RESEARCH ARTICLE

REVISED Gauging the learning environment at Damascus University Pharmacy School in Syria using the DREEM questionnaire: A cross-sectional study [version 2; peer review: 2 approved, 1 approved with reservations]

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Abstract

Introduction: This study was undertaken to provide the first record of evaluation of the educational environment of the Bachelor of Pharmacy program at Damascus University (DU), Syria using the internationally adopted Dundee Ready Education Environment Measure (DREEM) tool and compare it with other pharmacy schools around the world.

Methods: A cross-sectional study was conducted at DU Pharmacy School in 2022. The validated DREEM 50-item inventory was added to Google Forms and used to collect data electronically. River sampling and snowball sampling methods were used. Data was collected during the second term between April 2022 and June 2022. Students from all years were included.

Results: A total of 269 students completed the questionnaire; that is about 6.7% of the total population. The Cronbach's alpha of the DREEM questionnaire was 0.94. The total DREEM score was 89.8±32.1/200. Senior students scored significantly less on the DREEM scale than their younger counterparts. DU Pharmacy School scored significantly less on the total DREEM score than its other counterparts around the world with a large effect size (d>0.80). All subscales scored below 50% and the lowest scoring subscales were students' perception of learning (SPL=41.8%) and students' perception of the social environment (SSP=42.5%).

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Conclusions: The findings implied that the educational environment is in need of major improvement, especially in areas related to teaching and learning practices and the general social environment; failure to address the current issues in the learning environment might hinder learning and clinical practice of the future generation of pharmacists. This study provides a quality improvement map which could be used preciously address the areas that need most attention at DU Pharmacy School.

Keywords
Pharmacy education, undergraduate education, learning environment, quantitative study, DREEM questionnaire, developing country, Damascus University, Syria

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REVISED **Amendments from Version 1**

Author details changes include only one author-Ghaith Alfakhry- who added another affiliation with the University of Oxford. The modifications made to the Introduction include adding reliability and content validity studies of DREEM as well studies on its psychometric properties. The methods part has now been reorganized and information regarding the instrument has been separated from data collection procedure. We explained why we collected data at the time span we have mentioned; that is because it is a period during which students are less occupied. Normality of data has been discussed and now tests like skewness and kurtosis has been mentioned to confirm data normality; further information was given regarding the interpretation of Cohen's d with negative values- they are interpreted the same as the positive ones. In the Results section, the percentage of our sample in comparison to the whole population has been added-6.7% (269/4000). Further, the year of study has been considered as a factor and DREEM scores of students in different years of study were compared to each other using the One-ANOVA test; for this reason, Table 3 has been added to compare the DREEM scores of students in different years of study; results show that younger students had higher DREEM scores than their older counterparts and this has been highlighted in the discussion and matched with the findings of previous studies. The conclusion has been rewritten and implications of our findings have been highlighted.

Any further responses from the reviewers can be found at the end of the article

Introduction

In health profession education, the learning environment (LE) has an influence on students' academic achievement, professional development, and general well-being (Enns *et al*., 2016; Tempski *et al*., 2015). The LE can be defined as students' experience of their institutions' curriculum, facilities, and social interactions with colleagues and staff members (Tackett *et al*., 2017). Since the LE revolves around students' experience and perception, more and more attention is being given to students' feedback as a key component in the assessment of the learning environment. Measuring the quality of the LE is the first step toward addressing issues that hinder students' development. This evaluation builds a blueprint of the desirable LE that can enable students to excel academically, socially, and professionally.

Several methods and tools have been used to capture students' perceptions of the LE. Some researchers adopted a qualitative approach while others adopted a quantitative questionnaire-based approach. The latter is advantageous especially when trying to quantify and compare the LE of different institutes (Al-Hazimi *et al*., 2004). One of the most common questionnaire-based tools is the DREEM (Dundee Ready Education Environment Measure) (Roff, 2005). This tool has been adopted and used globally across various healthcare fields including medicine, dentistry, nursing, and pharmacy (Bashir *et al*., 2020; Miles *et al*., 2012). Other questionnaires have been used to measure the LE such as MEEM (Medical Education Environment Measure) and Health Education Learning Environment Survey (HELES) (Pimparyon *et al*., 2000; Rusticus *et al*., 2020). However, DREEM is the most widely adopted measure of the LE in medical schools and other health professions (Miles *et al*., 2012). A review revealed that DREEM showed to be consistently reliable across countries in comparison to 11 other educational environment measures and hence recommended the use of DREEM as the best measure for the educational environment in undergraduate settings (Soemantri *et al*., 2010). Another review study revealed that although the DREEM inventory showed some content validity evidence, it compared unfavourably to other tools (Colbert-Getz *et al*., 2014); nonetheless, its face and content validity in measuring the learning environment in pharmacy undergraduate settings has been supported by one study (Wong *et al*., 2015). Psychometric property evaluation of the DREEM instrument has been conducted in multiple studies in various settings, some supported the construct validity of the instrument (Rotthoff *et al*., 2011), others did not (Yusoff, 2012). One study in particular showed that the internal consistency of the five subscales can be quite variable (Hammond *et al*., 2012). Notwithstanding these shortcomings, the wide use of DREEM instrument globally does encourage its use so that comparisons could be made between different studies (Colbert-Getz *et al*., 2014). Additionally, DREEM score has shown positive correlates with academic achievement, quality of life, positive attitude towards the program, less psychological distress and greater social support (Chan *et al*., 2018). All of these factors encourage the use of the DREEM inventory.

In Syria, pharmacy education is comprised of a 5-year term-based program that ends with students acquiring a Bachelor of Pharmacy (B.Pharm) degree (Bahnassi, 2020). Enrolment in pharmacy schools is accessible only after completing secondary education and one preparatory year (Bahnassi, 2020). In 2015, the preparatory year was made compulsory for all students wanting to enroll in one of the healthcare-related faculties which include medicine, dentistry, and pharmacy (Bahnassi, 2020). After finishing the preparatory year, students become second-year pharmacy students. Damascus University (DU) Pharmacy School is considered one of the largest and oldest schools of its kind in Syria, hosting over 4000 students according to 2022 records. Pharmacy schools at DU and other Syrian universities still use traditional teaching practices (Bahnassi, 2020). Additionally, Damascus University is the only university in the Arab World that maintained the use of the native Arabic language as the primary language of instruction in health profession education (Alfakhry *et al*., 2020). In 2007, a curriculum reform at DU Pharmacy school was attempted with the help of international experts (Kayyal & Gibbs, 2012); the reform aimed to modernize the curriculum to address society's needs and meet the expectations of stakeholders. However, by 2009, no progress was made by the assigned working groups and the curriculum reform was abandoned; some of the factors that hindered the curriculum reform were the low motivation for curriculum change within the University and poor knowledge in curriculum development and reform strategies among faculty members (Kayyal & Gibbs, 2012). It is only normal to speculate that the outdated curriculum at DU Pharmacy School is not ideal for fostering a positive LE. The curriculum is not the only factor that could have

affected the LE, the state of war Syria has been living in for the past decade has greatly also affected higher education and the Syrian universities' capacity to train a competent workforce (Dashash, 2019). A study that evaluated stress factors at DU Dental School indicated some stressors that pertained to the educational environment (Shehada *et al*., 2022). Nevertheless, the LE in DU pharmacy education is an area that was not investigated before. Therefore, this study aims to provide the first evaluation of the students' perception of the learning environment at Damascus University Pharmacy School in 2022 using the internationally adopted DREEM questionnaire and compare it with other pharmacy schools around the world.

Methods

Ethical considerations

Ethical approval for the study was granted by the Syrian Virtual University (SVU) no. 479/0 on 19th April, 2022. Participation in the study was voluntary and anonymous. It was explained in the questionnaire introduction that the generated data will be used for research purposes only and to evaluate the quality of the learning environment at Damascus University Pharmacy School. Participants provided their consent to participate via answering yes-or-no consent in the electronic questionnaire.

Study design

This is an observational cross-sectional study. By considering quantitative indicators pre-specified by the DREEM inventory, the learning environment at Damascus University Pharmacy School was evaluated.

Participants and setting

Seven public universities in Syria offer Bachelor of Pharmacy (B.Pharm) degrees; the major university being Damascus University. Other universities have been greatly affected by the Syrian conflict, which led many pharmacy students to go to Damascus University which is in a relatively conflict-free zone. In this study, the defined population included all students at Damascus University Pharmacy School except for first-year students who could not be considered pharmacy students as they were still in the preparatory year. River sampling and snowball sampling (non-probability sampling methods) were used; social media platforms such as Facebook, WhatsApp and Telegram were used to approach participants who completed an anonymous electronic questionnaire designed on Google Forms. The research team tried to approach as many participants as possible and data collection stopped only after exhausting all efforts.

Data collection

Data collection instrument : DREEM questionnaire. The validated DREEM questionnaire was used; the questionnaire was anonymous and no identifying information was collected. This study used an Arabic version of the questionnaire which was reported and used in a previous study (Al-Qahtani, 1999). A blank copy of the Arabic questionnaire that was used as well as an English version are available on Figshare (Alfakhry *et al*., 2022a; Alfakhry *et al*., 2022b). Previous studies reported the validity and reliability of the DREEM questionnaire (Roff, 2005; Roff *et al*., 1997). The internal consistency of DREEM as measured by the Cronbach's alpha measure was over 0.90 in study conducted in 2023 on a sample of Syrian medical and dental students (Alfakhry *et al*., 2023a; Alfakhry *et al*., 2023b; Rotthoff *et al*., 2011). Additionally, the DREEM questionnaire was used previously to evaluate the LE at pharmacy schools (Bashir *et al*., 2020; Wong *et al*., 2015). The DREEM questionnaire includes 50 closed-ended statements under 5 dimensions which are supported by factor analysis of one study (Rotthoff *et al*., 2011) and the qualitative validation during its development (Roff *et al*., 1997):

- Students' perception of learning (SPL): 12 items, score out of 48
- Students' perception of teachers (SPT): 11 items, score out of 44
- Students' academic self-perceptions (ASP): 8 items, score out of 32
- Students' perception of atmosphere (SPA): 12 items, score out of 48
- Students' social self-perception (SSP): 7 items, score out of 28

Each item is scored on a 5-point rating scale: strongly disagree (0), disagree (1), unsure/doesn't apply (2), agree (3), strongly agree (4). Reverse coding was done for negative items 4, 8, 9, 17, 25, 35, 39, 48, and 50 so that a higher value donates a more positive result. The interpretation of the DREEM scale and its subscales is illustrated in Table 1 according to McAleer & Roff (2002). As for the individual item, any item that scored below 2 was considered an area that needs attention.

Sampling method and data collection procedure. River sampling and snowball sampling (non-probability sampling methods) were used; social media platforms such as Facebook, WhatsApp and Telegram were used to approach participants who completed an anonymous electronic questionnaire designed on Google Forms. The research team tried to approach as many participants as possible and data collection stopped only after exhausting all efforts.

No identifying information was required to maintain anonymity. Google Forms was used to collect responses electronically via posting it on social media platform and inviting students to complete it. Google Forms settings were adjusted so that participants needed to fill in all items to submit their responses. Therefore, missing data was not encountered. No specific time-frame was set for participants to complete the questionnaire. Data collection started on 25th April, 2022, and ended on 20th June, 2022 when no more questionnaire forms were being filled. Data collection occurred at this particular time because it is a bit after the beginning of the second term which starts late March to allow students time to settle in with the new term and before students become occupied with the final exams which take place in July.

Table 1. A guide for interpretating the DREEM scale and its subscales.

	Score	Interpretation
Total DREEM	0-50	Very poor
	51-100	Plenty of problems
	101-150	More positive than negative
	151-200	Excellent
Subscales		
SPL	0-12	Very poor
	13-24	Teaching is viewed negatively
	25-36	A more positive approach
	37-48	Teaching highly thought of
SPT	0-11	Abysmal
	12-22	In need of some retraining
	23-33	Moving in the right direction
	34-44	Model teachers
ASP	0-8	Feeling of total failure
	9-16	Many negative aspects
	17-24	Feeling more on the positive side
	25-32	Confident
SPA	0-12	A terrible environment
	13-24	There are many issues that need to be changed
	25-36	A more positive atmosphere
	37-48	A good feeling overall
SSP	0-7	Miserable
	8-14	Not a nice place
	15-21	Not very bad
	22-28	Very good socially

DREEM data of other international universities

The DREEM questionnaire data of different universities around the world were also extracted from different studies (Bashir *et al.*, 2020; Brown *et al.*, 2011; Wong *et al.*, 2015). These universities included Taylor's University in Malaysia, Cardiff University in the United Kingdom, Monash University in Australia, and an anonymous institute coded as 1 as reported in the cited study from Pakistan (Bashir *et al.*, 2020). University ranking data was extracted from the most recent record on QS World University Rankings (QS World University Rankings).

Data analysis

Data normality has been checked and confirmed using skewness and Kurtosis; therefore, parametric tests were conducted. One-sample *t*-test was used to compare Damascus University Pharmacy School DREEM data with that of other pharmacy schools around the world. A *P*-value less than 0.05 was considered statistically significant. Cohen's *d* was used as a measure of effect size. The effect size (Cohen's d) can be either negative or positive depending on the direction of the comparison. If the effect size is negative, this indicates that the first mean is smaller than the second one. This can be deduced from Cohen's d formula which is as follows: M1-M2/SD (Cohen, 1988). The negative effect size value is interpreted just as the positive one. A *d* value between 0.2–0.5 is considered small, 0.5–0.8 is medium, and when it's over 0.8, it's considered large according to Cohen 1988 (Cohen, 1988). Cronbach's alpha was used as a measure of internal consistency of the used scale in the new environment. Google Forms was used to administer the questionnaire electronically; Microsoft Excel (2019) was used for data processing and IBM SPSS 26.0 (2020) was used to conduct statistical analysis.

Results

A total number of 269 students completed the DREEM questionnaire; that is about 6.7% (269/4000) of the total population. The sample age mean was 22.4 (SD=1.9); 82.2% (n=221) were female students**.** In terms of year of study, 147 were in their fifth year, 53 were fourth years, 41 were third-year students and 28 were second years. Cronbach's alpha value for the DREEM 50-item was 0.94. The full dataset can be found under *Underlying data* (Alfakhry *et al*., 2022a).

The overall DREEM score was 89.8/200. The DREEM scale and each of its subscales scores are illustrated in Table 2. All five subscales scored below 50%; SPL (41.8%); SPT (45.6%); ASP (48.7%); SPA (45.4%); SSP (42.5%). The percentage of negative items (which scored below 2.0) in each domain was as follows: 75% in SPL, 45% in SPT, 75% in ASP, 58% in SPA, and 57% in SSP. Table 3 shows the scores of participants according to their year of study; one-way ANOVA showed a significant between different groups and post-hoc demonstrated that it was Year 2 students who had significantly higher scores than their senior counterparts.

Table 4 compares Damascus University Pharmacy School's learning environment with other universities as measured by the DREEM inventory. All universities scored higher than DU Pharmacy School in the total DREEM score with a significant margin (P<0.001) and a large effect size.

At the subscale level, all universities showed a significant difference in comparison to DU Pharmacy School (P<0.001) at every subscale. Taylor's University, Cardiff University, and Monash University showed a large effect size, whereas the Pakistani university showed a large effect size in SPL and SSP and medium effect size in SPT, ASP, and SPA.

At the individual item level, the majority of items (62%, 31/50) scored less than 2. Only two items scored more than 3: item n. 15 (*I have good friends in this school*) and item n. 31 (*I have learned a lot about empathy in my profession*).

Table 2. Mean scores for the DREEM scale and subscales at Damascus University Pharmacy School.

	Mean (SD)	Interpretation
SPL (max=48)	20.1 (8.4)	Teaching is viewed negatively
SPT (max=44)	20.1 (8.0)	In need of some retraining
ASP (max=32)	15.6 (6.4)	Many negative aspects
SPA (max=48)	21.8 (9.6)	There are many issues that need to be changed
SSP (max=28)	11.9 (4.9)	Not a nice place
DREEM total score (max=200)	89.8 (32.1)	Plenty of problems
	n=269	

Table 3. Mean score with the standard deviation according to the year of study.

	Year of study				One-way ANOVA
	Year 2 (n=28)	Year 3 (n=41)	Year 4 (n=53)	Year 5 (n=147)	*P*-value
SPL (max=48)	25.3±7.7	19.4±7.5	19.0±9.1	19.8±8.2	0.007
SPT (max=44)	24.2±8.3	20.1±8.3	20.1±8.0	19.4±7.7	0.036
ASP (max=32)	17.8±5.1	13.3±6.1	14.5±6.7	16.3±6.3	0.008
SPA (max=48)	27.7±7.2	20.9±9.7	21.3±9.8	21.0±9.5	0.007
SSP (max=28)	14.8±4.2	11.4±4.9	11.6±5.5	11.6±4.6	0.011
DREEM (max=200)	110.0±27.7	58.3±30.7	86.7±34.3	88.2±31.4	0.005

Underlined cells indicate a value of negative interpretation.

Table 4. Comparison of DREEM scores between Damascus University Pharmacy School and that of other universities around the world (Bashir *et al.*, 2020; Brown *et al.*, 2011; Wong *et al.*, 2015).

	Damascus University (comparator)	Anonymous university		Taylor's University		Cardiff University		Monash University	
Country	Syria	Pakistan		Malaysia		UK		Australia	
University World Ranking	1201-1400	---		284		=154		42	
Degree	B. Pharm	Pharm.D		B.Pharm		MPharm		B.Pharm	
	Mean (SD)	**Mean**	**Eff. Size**	**Mean**	**Eff. size**	**Mean**	**Eff. Size**	**Mean**	**Eff. Size**
SPL (max=48)	20.1 (8.4)	28.5	-1.11	32.34	-1.57	35.11	-2.15	30.9	-1.41
SPT (max=44)	20.1 (8.0)	23.43	-0.47	27.4	-0.98	32.6	-1.88	30.3	-1.43
ASP (max=32)	15.6 (6.4)	18.09	-0.41	20.5	-0.82	22.2	-1.22	21.7	-0.87
SPA (max=48)	21.8 (9.6)	26.77	-0.55	29.4	-0.85	35.4	-1.71	32.3	-1.13
SSP (max=28)	11.9 (4.9)	15.50	-0.83	18.0	-1.33	20.02	-1.93	18.1	-1.63
DREEM total score (max=200)	89.8 (32.1)	112.28	-0.78	127.7	-1.28	145.4	-2.09	135.4	-1.50
	N=269	n=163		n=62		n=194		n=116	

Eff. Size: effect size. Cohen's d has been used as a measure of the effect size. Pharm D: Doctor of Pharmacy; B.Pharm: Bachelor of Pharmacy; MPharm: Master of Pharmacy. University World Ranking data are extracted from QS University World Ranking (QS World University Rankings).

The mean scores of each item are shown in Table 5 in ascending order. The lowest mean scores were observed in item n. 3 (*There is a good support system for students who get stressed*), item n. 4 (*I am too tired to enjoy the courses*), item n. 16 (*The teaching helps to develop my competence*), item n. 21 (*I feel I am being well prepared for my profession*), and item n. 9 (*The teachers are authoritarian*).

Discussion

The current study aimed to provide the first record of evaluation of the learning environment of the Bachelor of Pharmacy program at Damascus University. The findings showed that the learning environment at DU Pharmacy School is perceived negatively according to the DREEM scale. The DREEM total score indicated that there are plenty of problems that need to be addressed. All DREEM subscales (SPL, SPT, ASP, SPA, SSP) were on the negative spectrum indicating that all areas of the learning environment require major improvements. The finding also showed that pharmacy students at DU did not feel that they are being prepared well for practicing after graduation, nor did they believe that the current teaching helps develop their competence. Further, DU Pharmacy School scored the lowest in the DREEM scale and subscale in comparison to other pharmacy schools around the world including Pakistan which has a similar human development index to Syria (UNDP, 2020).

More senior participants seemed to display more negative perception of the learning environment in comparison to their younger counterparts. This finding seems to be consistent across disciplines, whether medical, dental, nursing according to one systematic review (Chan *et al.*, 2018) and even pharmacy education (Bashir *et al.*, 2020). The Cronbach's alpha of the 50-item DREEM scale indicated excellent internal consistency and this is consistent with other studies (Dimoliatis *et al.*, 2010; Roff *et al.*, 1997). The DREEM tool has been used to measure the LE in many pharmacy schools around the world. In Pakistan, the DREEM total score ranged between 109 and 131.7 out of 200 (Bashir *et al.*, 2020; Memon *et al.*, 2018); Taylor's University in Malaysia (Wong *et al.*, 2015) scored 127.7/200, and in more prestigious universities such as Cardiff University (the UK) (Wong *et al.*, 2015) and Monash University (Australia) (Brown *et al.*, 2011), the DREEM total scores were 145.5/200 and 133.0/200 respectively. In contrast, DU Pharmacy School scored 89.8/200 on the DREEM scale which is significantly lower than its counterparts across the world.

Similar to another study in Pakistan (Ezeala & Moleki, 2018), items n. 3 (*There is a good support system for students who get stressed)* and n. 9 *(The teachers are authoritarian)* also indicated a negative result (lower than 2); however, item n. 16 (*The teaching helps to develop my competence*), item n. 21 (*I feel I am being well prepared for my profession*) indicated a positive result in Pakistani universities in contrast to current study findings. A previous study (El-Hammadi, 2012) in Syria suggested that the graduate pharmacy programs at Damascus University do not seem to satisfy students' ambitions which is concurrent with this study's findings as the low scores on items no. 21 and 45 indicate. The previous study was conducted in 2010–2011 which

Table 5. Mean score for each DREEM item at Damascus University Pharmacy School categorized according to their domain with an ascending order.

Domain	Mean (SD)
Students' perception of learning (SPL)	
16. The teaching helps to develop my competence	1.09 (1.2)
22. The teaching helps to develop my confidence	1.24 (1.3)
13. The teaching is student centered	1.36 (1.3)
44. The teaching encourages me to be an active learner	1.39 (1.3)
47. Long term learning is emphasized over short-term learning	1.46 (1.3)
48. The teaching is too teacher centered	1.65 (1.2)
38. I am clear about the learning objectives of the courses	1.71 (1.3)
25. The teaching over emphasizes factual learning	1.78 (1.3)
1. I am encouraged to participate during teaching sessions	1.79 (1.2)
24. The teaching time is utilized properly	2.01 (1.3)
7. The teaching is often stimulating	2.35 (1.4)
20. The teaching is well focused	2.36 (1.2)
Students' perception of teaching (SPT)	
9. The teachers are authoritarian	1.14 (1.2)
39. The teachers get angry during teaching sessions	1.52 (1.3)
32. The teachers provide constructive criticism	1.62 (1.3)
8. The teachers ridicule the students	1.87 (1.4)
50. The students irritate the teachers	1.91 (1.3)
6. The teachers are patient with patients	2.00 (1.1)
29. The teachers are good at providing feedback to students	2.06 (1.3)
18. The teachers have good communication skills with patients	2.09 (1.0)
37. The teachers give clear examples	2.53 (1.2)
40. The teachers are well prepared for their teaching sessions	2.64 (1.2)
2. The teachers are knowledgeable	2.86 (1.0)
Students' academic self-perception (ASP)	
21. I feel I am being well prepared for my profession	1.13 (1.2)
27. I am able to memorize all I need	1.65 (1.3)
45. Much of what I have to learn seems relevant to a career in healthcare	1.79 (1.4)
26. Last year's work has been a good preparation for this year's work	1.80 (1.3)
5. Learning strategies which worked for me before continue to work even now	1.87 (1.4)
41. My problem solving skills are being well developed	1.96 (1.3)
10. I am confident about my passing this year	2.36 (1.5)
31. I have learned a lot about empathy in my profession	3.11 (1.0)
Student's perception of the atmosphere (SPA)	
42. The enjoyment outweighs the stress of the courses	1.23 (1.4)
43. The atmosphere motivates me as a learner	1.26 (1.3)
23. The atmosphere is relaxed during lectures	1.42 (1.3)
49. I feel I am able to ask the questions I want	1.54 (1.3)
30. There are opportunities for me to develop interpersonal skills	1.61 (1.3)
34. The atmosphere is relaxed during seminars/ tutorials	1.67 (1.3)
11. The atmosphere is relaxed during the clinical teaching	1.83 (1.0)
12. This school is well timetabled	2.10 (1.4)
17. Cheating is a problem in the school	2.15 (1.4)
35. I find my experience disappointing	2.15 (1.5)
33. I feel comfortable in teaching sessions socially	2.27 (1.4)
36. I am able to concentrate well	2.58 (1.2)
Students' social self-perception (SSP)	
3. There is a good support system for students who get stressed	0.52 (0.9)
4. I am too tired to enjoy the courses	0.90 (1.1)
14. I am rarely bored on the courses	1.14 (1.4)
46. My accommodation in the school is pleasant	1.37 (1.0)
28. I seldom feel lonely	2.30 (1.4)
19. My social life is good	2.58 (1.3)
15. I have good friends in this school	3.14 (1.1)

Underlined scores indicate a negative interpretation (<2.00)

marks the start of the Syrian conflict (El-Hammadi, 2012). At that time, the Syrian economy and living standards were in a much better state in comparison to 2022. Nevertheless, the results of the 2010 study and this 2022 study were similar as shown above. This implies that the problem might be associated with the curriculum of DU Pharmacy School rather than the general context (Bahnassi, 2020;

Kayyal & Gibbs, 2012). The majority of graduates from DU Pharmacy School work as community pharmacists which requires skills in general healthcare, pharmacy, pharmaceutical care, clinical pharmacy as well as business management skills (Bahnassi, 2020). On the other hand, the current pharmacy education in Syria focuses on the pharmaceutical industry and sciences, and the clinical component of the curriculum is still underdeveloped (Bahnassi, 2020). This could explain why most students did not feel that the pharmacy education they received prepared them well for the profession (El-Hammadi, 2012). The SPL subscale was perceived most negatively in comparison to other subscales; this suggests that current teaching and learning practices are not contributing to forming a positive LE. Another area in the LE at DU Pharmacy School that needs more attention is the general atmosphere and the social environment which were perceived as stressful and demotivating by students. The lack of a psychosocial support system is one of the areas that need to be considered seriously. This system is of utmost importance especially in fragile contexts such as the one in Syria.

The negative DREEM score at DU Pharmacy School can be understood in the light of the traditional curriculum which is characterized by teacher-centeredness and emphasis on information gathering learning approach; all modules of the program are mandatory; teaching is delivered using traditional methods such as lecturing and lab sessions. All these characteristics are substantiated by the current study results. The massive number of students who study pharmacy at DU is another detrimental element that is bound to affect the quality of education (Bahnassi, 2020; Shehada *et al*., 2022). Moreover, the considerable rise in pharmacy graduates at Damascus University in conjunction with the limited job opportunities further emphasizes the importance of extending the Syrian pharmacists' role and not limiting it to community pharmacy businesses (Bahnassi, 2020). However, this requires a new legislative framework that redefines the role of pharmacists in Syria along with a curriculum reform that puts forward clinical competence as a core component of the B.Pharm program (Bahnassi, 2020). There are multiple implications for having a generally negative educational environment such as decreasing academic performance, lower student satisfaction, and higher stress levels and burnout (Alhaffar *et al*., 2019; Dyrbye *et al*., 2020).

Limitations and strengths

The predominant percentage of female respondents is one of the limitations of this study. However, it is known that most pharmacy students at DU are females (El-Hammadi, 2012) and this still holds true at DU Pharmacy School. The non-probability sampling method and the small sample size in comparison to the population size (6.7%) are other areas of weakness that could affect the generalisability of the study findings. However, due to pragmatic reasons, collection of larger sample size and the use of random sampling were not feasible options. The data collection process faced a lot of obstacles due to the obstructive regulations and the lack of motivation of the school administration and faculty.

The significance of this study lies in that it is the first evaluation of the learning environment at DU Pharmacy School. This study could help raise awareness of the need for a total educational reform that has been advocated for decades now (Kayyal & Gibbs, 2012). If a curriculum reform is attempted at DU Pharmacy School, this study could act as a baseline reading of the reality of the LE. Furthermore, it could help identify potential areas of improvement that need to be prioritized.

Conclusions

The findings of this study suggest that the educational environment at DU Pharmacy School is in need of major improvements, especially in the areas related to teaching and learning, the social environment, and the general atmosphere as defined by the DREEM subscales. Failure to improve the learning environment might hinder skills attainment necessary for practice post graduation. The faculty should consider reforming its curriculum and add more modules which help students meet their job demands after graduation in Syria whose job market especially focuses on clinical community pharmacy. Delivery of teaching should focus more students and shift the paradigm of teacher-centered education to student-centered. This study provides a quality improvement blueprint that future interventional research could use preciously address the areas that need most attention at DU Pharmacy School.

Data availability

Underlying data

Figshare: Associated dataset and DREEM questionnaire forms for the study conducted at Damascus University Pharmacy School in 2022. https://doi.org/10.6084/m9.figshare.21152476.v6 (Alfakhry *et al*., 2022a)

This project contains the following underlying data:

- Data File.sav (dataset generated from this study)

Extended data

This project contains the following extended data:

- English version of DREEM questionnaire
- Arabic version of DREEM questionnaire

Acknowledgments

The authors would like to extend their thanks to all those who helped in collecting data including Sakr Meree, Lama Srour, Wafaa Madawi, and the Facebook page Up To Date الأدوية السورية.

Author contributions

Ghaith Alfakhry: Conceptualization (lead); data curation (lead); Data collection (lead) ; formal analysis (lead); investigation (lead); methodology (lead); project administration (lead); supervision (lead); writing—original draft preparation (lead); writing—review and editing (lead). **Rowaida Saymeh**: writing—review and editing. **Issam Jamous & Khaled Alhomsi:** contributed equally to methodology; supervision; writing—review and editing.

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Open Peer Review

Current Peer Review Status: ? ✓ ✓

Version 2

Reviewer Report 09 January 2024

https://doi.org/10.21956/mep.21157.r35784

✓ **P Ravi Shankar**
IMU Center for Education, International Medical University, Kuala Lumpur, Malaysia

Thanks for the invitation to review this important and interesting study. I would like to have more details on the ethical review process. The authors mention that the study was approved by the Syrian Virtual University. Is Damascus University Pharmacy School affiliated to this university? Also can the authors provide more details of the sampling methods. In my opinion as the sample size is very small caution should be exercised while making recommendations and suggestions based on this study. The study is well-written and presented.

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
I cannot comment. A qualified statistician is required.

Have any limitations of the research been acknowledged?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Health Professions Education, Small group learning, pharmacology and pharmacy education

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 24 August 2023

https://doi.org/10.21956/mep.21157.r34489

Marzia Lommi
[1] University of Rome Tor Vergata, Rome, Italy
[2] Local Health Authority Roma, Rome, Italy

I consider the new version approved.

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Have any limitations of the research been acknowledged?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of

expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 14 July 2023

https://doi.org/10.21956/mep.20717.r33611

?

Marzia Lommi
[1] University of Rome Tor Vergata, Rome, Italy
[2] Local Health Authority Roma, Rome, Italy

It is a pleasure to read this research article.
I would like to make some suggestions to the authors to make it clearer.

Abstract
Add information to introduction and results, based on my suggestions.

Keywords
Please, use if available MESH terms.

Introduction
DREEM is certainly an adopted tool for assessing the educational environment around the world and in Syria. I suggest the authors cite studies that have evaluated its content validity and psychometric properties in systematic reviews (with COSMIN or JOANNA BRIGGS methodology) to justify its use even more. This is to answer the question: why did I choose this particular instrument over others?

Instruments
After the section "participants and setting," describe the instrument used, its dimensions, psychometric properties, etc. I kindly ask the authors to divide the information regarding the instrument from that regarding the data collection procedure.

Data collection
Here I expect to find the procedures used for data collection. It would be helpful to give reasons why the data were collected at a particular time of the year.

Results
For the sample under study I would include a table that would consider the year of the course as the selection variable. It would be interesting to see by course year how the DREEM scores also vary. I would also put their significance (Chi square, Anova depending on the variable being

analyzed) in the table next to the variables under study.

Discussion
Based on the suggested modification I would also discuss these results in light of the literature.

Conclusion
I would add something more in light of the discussion and conclusions already provided For clinical practice, training, and research why are the results of this study important?

Thank you to the authors and the journal for the opportunity to enrich knowledge on this topic.

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Partly

Have any limitations of the research been acknowledged?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Public health, Gerontology, Educational learning, Training of health care personnel, Wound care, Self care, Quality of life

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 26 Jul 2023

Ghaith Alfakhry

Marzia Lommi It is a pleasure to read this research article. I would like to make some suggestions to the authors to make it clearer.

Response: The authors would like to thank the reviewer for the insightful comments and constructive feedback that helped us improve the quality of the reporting of our findings.

Abstract Add information to introduction and results, based on my suggestions.

Response: We would like to thank the reviewer for the feedback. The Abstract has been modified accordingly. Please see pg. 3

Keywords Please, use if available MESH terms.

Response: We thank the reviewer for this accurate feedback. We have revised the first three keywords and replaced them with their equivalent MeSH terms (education; pharmacy, undergraduate). However, the rest of the terms are not available on the MeSH, therefore, we had to use them as they are to make it easier to find our research for the larger community. Please see pg. 2, line 21: "Keywords: education; pharmacy, undergraduate; learning environment; Dundee Ready Educational Environment Measure; DREEM; Damascus University; Syria."

Introduction DREEM is certainly an adopted tool for assessing the educational environment around the world and in Syria. I suggest the authors cite studies that have evaluated its content validity and psychometric properties in systematic reviews (with COSMIN or JOANNA BRIGGS methodology) to justify its use even more. This is to answer the question: why did I choose this particular instrument over others?

Response: We would like to thank the reviewer for bringing to our attention this important point. After a through literature review, we have added the following to address the reviewer recommendation (content validity, psychometric properties of DREEM and the justification for the use of DREEM). Please see pg. 4, line 22-38: "A review revealed that DREEM showed to be consistently reliable across countries in comparison to 11 other educational environment measures and hence recommended the use of DREEM as the best measure for the educational environment in undergraduate settings (Soemantri et al., 2010). Another review study revealed that although the DREEM inventory showed some content validity evidence, it compared unfavourably to other tools(Colbert-Getz et al., 2014); nonetheless, its face and content validity in measuring the learning environment in pharmacy undergraduate settings has been supported by one study (Wong et al., 2015). Psychometric property evaluation of the DREEM instrument has been conducted in multiple studies in various settings, some supported the construct validity of the instrument (Rotthoff et al., 2011) while others did not (Yusoff, 2012). One study in particular showed that the internal consistency of the five subscales can be quite variable (Hammond et al., 2012). Notwithstanding these shortcomings, the wide use of DREEM instrument globally does encourage its use so that comparisons could be made between different studies (Colbert-Getz et al., 2014). Additionally, DREEM score has shown positive correlates with academic achievement, quality of life, positive attitude towards the program, less psychological distress and greater social support(Chan et al., 2018). All of these

factors encourage the use of the DREEM inventory."

Instruments After the section "participants and setting," describe the instrument used, its dimensions, psychometric properties, etc. I kindly ask the authors to divide the information regarding the instrument from that regarding the data collection procedure.

Response: We would like to thank the reviewer for helping organize our manuscript better. We have described the instrument used, its dimensions and psychometric properties in detail: Please see Data collection instrument: DREEM questionnaire, pg. 6, line 94-112*: "Data collection instrument : DREEM questionnaire* The validated DREEM questionnaire was used; the questionnaire was anonymous and no identifying information was collected. This study used an Arabic version of the questionnaire which was reported and used in a previous study (Al-Qahtani, 1999). A blank copy of the Arabic questionnaire that was used as well as an English version were provided on figshare (Alfakhry et al., 2022a, Alfakhry et al., 2022b). Previous studies reported the validity and reliability of the DREEM questionnaire (Roff et al., 1997, Roff, 2005). The internal consistency of DREEM as measured by the Cronbach's alpha measure was over 0.90 in study conducted in 2023 on a sample of Syrian medical and dental students (Alfakhry et al., 2023a, Alfakhry et al., 2023b). Additionally, the DREEM questionnaire was used previously to evaluate the LE at pharmacy schools (Wong et al., 2015, Bashir et al., 2020). The DREEM questionnaire includes 50 closed-ended statements under 5 dimensions which are supported by factor analysis of one study (Rotthoff et al., 2011) and the qualitative validation during its development (Roff et al., 1997):

- **Students' perception of learning (SPL): 12 items, score out of 48**
- **Students' perception of teachers (SPT): 11 items, score out of 44**
- **Students' academic self-perceptions (ASP): 8 items, score out of 32**
- **Students' perception of atmosphere (SPA): 12 items, score out of 48**
- **Students' social self-perception (SSP): 7 items, score out of 28"**

Response: We have also revised this section as advised and put other sub-headings to separate the instrument description section and the data collection procedure section. Please see the sub-headings in the following page. 6-8: *"Data collection instrument: DREEM questionnaire Sampling method and data collection procedure Sampling method and data collection procedure DREEM data of other international universities"*

Data collection Here I expect to find the procedures used for data collection. It would be helpful to give reasons why the data were collected at a particular time of the year.

Response: The authors would like to extend their thanks to the reviewer for the helpful comments. We have now added a subheading entitled "*Sampling method and data collection procedure*" (pg. 6, line 119-124) and explained the data collection procedure in detail as requested. As for why the data collection occurred at the particular time mentioned in the paper (between April and June), it is because we considered that the beginning of the term was late March and second semester final exams occur in July. Therefore, it's reasonable to collect data after students settle in

and before they get occupied with preparing for their exams. This is now highlighted in pg. 6, line 131-134: "Data collection occurred at this particular time because it is a bit after the beginning of the second term which starts late March to allow students time to settle in with the new term and before students become occupied with the final exams which take place in July."

Results For the sample under study I would include a table that would consider the year of the course as the selection variable. It would be interesting to see by course year how the DREEM scores also I would also put their significance (Chi square, Anova depending on the variable being analyzed) in the table next to the variables under study.

Response: We would like to thank the reviewer for recommending comparing students' perceptions of different years of study. We have now added a table a paragraph to address this point. Please see pg. 9, line 171-174: "Table 3 shows the scores of participants according to their year of study; one-way ANOVA showed a significant between different groups and post-hoc demonstrated that it was Year 2 students who had significantly higher scores than their senior counterparts."

Table 3. Mean score with the standard deviation according to the year of study. **Year of study One-way ANOVA** Year 2 (n=28) Year 3 (n=41) Year 4 (n=53) Year 5 (n=147) *P*-value **SPL (max=48)** 25.3±7.7 19.4±7.5 19.0±9.1 19.8±8.2 0.007 **SPT (max=44)** 24.2±8.3 20.1±8.3 20.1±8.0 19.4±7.7 0.036 **ASP (max=32)** 17.8±5.1 13.3±6.1 14.5±6.7 16.3±6.3 0.008 **SPA (max=48)** 27.7±7.2 20.9±9.7 21.3±9.8 21.0±9.5 0.007 **SSP (max=28)** 14.8±4.2 11.4±4.9 11.6±5.5 11.6±4.6 0.011 **DREEM (max=200)** 110.0±27.7 58.3±30.7 86.7±34.3 88.2±31.4 0.005 Underlined cells indicate a value of negative interpretation. *Discussion Based on the suggested modification I would also discuss these results in light of the literature.*

Response: We would like to thank the reviewer for the suggestions. We have now discussed the differences in scores between students of different years of study in the discussion. Please see pg. 14, line 218-221: "More senior participants seemed to display more negative perception of the learning environment in comparison to their younger counterparts. This finding seems to be consistent across disciplines, whether medical, dental, nursing according to one systematic review (Chan et al., 2018) and even pharmacy education (Bashir et al., 2020). "

Conclusion I would add something more in light of the discussion and conclusions already provided For clinical practice, training, and research why are the results of this study important?

Response: We would like to thank the reviewer for the insightful feedback. The conclusion has been rewritten in accordance with the comments provided. Please see pg. 15-16, line: 287-297: "Conclusion The findings of this study suggest that the educational environment at DU Pharmacy School is in need of major improvements, especially in the areas related to teaching and learning, the social environment, and the general atmosphere as defined by the DREEM subscales. Failure to improve the learning environment might hinder skills attainment necessary for practice post graduation. The faculty should consider reforming its curriculum and add more modules which help students meet their job demands after graduation in Syria whose

job market especially focuses on clinical community pharmacy. Delivery of teaching should focus more students and shift the paradigm of teacher-centered education to student-centered. This study provides a quality improvement blueprint that future interventional research could use preciously address the areas that need most attention at DU Pharmacy School."

Thank you to the authors and the journal for the opportunity to enrich knowledge on this topic.

Response: It is us the authors who would like to express their sincere thanks to the reviewer's time, effort, and honest dedication to help us improve the quality of our manuscript.

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Competing Interests: None

Reviewer Report 23 November 2022

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Andrea Manfrin
School of Pharmacy and Biomedical Sciences, University of Central Lancashire, Preston, UK

Dear Editor and Authors, thank you for allowing me to review this exciting study.

It is a significant study presenting the results of research conducted at Damascus University. The research provides the first evaluation of the Bachelor of Pharmacy programme adopting the Dundee Ready Education Environment Measure (DREEM) and comparing their results with other pharmacy schools worldwide.

The findings suggest the need for significant improvement, focusing on the area related to teaching and learning practice and the social environment.

This work is accurately presented and fits well with the current literature.

Study design:
The study has an appropriate design. However, I suggest adding the response rate to the abstract and result section. The paper indicated that there were over 4,000 students “according to 2022 records. **Therefore, the response rate should be 6.7% (**269/4000)
As suggested by the authors, it is one of the limitations of the generalizability of the results.

Data analysis:
The method is clearly described providing all the relevant details. Nonetheless, this study is not hypothesis testing; therefore, the sample calculation was not required.

It seems the authors considered the data normally distributed and performed the student t-test analysis providing means and SDs.
Looking at the results and the scores, which are not providing a positive outlook, the overall score was 89.8/200 (plenty of problems), and the score for each domain was well below the average; the data suggests a skewed distribution which could be non-normal.

The authors did not mention in the statistical analysis plan that they assessed the data's normality. I wonder whether a normality test could confirm a skewed distribution and, therefore, the requirement to use a non-parametric analysis.

Please provide this crucial information or sustain your approach using an evidence-based argument.

Table 3:
This table compares Damascus University School of Pharmacy and the other four schools. Nevertheless, the Damascus University School of Pharmacy is not embedded in the table but lists only the other schools.

I suggest redrafting this table and adding the Damascus University School of Pharmacy as a comparator. Then the table will become clearer and easy to understand.

Table 3 shows that all Cohen d values are negative, but their interpretation is not included in the data analysis plan. Please revise.

Limitations:
The percentage of responses could also help contextualise this study's generalizability.

Conclusions:
The conclusions support the results, but the non-normality of the data could change the data analysis, the results (partially), and the discussion section slightly. Still, it should not change the overall message of this study which is very clearly presented.

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Partly

Have any limitations of the research been acknowledged?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Health Services Research, Pedagogic Research, Advanced Statistics

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 26 Jul 2023

Ghaith Alfakhry

Andrea Manfrin School of Pharmacy and Biomedical Sciences, University of Central Lancashire, Preston, UK Dear Editor and Authors, thank you for allowing me to review this exciting study. It is a significant study presenting the results of research conducted at Damascus University. The research provides the first evaluation of the Bachelor of Pharmacy programme adopting the Dundee Ready Education Environment Measure (DREEM) and comparing their results with other pharmacy schools worldwide. The findings suggest the need for significant improvement, focusing on the area related to teaching and learning practice and the social environment. This work is accurately presented and fits well with the current literature.

Response: The authors would like to express their sincere appreciation to the reviewer for the constructive and complimenting feedback on our work.

Study design: The study has an appropriate design. However, I suggest adding the response rate to the abstract and result section. The paper indicated that there were over 4,000 students "according to 2022 records. Therefore, the response rate should be 6.7% (269/4000). As suggested by the authors, it is one of the limitations of the generalizability of the results.

Response: We would like to thank the reviewer for pointing this out. Although we agree with the reviewer in indicating that our sample is about 6.7% of the total population, we would not call it "response rate." Response rate insinuates that we have reached out to each and every pharmacy student at Damascus University; we are not sure that the electronic survey reached all students, and we would be at fault in assuming that. Therefore, we will simply point out that our sample which is consistent of 269 students form 6.7% of the total population. We have added this information to both the abstract and results sections. Please see Abstract pg. 3 "Abstract: Results: A total of 269 students completed the questionnaire; that is about 6.7% of the total population." and Results, pg. 9, line 161-162 "A total number of 269 students completed the DREEM questionnaire; that is about 6.7% (269/4000) of the total population."

Data analysis: The method is clearly described providing all the relevant details. Nonetheless, this study is not hypothesis testing; therefore, the sample calculation was not required.

Response: We would like to thank the reviewer for the comment. We only set the *P* value at 0.05 not for hypothesis testing but rather comparative purposes when using the t-test. The effect size on the other hand was used as a measure of the standardized difference between two means and to complement the information given by the p-value. It is important to mention the effect size along with the p-value, and this is supported by a previous paper in medical education research (Sullivan and Feinn, 2012): "The effect size is the main finding of a quantitative study. While a P value can inform the reader whether an effect exists, the P value will not reveal the size of the effect. In reporting and interpreting studies, both the substantive significance (effect size) and statistical significance (*P*-value) are essential results to be reported."

It seems the authors considered the data normally distributed and performed the student t-test analysis providing means and SDs. Looking at the results and the scores, which are not providing

a positive outlook, the overall score was 89.8/200 (plenty of problems), and the score for each domain was well below the average; the data suggests a skewed distribution which could be non-normal. The authors did not mention in the statistical analysis plan that they assessed the data's normality. I wonder whether a normality test could confirm a skewed distribution and, therefore, the requirement to use a non-parametric analysis. Please provide this crucial information or sustain your approach using an evidence-based argument.

Response: We would like to thank the reviewer for giving us the chance to elaborate on this important aspect. We have actually considered the normality of data before conducting the t-test. We used Skewness and Kurtosis as measures of data normality: please see the following studies: Hair Jr, J. F., Black, J. W., Babin, B. J., & Anderson, E. R. (2010). Multivariate Data Analysis (Seventh Ed., pp. 1–758). Edinburgh: Pearson Education Limited. Kline, R. B. (2011). Principles and Practice of Structural Equation Modeling (5th ed., pp. 3–427). New York: The Guilford Press Tabachnick, B. G., & Fidell, L. S. (2013). Using Multivariate Statistics (6th ed., pp. 1–983). New Jersey: Pearson Education Inc It has been suggested by Kline (2011) that if skewness is greater than 3 and Kurtosis is greater than 10, there might be a problem in data normality; however, our values (see the table below) is well below that cut-off point, supporting the normal distribution assumption. Moreover, Tabachnick and Fidell (2013) state that if the sample size is larger than 200 (our sample size is 269), deviation from normality of skewness and kurtosis often do not make real difference in the analysis. Skewness Kurtosis SPL 0.33 -0.53 SPT 0.13 -0.42 ASP 0.07 -0.44 SPA 0.18 -0.50 SSP -0.14 -0.20 DREEM 0.26 -0.22

We have now mentioned that data normality has been checked and confirmed in the manuscript in the Methods section, pg. 8, line: 146-147: "Data normality has been checked and confirmed using skewness and Kurtosis; therefore, parametric tests were conducted."

Table 3: This table compares Damascus University School of Pharmacy and the other four schools. Nevertheless, the Damascus University School of Pharmacy is not embedded in the table but lists only the other schools. I suggest redrafting this table and adding the Damascus University School of Pharmacy as a comparator. Then the table will become clearer and easy to understand.

Response: We would like to thank the reviewer for this insightful suggestion. We have now added Damascus University School of Pharmacy data to Table 4 as you have suggested. (Table 3 has been changed to table 4 after an additional table has been added (table 3)) Please see Table 4, pg. 10: Damascus University (comparator) Anonymous university Taylor's University Cardiff University Monash University

Country Syria Pakistan Malaysia UK Australia University World Ranking 1201-1400 --- 284 =154 42 Degree B. Pharm Pharm.D B.Pharm MPharm B.Pharm

Mean Eff. Size Mean Eff. size Mean Eff. Size Mean Eff. Size SPL (max=48) 20.1 (8.4) 28.5 -1.11 32.34 -1.57 35.11 -2.15 30.9 -1.41 SPT (max=44) 20.1 (8.0) 23.43 -0.47 27.4 -0.98 32.6 -1.88 30.3 -1.43 ASP (max=32) 15.6 (6.4) 18.09 -0.41 20.5 -0.82 22.2 -1.22 21.7 -0.87 SPA

(max=48) 21.8 (9.6) 26.77 -0.55 29.4 -0.85 35.4 -1.71 32.3 -1.13 SSP (max=28) 11.9 (4.9) 15.50 -0.83 18.0 -1.33 20.02 -1.93 18.1 -1.63 DREEM total score (max=200) 89.8 (32.1) 112.28 -0.78 127.7 -1.28 145.4 -2.09 135.4 -1.50 N=269 n=163 n=62 n=194 n=116

Table 3 shows that all Cohen d values are negative, but their interpretation is not included in the data analysis plan. Please revise.

Response: We would like to thank the reviewer for making us aware of this point. We have now added an interpretation of the effect size values in the data analysis plan. Please see pg. 8, line: 150-154: "The effect size (Cohen's d) can be either negative or positive depending on the direction of the comparison. If the effect size is negative, this indicates that the first mean is smaller than the second one. This can be deduced from Cohen's d formula which is as follows: M1-M2/SD (Cohen, 1988) .The negative effect size value is interpreted just as the positive one."

Limitations: The percentage of responses could also help contextualize this study's generalizability.

Response: We would like to thank the reviewer for the suggestion. We have now added the percentage of our sample in comparison to the whole population size in the limitations section. Please see pg. 15, Line 276: "The non-probability sampling method and the small sample size in comparison to the population size (6.7%) are other areas of weakness that could affect the generalisability of the study findings."

Conclusions: The conclusions support the results, but the non-normality of the data could change the data analysis, the results (partially), and the discussion section slightly. Still, it should not change the overall message of this study which is very clearly presented.

Response: We would like to thank the reviewer for the constructive feedback. The reviewer might agree with us that since the normality assumption was met, the results and discussion section can remain unchanged. However, we have made slight changes to the conclusion according to second reviewer's suggestions. Please see pg. 15-16, line 287-297: "Conclusions The findings of this study suggest that the educational environment at DU Pharmacy School is in need of major improvements, especially in the areas related to teaching and learning, the social environment, and the general atmosphere as defined by the DREEM subscales. Failure to improve the learning environment might hinder skills attainment necessary for practice post graduation. The faculty should consider reforming its curriculum and add more modules which help students meet their job demands after graduation in Syria whose job market especially focuses on clinical community pharmacy. Delivery of teaching should focus more students and shift the paradigm of teacher-centered education to student-centered. This study provides a quality improvement blueprint that future interventional research could use preciously address the areas that need most attention at DU Pharmacy School. "

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Competing Interests: None