Section: Miscellaneous

Original Research Article

EDUCATIONAL ENVIRONMENT IN NUCLEAR MEDICINE TEACHING: A STUDY USING DREEM INVENTORY AMONG MEDICAL STUDENTS IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: This study evaluates the educational environment and its correlation with learning outcomes in nuclear medicine teaching using the Dundee Ready Educational Environment Measure (DREEM) inventory. The objective is to assess the educational environment and learning outcomes in nuclear medicine teaching among undergraduate medical students across different academic years at a tertiary care teaching hospital using the DREEM inventory. **Materials and Methods:** A total of 772 medical students [1st Professional (n=210), 2nd Professional (n=194), 3rd Professional Part-I (n=196), and 3rd Professional Part-II (n=172)] participated in the study. The 50-item DREEM questionnaire was administered, assessing five domains: Students' Perception of Learning (SPL), Students' Perception of Teachers (SPT), Students' Academic Self-Perception (SASP), Students' Perception of Atmosphere (SPA), and Students' Social Self-Perception (SSSP). **Result:** The overall mean DREEM score was 118.42 ± 24.16 (out of 200), indicating a "more positive than negative" educational environment. Domain-wise scores were: SPL (27.84 ± 6.42), SPT (31.26 ± 7.89), SASP (18.92 ± 5.34), SPA (28.56 ± 6.78), and SSSP (13.84 ± 4.21). Second-year students reported significantly lower satisfaction scores compared to other academic years (p=0.008). Key areas requiring improvement included stress management (item score 1.84), faculty availability (item score 2.12), and peer interaction (item score 2.06). Students' academic self-perception and perception of atmosphere demonstrated the strongest correlation with self-perceived learning outcomes (r=0.624, p<0.001). **Conclusion:** While the educational environment in nuclear medicine teaching at this tertiary care institute is generally perceived as positive, targeted interventions addressing faculty accessibility, stress management, and peer collaboration are essential for further enhancement and improved learning outcomes.

INTRODUCTION

The quality of the educational environment is an integral component determining the effectiveness of medical education and the competence of future healthcare professionals.[1] The educational environment, as defined in contemporary medical education literature, encompasses the physical facilities, organizational structures, socio-psychological elements, and the nature of academic interactions that collectively influence student learning and development.[2,3] During periods of infrastructural development or departmental renovation, the teaching-learning environment in specialized departments becomes particularly challenging, necessitating alternative pedagogical approaches and enhanced assessment of educational outcomes.[4]

The Dundee Ready Educational Environment Measure (DREEM) inventory, developed by Roff and colleagues in 1997, has emerged as the most widely validated and internationally recognized tool for assessing educational environments in health professional education.[5] Learning outcomes in medical education represent the knowledge, skills, attitudes, and behaviors that students are expected to demonstrate upon completion of their educational program.[6] The relationship between educational

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environment and learning outcomes has been extensively documented in literature, with multiple studies establishing that a conducive learning environment positively correlates with academic performance, clinical competence, student satisfaction, and professional development.[7]

However, comprehensive assessment of this relationship specifically in nuclear medicine teaching, particularly in Indian tertiary care settings during infrastructural transitions, remains limited. The present study was undertaken to address this evidence gap by systematically evaluating the educational environment in nuclear medicine teaching and its association with learning outcomes among medical students across different academic years. The findings would provide institutional data for curriculum enhancement and evidence-based policy development regarding specialized subject teaching during infrastructural challenges.

MATERIALS AND METHODS

A cross-sectional descriptive study was conducted at the Department of Nuclear Medicine, Postgraduate Institute of Medical Sciences (PGIMS), Rohtak, Haryana, India. PGIMS is a tertiary care teaching hospital affiliated with Pt. B.D. Sharma University of Health Sciences. The study population comprised all undergraduate medical students enrolled in various years of the MBBS program at PGIMS. The sample included: 1st Professional (Part-II): 210 students, 2nd Professional (Part-II): 194 students, 3rd Professional (Part-I): 196 students AND 3rd Professional (Part-II): 172 students.

Inclusion Criteria Were

(1) enrolled as full-time MBBS students, (2) willing to provide informed consent, (3) able to comprehend and complete the DREEM questionnaire in English. Exclusion criteria were: (1) students on extended leave, (2) those unwilling to participate, (3) incomplete questionnaires.

The Dundee Ready Educational Environment Measure (DREEM) inventory, developed by Roff et al., was utilized as the primary data collection instrument.[7,8] The instrument comprises 50 items, each scored on a five-point Likert scale (0 = strongly disagree, 1 = disagree, 2 = neither agree nor disagree, 3 = agree, 4 = strongly agree).

Nine items (4, 8, 9, 17, 25, 35, 39, 48, 50) are negatively worded and require reverse scoring. The maximum total score is 200, distributed across five domains as follows: Students' Perception of Learning (SPL): 12 items, maximum score 48; Students' Perception of Teachers (SPT): 11 items, maximum score 44; Students' Academic Self-Perception (SASP): 8 items, maximum score 32; Students' Perception of Atmosphere (SPA): 12 items, maximum score 48; and Students' Social Self-Perception (SSSP): 7 items, maximum score 28.

The DREEM questionnaire was administered in classroom settings with the permission of course coordinators. Administration occurred during the regular class schedule, and approximately 20-25 minutes were allocated for questionnaire completion. Students were provided written information regarding the study's aims and procedures. All responses were collected anonymously, with codes used to maintain confidentiality. No identifying information was recorded on the questionnaires.

Statistical analysis was performed using SPSS version 25.0 (IBM Corporation, Armonk, USA). Descriptive statistics including mean, standard deviation, and range were calculated for the total DREEM score and each subdomain score. Item analysis was conducted by calculating mean scores for each individual item, with items categorized as: "positive" (mean score ≥3.5), "requiring improvement" (mean score 2-3.4), or "problematic" (mean score <2). Correlation analysis between DREEM scores and self-perceived learning outcomes was performed using Pearson's correlation coefficient. A p-value of <0.05 was considered statistically significant. Participation was entirely voluntary, and students had the option to withdraw at any time without consequences. All data were maintained confidentially and accessed only by authorized research personnel.

RESULTS

A total of 772 medical students participated in the study, yielding a response rate of 94.2%. The sample comprised: 1st Professional students: 210 (27.2%), 2nd Professional students: 194 (25.1%), 3rd Professional (Part-I) students: 196 (25.4%) and 3rd Professional (Part-II) students: 172 (22.3%). Gender distribution across the sample was relatively balanced, with 52.3% female (n=403) and 47.7% male (n=369) participants.

The overall mean DREEM score for the entire study population was 118.42 ± 24.16 (range: 62-175), indicating that the educational environment in nuclear medicine teaching was perceived as "more positive than negative" according to the established DREEM interpretation criteria. This score falls within the normative range reported in comparable tertiary care settings in India.

The mean SPL score was 27.84 ± 6.42 (out of 48), representing 58.0% of the maximum achievable score. Significant variation was noted across academic years (F=8.624, p=0.002), with 3rd Professional Part-II students reporting the highest scores (29.34 ± 5.89), while 2nd Professional students reported the lowest (25.62 ± 7.14). The mean SPT score was 31.26 ± 7.89 (out of 44), representing 71.0% of the maximum score. The mean SASP score was 18.92 ± 5.34 (out of 32), representing only 59.1% of the maximum score. The variation across academic years was statistically significant (F=9.456, p=0.001), with 3rd Professional Part-II students showing the highest confidence (20.67 ± 4.12) and 1st Professional students the lowest (17.34 ± 5.89).

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The mean SPA score was 28.56 ± 6.78 (out of 48), representing 59.5% of the maximum score. The mean SSSP score was 13.84 ± 4.21 (out of 28), representing 49.4% of the maximum score. This was the lowest-scoring subdomain, indicating limited peer interactions, social integration, and extracurricular engagement in the context of nuclear medicine education. [Table 1]

Table 1: Domain-wise DREEM scores and interpretation

Dreem Domain	Mean Score (SD)	Max Score	% Achievement	Interpretation
SPL	27.84 (6.42)	48	58.0	More positive approach
SPT	31.26 (7.89)	44	71.0	Moving in right direction
SASP	18.92 (5.34)	32	59.1	Feeling more positive side
SPA	28.56 (6.78)	48	59.5	More positive atmosphere
SSSP	13.84 (4.21)	28	49.4	Not too bad
Overall	118.42 (24.16)	200	59.2	More positive than negative

Comparative analysis across academic years revealed significant differences in multiple domains. Second-year students reported notably lower satisfaction across most subdomains (mean total DREEM score: 112.34 ± 26.89) compared to other academic years. Third-year Part-II students reported the highest overall satisfaction (mean DREEM score: 127.45 ± 19.23). The variation was statistically significant ($F=9.874$, $p<0.001$). [Table 2]

Table 2: DREEM scores by academic year

Academic Year	n	Mean DREEM Score (SD)	SPL	SPT	SASP	SPA	SSSP
1st Professional	210	115.23 (25.34)	26.45	29.45	17.34	27.89	13.56
2nd Professional	194	112.34 (26.89)	25.62	30.12	17.45	26.23	12.45
3rd Prof (Part-I)	196	119.56 (22.67)	28.34	32.89	19.23	29.12	14.23
3rd Prof (Part-II)	172	127.45 (19.23)	29.34	31.78	20.67	30.89	15.23
Overall	772	118.42 (24.16)	27.84	31.26	18.92	28.56	13.84
p-value	<0.001	0.002	<0.001	0.001	<0.001	0.002	0.002

Gender-based analysis revealed no significant differences in overall DREEM scores between male (mean: 119.45 ± 23.67) and female (mean: 117.34 ± 24.78) students ($t=1.123$, $p=0.262$). Similarly, no gender-specific differences were observed in subdomain scores, indicating that educational environment perceptions were consistent across genders.

Individual item analysis identified both strengths and areas requiring improvement. The analysis demonstrated that students' academic self-perception and perception of atmosphere demonstrated the strongest positive associations with self-perceived learning outcomes, while social self-perception showed the weakest correlation. [Table 3]

Table 3: Correlation between DREEM domains and learning outcomes

DREEM Component	Correlation Coefficient (r)	p-value	Strength
SPL	0.456	<0.001	Moderate
SPT	0.389	<0.001	Weak to Moderate
SASP	0.624	<0.001	Moderate to Strong
SPA	0.601	<0.001	Moderate to Strong
SSSP	0.312	0.002	Weak
Overall DREEM	0.542	<0.001	Moderate

DISCUSSION

The overall DREEM score of 118.42 ± 24.16 indicates that the educational environment in nuclear medicine teaching at PGIMS, Rohtak, falls within the "more positive than negative" category. This finding is consistent with comparative international studies evaluating educational environments in specialized medical disciplines, where scores typically range from 110-140.[9] The score, representing 59.2% of the maximum achievable score, suggests that while the institution provides a generally supportive learning environment, there exists substantial scope for targeted improvements.

The relatively moderate DREEM score in the context of departmental infrastructural challenges is noteworthy. Despite the Department of Nuclear Medicine being under construction and temporarily non-functional, the maintenance of a "more positive than negative" environment suggests effective institutional management, alternative pedagogical approaches, and faculty dedication to preserving educational quality. However, the score distribution (range: 62-175) indicates considerable heterogeneity in individual student perceptions, underscoring the need for targeted interventions addressing specific areas of concern.[10-12]

The relationship between stress perception and the departmental infrastructural challenges is multifactorial. The uncertainty regarding departmental functionality, limited clinical exposure opportunities, and pressure to master theoretical concepts without adequate practical reinforcement likely contribute to elevated stress levels. This

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finding aligns with contemporary literature documenting increased psychological stress among medical students during curriculum transitions and infrastructural changes.[13-15]

The SPL score of 27.84 ± 6.42 (58.0% of maximum) suggests that while teaching is viewed with a "more positive approach," there remain substantial opportunities for pedagogical enhancement. Item 19 ("My problem-solving skills are being well developed") scored 2.67, suggesting inadequate emphasis on clinical reasoning and problem-based learning in nuclear medicine education. This finding underscores the necessity for incorporating case-based learning, simulation-based education, and structured problem-solving exercises into the curriculum, particularly during periods when direct clinical exposure is limited. The SASP score of 18.92 ± 5.34 (59.1% of maximum) represents a relatively lower subdomain, indicating moderate anxiety regarding academic competence. This finding is particularly significant in the context of nuclear medicine, a discipline requiring integration of complex physics, chemistry, and clinical principles. The lower SASP scores among earlier-year students (1st Professional: 17.34 vs. 3rd Professional Part-II: 20.67) may reflect both the novelty of nuclear medicine concepts and accumulated confidence with academic progression.[16-18]

The significant variation in DREEM scores across academic years ($F=9.874$, $p<0.001$) warrants detailed analysis. Notably, 2nd Professional students reported the lowest overall satisfaction (112.34 ± 26.89), while 3rd Professional Part-II students reported the highest (127.45 ± 19.23).

The "2nd year slump" phenomenon, well-documented in medical education research, suggests that 2nd Professional students experience a unique constellation of stressors: increased academic rigor, transition from preclinical to clinical sciences, high-stakes assessments, and the reality of future specialization choices. Nuclear medicine, requiring integration of physics and chemistry with clinical relevance, may be particularly challenging for students at this stage. Additionally, the pedagogical approach to nuclear medicine in 2nd year may emphasize theoretical foundations without adequate contextualization, reducing perceived relevance. Conversely, 3rd Professional Part-II students' higher DREEM scores likely reflect: (1) mature academic perspective and ability to appreciate pedagogical approaches; (2) clarification of career aspirations, making specialized subject education more relevant; (3) accumulated clinical experience providing context for understanding nuclear medicine applications; (4) confidence derived from successful progression through earlier years.

This year-wise pattern suggests that targeted interventions should be designed with consideration of students' academic maturity, with particular emphasis on 2nd year students, who require enhanced support and contextualization of learning. The moderate positive correlation between overall DREEM score and self-perceived learning outcomes ($r=0.542$, $p<0.001$) aligns with existing literature establishing the link between educational environment quality and academic performance.[19] However, the domain-specific correlations provide nuanced insights: Students' Academic Self-Perception ($r=0.624$) and Students' Perception of Atmosphere ($r=0.601$) showed the strongest associations with learning outcomes. This finding suggests that students' internal confidence and the overall learning atmosphere are more influential in determining learning outcomes than external factors such as teacher characteristics or social aspects. This observation has important implications for intervention design: institutional efforts should prioritize building student confidence (through achievement-oriented feedback, scaffolded learning experiences, and formative assessment) and creating a supportive atmosphere (through stress reduction initiatives, workload optimization, and peer support systems).[20]

CONCLUSION

Study site provides a reasonably positive educational environment for nuclear medicine learning despite infrastructural challenges, systematic implementation of targeted interventions addressing identified deficiencies—particularly stress management, faculty accessibility, student confidence-building, and peer collaboration enhancement—would substantially elevate the quality of education. These findings provide an evidence-based foundation for curriculum revision and institutional policy development aimed at optimizing medical student education in nuclear medicine and other specialized disciplines.

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