

Educational Outcomes and Student Perceptions Following a Blood Bank Visit in an Early Clinical Exposure ProgramSanhita Mukherjee¹, Goutam Banerjee², Arunima Datta³¹Professor, Department of Physiology, Calcutta National Medical College²Associate professor, Dept of Physiology, EAST WEST institute of Medical Science and Research³Assistant Professor, Department of Physiology, Calcutta National Medical College

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Conflict of interest: Nil

Abstract

Background: Early Clinical Exposure (ECE) is a substantial component of Competency-Based Medical Education (CBME) that fosters integration of basic sciences with clinical practice. Blood bank visits during Physiology teaching may intensify understanding of transfusion medicine, blood grouping, and patient care among undergraduate medical students. However, evidence regarding the impact of blood bank-based ECE in rural medical colleges remains limited.

Objectives: To determine the effect of a structured blood bank visit on knowledge, perception, and clinical orientation among first-year MBBS students.

Methods: A cross-sectional observational study was performed among 100 Phase I MBBS students at a rural medical college in West Bengal after obtaining Institutional Ethics Committee approval and informed consent. Students participated a structured blood bank visit following a lecture on blood grouping and transfusion-related physiology. Knowledge accession was evaluate using pre-test and post-test questionnaires. Student perceptions toward the educational usefulness of the ECE activity were rated using a validated Likert-scale questionnaire. Data were analyzed using Microsoft Excel, and statistical significance was considered at $p < 0.05$.

Results: Post-test scores substantiate significant progress compared with pre-test scores ($p=0.023$), denoting augmented understanding following the intervention. Most participants reported improved topic retention, better clinical correlation, increased interest in Physiology, and greater awareness regarding patient care and voluntary blood donation. The intervention showed a small-to-moderate educational effect size (Cohen's $d=0.33$).

Conclusion: Structured blood bank visits as part of ECE significantly upgraded knowledge, perception, and clinical orientation among first-year MBBS students. Integration of experiential learning modules into Physiology teaching may strengthen competency-based undergraduate medical education and encourage clinically relevant learning.

Keywords: Blood Bank Visit, Early Clinical Exposure, Educational outcome, Perception, Medical students.

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Introduction

Early Clinical Exposure (ECE) has emerged as a transformative approach in medical education, bridging the gap between theoretical knowledge and practical clinical application. Traditionally, medical students spent their initial years engrossed in preclinical studies, with minimal interaction with real patients. However, this approach often resulted in difficulties when transitioning to clinical practice. To address this, medical education systems worldwide have integrated ECE as an essential component of competency-based learning, fostering early engagement with patients and real-world healthcare settings [1,2].

In India, the Medical Council of India (now the National Medical Commission) mandated ECE as part of the Competency-Based Medical Education (CBME) framework introduced in 2019 [3]. This curriculum reform underscores the importance of early exposure to clinical environments to ensure that graduates develop the requisite competencies for patient-centered care. A study assessing ECE in Indian medical colleges found that over 90% of students perceived it as beneficial in enhancing their understanding of clinical subjects and professional skills [3].

The implementation of ECE varies across institutions, with three primary settings being

widely utilized: classroom-based, hospital-based, and community-based exposure [4]. Classroom-based ECE involves case-based discussions, simulations, and interactive learning activities where students analyze clinical scenarios. Hospital-based ECE allows students to observe patient interactions, participate in ward rounds, and witness medical procedures under faculty supervision. Community-based ECE extends learning beyond hospital walls, exposing students to primary healthcare settings where they can observe public health challenges and interact with diverse patient populations [2].

A critical component of ECE is the incorporation of blood bank visits as an educational tool. Blood banks play a vital role in healthcare systems by ensuring safe blood transfusion services. Introducing medical students to these settings as part of their early clinical exposure enhances their understanding of transfusion medicine, blood donation processes, and the ethical considerations surrounding blood banking [5].

Studies have shown that medical students who participate in blood bank visits develop a deeper appreciation for voluntary blood donation and are more likely to become donors themselves [5]. In addition to enhancing their knowledge of hematology and immune-hematology, students also gain exposure to the ethical and logistical considerations involved in blood transfusion services [5].

Gap of knowledge: Although Early Clinical Exposure (ECE) has been extensively imported in competency-based medical education, several gaps still prevail in the literature regarding its implementation and validity. Former studies have mainly appraised ECE in general clinical or classroom-based settings, while limited studies have specifically evaluated blood bank visits as a structured ECE module in Physiology. Most available studies were executed in urban or tertiary-care institutions, with very little documentation from rural medical colleges of West Bengal, creating a geographical gap. Prior research principally focused on students' perceptions, whereas simultaneous estimation of both educational outcomes and perception changes using pre-test and post-test analysis remains ineptly explored, representing a conceptual gap. Furthermore, minimal studies have specifically evaluated first-year MBBS students during their early transition into medical education, citing a population gap. Current literature has also insufficiently analyzed affective-domain outcomes such as empathy, patient sensitivity, and awareness regarding voluntary blood donation following blood bank exposure. Besides, institution-specific evidence regarding transfusion medicine learning, component separation, blood storage practices, and

compatibility testing through experiential learning stays limited, thereby creating methodological, practical, and evidence gaps.

The aim of the present study was to assess the educational outcomes and perception changes among first-year MBBS students following a blood bank visit organized as a part of Early Clinical Exposure (ECE) in Physiology. The study specifically designed to assess knowledge gain regarding blood donation, component separation, blood storage, and compatibility testing using pre-test and post-test assessment. It also contemplated to evaluate students' perceptions toward blood bank-based experiential learning, establish its role in improving clinical correlation and interest in Physiology, and ascertain whether such exposure enhance empathy, patient sensitivity, and awareness regarding voluntary blood donation among undergraduate medical students.

Methods:

This was a cross-sectional, observational study conducted by the Department of Physiology in collaboration with Departments of Transfusion Medicine of Rampurhat Govt. Medical College on January 2025. After taking approval from the Institutional Ethics Committee, 100 students of the phase I MBBS (First year medical students) of 2024-25 batch were recruited into the study and were explained the procedure and purpose of the study and written informed consent was taken from the participants.

Study Area: Department of Physiology and Blood Bank, RPHGMC

Sample size: The sample size was calculated using the formula for estimating a single proportion, $n = Z^2pq/d^2n = Z^2pq/d^2n = Z^2pq/d^2$. Assuming 90% positive perception toward Early Clinical Exposure based on previous literature, 95% confidence level, and 6% absolute precision, the minimum required sample size was calculated as 96. Considering possible non-response, 100 Phase I MBBS students were recruited.

Sampling technique: Convenience sampling was adopted for the present study. All eligible First Phase MBBS students who attended the blood bank visit as part of Early Clinical Exposure during the study period and provided informed consent were included consecutively until the desired sample size was achieved.

Inclusion Criteria: First-year MBBS students (2024–25 batch), students who voluntarily participated in the blood bank visit, participants providing written informed consent.

Exclusion Criteria: Students absent during the intervention or assessments. Those who declined consent, incomplete questionnaire response

Voluntarily participated students were divided into three batches each containing 33 students. A prior 60 minutes lecture on physiology of blood grouping was taken.

Students were distributed a hand out supplied by transfusion medicine department after their pre-test and before their visit to the blood bank. Blood bank visit lasted for 2 hours. Two faculty members from Physiology accompanied them to the blood bank.

In the blood bank discussion the learning objective was:

By the end of this visit, students would be able to:

1. Understand the importance of blood banks in healthcare.
2. Describe the process of blood donation, screening, and component separation.
3. Explain blood storage conditions and shelf life.
4. Recognize the significance of crossmatching and blood group compatibility.

5. Identify the ethical and legal considerations in blood donation

The lesson plan was as follows:

Topic: Blood Bank Visit – Understanding Blood Donation, Processing, and Storage. Target Audience: 1st Year MBBS Students

Duration: 2-3 Hours

Learning Objectives

By the end of this visit, students should be able to:

- Understand the importance of blood banks in healthcare.
- Describe the process of blood donation, screening, and component separation.
- Explain blood storage conditions and shelf life.
- Recognize the significance of crossmatching and blood group compatibility.
- Identify the ethical and legal considerations in blood donation.

Table 1:

Time	Activity	Details	Teaching Method
0-15 min	Introduction & Orientation	- Brief introduction to the blood bank. - Explain the objectives of the visit. - Discuss the importance of voluntary blood donation.	Interactive discussion by faculty & blood bank staff
15-45 min	Observation of Blood Donation Process	- Observe donor registration and pre-donation screening. - Learn about donor eligibility criteria (age, weight, hemoglobin levels). - Observe phlebotomy (blood collection process).	Demonstration by blood bank staff
45-75 min	Blood Processing & Component Separation	- Observe centrifugation for component separation (RBCs, platelets, plasma). - Learn the importance of each component in clinical practice.	Live demonstration, Q&A
75-90 min	Crossmatching	Understand crossmatching and compatibility testing.	Laboratory demonstration
90-110 min	Storage & Preservation	- Learn storage conditions for whole blood and components. - Discuss storage temperatures (RBCs: 1-6°C, Platelets: 20-24°C, Plasma: -30°C).	Guided tour of storage area
110-130 min	Legal & Ethical Aspects	- Discuss the ethical considerations in blood donation. - Learn about the role of blood banks in emergency medicine and disaster management.	Short lecture by faculty

Study Design:

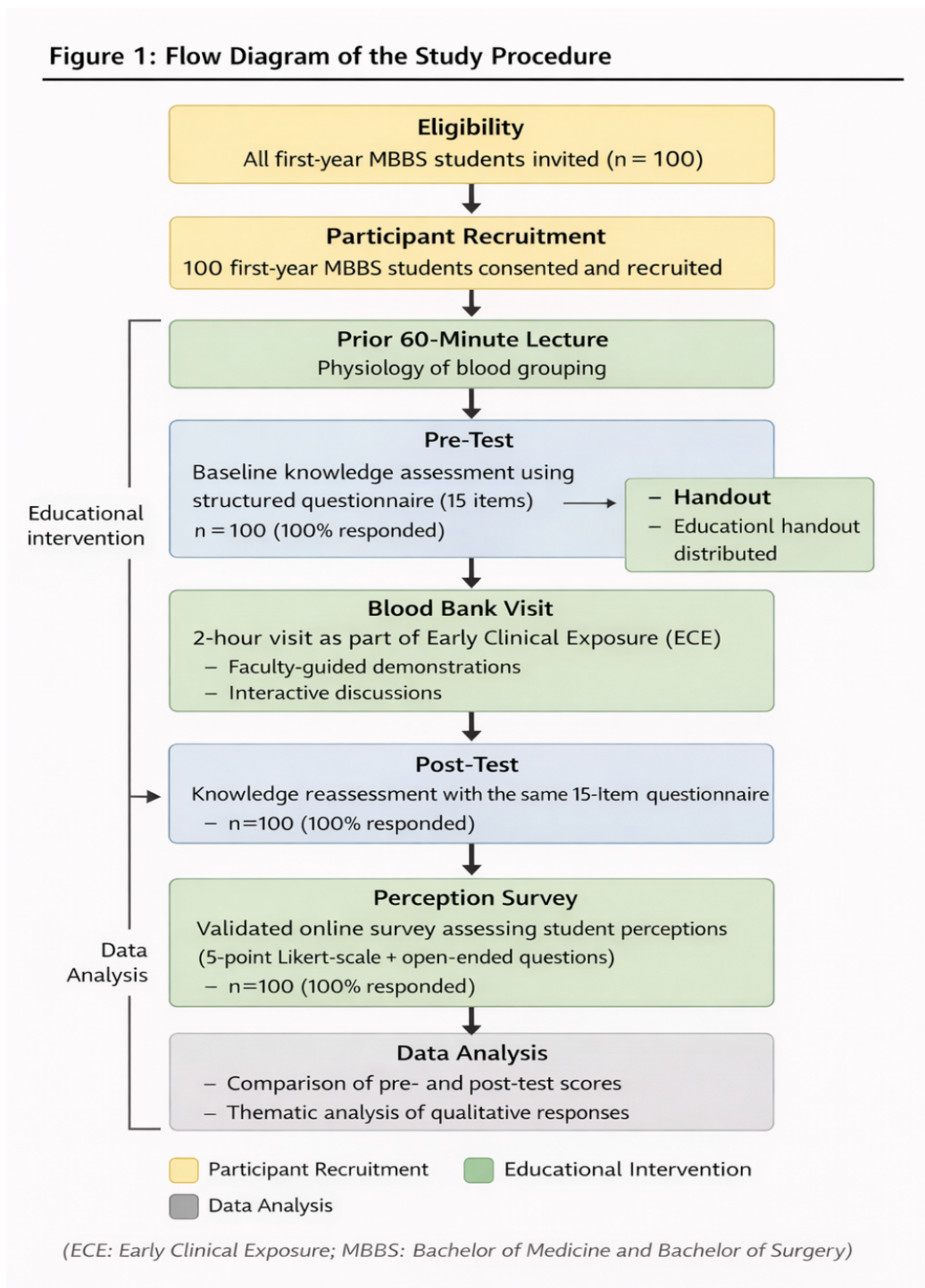


Figure 1:

Study instrument for recording knowledge gain by students on completion blood bank visit: The students’ knowledge gain was analyzed immediately prior to and shortly after their experience of blood bank visit as part of ECE by pretest & posttest questionnaire as prepared by the subject experts of physiology department.

Study instrument for recording perception on electives: To study the perception of students and teachers on electives, an online survey with validated questionnaire which was developed by

the authors after a series of students’ and staff focus group discussions, was used. It was validated by three experts in the field of medical education.

The questionnaire was sent to the students who had taken part in the blood bank visit in January 2025 via Google documents. The survey was instituted in collaboration with experts in medical education and medical students involved in the elective. The pilot tested on a sample of students for comprehensibility and construct validity.

The anonymous, self-administered, English language questionnaire was used with 16 survey items for gathering the participants' answers. Out of the total 16 items, there were 2 items, for demographics; 10 items seeking students' responses on a 5-point Likert scale from strongly agree to strongly disagree, 1 item concerning mainly about reason they took PFT and ECG as elective; and, 3 items were an open-ended question, asking participants for their opinion on strength and weakness of this program and their suggestions to improve it.

Another cross-sectional questionnaire survey was conducted among faculty members actively engaged in the elective module implementation at Physiology department. This fully non-experimental, anonymous study was started only after informed consent was received from all participants.

Members of institute's Medical Education Unit (MEU) created a pre-validated questionnaire to collect opinions on how the elective module was implemented. An online Google form was used to create the questionnaire, and all participants were sent the link via email and a WhatsApp group. All 6 academic members answered the questionnaire, and their answers were used in the data analysis.

Bias reduction strategy: To minimize selection bias, all eligible first-year MBBS students attending the Early Clinical Exposure session were invited to participate, and uniform inclusion and exclusion criteria were applied. Information bias was reduced by using structured pre-test and post-test questionnaires along with validated perception tools. Recall bias was minimized by conducting the post-test immediately after the blood bank visit. To reduce observer bias, faculty members followed a standardized lesson plan during demonstrations and

discussions. Anonymous and self-administered questionnaires were used to decrease social desirability bias and encourage honest responses. Statistical analysis was performed uniformly using predefined methods to improve reliability and consistency of findings.

Participant Dropout/Exclusion Details: A total of 100 Phase I MBBS students were initially recruited for the study after obtaining informed consent. Among them, 8 students were excluded from final analysis because of incomplete pre-test/post-test responses or absence during one of the assessment sessions. Therefore, data from 92 students were included in the final statistical analysis of educational outcomes.

Statistical Methods: Data were entered into Microsoft Excel 2007® and analyzed using appropriate statistical software. Descriptive statistics were expressed as mean, standard deviation (SD), frequency, and percentage. Normality of quantitative variables was assessed before application of inferential statistics. Pre-test and post-test scores were compared using appropriate parametric tests. Categorical perception responses obtained through Likert-scale questionnaires were summarized as proportions and percentages.

Association between variables was assessed using Chi-square test where applicable. A p-value of less than 0.05 was considered statistically significant. Effect size was calculated using Cohen's d to determine the magnitude of educational impact. Qualitative responses from open-ended questions were analyzed using thematic analysis. Statistical procedures were predefined to improve reproducibility, consistency, and reliability of findings.

Results:

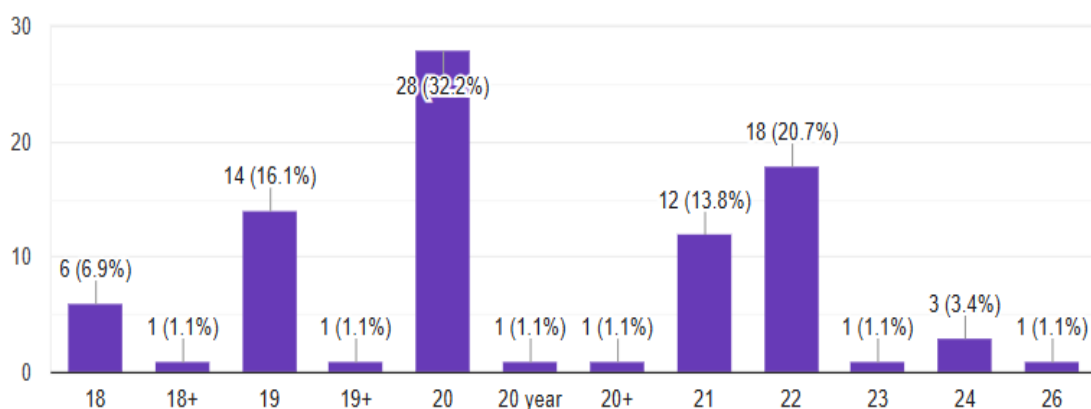


Figure 2: Age distribution of participants

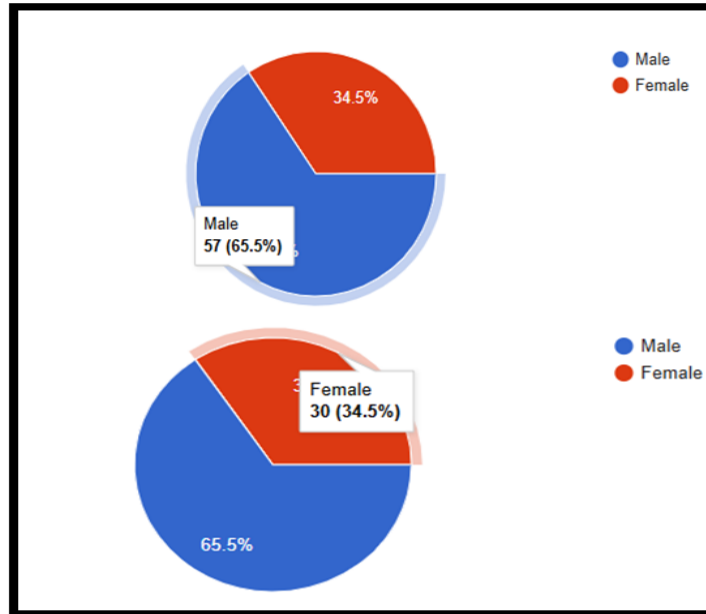


Figure 3: Gender distribution of participants

Q-Q plot, The Shapiro-Wilk test and Kolmogorov-Smirnov test results indicate that both pre-test and post-test scores are normally distributed ($p > 0.05$)

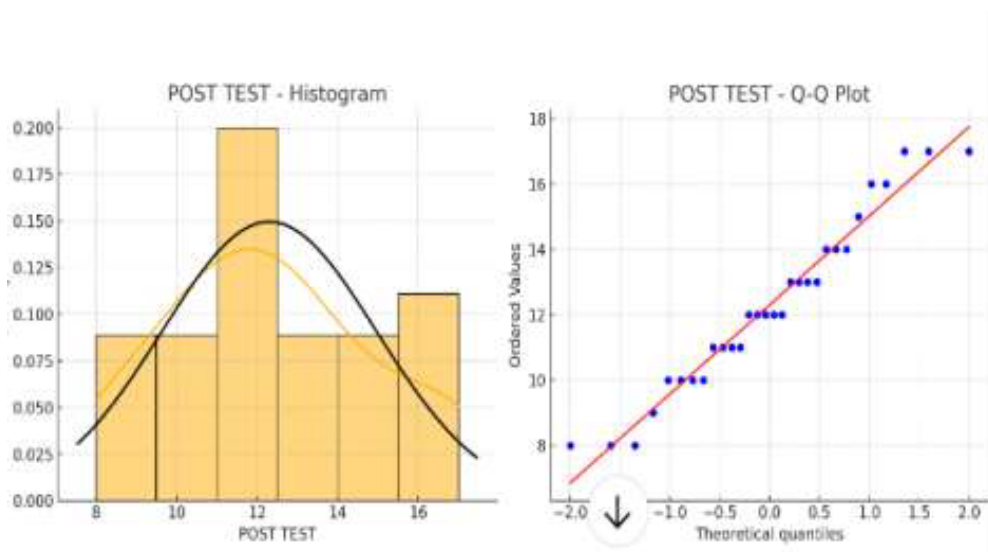


Figure 4:

Table 2: Comparison between pre-test and post-test score

Group	N	Mean	Std. Deviation
Pre-Test Score	92	10.500	2.834249
Post test score	92	9.586957	2.559843

Paired t Samples Test:

t	df	Sig. (2-tailed)
2.293088	180.145	0.022998***

Since the p-value (Sig. 2-tailed) is approximately 0.023, it suggests a statistically significant difference between the two groups at a 5% significance level.

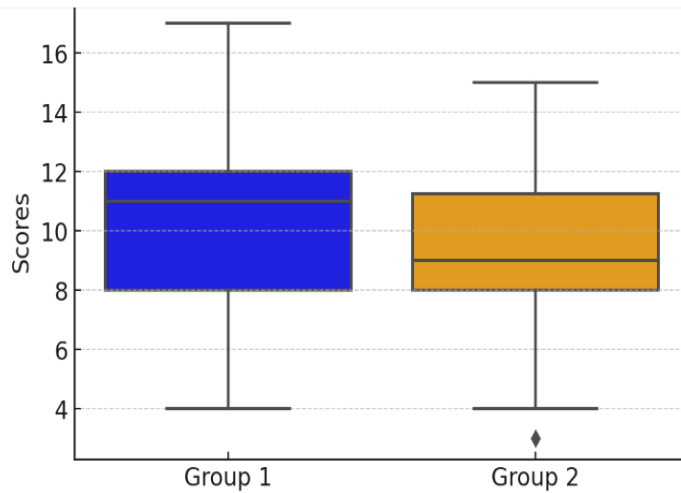


Figure 4: Comparison between pre-test and post-test score

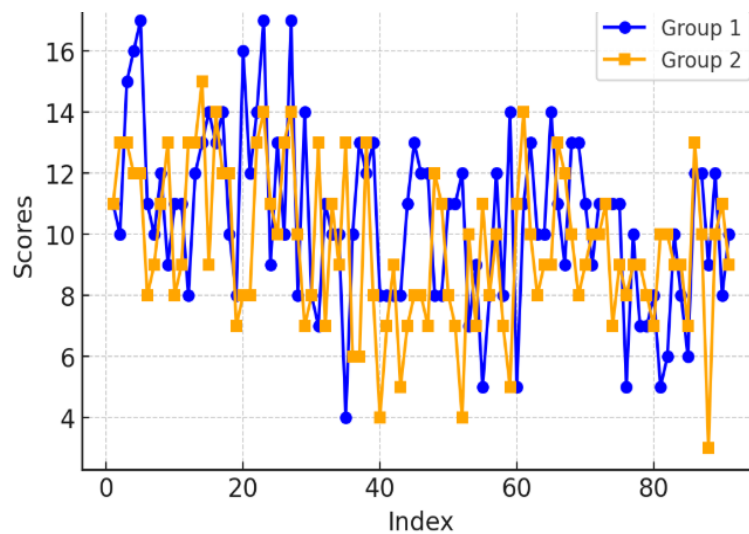


Figure 5: Comparison between pre-test and post-test score of individual student

Table 3: Perception of students about Blood bank visit as a part of ECE

Question	Strongly Agree (n, %)	Agree (n, %)	Neutral (n, %)	Disagree (n, %)	Strongly Disagree (n, %)
Q1: Blood bank visit helped me in better retention of the topic	33 (37.9%)	53 (60.9%)	0 (0.0%)	1 (1.1%)	-
Q2: Blood bank visit helped to develop interest in the subject	35 (40.2%)	50 (57.5%)	0 (0.0%)	1 (1.1%)	1 (1.1%)
Q3: Blood bank visit imparted better clinical context	-	47 (97.9%)	0 (0.0%)	1 (2.1%)	-
Q4: Blood bank visit motivated me to correlate the blood transfusion method with basic physiological knowledge	34 (39.1%)	49 (56.3%)	0 (0.0%)	1 (1.1%)	3 (3.4%)
Q5: Blood bank visit helped me to develop sensitivity towards patient problems and needs	35 (40.2%)	45 (51.7%)	0 (0.0%)	5 (5.7%)	2 (2.3%)
Q6: Blood bank visit will equip me to apply the knowledge when the opportunity arise	-	49 (92.5%)	0 (0.0%)	2 (3.8%)	2 (3.8%)

Cohens d= (9.8-10.5)/2.7= 0.33

Discussion

The present study appraised the educational outcomes and perception changes among first-year MBBS students following a blood bank visit conducted as a part of Early Clinical Exposure (ECE) in Physiology. The findings substantiated significant improvement in students' knowledge and positive perception toward clinically integrated physiology teaching.

In the present study, post-test scores showed statistically significant enhancement compared to pre-test scores ($p \approx 0.023$), suggesting that blood bank visits accentuated understanding of transfusion medicine and related physiological concepts. Similar findings were reported by Tayade and Latti, who complied with that ECE improves comprehension of pre-clinical subjects by integrating theory with practical clinical exposure.² Their review stressed that clinically contextual teaching ameliorates retention and motivation among undergraduate medical students. Likewise, Singh et al. depicted that more than 90% of first-year MBBS students perceived ECE as effective for understanding clinical relevance and improving learning interest. [3] The findings of the present study are therefore in agreement with these earlier reports.

The current study also observed that most students believed that the blood bank visit improved topic retention, stimulated interest in physiology, and enhanced clinical correlation. Similar findings were made by Tayade et al., who reported that hospital-based ECE significantly improved professional attitude, engagement, and active learning among medical students. [4] Lee et al. further validated that exposure to blood donation centers positively influenced students' understanding of transfusion medicine and heightened appreciation for voluntary blood donation.[7] The agreement between the present study and these studies suggests that observational clinical experiences are highly effective in bridging the gap between theoretical and applied medical sciences.

The present study additionally explored that students developed increased sensitivity toward patient problems and healthcare needs after the blood bank visit. Similar findings were documented by Savitha et al., who demonstrated that reflective and clinically oriented learning activities in physiology improved empathy and patient-centered attitudes among first-year medical students. [5]

This reflects the importance of ECE in promoting affective-domain learning alongside cognitive development. The National Medical Commission's Competency-Based Medical Education (CBME) curriculum also emphasizes development of communication skills, ethics, and professionalism

through early patient exposure. [10] The Cohen's d value of 0.33 observed in the present study indicated a small-to-moderate educational effect size. Although the intervention produced statistically significant improvement, the effect size was modest. This finding is comparable to previous ECE studies where short-duration interventions improved student perception and learning outcomes but showed moderate effect sizes because of limited exposure duration. [2,8] Repeated ECE sessions, longitudinal integration, and reflective exercises may further improve educational impact.

Unlike many previous studies conducted in urban or tertiary-care settings, the present study was executed in a rural medical college of West Bengal. Therefore, it contributes valuable regional evidence regarding implementation of ECE in resource-constrained settings. This finding is particularly important because most available Indian studies on ECE have focused on general clinical exposure rather than blood bank-based learning modules. [3,9]

However, certain limitations must be regarded while interpreting the findings. The study was conducted at a single institution with a relatively limited sample size, which may reduce external validity. The cross-sectional design and immediate post-test assessment could not evaluate long-term retention of knowledge. Additionally, self-reported perception responses might have introduced social desirability bias. Nevertheless, use of structured lesson plans, validated questionnaires, and supervised learning sessions strengthened the methodological quality of the study.

Overall, the present study advocates existing evidence that blood bank visits as part of ECE significantly improve understanding, clinical orientation, and perception among first-year MBBS students. Inclusion of structured ECE modules in physiology teaching may facilitate development of clinically competent and empathetic future physicians.

Limitations: The present study has some limitations. First, the study was conducted in a single rural medical college with a relatively small sample size, which may limit the generalizability of the findings to other institutions or regions. Second, the cross-sectional design and immediate post-test assessment evaluated only short-term knowledge gain and could not assess long-term retention of learning outcomes. Third, perception data were collected using self-reported questionnaires, which may be affected by response bias and social desirability bias. Fourth, absence of a control group limited the ability to compare the effectiveness of blood bank visit-based ECE with traditional teaching methods. Additionally, variability in students' prior knowledge, learning motivation, and

engagement during the visit may have influenced the educational outcomes. Despite these limitations, the study provides important preliminary evidence regarding the usefulness of blood bank visits as an Early Clinical Exposure strategy in physiology education.

External validity/Generalizability: The findings of the present study may be generalized mainly to first-year MBBS students undergoing Early Clinical Exposure (ECE) in similar competency-based medical education settings, particularly in rural medical colleges. The use of a structured lesson plan, supervised blood bank visit, and standardized assessment methods improves applicability of the intervention in undergraduate physiology teaching. However, external validity is

limited because the study was conducted in a single institution using convenience sampling and a relatively small sample size. Variations in institutional infrastructure, faculty involvement, and student characteristics may influence outcomes. Therefore, multi-centric studies involving larger and more diverse populations are recommended to improve generalizability of the findings

Translatory Component: The study demonstrates a moderate-to-high translatory impact because it successfully translates basic physiology teaching into clinically relevant experiential learning and has potential applicability in undergraduate medical curriculum development and professional competency enhancement.

Table 4:

Translatory Component	Description	Translatory Score*
T0 – Basic Educational Research	The study generated knowledge regarding effectiveness of blood bank visit as an Early Clinical Exposure (ECE) module in Physiology.	1
T1 – Translation to Educational Practice	The intervention translated theoretical physiology concepts into practical clinical exposure through blood bank demonstration and observation.	2
T2 – Application in Academic Setting	The findings can be directly implemented in undergraduate MBBS teaching curriculum to improve clinical orientation, retention, and experiential learning.	3
T3 – Institutional Educational Impact	The study may help institutions strengthen Competency-Based Medical Education (CBME) implementation and structured ECE programs.	4
T4 – Broader Healthcare/Behavioral Impact	Increased awareness regarding voluntary blood donation, empathy, and patient-centered care may influence future professional behavior and healthcare delivery.	4
	Total Score	3.5 out of 5

Conclusion

The present study concludes that blood bank visits as a part of Early Clinical Exposure significantly enhanced knowledge, clinical correlation, and perception among first-year MBBS students. Students showed better understanding of blood donation, transfusion practices, component separation, and clinical applications of physiology after participation in the ECE program.

Most students perceived the intervention positively and reported improved interest, retention, empathy, and clinical orientation toward the subject. The findings support the role of competency-based, clinically integrated teaching methods in enhancing undergraduate medical education. Inclusion of structured blood bank visits and similar experiential learning modules in physiology curriculum may help bridge the gap between theoretical knowledge and clinical practice while fostering development of competent, empathetic, and patient-centered future physicians.

References

1. Shah C. Early clinical exposure- Why and how? *J Educ Technol Health Sci.* 2018;5(1):2-7.
2. Tayade MC, Latti RG. Effectiveness of early clinical exposure in medical education: Settings and scientific theories – Review. *JEduc Health Promot.* 2021;10:117.
3. Singh RA. Perception of Early Clinical Exposure (ECE) among Phase I MBBS Students in a Medical College in Northeastern India. *J Med Sci Health.* 2024;10(2):169-72.
4. Tayade MC, Giri PA, Latti RG. Effectiveness of early clinical exposure in improving attitude and professional skills of medical students in current Indian medical education set up. *J Family Med Prim Care.* 2021;10:681-5.
5. Savitha D, Anto T, Sevil TV. Introducing reflective narrative for first-year medical students to promote empathy as an integral part of the physiology curriculum. *Adv Physiol Educ.* 2021;45:207-16.

6. Dawadi P, Khadka S, Khanal MC, Thapa RK. Blood Donation Practice among Undergraduate Students in a Tertiary Care Hospital: A Descriptive Cross-sectional Study. *J Nepal Med Assoc.* 2020;58(232):998-1004.
7. Lee J, Kim S, Jeong SY, Yoon SY, Lee N, Won JH, et al. Educational Outcomes and Perception Changes in Medical Students After Visiting a Blood Donation Center. *Ann Lab Med.* 2024;44:455-8.
8. Tayade MC, Latti RG. Role of early clinical exposure in competency-based medical education: A review. *J Educ Health Promot.* 2021; 10:117.
9. Singh R. Implementation challenges and perception of medical students regarding early clinical exposure. *J Med Sci Health.* 2024; 10(2):169-72.
10. Medical Council of India. Competency-based undergraduate curriculum for the Indian Medical Graduate. National Medical Commission. 2018.