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Research Protocol

Biochemistry Section

Evaluating the Influence of Near-Peer Teaching on Biochemistry Learning Outcomes: A Case-control Study Research Protocol

SANGHAMITRA CHAKRABORTY[1], MITHILESH DHAMANDE[2], VAIBHAV ANJANKAR[3]

ABSTRACT

Introduction: Near-Peer Teaching (NPT) is a rapidly expanding area of research in medical education. Literature reviews show that peer-assisted learning is embedded in the curriculum of various medical schools. Several studies indicate that NPT is an effective teaching tool in problem-based learning. Moreover, the close proximity in age and recent shared experiences of peer tutors in medical school examinations provides an added benefit, allowing learners to appreciate the tutors' knowledge and facilitating teaching at an appropriate level. Additionally, learners can interact more comfortably with peer tutors.

Need of the study: In the context of the new competency-based curriculum, which includes provisions for early clinical exposure and electives, alternative teaching methods are increasingly required. NPT serves as a viable supplement to traditional faculty-led teaching. Furthermore, it enhances the teaching skills of near-peer tutors while enriching their own learning. Therefore, there is a need to study formal and structured NPT to validate its effectiveness, particularly in preclinical disciplines like biochemistry, and to explore its impact on student self-efficacy.

Aim: The present case-control study aims to analyse the impact, effectiveness, and acceptability of NPT in biochemistry practical training sessions as an alternative teaching method to conventional faculty teaching.

Materials and Methods: The proposed case-control study will be conducted over one year (October 2024 to November 2025) in the Department of Biochemistry at Nil Ratan Sircar Medical College and Hospital, Kolkata, India. Phase I MBBS students of Batch 2024-2025 will be selected as study participants on a voluntary basis. Near-Peer Tutors (NPTs) will be trained regarding the specific learning objectives, desired competencies, and teaching-learning methodologies for the sessions. Students will be divided into two equal groups: one group taught by Near-Peer Tutor and the other by traditional faculty. Both groups will cover the same topic. The effectiveness of NPT versus conventional teaching will be evaluated by comparing students' scores. Students' perceptions of NPT will be recorded using a pre-validated questionnaire (Kirkpatrick Level 1).

Keywords: Medical education, Peer assisted learning, Perception, Teaching

INTRODUCTION

"The best way to learn is to teach," as quoted by the celebrated scientist Robert Oppenheimer, is a principle accepted for generations. Peer-assisted learning is a well-known teaching model where learners teach their peers or juniors. In medical education, a Near-Peer Tutor is defined as a student at least one academic year senior to the learner [1,2].

Literature suggests that Whitman NA and Fife JD first described peer education strategies in tertiary education and proposed peer-to-peer teaching in 1988 [3]. However, this concept has been in practice since 1950, when medical undergraduates were employed as laboratory assistants to reduce the time and constraints of didactic lectures [4]. Learners have reported that peer education facilitates better understanding of subjects at an appropriate level. Furthermore, peer tutors serve as role models, enhancing motivation and confidence among learners. Some studies have even suggested that peer educators are occasionally preferred over conventional facilitators [5,6].

The paradigm shift in Indian medical education from curriculum-based teaching to learner-centric Competency-Based Medical Education emphasises the use of interactive teaching-learning methodologies [7,8]. NPT builds confidence in both learners and peer tutors, supports assessment preparation, and addresses gaps in curriculum delivery [9]. Learning is a complex process involving rigorous preparation, social interaction during class, and effective utilisation of structured teaching methods and communication tools [10].

Peer-Assisted Learning (PAL) benefits both students and peer tutors. NPT enhances self-esteem, independence, clinical competency, self-evaluation, and peer interaction. Peer tutors also gain from the program by improving cognition, skills, clinical reasoning, communication, and leadership competencies. NPT allows peer tutors to become better learners, enhancing their undergraduate medical education and future opportunities for specialisation [11].

Succinctly, NPT may achieve multiple goals in our medical education system. It can help address the shortage of faculty members in many institutions across the country, enhance the overall teaching-learning experience of medical students, and contribute to the development of three key qualities expected of an Indian Medical Graduate: 'Leader,' 'Communicator,' and 'Lifelong Learner' [12].

In a report by Dumas BP et al., scores in paediatric simulation were higher among junior nursing students trained by senior peers compared to those taught by conventional faculty [13]. This was attributed to better social compatibility between near-peer tutors and learners in terms of language and cognition [14]. According to Khapre M et al., a socially safe learning environment, where junior students feel free to ask questions and receive answers from near-peer tutors who have recently passed examinations, is also observed [15].

NPT can be classified into two types: formal and informal. In informal NPT, near-peer tutors teach juniors without faculty input or formal preparation of learning objectives. In formal NPT, tutors teach learners with structured input and guidance from conventional faculty [16]. Schmidt HG and Moust JH also highlighted the advantages of a relaxed and transparent learning environment in NPT [17].

Despite these promising potentials, NPT has not yet been extensively implemented, and its impact has not been systematically evaluated in most medical institutions in West Bengal, India. The present proposed study represents an initial step toward addressing this gap. The null hypothesis of the study posits that there is no difference in the effect of NPT on learning Biochemistry among Phase I medical students compared to conventional practical teaching.

The present study aimed to analyse the impact, acceptability, and effectiveness of NPT in Biochemistry practical training sessions as an alternative teaching method to conventional faculty teaching.

Study Objectives:

- To assess the effectiveness of NPT compared to conventional faculty teaching by comparing scores in a time-bound written exam.
- To analyse students' perceptions of NPT in Biochemistry using a pre-validated questionnaire.

REVIEW OF LITERATURE

The NPT is practiced in medical colleges in an informal and non-structured manner. In a study by Kumar SS et al., approximately 83.3% of students strongly reported that three months of NPT sessions improved their confidence and attitude toward teaching [12]. A similar finding was reported by Shohani M et al., in the teaching of hand hygiene skills among first-year nursing students at Ilam University, Iran, although the study population consisted of nursing students [18].

In a study by Nicholas T et al., peer tutors were found to be receptive to learners' inputs and more aware of learning outcomes [19]. Narrative analysis of students' perspectives by Grover S et al., suggested that students feel more at ease when peers serve as tutors [20]. A study by Dandavino M et al., emphasised that medical students must possess strong communication skills to succeed in various teaching roles within the hospital setting [21].

An extensive literature review indicates that the majority of studies focused on informal NPT and primarily assessed students' perceptions using Likert scales, providing only qualitative analysis. Moreover, most NPT interventions by medical undergraduates involved clinical skill teaching. Considering the study population, methodology, and identified knowledge gap, this mixed-method educational interventional study has been designed to involve Phase I medical undergraduates and focus on the Biochemistry curriculum.

MATERIALS AND METHODS

The present case-control study will be conducted among the 2024-2025 batch of Phase I MBBS (Bachelor of Medicine and Bachelor of Surgery) students in the Department of Biochemistry at Nil Ratan Sircar Medical College, Kolkata, India, over a period of one year (October 2024 to November 2025). First-year MBBS students from the 2024-2025 batch who voluntarily agree to participate will be included. The study has been approved by the Institutional Ethics Committee (IEC) vide Memo no: NRSMC/IEC/031/2025 dated 4th March 2025.

Sample size calculation: Purposive sampling will be employed. As this survey involves categorical variables, the sample size was calculated using a 95% confidence interval and a margin of error of 0.05, based on the table reported by Adam AM. The minimum required sample size was found to be 152 [22]. A total of 152 participants will be included in the study, divided equally as cases and controls (76 cases and 76 controls).

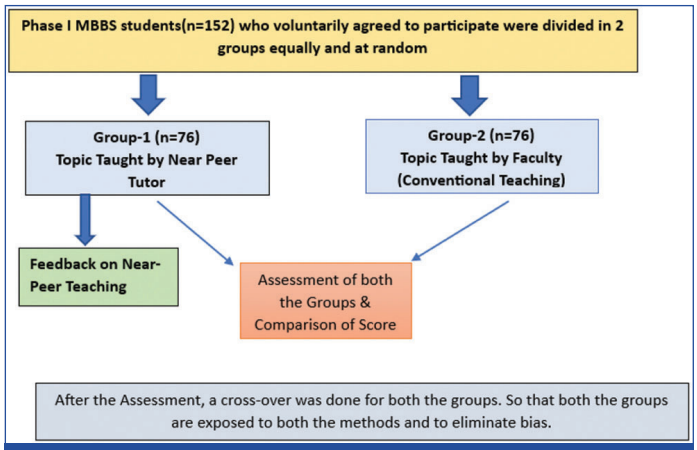
Inclusion criteria: All Phase I MBBS students of the batch who voluntarily agree to participate and provide informed consent.

Exclusion criteria: Students unwilling to participate.

The NPTs will be briefed regarding the specific learning objectives of the class, desired competencies, and teaching-learning methodologies. Handouts and study materials will be provided to both the NPTs and faculty for class preparation.

Study Procedure

Students will be randomly divided into two equal groups, Group 1 and Group 2. Small group tutorials of 45 minutes will be conducted on similar topics (BC 9.3 and BC 14.8-"Processes involved in maintenance of electrolyte balance of body fluids" and "Electrolyte measurement by ISE"), with one group taught by faculty and the other by NPTs. Following the session, students will complete a written assessment (Link: https://drive.google.com/file/d/1jZ4Bp7MIw6UFVRpqelhQjyfcDtgjHSq2/view?usp=sharing) and provide feedback on the quality of NPT. After the assessment, a crossover will be performed to reduce bias. The schematic diagram of the study design is outlined in [Table/Fig-1].



[Table/Fig-1]: Theme of Conducting the study.

Students' feedback regarding NPT will be assessed using a 5-point Likert scale questionnaire: 1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly Disagree. The questionnaire is adapted and modified from a previously published study [12] and pre-validated prior to administration (Cronbach's alpha=0.897). The questionnaire will be distributed via Google Forms (https://forms.gle/rJ2zWFpSXkKt6PWH8) and will include the following items:

- Were the learning objectives achieved at the end of the NPT session?
- Did NPT provide better communication between teacher and learner compared to conventional teaching?
- Did NPT create a more cordial environment to enhance learning opportunities compared to conventional teaching?
- Do you think the NPT methodology is a better teaching-learning method than conventional faculty teaching?
- Would you encourage the use of NPT for future practical Biochemistry classes?

Focused group discussions will also be conducted to explore the merits and demerits of NPT. These discussions will generate a narrative synthesis of the advantages and disadvantages of NPT compared to traditional faculty teaching.

Primary outcomes:

- To explore alternative teaching methods in the context of the new competency-based curriculum, which provides early clinical exposure and electives.
- To assess the advantages of a structured near-peer-led educational program in promoting effective learning.

Secondary outcomes:

- To better understand the concept of cognitive congruence and potentially open a new domain of research in medical education.

STATISTICAL ANALYSIS

Data will be compiled in Microsoft Excel 2016. Students' scores obtained after conventional teaching and NPT will be compared. Questionnaire responses will be described using percentage distributions. Appropriate statistical software will be used for data analysis. Descriptive and inferential statistics will be applied. An unpaired t-test will be used to compare mean scores between the two groups. Student opinions on the Likert scale will be analysed using the consensus score method devised by Tastle and Wierman [23].

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PARTICULARS OF CONTRIBUTORS:
1. Assistant Professor, Department of Biochemistry, Nil Ratan Sircar Medical College, Kolkata, West Bengal, India.
2. Associate Professor, Department of Prosthodontics and Crown and Bridge, Sharad Pawar Dental College and Hospital, Datta Meghe Institute of Higher Education and Research (DMIHER) (Deemed to be University), Sawangi (Meghe), Wardha, Maharashtra, India.
3. Director and Professor, School of Higher Education and Research (SHER) and Department of Anatomy, Datta Meghe Institute of Higher Education and Research (DMIHER) (Deemed to be University), Sawangi (Meghe), Wardha, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Sanghamitra Chakraborty,
IA-298/7, Sector-3, Salt Lake, Kolkata-700097, West Bengal, India.
E-mail: chakrabortydrsanghamitra@gmail.com

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