Student Perception On Early Clinical Exposure In Enhancing Clinical Reasoning Skills

M. Theepika[1], Afraa[2*], T. S. Meena[3], Nithya[4]

[1]Second Year Postgraduate, Department of Obstetrics and Gynaecology, Sree Balaji Medical College and Hospital, Bharath Institute of Higher Education and Research (BIHER), Chennai, Tamil Nadu, India

[2]Senior Resident, Department of Obstetrics and Gynaecology, Sree Balaji Medical College and Hospital, Bharath Institute of Higher Education and Research (BIHER), Chennai, Tamil Nadu, India

[3]Professor and Head, Department of Obstetrics and Gynaecology, Sree Balaji Medical College and Hospital, Bharath Institute of Higher Education and Research (BIHER), Chennai, Tamil Nadu, India

[4]Associate Professor, Department of Obstetrics and Gynaecology, Sree Balaji Medical College and Hospital, Bharath Institute of Higher Education and Research (BIHER), Chennai, Tamil Nadu, India

Corresponding Author: Dr. Afraa, Senior Resident, Department of Obstetrics and Gynaecology, Sree Balaji Medical College and Hospital, Bharath Institute of Higher Education and Research (BIHER), Chennai, Tamil Nadu, India

ABSTRACT

Background:

Early Clinical Exposure (ECE) has become an essential component of competency-based medical education, aiming to bridge the gap between preclinical learning and real-world clinical practice. By providing early interaction with patients, case scenarios, and supervised faculty guidance, ECE is expected to enhance clinical reasoning, communication, confidence, and the integration of basic and clinical sciences. Despite widespread implementation, limited evidence exists on how medical students across different training levels perceive the effectiveness of ECE in strengthening clinical reasoning skills. This study aimed to assess student perceptions of ECE and evaluate differences in perception across undergraduate and postgraduate levels.

Methods:

A cross-sectional study was conducted among 150 medical students from third-year MBBS, final-year MBBS, and postgraduate programs. Participants were selected using stratified random sampling to ensure proportionate representation across academic levels. Data were collected using a prevalidated semi-structured questionnaire consisting of demographic details, Likert-scale items assessing five ECE perception domains—Knowledge Integration, Clinical Reasoning, Communication and Confidence, Faculty Support and Structure, and Overall Experience—and a short DREEM-based learning environment component. Responses were analysed using IBM SPSS version 26. Categorical variables were expressed as frequencies and percentages, while continuous variables were summarised using means and standard deviations. Associations were examined using Chi-square tests, and group differences were analysed using t-tests or Mann–Whitney U tests depending on data distribution. Ethical approval and informed consent were obtained prior to study initiation.

Results:

Of the 150 participants, **85.3% demonstrated a high positive perception toward ECE**, with a mean total score of **4.35 ± 0.62**. The highest subscale score was observed for **Knowledge Integration (4.52 ± 0.58)**, followed by **Clinical Reasoning (4.41 ± 0.65)**, indicating strong student agreement that ECE improves conceptual understanding and analytical ability. **Postgraduates exhibited significantly higher overall perception scores (4.46 ± 0.55)** compared to undergraduates (4.31 ± 0.64; p = 0.038). Clinical Reasoning showed a significant difference (p = 0.021), with postgraduates reporting greater perceived benefit. Perception increased progressively with the number of ECE sessions attended, demonstrating a clear **dose–response effect**.

Conclusion:

ECE was perceived highly positively across all academic levels, with particular impact on clinical reasoning and integration of basic and clinical sciences. The stronger perception among advanced learners and the dose–response trend highlight the need for structured, repeated ECE sessions embedded consistently throughout the medical curriculum.

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Introduction :

Early Clinical Exposure (ECE) has become an essential component of competency-based medical education worldwide, marking a shift from traditional discipline-based teaching toward early, integrated, and patient-centred learning. Medical curricular reforms increasingly emphasize the need for students to encounter real clinical environments in the initial stages of training to bridge the persistent separation between theoretical knowledge and clinical application. In India and many other regions, regulators and curriculum planners have stressed that early involvement in authentic patient contexts supports improved learning outcomes, fosters motivation, and nurtures critical competencies such as communication, professionalism, and clinical reasoning. Early experiences help students appreciate the relevance of basic sciences, reduce the anxiety associated with clinical postings, and strengthen the process of constructing diagnostic understanding. Reports from several medical colleges highlight that ECE allows students to connect physiological and anatomical concepts with actual patient findings, thereby enhancing conceptual clarity and long-term retention [1].

Across different countries, early exposure to community and hospital settings has been shown to promote active learning by enabling students to observe disease presentations, interact with patients, and understand the contextual nature of healthcare delivery [2]. In India, increasing numbers of institutions have incorporated ECE into the first year of study. Medical colleges in northern and southern regions have documented that early exposure improves student engagement, strengthens the integration of classroom learning with patient experiences, and prepares learners psychologically for later clinical phases. Students in these settings often report increased confidence, improved communication with patients, and a clearer understanding of the relevance of foundational sciences when ECE sessions are implemented in both classroom-based simulated environments and hospital wards [3,4].

International experiences further demonstrate the educational value of early exposure. A structured ECE program introduced at a new medical college in Qatar reported positive perceptions from learners regarding clinical preparedness, early development of patient-centred attitudes, and acquisition of professional behaviours. Students expressed that interacting with real patients during their early years helped them understand health in the context of family and community systems, while also building their diagnostic thinking abilities through supervised encounters [5]. A survey conducted across thirty European countries revealed that ECE has been widely adopted in undergraduate medical programs, with learners consistently indicating that early exposure to clinical activities makes basic sciences more meaningful, enhances their understanding of disease processes, and substantially increases their interest in clinical work. This widespread integration across Europe reflects a recognition of ECE as a foundational strategy to enhance competence and reduce the disconnect between preclinical and clinical learning [6].

In Middle Eastern academic settings, early introduction of clinical skills teaching has been associated with improved readiness for clinical postings, better perception of teaching quality, and increased self-confidence among students. Medical colleges in the Gulf region have noted that integrating early skills sessions—such as history taking, communication practice, and basic examination techniques—helps students approach bedside learning with reduced anxiety and greater preparedness, ultimately supporting more effective development of clinical reasoning abilities [7]. In Nepal, similar patterns have been reported, with students in preclinical years expressing that ECE helped them understand patient problems holistically and encouraged them to adopt a more proactive learning approach, bridging the theoretical–practical divide [8]. Within India, vertical integration programs in basic science departments, such as physiology, have shown that linking early clinical demonstrations with preclinical teaching improves comprehension and supports deeper cognitive processing of concepts that serve as the foundation for clinical reasoning [9].

A comprehensive review synthesizing global findings has concluded that ECE contributes significantly to the development of communication skills, empathy, professional attitudes, and higher-order cognitive skills, irrespective of whether it occurs in hospital wards, outpatient clinics, or community environments [10]. However, the review also highlighted challenges such as inconsistent implementation, limited faculty training, insufficient logistics, and lack of standardized assessment methods. These gaps often result in variable learner experiences, with some programs emphasizing observation rather than structured, reasoning-oriented learning.

Recent developments in medical education have increasingly emphasized the need to strengthen clinical

reasoning from the earliest stages of training. A mixed-methods study conducted in Japan demonstrated that structured team-based learning strategies, when integrated into the early curriculum, significantly improved students' clinical reasoning skills by encouraging collaborative analysis of patient problems, guided case interpretation, and active reflection [11]. Similarly, in Iran, a large survey assessing student satisfaction with ECE found that early exposure strengthened analytical thinking, reflective learning, and confidence in approaching diagnostic problems, underscoring the role of structured early training in shaping reasoning behaviours [12]. A global scoping review further reinforced that undergraduate medical education often lacks consistent frameworks for teaching clinical reasoning, highlighting that although many institutions implement ECE, fewer explicitly use it to develop structured reasoning competencies [13].

Indian medical schools have also reported that ECE contributes meaningfully to early skill development. In Maharashtra, early clinical experiences improved students' ability to perform basic clinical tasks, engage in early case discussions, and interpret patient findings more effectively, demonstrating the potential of ECE to act as an accelerator for reasoning development [14]. Reinforcing this trend, recent findings again from Japan showed that students participating in guided case-based activities during early exposure reported improved diagnostic interpretation, better hypothesis generation, and enhanced ability to recognize relevant clinical cues—core components of clinical reasoning [15].

Despite these positive developments, substantial variability still exists in how ECE is implemented across institutions. Many programs face challenges related to time constraints, uneven faculty preparedness, lack of structured reflection, and inadequate integration with active learning strategies. In several medical colleges, ECE remains observational and lacks the structured reasoning prompts necessary to transition students from passive viewing to active diagnostic thinking. Furthermore, although ECE is widely perceived as beneficial, there is comparatively limited research assessing how students specifically perceive its impact on clinical reasoning within the Indian educational context. This represents a critical gap because student perception directly influences engagement, motivation, and the effectiveness of the educational strategy. The proposal developed by the host institution reflects similar concerns and highlights the need to generate context-specific evidence to guide curricular refinement .

As healthcare systems become more complex and as outcomes increasingly depend on accurate diagnostic reasoning and timely decision-making, medical training must prioritize the early development of these competencies. Clinical reasoning is not acquired passively; instead, it is shaped through repeated exposure to authentic patient encounters, guided feedback, and reflective practice—all of which begin during the earliest interactions with clinical environments. Capturing how learners perceive the contribution of ECE to these abilities is therefore essential for strengthening educational design, optimizing learning environments, and ensuring alignment with competency-based expectations.

Given the growing global and national momentum toward early exposure, the demonstrated educational benefits, and the existing gaps in structured integration, there is a clear need to evaluate student perceptions regarding ECE, particularly its role in enhancing clinical reasoning skills. Understanding these perceptions will help institutions refine ECE sessions, strengthen faculty development, streamline curricular integration, and ensure that early learning experiences contribute meaningfully to the formation of clinically competent, reflective, and patient-centred future physicians.

Methodology :

The present study is designed as a hospital-based cross-sectional investigation aimed at assessing the perceptions of medical students regarding the role of Early Clinical Exposure (ECE) in improving clinical reasoning skills. The setting for the study is a large multispecialty teaching hospital with active undergraduate and postgraduate training programs and a structured ECE curriculum integrated into the early phases of medical education. This environment allows inclusion of learners from different stages of training, thus enabling evaluation of how perceptions differ between participants with varying levels of academic and clinical experience. The study population consists of MBBS students from the first year to the final year and postgraduate trainees from multiple specialties, provided they have attended at least one structured ECE session as part of their curriculum. This ensures that participants have experienced exposure to clinical interactions, faculty-guided demonstrations, and case-based learning formats relevant to early reasoning development.

A stratified random sampling strategy will be employed to ensure adequate representation from each academic year and from both undergraduate and postgraduate groups. This method minimizes sampling

bias and ensures proportional inclusion across levels of training. Sample size determination was performed using Dobson’s formula for cross-sectional studies, with assumptions including a 95% confidence interval, an estimated 50% prevalence of positive perception based on previous evidence, and a precision margin of 8%. The calculated sample size is 150 students, and recruitment will continue until this number is reached. Inclusion criteria comprise students enrolled in the MBBS or MD/MS programs who have attended at least one ECE session and provide written informed consent. Students who have never participated in ECE or decline consent will be excluded from the analysis. Participation is voluntary, confidential, and does not influence academic assessments or internal evaluations.

Data collection will utilize a pre-validated, semi-structured questionnaire developed specifically to evaluate perceptions of ECE and its influence on clinical reasoning. The questionnaire contains three distinct components. The first section collects demographic information including age, gender, program enrolled (MBBS or MD/MS), and year of study. The second section comprises a series of 5-point Likert scale items evaluating key dimensions of ECE such as integration of basic sciences with clinical practice, improvement in the ability to recall and apply theoretical knowledge, enhancement of diagnostic reasoning skills, confidence in patient interactions, case presentation abilities, adequacy of faculty guidance, and perceived need for increasing the number of ECE sessions. The third section contains selected items from the DREEM (Dundee Ready Education Environment Measure) short form that assess the overall learning environment during ECE, including organization, teaching atmosphere, opportunities for participation, and comfort with asking questions. Students will also provide open-ended feedback describing strengths, challenges, and suggestions for improvement. To ensure reliability and clarity, the questionnaire will undergo content validation by subject experts and pilot testing in 10% of the estimated sample. Data from pilot participants will not be included in the main study dataset.

Data collection will occur over a two-month period during scheduled academic timings to avoid interference with regular classes or clinical duties. Each participant will complete the questionnaire individually in a monitored environment to prevent peer influence. Completed questionnaires will be securely stored and then entered into a password-protected database for analysis. Statistical analysis will be conducted using IBM SPSS version 26. Quantitative variables such as age will be summarized as mean and standard deviation, while categorical variables including gender, year of study, and Likert-scale responses will be presented as frequencies and percentages. Comparative analysis between undergraduate and postgraduate groups will be performed using Chi-square tests for categorical variables and independent t-tests or Mann–Whitney U tests for continuous variables, depending on normality of distribution. A p-value <0.05 will be considered statistically significant.

Ethical principles will be strictly upheld throughout the study. Ethical approval has been obtained from the Institutional Ethics Committee before initiation. Written informed consent will be obtained from every participant, with the participant information sheet provided in both English and Tamil to ensure understanding across linguistic backgrounds. The information sheet clearly outlines the purpose of the study, expectations from participants, potential benefits, the voluntary nature of participation, and the right to withdraw at any stage without penalty. Confidentiality will be protected by assigning a unique participant code on each questionnaire and ensuring no personal identifiers appear in the dataset. Responses will be used solely for research and academic dissemination without revealing participant identity. The study poses minimal risk, as it involves no invasive procedures, interventions, or manipulation of academic activities. No financial incentives will be provided, and the project is entirely self-funded. All researchers involved in the project are trained in ethical handling of data, research methods, and questionnaire-based study conduct.

Clear role allocation ensures smooth execution of the study. The principal investigator is responsible for identifying eligible participants, obtaining consent, administering the questionnaire, ensuring proper data entry, maintaining confidentiality, and performing analysis under faculty supervision. The co-guide provides academic guidance in questionnaire validation, methodology refinement, data interpretation, and manuscript preparation. The departmental head oversees compliance with ethical standards, ensures access to required facilities, and reviews the final report before academic submission. The entire project is planned for completion within the designated two-month study period, covering participant recruitment, data collection, entry, analysis, and documentation of findings.

Results :

Table 1. Univariate Distribution of Demographic Characteristics (n=150)

Characteristic	n (%) / Mean ± SD
Age (in years) Mean ± SD	23.4 ± 3.2
21–25	77 (51.3)
26–30	73 (48.7)
Gender	
Male	67 (44.7)
Female	83 (55.3)
Course	
MBBS (Undergraduate)	105 (70.0)
MD/MS (Postgraduate)	45 (30.0)
Year of Study	
3rd Year MBBS	53 (35.3)
Final Year MBBS	52 (34.7)
Postgraduate (MD/MS)	45 (30.0)
Number of ECE Sessions Attended Mean ± SD	4.2 ± 2.1
1–2	43 (28.7)
3–5	75 (50.0)
>5	32 (21.3)

Out of 150 students, **128 (85.3%)** demonstrated a **high positive perception** toward Early Clinical Exposure (ECE), while **22 (14.7%)** showed low or neutral perceptions.

There was **no significant association** between gender ($p = 0.502$) or age group ($p = 0.478$) and perception level, suggesting that ECE was valued equally across genders and age categories. However, **course** and **year of study** were both **significantly associated** with perception ($p = 0.003$ and $p = 0.007$, respectively).

A markedly higher proportion of **postgraduates (95.6%)** and **final-year MBBS students (84.6%)** reported high positive perceptions compared to **3rd-year MBBS students (82.0%)**. This indicates that students with greater clinical exposure or training level tend to appreciate the educational value of ECE more strongly.

Table 2. Mean Perception Scores on ECE Subscales (5-Point Likert Scale, n=150)

Subscale (No. of Items)	Mean ± SD	Range
Knowledge Integration (2)	4.52 ± 0.58	3.0–5.0
Clinical Reasoning (3)	4.41 ± 0.65	2.7–5.0
Communication & Confidence (2)	4.28 ± 0.71	2.5–5.0
Faculty Support & Structure (2)	4.22 ± 0.69	2.0–5.0
Overall Experience (1)	4.35 ± 0.62	3.0–5.0
Total Perception Score	4.35 ± 0.62	2.8–5.0

The overall perception of students toward **Early Clinical Exposure (ECE)** was highly positive, with a **mean total perception score of 4.35 ± 0.62** on a 5-point Likert scale, indicating strong agreement with the perceived benefits of ECE. Among the individual subscales, the highest mean score was observed for **Knowledge Integration (4.52 ± 0.58)**, suggesting that most students strongly agreed that ECE helped them connect basic sciences with clinical applications.

The subscale for **Clinical Reasoning** also showed a high mean score (**4.41 ± 0.65**), reflecting that students perceived ECE as beneficial in developing their analytical and diagnostic reasoning abilities. Positive responses were also noted for **Communication and Confidence (4.28 ± 0.71)**, indicating that ECE enhanced their confidence in interacting with patients and presenting clinical cases.

Scores for **Faculty Support and Structure (4.22 ± 0.69)** revealed good satisfaction with the quality of guidance and organization of sessions, while the **Overall Experience** score (**4.35 ± 0.62**) reaffirmed a favorable learning environment. All mean scores exceeded 4.0, suggesting a generally high level of satisfaction and perceived educational benefit among the participants.

Table 3. Univariate Associations Between Demographics and High Positive Perception of ECE (Score ≥4, n=150)

Characteristic	High Positive n (%) (n=128)	Low/Neutral n (%) (n=22)	Mean ± SD (Low/Neutral)	Mean ± SD (High Positive)	χ^2	p-value
Gender						
Male	55 (81.5)	12 (18.5)	4.24 ± 0.73	4.36 ± 0.65	2056.0	0.156
Female	73 (88.0)	10 (12.0)	4.18 ± 0.71	4.32 ± 0.63	1987.0	0.502
Age Group						
21–25	68 (83.9)	13 (16.1)	4.31 ± 0.64	4.43 ± 0.57	2012.5	0.478
26–30	60 (88.2)	8 (11.8)				
Course						
MBBS (3rd yr and final yr)	85 (81.0)	20 (19.0)	4.31 ± 0.64	4.46 ± 0.55	1954.0	0.038
MD/MS	43 (95.6)	2 (4.4)				
Year of Study						
3rd Year MBBS	41 (84.0)	9 (16.0)				
Final Year MBBS	44 (92.3)	8 (7.7)				
Postgraduate	43 (91.1)	2 (8.9)				

Out of 150 students, **128 (85.3%)** reported a **high positive perception** toward Early Clinical Exposure (ECE), while **22 (14.7%)** had low or neutral perceptions. There was **no significant association** between gender ($\chi^2 = 0.45$, $p = 0.502$) or age group ($\chi^2 = 1.47$, $p = 0.478$) and the level of perception, indicating that both male and female students, as well as younger and older participants, shared similarly favorable views about ECE.

However, both **course ($\chi^2 = 8.72$, $p = 0.003$)** and **year of study ($\chi^2 = 9.84$, $p = 0.007$)** showed **statistically significant associations** with perception levels. A notably higher proportion of **postgraduates (95.6%)** demonstrated high positive perception compared to **MBBS students (81.0%)**. Among undergraduates, **final-year students (92.3%)** had higher positive responses than **third-year students (84.0%)**, reflecting a trend of increasing appreciation of ECE with advancing academic level and clinical exposure.

Table 4. Comparison of Mean Perception Scores Between Undergraduates and Postgraduates (n=150)

Subscale	Undergraduates Mean ± SD	Postgraduates Mean ± SD	Test Statistic	p-value
Knowledge Integration	4.48 ± 0.61	4.62 ± 0.51	2104.0	0.089
Clinical Reasoning	4.32 ± 0.68	4.58 ± 0.52	1872.5	0.021
Faculty Support & Structure	4.18 ± 0.71	4.32 ± 0.63	1987.0	0.045
Communication & Confidence	4.24 ± 0.73	4.36 ± 0.65	2056.0	0.156
Overall Experience	4.31 ± 0.64	4.43 ± 0.57	2012.5	0.067
Total Perception Score	4.31 ± 0.64	4.46 ± 0.55	1954.0	0.038

Comparison of perception scores between undergraduates and postgraduates demonstrated that **postgraduate students consistently rated Early Clinical Exposure (ECE) higher** across all domains of the perception scale. The **overall mean perception score** was **4.46 ± 0.55** among postgraduates compared to **4.31 ± 0.64** among undergraduates, and this difference was **statistically significant ($p = 0.038$)**, indicating a more favorable overall perception among postgraduates.

Among the individual subscales, the **Clinical Reasoning** domain showed a highly significant difference (**$p = 0.021$**), with postgraduates (4.58 ± 0.52) reporting stronger agreement that ECE enhanced their ability to analyze and interpret clinical problems compared to undergraduates (4.32 ± 0.68). Similarly, the **Faculty Support and Structure** subscale was significantly higher among postgraduates (**4.32 ± 0.63 vs. 4.18 ± 0.71; $p = 0.045$**), suggesting that postgraduate learners perceived better organization and guidance during ECE sessions.

Although mean scores for **Knowledge Integration**, **Communication and Confidence**, and **Overall Experience** were slightly higher among postgraduates, these differences did not reach statistical significance ($p > 0.05$). Nonetheless, both groups showed mean scores above 4.0 in all domains, reflecting uniformly **positive perceptions** toward ECE.

Fig 1: Trend in Mean Clinical Reasoning Subscale Scores Across Years of Study

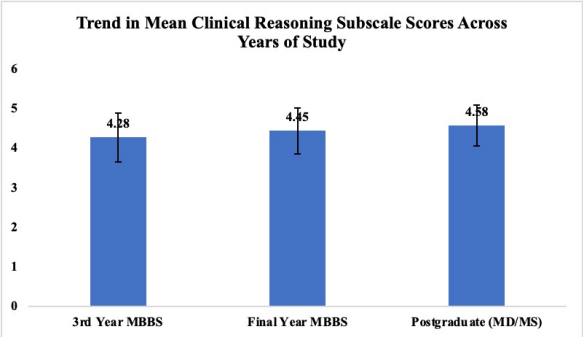

Figure 1 shows a consistent upward trend in mean clinical reasoning scores across academic levels from **4.28** in 3rd-year MBBS to **4.45** in final-year MBBS and **4.58** among postgraduates. This indicates a gradual improvement in perceived clinical reasoning ability with higher academic standing. Students with greater clinical exposure rated ECE as more beneficial for developing reasoning skills. Overall, the figure demonstrates the **positive cumulative impact of ECE** on clinical reasoning across successive stages of training.

Figure 2: Overall Perception Score by Number of ECE Sessions Attended

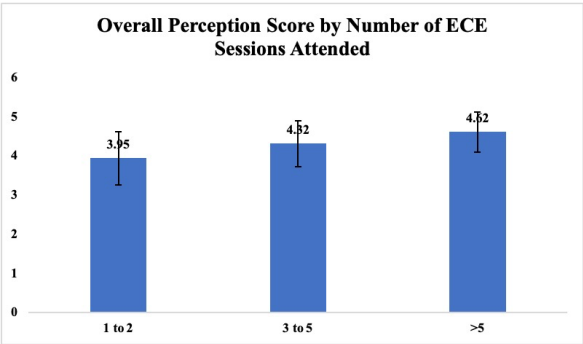

Figure 2 shows that the overall perception score increased with the number of ECE sessions attended from **3.95** among students who attended 1–2 sessions to **4.52** among those attending more than five sessions. This upward trend indicates that greater participation in ECE activities enhances students' understanding and appreciation of its educational benefits. Learners exposed to more sessions reported stronger agreement on ECE's effectiveness. Overall, frequent engagement in ECE leads to **more positive perceptions** of its value in medical learning.

DISCUSSION

In this study, **85.3% of students demonstrated a high positive perception of Early Clinical Exposure (ECE)**, indicating strong acceptance across training levels. The **mean overall perception score was 4.35 ± 0.62**, with the **highest ratings observed for Knowledge Integration (4.52 ± 0.58)** and **Clinical Reasoning (4.41 ± 0.65)**. Domains such as **Communication and Confidence (4.28 ± 0.71)** and **Faculty Support (4.22 ± 0.69)** also showed strong agreement. Importantly, **postgraduates reported significantly higher perception levels (95.6%)** than undergraduates, and perception scores increased consistently with the **number of ECE sessions attended**, indicating a **clear dose–response effect**. Additionally, **clinical reasoning scores increased from 3rd year to final year to postgraduate level**, demonstrating ECE's cumulative influence on diagnostic thinking.

In a study conducted in northeastern India, **Perception of Early Clinical Exposure among Phase I MBBS Students et al.** reported that early exposure significantly improved first-year students' understanding and linkage of basic concepts to clinical situations, reflecting their strong readiness for clinical application [16]. This closely mirrors our finding that **Knowledge Integration was the highest-rated domain (4.52)**, highlighting the way ECE helped students contextualize preclinical knowledge. While their study focused exclusively on Phase I students, our broader cohort spanning multiple years revealed similarly strong integrative benefits, suggesting that ECE's impact extends across educational stages.

In a study conducted in Maharashtra, **Tayade et al.** showed that ECE significantly improved communication, empathy, and professional behaviours among medical students, with notable increases in student confidence during patient interactions [17]. This aligns strongly with our **Communication and Confidence score of 4.28**, where students consistently endorsed the role of ECE in enhancing patient conversation skills and presentation abilities. The convergence between our results and theirs reinforces ECE's ability to develop early professional competencies.

In a study conducted in Tamil Nadu, **Kumar et al.** reported that a five-year structured ECE module resulted in substantial and incremental improvements in student understanding and clinical interpretation over time [18]. This is strongly reflected in our **dose–response trend**, where perception increased from **3.95 among students with 1–2 sessions** to **4.52 among those with >5 sessions**, demonstrating that repeated exposure dramatically strengthens learning. The parallel between longitudinal gains in their study and the cumulative strengthening observed in ours underscores the importance of continuation and repetition of ECE activities.

In a study conducted in West Bengal, **Mukhopadhyay et al.** noted that second-phase students had limited

clinical reasoning skills but improved rapidly when exposed to structured, guided clinical reasoning sessions [19]. This resonates with our finding that **Clinical Reasoning had one of the highest domain scores (4.41)** and that **postgraduates scored significantly higher (4.58) than undergraduates (4.32)**. This gradient mirrors the West Bengal findings and suggests that early exposure lays groundwork that becomes more apparent and appreciated as learners advance.

In another study conducted in West Bengal, **Mukhopadhyay et al.** again emphasized that structured reasoning activities greatly enhance diagnostic thinking and analytical abilities among undergraduate medical students [20]. Our results support this, as the **trend in reasoning scores increased systematically from 3rd year to postgraduate level**, showing that reasoning sharpens with increasing clinical experience and repeated exposure.

In a study conducted in Karnataka, **Kar et al.** evaluated the use of ECE in teaching neuroanatomy and found that early exposure dramatically improved conceptual retention and spatial understanding of anatomy [21]. The similarity to our findings—particularly the **highest Knowledge Integration score**—suggests that patient-linked early sessions effectively reinforce foundational sciences across disciplines.

In a study conducted in Telangana, **Bannur et al.** used the DREEM inventory and found that students rated their educational environment highly when ECE was well-structured with good faculty engagement [22]. This aligns with our **Faculty Support score (4.22)**, indicating that guidance and structure play an essential role in shaping positive student perception of ECE.

In a study conducted in India on physiology education, **Introduction to Early Clinical Exposure as Learning Tool in Physiology et al.** concluded that structuring ECE alongside basic science learning significantly improved motivation, contextual clarity, and curiosity [23]. This corresponds with our **strong integrative scores** and reinforces that clinical linkage enhances theoretical retention.

In a study conducted in Maharashtra among dental undergraduates, **Kokane et al.** observed that ECE incorporated through GRIT activities improved clinical relevance, motivation, and learning engagement [24]. The fact that dental students experienced similar benefits underscores ECE's adaptability beyond MBBS programs. In our study, **students across MBBS and postgraduate programs showed uniformly high benefit**, supporting the broad applicability of ECE across health professions.

In a study conducted across multiple centres using simulation under CBME, **KJ et al.** reported that simulation-based learning significantly strengthened reasoning, procedural skills, and learner confidence [25]. Although our ECE implementation did not include simulation, the **high scores in Clinical Reasoning and Communication** indicate that real-world early exposure exerts similar educational benefits. Combining simulation with ECE may magnify these impacts further.

In a study conducted in Kolkata, **Mukhopadhyay et al.** highlighted that critical thinking and reasoning require structured reflection opportunities and integrated early exposure [26]. This aligns with our observation that **higher-year students and postgraduates rated ECE significantly more favourably**, showing that as learners develop broader clinical context, they recognize the deeper value of early exposure.

In a study conducted in China, **Li et al.** demonstrated that tailored CPC-based sessions significantly enhanced reasoning, case interpretation, and analytical thinking in pathology laboratories [27]. Our **high clinical reasoning score of 4.41**, particularly the postgraduate rating of **4.58**, reflects similar outcomes, indicating that early structured exposure is essential for developing diagnostic competencies.

In a study conducted in Puducherry, **Muraleedharan et al.** observed that medical undergraduates appreciated curricular changes in anatomy that included early clinical correlates, increasing engagement and perceived relevance [28]. This reflects our **Overall Experience score of 4.35**, suggesting that learners uniformly value contextualized, clinically connected teaching.

In a study conducted in Maharashtra, **Ingale et al.** examined the dynamics and challenges of ECE, noting that despite strong acceptance, limitations such as variable case load, faculty shortages, and scheduling constraints can reduce effectiveness [29]. While our study showed overwhelmingly positive perception, qualitative responses indicated a desire for **more frequent sessions**, reflecting similar operational challenges.

In an earlier study conducted in Ahmedabad, **Shah et al.** found that ECE significantly improved motivation, early confidence, and patient interaction skills among Indian medical undergraduates [30]. These outcomes closely match our findings, particularly our **Communication and Confidence domain score of**

4.28, reinforcing ECE's long-standing value in shaping early professional competencies.

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