5)	2.56 (1.04)	3 (2–3)	15 (3.8)
I am able to concentrate well	23 (6.1)	58 (15.5)	69 (18.4)	182 (48.5)	43 (11.5)	2.45 (1.05)	3 (2–3)	15 (3.8)
The atmosphere is relaxed during ward teaching	10 (2.7)	28 (7.5)	108 (28.9)	180 (48.1)	48 (12.8)	2.61 (0.85)	3 (2–3)	16 (4.1)
This school is well timetabled	36 (9.6)	76 (20.3)	74 (19.7)	149 (39.7)	40 (10.7)	2.19 (1.17)	2 (1–3)	15 (3.8)
I find the experience disappointing[a]	73 (19.4)	168 (44.6)	64 (17.0)	51 (13.5)	21 (5.6)	2.62 (1.08)	3 (2–3)	13 (3.3)
Cheating is a problem in this school[a]	108 (28.6)	81 (21.5)	70 (18.6)	63 (16.7)	55 (14.6)	2.35 (1.34)	3 (1–4)	13 (3.3)
Domain V: Social self-perception								
I have good friends in this school	12 (3.2)	20 (5.3)	32 (8.5)	172 (45.8)	140 (37.2)	3.09 (0.93)	3 (3–4)	14 (3.6)
There is a good support system for students who get stressed	32 (8.5)	61 (16.2)	108 (28.7)	124 (33.0)	51 (13.6)	2.29 (1.14)	3 (2–3)	14 (3.6)
I am too tired to enjoy this course[a]	21 (5.6)	98 (26.1)	84 (22.4)	113 (30.1)	59 (15.8)	1.78 (1.16)	2 (1–3)	15 (3.8)
I am rarely bored on this course	34 (9.0)	114 (30.4)	94 (25.0)	108 (28.7)	26 (6.9)	1.92 (1.11)	2 (1–3)	14 (3.6)
My accommodation is pleasant	6 (1.6)	20 (5.4)	83 (22.3)	181 (48.7)	82 (22.0)	2.87 (0.88)	3 (2–3)	18 (4.6)
My social life is good	18 (4.8)	55 (14.6)	49 (13.0)	181 (48.2)	73 (19.4)	2.65 (1.09)	3 (2–3)	14 (3.6)
I seldom feel lonely	33 (8.8)	86 (22.9)	100 (26.6)	124 (33.0)	33 (8.7)	2.11 (1.09)	2 (2–3)	14 (3.6)

Table 2 (continued)

Domain/item	Strongly disagree n (%)	Disagree n (%)	Unsure n (%)	Agree n (%)	Strongly Agree n (%)	Mean (± SD)	Median (IQR)	Missing n (%)
Macleod Clark Professional Identity (MCPIS-9)								
I feel like i am a member of this profession	10 (2.9)	18 (5.2)	65 (18.8)	181 (52.3)	72 (20.8)	2.17 (0.95)	2 (2–3)	44 (11.3)
I feel i have strong ties with members of this profession	7 (2.0)	45 (13.0)	99 (28.7)	135 (39.1)	59 (17.2)	2.46 (0.97)	2 (1–3)	45 (11.5)
I am often ashamed to admit that i am studying for this profession	183 (53.4)	88 (25.6)	27 (7.8)	29 (8.5)	16 (4.7)	4.19 (1.11)	5 (4–5)	47 (12.1)
I find myself making excuses for belonging to this profession	142 (41.4)	93 (27.0)	49 (14.2)	38 (11.0)	22 (6.4)	3.89 (1.22)	4 (3–5)	46 (11.8)
I try to hide that i am studying to be part of this profession	183 (53.0)	85 (24.6)	32 (9.3)	30 (8.7)	15 (4.5)	4.18 (1.12)	5 (4–5)	45 (11.5)
I am pleasant to belong to this profession	0 (0)	6 (1.7)	41 (11.9)	135 (39.2)	162 (47.2)	1.69 (0.74)	2 (1–2)	46 (11.8)
I can identify positively with members of this profession	5 (1.4)	8 (2.3)	52 (15.1)	166 (48.2)	114 (33.0)	1.91 (0.81)	2 (1–2)	45 (11.5)
Being a member of this profession is important to me	3 (0.9)	6 (1.7)	44 (12.8)	139 (40.4)	152 (44.2)	1.76 (0.79)	2 (1–2)	46 (11.8)
I feel i share characteristics with other members of the profession	4 (1.2)	16 (4.7)	67 (19.5)	161 (46.8)	96 (27.8)	2.05 (0.86)	2 (1–2)	46 (11.8)

[a] Reverse-coded items

that they had good friends at their colleges (83% [$n=314$]) and that their social lives were good (68% [$n=254$]).

Table 3 illustrates the differences in the perception of students of their overall learning environment according to their demographic and professional characteristics. No significant differences were noted in the perception of the learning environment among the subgroups with selected demographic and professional characteristics, except for the health profession program in which they were enrolled (p-value < 0.001), whether they had relatives who studied or had studied the same profession (p-value < 0.002), and whether they started their experiential learning (p-value = 0.043). Further analyses comparing the DREEM subscale scores according to their demographic and professional characteristics are presented in Supplementary Material 1.

Students' perceptions of their professional identities

The students provided positive responses relating to their perceptions of their professional identity (24.00 IQR = [22–27]). The reliability analysis of this sample indicated a Cronbach's alpha of 0.605. The individual item responses representing the MCPIS-9 tool are presented in Table 2. Most students (85% [$n=297$]) expressed pleasant feelings about belonging to their own profession, and 81% ($n=280$) identified positively with members of their profession. No significant differences were noted in the perception of students of their professional identity when analyzed against selected demographic subgroups, except for whether they had relatives who had studied or were studying the same profession (p-value = 0.027). Students who had relatives studying or had studied the same profession tended to perceive their professional identity better (25 IQR = [22–27] and 24 IQR = [21–26], respectively) (Table 3).

Association between MCPIS-9 and DREEM

Spearman's rank correlation between the DREEM and MCPIS-9 total scores indicated an intermediate positive correlation between perceptions of students toward their learning environment and their professional identity development (r = 0.442, p-value < 0.001). The DREEM questionnaire, with its 50 items divided into five subscales, comprehensively assessed various dimensions of the learning environment. Each subscale evaluated a distinct aspect of the educational experience, such as the effectiveness of teaching, teacher behavior and attitudes, academic confidence, the overall learning atmosphere, and social integration. The MCPIS-9 questionnaire specifically assessed professional identity through nine items that measure attitudes, values, and self-perceived competence in the professional domain. The positive correlation demonstrated between the DREEM and MCPIS-9

Table 3 Difference in the perception of learning environment and professional identity according to sociodemographic characteristics

Variable	n (%)	Median (IQR)	*P*-Value[#]
Difference in the perception of learning environment			
Gender			
Female	332 (85.3)	130 (113–147)	0.643
Male	57 (14.7)	134 (110–149)	
Current professional year			
1	64 (16.5)	126 (111–145)	0.408
2	146 (37.5)	129 (112–147)	
3	88 (22.6)	133 (118–145)	
4	66 (17.0)	134 (114–151)	
5	21 (5.40)	128 (100–135)	
6	4 (1.0)	133 (96–152)	
Program			
Dental Medicine	44 (11.3)	124 (108–149)	**< 0.001***
Biomedical Sciences	46 (11.8)	129 (116.5–141.5)	
Human Nutrition	40 (10.3)	134 (124–143)	
Physiotherapy	49 (12.6)	147 (132–156)	
Public Health	9 (2.30)	126 (102 -152)	
Medicine	91 (23.4)	124 (109–133.5)	
Pharmacy	110 (28.3)	136 (120–149)	
Started undergraduate rotations?			
Yes	116 (29.9)	135 (117–149)	**0.043***
No	272 (70.1)	129 (112–145)	
Relatives studying/studied the same profession?			
Yes	133 (35.7)	125 (108–144)	**0.002***
No	240 (64.3)	133 (121.5–149.5)	
Time spent studying/ week (hours)			
0–5	91 (22.4)	129 (110.5–145)	0.712
6–10	123 (31.6)	134 (113 -147)	
11–15	90 (23.1)	129 (117- 147)	
> 16	85 (21.9)	128 (111–146)	
Place of high school completion			
Outside Qatar	375 (96.4)	130 (112–146)	0.305
Inside Qatar	13 (3.6)	134 (107–160)	
Difference in the perception of professional identity			
Gender			
Female	285 (85.3)	24 (22–27)	0.214
Male	49 (14.7)	23 (22–26)	
Current professional year			
1	53 (15.9)	24 (21–26)	0.474
2	124 (37.1)	24 (22–27)	
3	78 (23.4)	25 (22–27)	
4	58 (17.3)	24 (23–27)	
5	18 (5.4)	24 (23–26)	
6	3 (0.9)	21 (21–21)	
Program			
Dental	39 (11.7)	25 (23–27)	0.543
Biomedical Sciences	38 (11.4)	24 (21–27)	
Human Nutrition	31 (9.3)	24 (20–27)	
Physiotherapy	44 (13.2)	24 (22–27)	
Public Health	7 (2.1)	24 (22 -28)	
Medicine	79 (23.7)	24 (22–27)	
Pharmacy	96 (28.6)	24 (22–26)	
Started undergraduate rotations?			
Yes	98 (29.3)	24 (22–27)	0.983
No	236 (70.7)	24 (22–27)	
Relatives studying/studied the same profession			
Yes	117 (35.2)	25 (22–27)	**0.027***
No	215 (64.8)	24 (21–26)	
Time spent studying/ week (hours)			
0–5	81 (24.2)	25 (23–27)	0.359
6–10	108 (32.3)	24 (21–27)	
11–15	71 (21.3)	24 (22–27)	
> 16	74 (22.2)	24 (22–27)	
Place of high school completion			
Outside Qatar	323 (96.7)	24 (22–27)	0.166
Inside Qatar	11 (3.3)	23 (18–27)	

[#] *P*-value < 0.05 calculated using Kruskal–Wallis Test or Mann–Whitney U-Test

[*] The post-hoc analysis showed that physiotherapy students have a statistically significant higher perception of their LE when compared to dental, biomedical and medicine students. Pharmacy students showed higher perception of their LE compared to medical students

scores indicated that as students perceive their learning environment more positively, their professional identity is also enhanced.

Qualitative phase

Thirty-seven students from the QU Health colleges were interviewed: eleven from CPH, eight from CMED, four from CDEM, and fourteen from CHS (six from Nut, three from PS, three from Biomed, and three from PH). Four conventional themes were generated deductively using Gruppen et al.'s conceptual framework, while one theme was derived through inductive analysis. The themes and sub-themes generated are demonstrated in Table 4.

Theme 1. The personal component of the learning environment

This theme focused on student interactions and experiences within their learning environment and their impact on perceptions of learning, processes, growth, and professional development.

Table 4 Themes and subthemes generated from the FGs

Theme	Sub-theme
Deductive themes	
Theme 1. The personal component of the learning environment	Sub-theme 1.1. Experiences influencing professional identity formation
	Sub-theme 1.2. Strategies used by students to pursue their goals
Theme 2. Social component of the learning environment	Sub-theme 2.1. Opportunities for community engagement
	Sub-theme 2.2. Opportunities for learner-to-patient interactions
Theme 3. Organizational component of the learning environment	Sub-theme 3.1. Curriculum and study plan
	Sub-theme 3.2. Organizational climate and policies
Theme 4. Materialistic component of the learning environment	Sub-theme 4.1. The physical space for learning
	Sub-theme 4.2. The virtual space for online learning
Inductive themes	
Theme 5. Characteristics of an ideal learning environment	Sub-theme 5.1. Active learning and professional development supporting environment
	Sub-theme 5.2. Supportive physical environment

Sub-theme 1.1. Experiences influencing professional identity formation Students classified their experiences into positive and negative. Positive experiences included hands-on activities such as on-campus practical courses and pre-clinical activities, which built their confidence and professional identity. In this regard, one student mentioned:

> *"Practical courses are one of the most important courses to help us develop into pharmacists. They make you feel confident in your knowledge and more willing to share what you know." [CPH-5]*

Many students claimed that interprofessional education (IPE) activities enhanced their self-perception, clarified their roles, and boosted their professional identity and confidence. An interviewee stated:

> *"I believe that the IPE activity,…., is an opportunity for us to explore our role. It has made me know where my profession stands in the health sector and how we all depend on each other through interprofessional thinking and discussions." [CHS-Nut-32]*

However, several participants reported that an extensive workload hindered their professional identity development. A participant stated:

> *"The excessive workload prevents us from joining activities that would contribute to our professional identity development. Also, it restricts our networking opportunities and makes us always feel burnt out." [CHS-Nut-31]*

Sub-theme 1.2. Strategies used by students to pursue their goals QU Health students employed various academic and non-academic strategies to achieve their objectives, with many emphasizing list-making and identifying effective study methods as key approaches:

> *"Documentation. I like to see tasks that I need to do on paper. Also, I like to classify my tasks based on their urgency. I mean, deadlines." [CHS-Nut-31]*

> *"I always try to be as efficient as possible when studying and this can be by knowing what studying method best suits me." [CHS-Biomed-35]*

Nearly all students agreed that seeking feedback from faculty was crucial for improving their work and performance. In this context, a student said:

> *"We must take advantage of the provided opportunity to discuss our assignments, projects, and exams, like what we did correctly, and what we did wrongly. They always discuss with us how to improve our work on these things." [CHS-Nut-32]*

Moreover, many students also believed that developing communication skills was vital for achieving their goals, given their future roles in interprofessional teams. A student mentioned:

> *"Improving your communication skills is a must because inshallah (with God's will) in the future we will not only work with biomedical scientists, but also with nurses, pharmacists, and doctors. So, you must have good communication abilities." [CHS-Biomed-34]*

Finally, students believe that networking is crucial for achieving their goals because it opens new opportunities for them as stated by a student:

"Networking with different physicians or professors can help you to know about research or training opportunities that you could potentially join." [CMED-15]

Subtheme 1.3. Students' mental and physical well-being Students agreed that while emotional well-being is crucial for good learning experiences and professional identity development, colleges offered insufficient support. An interviewee stated:

"We simply don't have the optimal support we need to take care of our emotional well-being as of now, despite how important it is and how it truly reflects on our learning and professional development" [CDEM-20]

Another student added:

"…being in an optimal mental state provides us with the opportunity to acquire all required skills that would aid in our professional identity development. I mean, interpersonal skills, adaptability, self-reflection" [CPH-9]

Students mentioned some emotional support provided by colleges, such as progress tracking and stress-relief activities. Students said:

"During P2 [professional year 2], I missed a quiz, and I was late for several lectures. Our learning support specialist contacted me … She was like, are you doing fine? I explained everything to her, and she contacted the professors for their consideration and support." [CPH-7]

"There are important events that are done to make students take a break and recharge, but they are not consistent" [CHS-PS-27]

On the physical well-being front, students felt that their colleges ensured safety, especially in lab settings, with proper protocols to avoid harm. A student mentioned:

"The professors and staff duly ensure our safety, especially during lab work. They make sure that we don't go near any harmful substances and that we abide by the lab safety rules" [CHS-Biomed -35]

Theme 2. Social component of the learning environment

This theme focused on how social interactions shape students' perceptions of learning environments and learning experiences.

Sub-theme 2.1. Opportunities for community engagement Participants identified various opportunities for social interactions through curricular and extracurricular activities. Project-based learning (PBL) helped them build connections, improve teamwork and enhance critical thinking and responsibility as stated by one student:

"I believe that having PBL as a big part of our learning process improves our teamwork and interpersonal skills and makes us take responsibility in learning, thinking critically, and going beyond what we would have received in class to prepare very well and deep into the topic." [CMED-12]

Extracurricular activities, including campaigns and events, helped students expand their social relationships and manage emotional stress. A student stated:

"I think that the extracurricular activities that we do, like the campaigns or other things that we hold in the college with other students from other colleges, have been helpful for me in developing my personality and widening my social circle. Also, it dilutes the emotional stress we are experiencing in class" [CDEM-22]

Sub-theme 2.2. Opportunities for learner-to-patient interactions Students noted several approaches their colleges used to enhance patient-centered education and prepare them for real-world patient interactions. These approaches include communication skills classes, simulated patient scenarios, and field trips. Students mentioned:

"We took a class called Foundation of Health, which mainly focused on how to communicate our message to patients to ensure that they were getting optimal care. This course made us appreciate the term 'patient care' more." [CHS-PH-38]

"We began to appreciate patient care when we started to take a professional skills course that entailed the implementation of a simulated patient scenario. We started to realize that communication with patients didn't go as smoothly as when we did it with a colleague in the classroom." [CPH-1]

"We went on a field trip to 'Shafallah Center for Persons with Disability' and that helped us to realize that there were a variety of patients that we had to care for, and we should be physically and mentally prepared to meet their needs." [CDEM-21]

Theme 3. Organizational component of the learning environment

This theme explored students' perceptions of how the college administration, policies, culture, coordination, and curriculum design impact their learning experiences.

Sub-theme 3.1. Curriculum and study plan Students valued clinical placements for their role in preparing them for the workplace and developing professional identity. A student stated:

> *"Clinical placements are very crucial for our professional identity development; we get the opportunity to be familiarized with and prepared for the work environment." [CHS-PS-27]*

However, students criticized their curriculum for not equipping them with adequate knowledge and skills. For example, a student said:

> *"... Not having a well-designed curriculum is of concern. We started very late in studying dentistry stuff and that led to us cramming all the necessary information that we should have learned." [CDEM-20]*

Furthermore, students reported that demanding schedules and limited course availability hindered learning and delayed progress:

> *"Last semester, I had classes from Sunday to Thursday from 8:00 AM till 3:00 PM in the same classroom, back-to-back, without any break. I was unable to focus in the second half of the day." [CHS-Nut-38]*

> *"Some courses are only offered once a year, and they are sometimes prerequisites for other courses. This can delay our clinical internship or graduation by one year." [CHS-Biomed-36]*

Additionally, the outdated curriculum was seen as misaligned with advancements in artificial intelligence (AI). One student stated:

> *"... What we learn in our labs is old-fashioned techniques, while Hamad Medical Corporation (HMC) is following a new protocol that uses automation and AI. So, I believe that we need to get on track with HMC as most of us will be working there after graduation." [CHS-Biomed-35]*

Sub-theme 3.2. Organizational climate and policies Students generally appreciated the positive university climate and effective communication with the college administration which improves course quality:

> *"Faculty members and the college administration usually listen to our comments about courses or anything that we want to improve, and by providing a course evaluation at the end of the semester, things get better eventually." [CPH-2]*

Students also valued faculty flexibility with scheduling exams and assignments, and praised the new makeup exam policy which enhances focus on learning:

> *"Faculty members are very lenient with us. If we want to change the date of the exam or the deadline for any assignment, they agree if everyone in the class agrees. They prioritize the quality of our work over just getting an assignment done." [CHS-PS-37]*

> *"I am happy with the introduction of makeup exams. Now, we are not afraid of failing and losing a whole year because of a course. I believe that this will help us to focus on topics, not just cramming the knowledge to pass." [CPH-9]*

However, students expressed concerns about the lack of communication between colleges and clinical placements and criticized the lengthy approval process for extracurricular activities:

> *"There is a contract between QU and HMC, but the lack of communication between them puts students in a grey area. I wish there would be better communication between them." [CMED-15]*

> *"To get a club approved by QU, you must go through various barriers, and it doesn't work every time. A lot of times you won't get approved." [CMED-14]*

Theme 4. Materialistic component of the learning environment

This theme discussed how physical and virtual learning spaces affect students' learning experiences and professional identity.

Sub-theme 4.1. The physical space for learning Students explained that the interior design of buildings and the fully equipped laboratory facilities in their programs enhanced focus and learning:

> *"The design has a calming effect, all walls are simple and isolate the noise, the classrooms are big with big windows, so that the sunlight enters easily, and we can see the green grass. This is very important for focusing and optimal learning outcomes." [CPH-5]*

> *"In our labs, we have beds and all the required machines for physiotherapy exercises and practical training, and we can practice with each other freely." [CHS-PS-27]*

Students from different emphasized the need for dedicated lecture rooms for each batch and highlighted the importance of having on-site cafeterias to avoid disruptions during the day:

"We don't have lecture rooms devoted to each batch. Sometimes we don't even find a room to attend lectures and we end up taking the lectures in the lab, which makes it hard for us to focus and study later." [CDEM-23]

"Not having a cafeteria in this building is a negative point. Sometimes we miss the next lecture or part of it if we go to another building to buy breakfast." [CHS-Nut-29]

Sub-theme 4.2. The virtual space for online learning Students appreciated the university library's extensive online resources and free access to platforms like Microsoft Teams and Webex for efficient learning and meetings. They valued recorded lectures for flexible study and appreciated virtual webinars and workshops for global connectivity.

"QU Library provides us with a great diversity and a good number of resources, like journals or books, as well as access medicine, massive open online courses, and other platforms that are very useful for studying." [CMED-16].

"Having your lectures recorded through virtual platforms made it easier to take notes efficiently and to study at my own pace." [CHS-PS-38]

"I hold a genuine appreciation for the provided opportunities to register in online conferences. I remember during the COVID-19 pandemic, I got the chance to attend an online workshop. This experience allowed me to connect with so many people from around the world." [CMED-15]

Theme 5. Characteristics of an ideal learning environment

This theme explored students' perceptions of an ideal learning environment and its impact on their professional development and identity.

Sub-theme 5.1. Active learning and professional development supporting environment Students highlighted that an ideal learning environment should incorporate active learning methods and a supportive atmosphere. They suggested using simulated patients in case-based learning and the use of game-based learning platforms:

"I think if we have, like in ITQAN [a Clinical Simulation and Innovation Center located on the Hamad Bin Khalifa Medical City (HBKMC) campus of Hamad Medical Corporation (HMC)], simulated patients, I think that will be perfect like in an "Integrated Case-Based Learning" case or professional skills or patient assessment labs where we can go and intervene with simulated patients and see what happens as a consequence. This will facilitate our learning." [CPH-4]

"I feel that 'Kahoot' activities add a lot to the session. We get motivated and excited to solve questions and win. We keep laughing, and I honestly feel that the answers to these questions get stuck in my head." [CHS-PH-38].

Students emphasized the need for more opportunities for research, career planning, and equity in terms of providing resources and opportunities for students:

"Students should be provided with more opportunities to do research, publish, and practice." [CMED-16]

"We need better career planning and workshops or advice regarding what we do after graduation or what opportunities we have." [CHS-PS-25]

"I think that opportunities are disproportionate, and this is not ideal. I believe all students should have the same access to opportunities like having the chance to participate in conferences and receiving research opportunities, especially if one fulfills the requirements." [CHS-Biomed-35]

Furthermore, the students proposed the implementation of mentorship programs and a reward system to enable a better learning experience:

"Something that could enable our personal development is a mentorship program, which our college started to implement this year, and I hope they continue to because it's an attribute of an ideal learning environment." [CPH-11]

"There has to be some form of reward or acknowledgments to students, especially those who, for example, have papers published or belong to leading clubs, not just those who are, for example, on a dean's list because education is much more than just academics." [CHS-PS-26]

Subtheme 5.2. Supportive physical environment Participants emphasized that the physical environment of the

college significantly influences their learning attitudes. A student said:

> *"The first thing that we encounter when we arrive at the university is the campus. I mean, our early thoughts toward our learning environment are formed before we even know anything about our faculty members or the provided facilities. So, ideally, it starts here." [CPH-10]*

Therefore, students identified key characteristics of an optimal physical environment which included: having a walkable campus, designated study and social areas, and accessible food and coffee.

> *"I think that learning in what they refer to as a walkable campus, which entails having the colleges and facilities within walking distance from each other, without restrictions of high temperature and slow transportation, is ideal." [CPH-8]*

> *"The classrooms and library should be conducive to studying and focusing, and there should also be other places where one can actually socialize and sit with one's friends." [CDEM-22]*

> *"It is really important to have a food court or café in each building, as our schedules are already packed, and we have no time to go get anything for nearby buildings." [CHS-Biomed-34]*

Data integration

Table 5 represents the integration of data from the quantitative and qualitative phases. It demonstrates how the quantitative findings informed and complemented the qualitative analysis and explains how quantitative data guided the selection of themes in the qualitative phase. The integration of quantitative and qualitative data revealed both convergences and divergences in students' views of their learning environment. Both data sources consistently indicated that the learning environment supported the development of interpersonal skills, fostered strong relationships with faculty, and promoted an active, student-centered learning approach. This environment was credited with enhancing critical thinking, independence, and responsibility, as well as boosting students' confidence and competence through clear role definitions and constructive faculty feedback.

However, discrepancies emerged between the two phases. Quantitative data suggested general satisfaction with timetables and support systems, while qualitative data uncovered significant dissatisfaction. Although quantitative results indicated that students felt well-prepared and able to memorize necessary material, qualitative findings revealed challenges with concentration and focus. Furthermore, while quantitative data showed contentment with institutional support, qualitative responses pointed to shortcomings in emotional and physical support.

Discussion

This study examined the perceptions of QU Health students regarding the quality of their learning environment and the characteristics of an ideal learning environment. Moreover, this study offered insights into the development of professional identity, emphasizing the multifaceted nature of learning environments and their substantial impact on professional identity formation.

Perceptions of the learning environment

The findings revealed predominantly positive perceptions among students regarding the quality of the overall learning environment at QU Health and generally favorable perception of all five DREEM subscales, which is consistent with the international studies using the DREEM tool [43, 50–54]. Specifically, participants engaged in experiential learning expressed heightened satisfaction, which aligns with existing research indicating that practical educational approaches enhance student engagement and satisfaction [55, 56]. Additionally, despite limited literature, students without relatives in the same profession demonstrated higher perceptions of their learning environment, possibly due to fewer preconceived expectations. A 2023 systematic review highlighted how students' expectations influence their satisfaction and academic achievement [57]. However, specific concerns arose regarding the learning environment, including overemphasis on factual learning in teaching, student fatigue, and occasional boredom. These issues were closely linked to the overwhelming workload and conventional teaching methods, as identified in the qualitative phase.

Association between learning environment and professional identity

This study uniquely integrated the perceptions of the learning environment with insights into professional identity formation in the context of healthcare education which is a relatively underexplored area in quantitative studies [44, 58–60]. This study demonstrated a positive correlation between students' perceptions of the learning environment (DREEM) and their professional identity development (MCPIS-9) which suggested that a more positive learning environment is associated with

Table 5 Integration of qualitative and quantitative findings

Quantitative Phase				Qualitative Phase	
The Dundee Ready Education Environment Measure (DREEM)					
Aligning results					
Domain	**Median (IQR)**	**Item**	**Agreement % vs Disagreement %**	**Sub-theme**	**Quote**
Perception to learning	32 (27–36)	The teaching is sufficiently concerned to develop my confidence	67.8% vs. 13.1%	Experiences influencing the learning experience and the professional development of students	"The pre-clinical activities that we have on a weekly basis help in developing our confidence, and I believe, as a future physician, this is crucial to develop before stepping into the workplace." [CMED-16]
		The teaching encourages me to be an active learner	73.0% vs. 10.6%	Opportunities for active learning	"I feel that "Kahoot" activities adds a lot to the session, we get motivated and excited to solve questions and win, we keep just laughing and I honestly feel that answers to these questions get engraved in my head" [CHS-PH-38]
		The teaching is sufficiently concerned to develop my competence	72.0% vs. 12.2%	Experiences influencing the learning experience and the professional development of students	"IPE activities provides us with a chance to identify our roles and responsibilities while developing the necessary skills important for success when becoming a part of a mutli-displanary team." [CHS-PS-25]
		The teaching is student centered	66.1% vs. 14.1%	Opportunities for community engagement and its impact on PI	"I believe that having PBL as a big part of our learning process improves our teamwork and interpersonal skills and makes us take responsibility of my learning, think critically, and go beyond what I would have received in class to prepare very well and deep into the topic." [CMED-12]

Table 5 (continued)

Quantitative Phase				Qualitative Phase	
Perception of teacher	30 (26–34)	The teachers are good at providing feedback to students	63.8% vs. 22.9%	Strategies used by students to pursue their personal and professional goals	"We usually get the chance to discuss our performance with our professors; I cherish their feedback because it usually gives us insight into what to do next, how to improve, and so on." [CPH-9]
Academic self-perceptions	22 (19–25)	I have learned a lot about empathy in my profession	81.4% vs. 5.7%	The impact of patient-centered education on students' perception of patient care	"Through our clinical rotations, we learnt the true essence of empathy. Our understanding was only confined to the disease conditions, however, when we started seeing patients, we discovered profound impact and burden these conditions place patients. I believe this positively impacted our performance to a great extent." [CMED-19]
Perception to atmosphere	32 (14–19)	There are opportunities for me to develop interpersonal skills	77.7% vs. 8.2%	Opportunities for community engagement and its impact on PI	"There are so many opportunities to develop the required skills for practice, outreach campaigns, group work, activities, also joining the student clubs. All these opportunities enhance our practical skills and improve our overall learning" [CDEM-21]

Table 5 (continued)

Quantitative Phase				Qualitative Phase	
Social self-perception	17 (27–36)	There is a good support system for students who get stressed	46.6% vs. 24.7%	Emotional and physical wellbeing of students	"I am grateful for our learning support specialist. During year 2, I missed a quiz, and I was late for several lectures. She contacted me and we met online. She was like, are you doing fine? I explained everything to her, and she contacted the professors for their consideration and support." [CPH-7]
Contradicting results					

Table 5 (continued)

Quantitative Phase				Qualitative Phase	
Academic self-perceptions	22 (19–25)	I am able to memorize all I need	44.7% vs. 39.3%	Experiences influencing the learning experience and the professional development of students	"During the COVID-19 pandemic and virtual learning, I believe there were so many units that we were not able to grasp them as we should. Also, the workload is sometimes insane that we get work done for the sake of getting it done not to learn," [CPH-11]
		I feel I am being well prepared for my profession	67% vs. 11.9%	Curriculum and course syllabus	"I would say, not having a well-designed curriculum, I mean, we started very late in studying dentistry stuff and that led to us cramming all the necessary information that we should have learned." [CDEM-20] "After doing our rotations, we have discovered that everything we learned in our labs is old fashioned techniques and that HMC is following a new protocol. So, it is good to learn the old protocols because AI is not going to replace humans, of course, but still, we need to be on track with HMC as most of us will be working there after graduation." [CHS-Biomed-35]

Table 5 (continued)

Quantitative Phase					Qualitative Phase	
Perception to atmosphere	32 (14–19)	I able to concentrate well		60% vs. 21.6%	Experiences influencing the learning experience and the professional development of students	"The workload is negatively affecting our learning process because we have too many things to do, so we can't focus on one thing, and we may do something in a way that we just want to finish it. So, we don't learn what we are required to learn, and we get so tired." [CHS-Nut-30]
		This school is well timetabled		50.4% vs. 29.9%	Organizational coordination, climate, and policies	"We have back-to-back classes, and our classes are actually long in duration so definitely it is going to take a toll on focus and concertation" [CHS-Nut-28]
Social self-perception	17 (27–36)	There is a good support system for students who get stressed		46.6% vs 24.7%	Emotional and physical wellbeing of students	"We lack necessary support, in the emotional aspect. The college is trying, but still, we are way away from the required, to be honest." [CPH-7]
The Macleod Clark Professional Identity Scale-9 (MCPIS-9)						
Aligning results						
Domain		**Median (IQR)**	**Item**	**Agreement % vs. Disagreement %**	**Subtheme**	**Quote**

Table 5 (continued)

Quantitative Phase				Qualitative Phase	
	24 (22–27)	I feel I have strong ties with members of this profession	56.3% vs. 15%	Opportunities for community engagement and its impact on PI	"The curricular and extracurricular activities that usually have, have actually enabled us to build strong connections not only within our profession but also across other fields" [CMED-13]
		I feel I share characteristics with other members of the profession	74.6% vs. 5.9%	Opportunities for community engagement and its impact on PI	"Through community engagement that our college provides, they teach you things that aren't really taught in the classroom, communication skills, like leadership skills, critical thinking, teamwork and so on." [CHS-PH-37]

enhanced professional identity formation. For example, a supportive and comfortable learning atmosphere (i.e., high SPoA scores) can enhance students' confidence and professional self-perception (i.e., high MCPIS-9 scores). The relationship between these questionnaires is fundamental to this study. The DREEM subscales, particularly Perception of Learning (SpoL) and Academic Self-Perception (SASP), relate to how the learning environment supports or hinders the development of a professional identity, as measured by MCPIS-9. Furthermore, the Perception of Teachers (SpoT) subscale examines how teacher behaviors and attitudes impact students, which can influence their professional identity development. The Perception of Atmosphere (SPoA) and Social Self-Perception (SSSP) subscales evaluate the broader environment and social interactions, which are crucial for professional identity formation as they foster a sense of community and belonging.

Employing a mixed methods approach and analyzing both questionnaires and FGs through the framework outlined by Gruppen et al. highlighted key aspects across four dimensions of the learning environment: personal development, social dimension, organizational setting, and materialistic dimension [1]. First, the study underscored the significance of both personal development and constructive feedback. IPE activities emerged as a key factor that promotes professional identity by cultivating collaboration and role identification which is consistent with Bendowska and Baum's findings [61]. Similarly, the positive impact of constructive faculty feedback on student learning outcomes aligned with the work of Gan et al. which revealed that feedback from faculty members positively influences course satisfaction and knowledge retention, which are usually reflected in course results [62]. Importantly, the research also emphasized the need for workload management strategies to mitigate negative impacts on student well-being, a crucial factor for academic performance and professional identity development [63, 64]. The inclusion of community events and support services could play a significant role in fostering student well-being and reducing stress, as suggested by Hoferichter et al. [65]. Second, the importance of the social dimension of the learning environment was further highlighted by the study. Extracurricular activities were identified as opportunities to develop essential interpersonal skills needed for professional identity, mirroring the conclusions drawn by Achar Fujii et al. who argued that extracurricular activities lead to the development of fundamental skills and attitudes to build and refine their professional identity and facilitate the learning process, such as leadership, commitment, and responsibility [66]. Furthermore, Magpantay-Monroe et al. concluded that community and social engagement led to professional identity development in nursing students through the expansion of their knowledge and communication with other nursing professionals [67]. PBL activities were another key element that promoted critical thinking, learning, and ultimately, professional identity development in this study similar to what was reported by Zhou et al. and Du et al. [68, 69]. Third, the organizational setting, particularly the curriculum and clinical experiences, emerged as crucial factors. Clinical placements and field trips were found to be instrumental in cultivating empathy and professional identity [70, 71]. However, maintaining an up-to-date curriculum that reflects advancements in AI healthcare education is equally important, as highlighted by Randhawa and Jackson in 2019 [72]. Finally, the study underlined the role of the materialistic dimension of the learning environment. Physical learning environments with natural light and managed noise levels were found to contribute to improved academic performance [73, 74]. Additionally, the value of online educational resources, such as online library resources and massive open online course, as tools facilitating learning by providing easy access to materials, was emphasized, which is consistent with the observations of Haleem et al. [75].

The above collectively contribute to shaping students' professional identities through appreciating their roles, developing confidence, and understanding the interdependence of different health professions. These indicate that a supportive and engaging learning environment is crucial for fostering a strong sense of professional identity. Incorporating these student-informed strategies can assist educational institutions in cultivating well-rounded healthcare professionals equipped with the knowledge, skills, and emotional resilience needed to thrive in the dynamic healthcare landscape. Compared to existing quantitative data, this study reported a lower median MCPIS-9 score of 24.0, in contrast to previously reported scores of 39.0, 38.0, 38.0, respectively. [76–78]. This discrepancy may be influenced by the fact that the participants were in their second professional year, known for weaker identity development [79]. Students with relatives in the same profession perceived their identity more positively, which is likely due to role model influences [22].

Expectations of the ideal educational learning environment

This study also sought to identify the key attributes of an ideal learning environment from the perspective of students at QU-Health. The findings revealed a strong emphasis on active learning strategies, aligning with Kolb's experiential learning theory [80]. This preference suggests a desire to move beyond traditional lecture formats and engage in activities that promote

experimentation and reflection, potentially mitigating issues of student boredom. Furthermore, students valued the implementation of simple reward systems such as public recognition, mirroring the positive impact such practices have on academic achievement reported by Dannan in 2020 [81]. The perceived importance of mentorship programs resonates with the work of Guhan et al. who demonstrated improved academic performance, particularly for struggling students [82]. Finally, the study highlighted the significance of a walkable campus with accessible facilities. This aligns with Rohana et al. who argued that readily available and useable facilities contribute to effective teaching and learning processes, ultimately resulting in improved student outcomes [83]. Understanding these student perceptions, health professions education programs can inform strategic planning for curricular and extracurricular modifications alongside infrastructural development.

The complementary nature of qualitative and quantitative methods in understanding student experiences

This study underscored the benefits of employing mixed methods to comprehensively explore the interplay between the learning environment and professional identity formation as complex phenomena. The qualitative component provided nuanced insights that complemented the baseline data provided by DREEM and MCPIS-9 questionnaires. While DREEM scores generally indicated positive perceptions, qualitative findings highlighted the significant impact of experiential learning on students' perceptions of the learning environment and professional identity development. Conversely, discrepancies emerged between questionnaire responses and FG interviews, revealing deeper issues such as fatigue and boredom associated with traditional teaching methods and heavy workloads, potentially influenced by cultural factors. In FGs, students revealed cultural pressures to conform and stigma against expressing dissatisfaction, which questionnaire responses may not capture. Qualitative data allowed students to openly discuss culturally sensitive issues, indicating that interviews complement surveys by revealing insights overlooked in quantitative assessments alone. These insights can inform the design of learning environments that support holistic student development. The study also suggested that cultural factors can influence student perceptions and should be considered in educational research and practice.

Application of findings

The findings from this study can be directly applied to inform and enhance educational practices, as well as to influence policy and practice sectors. Educational institutions should prioritize integrating active learning strategies and mentorship programs to combat issues such as student fatigue and boredom. Furthermore, practical opportunities, including experiential learning and IPE activities, should be emphasized to strengthen professional identity and engagement. To address these challenges comprehensively, policymakers should consider developing policies that support effective workload management and community support services, which are essential for improving student well-being and academic performance. Collaboration between educational institutions and practice sectors can greatly improve students' satisfaction with their learning environment and experience. This partnership enhances the relevance and engagement of their education, leading to a stronger professional identity and better preparation for successful careers.

Limitations

As with all research, this study has several limitations. For instance, there was a higher percentage of female participants compared to males; however, it is noteworthy to highlight the demographic composition of QU Health population, where students are majority female. Furthermore, the CHS, which is one of the participating colleges in this study, enrolls only female students. Another limitation is the potentially underpowered statistical comparisons among the sociodemographic characteristics in relation to the total DREEM and MCPIS-9 scores. Thus, the findings of this study should be interpreted with caution.

Conclusions

The findings of this study reveal that QU Health students generally hold a positive view of their learning environment and professional identity, with a significant positive correlation exists between students' perceptions of their learning environment and their professional identity. Specifically, students who engaged in experiential learning or enrolled in practical programs rated their learning environment more favorably, and those with relatives in the same profession had a more positive view of their professional identity. The participants of this study also identified several key attributes that contribute to a positive learning environment, including active learning approaches and mentorship programs. Furthermore, addressing issues like fatigue and boredom is crucial for enhancing student satisfaction and professional development.

To build on these findings, future research should focus on longitudinal studies that monitor changes in the perceptions of students over time and identify the long-term impact of implementing the proposed attributes of an ideal learning environment on the learning process and

professional identity development of students. Additionally, exploring the intricate dynamics of learning environments and their impact on professional identity can allow educators to better support students in their professional journey. Future research should also continue to explore these relationships, particularly on diverse cultural settings, in order to develop more inclusive and effective educational strategies. This approach will ensure that health professional students are well-prepared to meet the demands of their profession and provide high-quality care to their patients.

Abbreviations

UNESCO	United Nations Educational, Scientific, and Cultural Organization
EU	European Union
ACE	American Council on Education
WFME	World Federation for Medical Education
CoP	Communities of Practice
QU Health	Qatar University Health
CHS	College of Health Sciences
CPH	College of Pharmacy
CMED	College of Medicine
CDEM	Dental Medicine
CNUR	College of Nursing
Nut	Human Nutrition
Biomed	Biomedical Science
PH	Public Health
PS	Physiotherapy
DREEM	Dundee Ready Education Environment Measure
SpoL	Perception to Learning
SpoT	Perception to Teachers
SASP	Academic Self-Perception
SpoA	Perception of the Atmosphere
SSSP	Social Self-Perception
MCPIS-9	Macleod Clark Professional Identity Scale
FG	Focus Group
IPE	InterProfessional Education
PBL	Project-Based Learning
HMC	Hamad Medical Corporation
HBKMC	Hamad Bin Khalifa Medical City
AI	Artificial Intelligence

Supplementary Information

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Supplementary Material 1

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Study conception and design: BM, and SE; data collection: BM, OY, AA, and AD; analysis and interpretation of results: all authors; draft manuscript preparation: all authors. All authors reviewed the results and approved the final version of the manuscript.

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Availability of data and materials
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The data of human participants in this study were conducted in accordance with the Helsinki Declaration. Ethical approval for the study was obtained from the Qatar University Institutional Review Board (approval number: QU-IRB 1734-EA/22). All participants provided informed consent prior to participation.

Consent for publication
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Competing interests
The authors declare no competing interests.

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