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Science students' perceptions of the learning environment in Science degree programs

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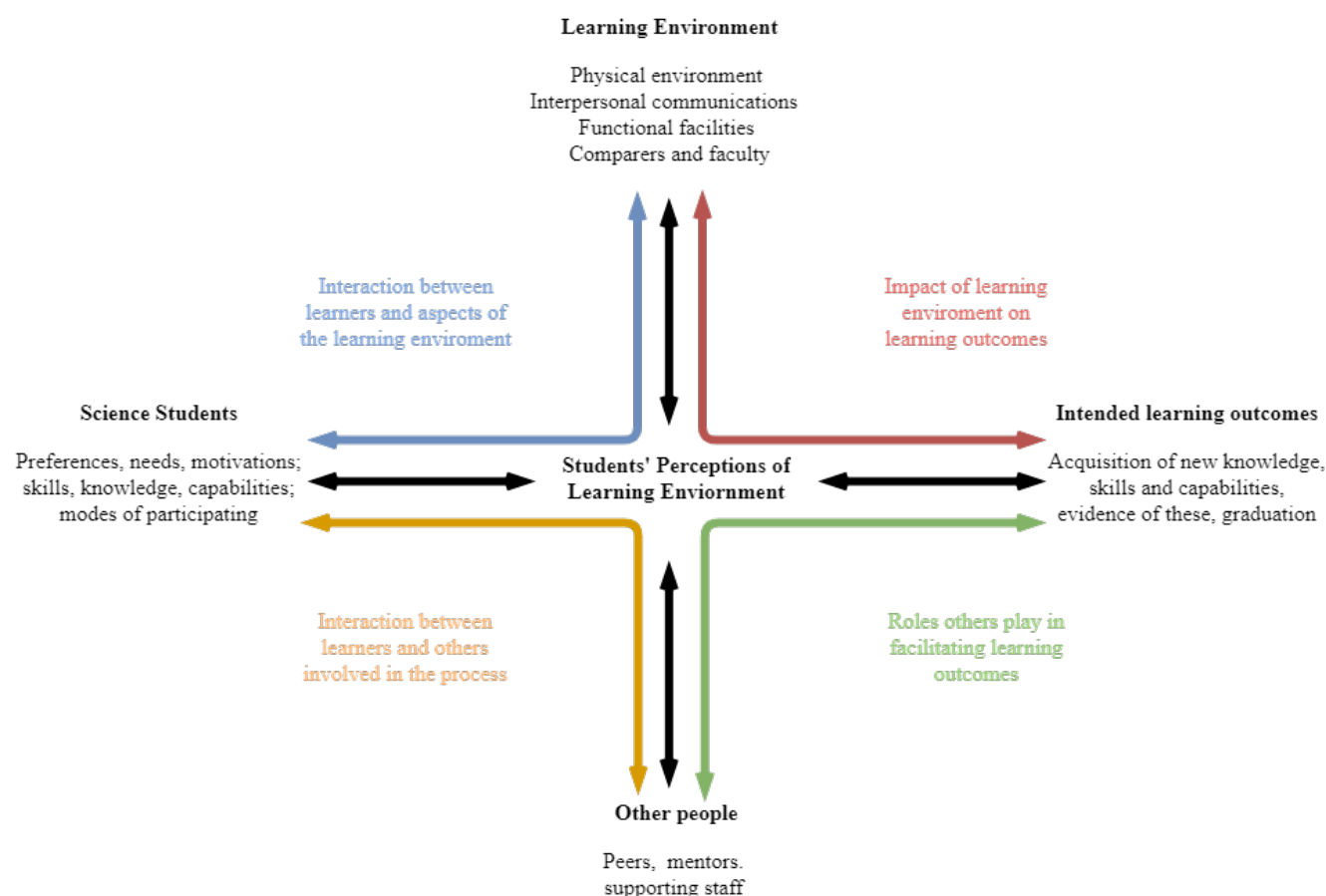
Abstract

Background/Objectives: Learning environment plays a crucial role in students' academic achievements. To understand this relationship, the study explores the perceptions of international science students in degree programs. **Methods/Statistical analysis:** This study used a mixed-method research design. Five interviews were conducted to explore and confirm the quantitative findings. Dundee Ready Educational Environment Measure (DREEM) questionnaire was used to collect quantitative data from a sample size of 71 participants in three faculties, including life sciences, chemistry, and physics. Qualitative data were collected through semi-structured interviews. Cronbach's alpha, Mean, standard deviation, ANOVA, and thematic analysis were conducted to analyze the data. **Findings**: The overall mean score of the DREEM was 142.49/200, indicating that international science students held positive perceptions of their learning environment. However, interviews explored the problematic areas, such as lack of a support system for students who got stressed, orientations about degree programs do not provide information for the next steps during the programs. Labs are well-equipped; however, all labels and instructions inside labs are in the Chinese language. **Conclusion**: There is a need for a student support system to enhance the learning environment. Well-planned orientation should be conducted at the start and mid of the programs to facilitate students' learning environment.

Keywords: Science; perceptions; learning environment; student support system; international students

1 Introduction

Graphical Abstract

Learning Environment

Physical environment
Interpersonal communications
Functional facilities
Comparers and faculty

Interaction between
learners and aspects of
the learning enviroment

Impact of learning
enviroment on
learning outcomes

Science Students

Preferences, needs, motivations;
skills, knowledge, capabilities;
modes of participating

**Students' Perceptions of
Learning Enviornment**

Intended learning outcomes

Acquisition of new knowledge,
skills and capabilities,
evidence of these, graduation

Interaction between
learners and others
involved in the process

Roles others play in
facilitating learning
outcomes

Other people

Peers, mentors.
supporting staff

When many students choose to study abroad, they often conceptualize modern foreign education systems and learning environments that are entirely different from those in their home countries. Often, the learning environment is also an essential criterion for measuring the quality of a university. The learning environment creates a pleasant learning atmosphere and inevitably cultivates high-quality students as well. So, what is the better learning environment for prestigious world-class universities? University is not a paradise, nor is it a place of entertainment, but a platform before entering the workplace. Students find this place so familiar but completely different from their previous one, and they need to adapt and face it bravely.

The learning environment is generally divided into the surrounding physical environment and interpersonal communication atmosphere during learning, that is, people and things. Excellent talents create a pleasant environment, and first-class environments cultivate high-end talents. Academic growth, actions, and health of students are affected by the educational setting in which they stay and study [1–3].

Functional facilities such as meeting halls, workshops, educational events, and the environment produced by the comparers and faculty are elements of learning environment [4–6]. Researchers have pointed out an outstanding debate on topics and problems relevant to the learning environments. Learning environments have a significant influence on students' attitudes toward learning [7–9], understanding of practice [10], and the educational outcomes achieved [8,11].

Educational and learning attainments of students are influenced by their learning environment [12–14]. Numerous methods have been introduced to evaluate the perspectives of students regarding their learning environment [1,6,15,16]. The learning environment includes a wide variety of factors in the fields of social, pedagogical, scientific, cultural, and practical actions [17].

Effective teaching and learning are attributed to a healthy academic environment[18]. Academic growth, attitudes, and well-being of students are affected by their learning environment[1–3].

However, students' previous educational attainment has no significant influence on how they assess their current learning environment, the essentials of the teacher-controlled learning environment, and how they optimistically influence the students' mode of approach to their learning and the learning results they may accomplish[9]. The quality of the instructive atmosphere reflects the excellence of the course[2].

Positive perceptions about the course environment imply a student-centered approach by the university, which might create successful results for students[19]. However, heavy workload increases facade dispensation and deprives quality education results and satisfaction with the learning environment. Students who perceived their learning environments to confirm excellent instruction reported themselves more likely to embrace meaning-based and less likely to follow reproductive learning approaches[9].

The analysis of the relationship between learning methods and assessment of the learning environment will be more beneficial at the departmental level, and the recognition of such findings at this stage may be required to immediately complement the examination and modification of program design and teaching activities[20].

Scientific knowledge can make people get along with nature more harmoniously, and it can also make people's lives more convenient. Moreover, in the process of scientific learning, learners can promote the development of personal cognitive levels while learning and improving their memory, comprehension, and comprehensive analytical capabilities. The role of mental training lies in science education. The salient feature of science education is that individuals have direct contact with facts. Understanding nature from observation, summarizing the laws, and drawing conclusions one by one are crucial features of science education.

This study aimed to add to the body of knowledge, theoretical and realistic contributions about international science students' perceptions of their learning environment. The improvement of the learning environment is an essential goal for higher education institutions. This study investigated international students' perceptions of the learning environment concerning three different science faculties: Physics, Chemistry, and Life Sciences. The following research questions guided the study:

1. How do international science students in degree programs perceive their learning environment?
2. Is there any significant difference among science students' perceptions of learning environment based on their enrolled program?
3. Is there any significant difference among science students' perceptions of learning environment based on their stay in China?

2 Materials and Methods

This study used a mixed-method research design based on explanatory sequential research design[21–23]. First, quantitative data were collected. And in the second phase, qualitative data were collected through semi-structured interviews.

2.1 Participants and settings

The population of the study is international students who are enrolled in degree programs on scholarships and self-financed and having student visas from 12 different countries of the world, including Pakistan, Yemen, Egypt, Australia, Sudan, Ethiopia, Iraq, Russia, Nigeria, Cameroon, Japan, and Rwanda. All students were non-Chinese and are fluent in the English language. The final samples for the quantitative data comprised 71 master and doctoral students from three faculties of the university, including Physics, Chemistry, and Life sciences. Five participants were selected purposefully for qualitative data collection.

2.2 Instruments

The research instruments include two questionnaires and one interview guide. First, an ad-hoc questionnaire was used to collect the demographics of the participants. Second, the DREEM questionnaire[15] was used to collect data regarding the perceptions of the participants. The DREEM questionnaire (see Table 1 for detailed information) consisted of 50 items and five dimensions that have been adopted/adapted into several languages and have been used in numerous educational environments around the world including pharmacy, nutrition, dentistry, chiropractic, and education[19,24–29].

A five-point Likert scale was used to measure each item of the DREEM questionnaire: (0) Strongly disagree, (1) Disagree, (2) Neutral, (3) Agree, and (4) Strongly agree. All negative items were scored reversely. Third, a semi-structured interview protocol was used to collect qualitative data.

2.3 Data collection

First, a random sampling technique was used to collect quantitative data for this study. A detailed, informative message was sent to all students about the questionnaire purpose in the WeChat groups so that every student interested in the study could participate. Afterward, an online link of recruitment blurb and DREEM questionnaire was sent in May 2020 through WeChat to all international students enrolled in master and doctoral degree programs and they were requested to complete it within two weeks.

After quantitative data collection and analysis, an interview guide was developed to collect qualitative data, which addressed the specific problem areas. Few interview questions asked, were: how do you describe the learning environment in your university (e.g., teachers, labs, facilities, etc.)? Do you think the teachers in your department are well trained? Please explain your answer. How do you perceive your academic motivation?

We recruited five interviewees through the snowball sampling technique and all five interviews were conducted through skype because of COVID-19. All interviews were audio-recorded with the permission of interviewees. Each interview lasted for 30-35 minutes.

2.4 Data analysis

Quantitative data were analyzed using IBM SPSS Statistics[30] version 24.0. Later, all qualitative data were transcribed and analyzed using thematic coding[31,32].

2.5 Ethical consideration

First, ethical approval was obtained from the university committee. After the approval, the data collection process was started— a detailed recruitment blurb attached to the questionnaire as a first part. If participants agreed to participate in the study, they proceeded to the next part of the questionnaire. All information of participants were kept confidential.

3 Results

Extensive stats are provided in order to enable certain entities to analyze the data reported here[33]. The Cronbach's alpha for the DREEM was 0.91. It showed that the internal consistency of the questionnaire was suitable for further use. Figure 1 also reports the statistics data for the DREEM subscales.

3.1 Interpretation protocol of the DREEM questionnaire

Table 1 consists of detailed information including dimensions of the DREEM questionnaire, scoring procedure for each dimension and overall scoring, negative items and scoring procedure[3,15].

Table 1. Interpretation protocol of the DREEM questionnaire

Dimensions	Items	Scoring Procedure
Students' perceptions of learning	12	0-12, very poor 13–24, teaching is viewed negatively 25–36, a more positive approach 37–48, teaching highly thought of
Students' perceptions of teachers	11	0-11, abysmal 12–22, in need of some retraining 23–33, moving in the right direction 34–44, model teachers
Students' perceptions of atmosphere	12	0-12, a terrible environment 13–24, many issues that need changing 25–36, a more positive atmosphere 37–48, a good feeling overall
Students' academic self-perceptions	8	0-8, feeling of total failure 9–16, many negative aspects 17–24, feeling more positive side 25–32, confident
Students' social self-perceptions	7	0-7, miserable 8–14, not a nice place 15–21, not too bad 22–28, very good socially
Total items	50	very poor (0–50), has plenty of problems (51–100), more positive than negative (101–150), excellent (151–200)
Mean score of items		3 or more are true positive points. Between 2.0 and 3.0 are aspects of the educational environment that could be enhanced. 2.0 or less problem area
Negative items = 9	4, 8, 9, 17, 25, 35, 39, 48, 50	Reverse scoring used for these items

3.2 Demographic information

A total of 71 completed questionnaires were integrated into the concluding investigation. The majority of the participants were from the school of chemistry (42.26%), and Males accounted for 57.7%. Among them, most of the participants were Ph.D. students (57.75%). The mean age score was 24.4 years (see Table 2).

Table 2. Demographic characteristics of participants.

n=71	Number(n)	Percentage (%)
Gender		
Male	41	57.7
Female	30	42.3
Age(years)		
20-29	51	71.9
30-39	18	25.3
≥40	2	2.8
Level of study		
Master	30	42.25
PhD	41	57.75
Major		
Physics	13	18.30
Chemistry	30	42.26
Life Sciences	28	39.44
Years of stay in China		
Below 1 year	13	18.32
1-3 (years)	40	56.33
3-5(years)	18	25.35

3.3 Quantitative findings

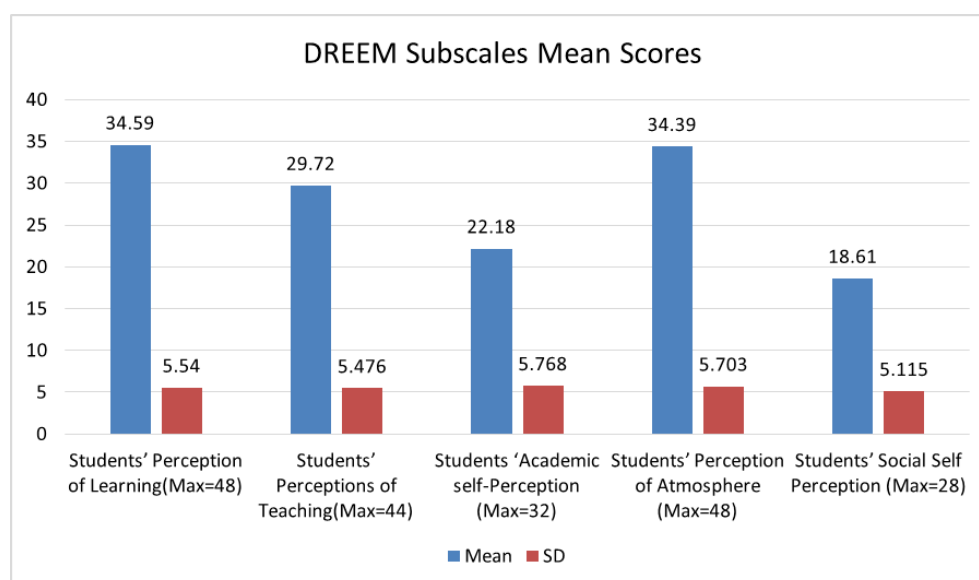*3.3.1 Overall perceptions of International science students' towards their learning environment*

Fig 1. DREEM sub scales mean scores

The overall mean DREEM score was 142.49. Furthermore, DREEM subscales' findings (Figure 1) show the direction of the perception of students. Students were more positive about learning; they believe that the learning environment is moving in the right direction; they feel more positive about self-academic. Moreover, students were more positive about the atmosphere, and they had perceptions that student social life is not too bad. These findings are according to criteria defined earlier (Table 1) about the mean score interpretation of DREEM.

3.3.2 Perceptions about the learning environment based on the enrolled program

Table 3. Students' perceptions of learning environment based on their majors.

	Sum of Squares	df	Mean square	F	Sig.
Between Groups	634.596	2	314.298	1.255	0.27
Within Groups	14548.649	59	251.839		
Total	15183.246	61			

p < 0.05

An ANOVA was conducted, and results (Table 3) showed that there were no significant differences in the learning environment of students according to their enrolled program [F (2, 59) = 1.255, p = 0.27].

3.3.3 Perceptions based on the number of years stay in China

Table 4. Students' perceptions of learning environment based on their stay in China

	Sum of squares	df	Mean Square	F	Sig.
Between Groups	563.684	2	281.842	1.114	0.34
Within Groups	14619.562	59	252.061		
Total	15183.246	61			

p < 0.05

An ANOVA was conducted, and results (Table 4) showed that there were no significant differences in the perceptions of students on the learning environment based on their stay in China [F (2, 59) = 1.114, p = 0.34].

3.3.4 Problem areas in learning environment

Table 5. Problem areas in learning environment

Sub-Scale	Problem Area	Mean
Students' Social Self Perception (SSSP)	There is a good support system for students who get stressed I am rarely bored in class	1.85 1.90
Students' Perception of Learning (SPoL)	The teaching over emphasizes theoretical learning	1.82

During the quantitative analysis, we found some problem areas to address these problems. Further, semi-structured interviews were conducted.

3.4 Qualitative findings

Interviews were conducted to explore and understand the questionnaire findings in a sophisticated way. The following themes were generated from the qualitative data.

Fig 2. Themes from qualitative data

Language

Most Students faced a language barrier during their first year of study. Most of them coped in the coming years.

I came three years before and was shocked to see that everything is in the Chinese language. I spent one year in language learning, but my level is still very low compared to that required for academic learning. My lab-mates are cooperative, however, I felt terrible when I did not get their meanings. All stuff, including chemicals, machines, or manuals are in Chinese, so it is challenging coping up with this situation. I do believe if I lack in any skill, language is the major cause (Student 1)

The orientation of the program

International students always lack information compared to the locals. So, orientations play an essential role in their adjustment to new places. Orientation could be multiple, e.g., general orientation, program orientation, etc.

When we arrived at university, the international office gave us a general orientation about our scholarship, faculty, and other social life-related things. However, after this, we did not get any proper orientation. I am going to graduate but do not know the credits hours of the program, mandatory courses, optional courses, graduation requirements. It is challenging for me. Our school secretary also is not well aware of these things (Student 3)

Teaching

Teaching is an essential part of the learning environment. A good teacher can lead the whole team toward success.

There is no doubt about that in teacher capabilities and knowledge. Faculty members have a strong base of their respective domains. They are well-known in their respective areas and facilitate the students with their innovative ideas. All the faculty members are encouraged in knowledge sharing and proactive (Student 2)

My supervisor is a good man. He cannot speak English, but he asked one student as my assistant for communication. Although it is good, I think most of the time I failed to communicate my feelings and thinking (Student 5)

I think there should be some training programs for teachers. In my opinion, international students do not receive the guidance they need (Student 3)

I think students do not receive the necessary required training. They have to learn most of the things on their own and train themselves. Apart from that lab, other facilities are excellent (Student 2)

Lab facilities

Labs are the essential resources for science degree programs. If a university provides an excellent lab facility, it leads its students towards success.

We have very good and advance labs. However, most of the machines and equipment are in the Chinese language. So, often we need to ask for help from Chinese lab-mates (Student 4).

Student support system

A student support program is a basic requirement for a modern learning environment. Students may face many problems during their stay in university. For example, students may get depressed; they may be depressed due to academic work or homesickness. Students may face problems during their study period, so student support programs can help to resolve these issues.

I am self-motivated. I do not think school is helping in any significant way to improve my motivation. I have not found any support group here, and students are on their own (in my case) (Student 4)

4 Discussion

This study was conducted to explore the international students' perceptions about the learning environment in their science degree programs. Management of the learning environment is an essential aspect of program evaluation[29]. The researchers used the DREEM questionnaire and semi-structured interviews to investigate international students' perceptions of the learning environment concerning three different science faculties: Physics, Chemistry, and Life Sciences. The findings of this study concluded that the average mean DREEM score was 142.49/200, indicating that students had more positive perceptions than negative[15,27].

Furthermore, five sub-scales of the DREEM questionnaire indicated a positive learning environment: SPoL =34.69/48 means more positive perception, SPoT =29.72/44 means moving in the right direction, SASP = 22.18/32, means feeling more on the positive side, SPoA = 34.39/48 means a more positive atmosphere, SSSP = 18.61/28 means not too bad. The findings of this study are consistent with previous studies[3,27,29].

Students had a better perception of the teaching atmosphere than about social self-perception and Learning. Students' academic progress, behavior, and well-being are influenced by the learning environment within which they study[1–3].

All five interviewees reported that they did not get any detailed orientation about their program. Few pointed out that all machines and materials are in the Chinese language in labs and non-availability of the student support system for students who got frazzled up. None availability of a sound support system for stressed students and theoretical emphasized learning were also identified as the most considerable problems by learners. Researchers pointed out that higher education is supposed to develop a good quality educational environment. The academic setting covers a wide variety of factors in the fields of social, pedagogical, scientific, cultural, and realistic science[17]

5 Conclusion

The study shows that students participating in science programs have favorable views about their educational environment. Students identified several areas of their learning environment that are addressable to enhance the learning environment positively. The student support system is needed to help students who suffer from stress and other study-related problems. Moreover, well-planned orientation should be conducted for students at the start and mid of the programs to facilitate their learning.

Limitation of the study

This study had a few limitations. First, this is a small-scale study and the number of participants is limited. Second, only the few science programs were included in this study. Third, only five interviews were conducted. So findings of the study cannot be generalized.

Future recommendations

In the future, this type of study could be conducted comparatively to figure out the real situation of the learning environment, overall. Furthermore, future studies could include all science disciplines. Future researchers should concentrate on focusing the need for learning on skill development and social problem-solving; how learning can be more realistic for international students.

Although the current study did not focus on COVID-19 effects on the learning environment in universities, however, universities still need to prepare crisis teaching for their learning environment for future threats similar to COVID-19 and should be tackled in academic perspectives especially international students' learning.

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