

Outcome of remedial coaching in Biochemistry with peer assisted learning as teaching learning methodology – An observational study among undergraduate medical students

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ABSTRACT

Introduction: Peer-assisted remedial teaching (PART) is an inclusive educational approach that fosters a collaborative learning environment. It encourages students with varying proficiency levels to engage in reciprocal teaching relationships, where more capable students provide guidance and support to their peers. This strategy is designed to enhance learning outcomes, boost confidence and improve academic performance through targeted intervention. This study aimed to assess the effectiveness of peer-assisted teaching for slow learners among medical students, evaluating its impact on academic performance, student engagement, and overall learning experience.

Material and methods: Peer-assisted structured remedial tutoring was provided by peer tutors to slow learners at regular intervals during the second and third block of learning in biochemistry during 1st MBBS. The 1st Internal Assessment (IA) scoring pattern was compared with the 2nd IA, Prefinal assessment and Final summative examination.

Results: The average scoring pattern (%) was 34.29 ± 5.98 in 1st IA and showed a significant improvement to 46.33 ± 11.97 , 51.08 ± 9.65 and 52.34 ± 11.47 in 2nd IA, pre-final and final examination. Repeated Measures ANOVA proved that there was a significant effect of PART in increasing the academic performance of slow learners (Wilks' Lambda = 0.194, $F(3, 24) = 33.24$, $p < 0.005$, $\eta^2 = 0.80$). There was significant improvement in the academic performance in short term and long-term analysis. Peer mentors improved their knowledge-retaining abilities, reinforcing their learning while helping others.

Conclusion: PART has shown promising potential as a valuable tool for enhancing slow learners' academic performance and confidence in medical education.

Keywords: Peer-assisted remedial teaching (PART), slow learners, peer to peer tutoring.

1. INTRODUCTION

Biochemistry forms a critical component of the undergraduate medical curriculum, providing essential knowledge about the molecular mechanisms underlying normal physiological processes, disease pathogenesis, and therapeutic interventions. However, many medical students find biochemistry challenging due to its abstract nature, complex biochemical pathways, and interconnections between various physiological systems. The conventional methods of instruction, typically lecture-based, may not be sufficient to address the diverse learning needs of students. As a result, students often experience academic stress, leading to poor performance and reduced motivation. Even though many student-centric teaching-learning strategies are employed with didactic lectures in the Competency-Based Medical Education (CBME) Curriculum, a few learners still face difficulty in active learning.

Evidence shows that six to fifteen percent of medical students experience academic difficulties, and these percentages are increasing¹. Remedial coaching is a multifaceted approach, tailoring various strategies to a learner's needs. Remedial teaching helps find specific learning difficulties, such as understanding complex metabolic pathways, grasping the concept of enzyme kinetics and clinical reasoning. It provides suitable remedial measures and supports to prevent them in the

future, thus resolving learning difficulties in low achievers². Many strategies that can be involved in remedial instruction are One-to-One Tutoring, Peer Tutoring, group-assisted learning, computer-assisted learning, peer-assisted remedial teaching and many more.

Peer-assisted learning (PAL) has emerged as a potent pedagogical strategy to address these challenges. Peer-assisted remedial teaching (PART) is a subset of PAL where more proficient students help their peers struggling with particular subjects or concepts. With its proven success in various disciplines, including Biochemistry, this approach offers a promising avenue to enhance students' academic achievements, motivation, and confidence.

The literature reveals that PART has established slow learners in a comfortable learning environment, enabling them to gain learning improvement strategies and self-motivation³. Peer tutoring, with its proven track record in providing academic support, reinforcement of learning, skill development, retention of knowledge, a sense of openness and confidence, building social skills, and many more, is a well-established and effective strategy⁴. Pairing a peer in one-to-one tutoring for slow learners among medical students is a highly effective and beneficial approach that addresses academic and emotional challenges. This strategy helps create a supportive learning environment that can improve short-term academic performance and collaborative learning.

Therefore, this study was done to evaluate the outcome of remedial coaching in Biochemistry by adopting one-to-one peer-assisted learning, also called peer-to-peer tutoring, as a teaching-learning strategy.

2. MATERIAL AND METHODS

This retrospective observational study, conducted by the Department of Biochemistry at KLE JGMMC, Hubballi, was meticulously designed. Ethics clearance was obtained from the JGMMC-Institutional Ethics Committee, ensuring the study's ethical integrity. The data on the remedial teaching-learning methodology was rigorously analysed from Feb 2024 to July 2024, reflecting the comprehensive nature of our research.

The teaching-learning methodology, which involved pairing an advanced learner for peer tutoring with a slow learner in a 1:1 ratio, was implemented with great care and consideration. This approach, also known as peer-to-peer tutoring, was carried out from Feb 2024 to July 2024, demonstrating our commitment to a thoughtful and effective methodology.

The peer tutors were identified from the advanced learner group based on their performance in the first IA theory with scores > 70%. The slow learner group (tutees) was those students who got < 40% marks in the First Internal Assessment. This is based on guidelines set by Criteria 2 guidelines framed by IQAC KAHAR and adopted by our institute for NAAC, wherein students obtaining less than 40 % and more than 70 % marks in First Internal Assessment are considered slow and advanced learners, respectively. Based on this, 29 learners and 29 peer tutors were identified for this remedial teaching-learning methodology.

The pairing process, which matched a slow learner with an advanced learner, was conducted with fairness and transparency. The consideration for pairing was based on criteria of Common Language, compatibility and gender, ensuring an equitable process. The list of paired students was made available for review, and only one student requested a change, which was accommodated. Out of the 29 pairs, two were non-compliant, and individualistic methods of remedial coaching were planned for those two students, maintaining the integrity of the study.

A structured weekly plan for paired peer teaching learning was designed regarding the weightage of topics in the upcoming Summative examination. A faculty member, crucial for supervision, facilitation, and fortnightly follow-up evaluations of their learning sessions, was assigned to every nine pairs of students. Assignments were taken from the learners, and practice exams were conducted. The facilitators and all other students reviewed practice exams as part of completion tests.

3. STATISTICAL ANALYSIS

The data was meticulously entered into an Excel sheet and then transferred to SPSS for thorough analysis. Quantitative variables were evaluated using mean and standard deviation. Internal assessment and University Examination scores after the First IA were compared statistically using the Repeated measures Anova Test. A p-value of less than 0.05 was considered to be significant. The perception and feedback of the peer tutors and learners were analyzed using Focused Group Discussions.

4. RESULTS

In the present study, which focused on Peer Assisted Remedial Teaching (PART) using peer-to-peer tutoring, a total of 27 tutees (identified as slow learners) were paired with tutors (advanced learners) from the first-year medical undergraduate students studying Biochemistry. These tutees were selected based on their performance in the subject, and the tutors were chosen from a pool of high-achieving students. The academic performance of these pairs was analyzed retrospectively at the end of the academic year. The group of tutees included 16 male and 11 female students.

The paired t-test underscored the following key findings. The average scoring pattern (in %) was 34.29 ± 5.98 in the 1st Internal Assessment (IA) and 46.33 ± 11.97 in the 2nd Internal Assessment (Figure 1). The difference in mean between the two sets of examinations was found to be statistically significant ($p < 0.05$), a crucial indication of the substantial improvement in academic performance post PART.

The average scoring pattern (in %) was 34.29 ± 5.98 in the 1st Internal Assessment (IA) and 51.08 ± 9.65 in the Pre-final examination (Figure 2). The difference in mean between the two sets of examinations was statistically significant ($p < 0.05$), suggesting the potential of peer-assisted tutoring to significantly improve academic performance.

The average scoring pattern (in %) was 34.29 ± 5.98 in the 1st Internal Assessment (IA) and 52.34 ± 11.47 in the Final Summative examination (Figure 3). The difference in mean between the two sets of examinations was statistically significant ($p < 0.05$), reinforcing the positive impact of peer-assisted tutoring on academic performance. Table 1 combines the statistical findings among different pairs.

Figure 1: Comparison of 1st and 2nd Internal Assessment scores of PART tutees before and after PART strategy

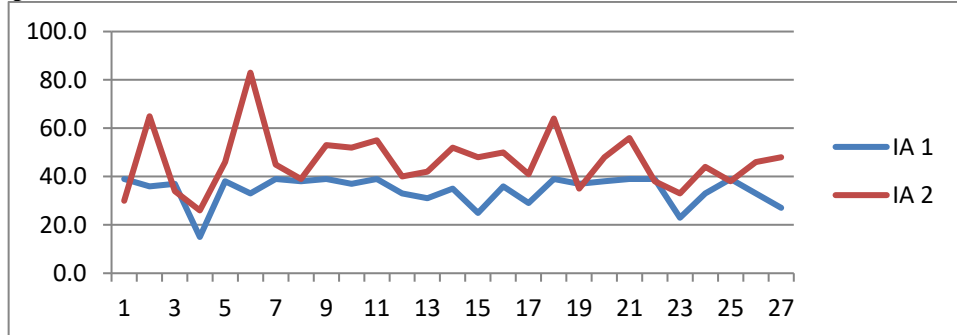


Figure 2: Comparison of 1st & Prefinal Exam scores of tutees before and after PART

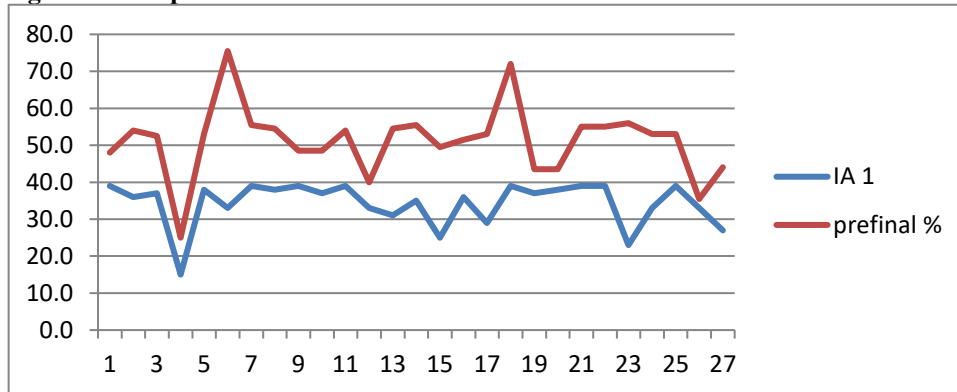


Figure 3: Comparison of 1st and Final summative scores of PAL tutees before and after PART strategy

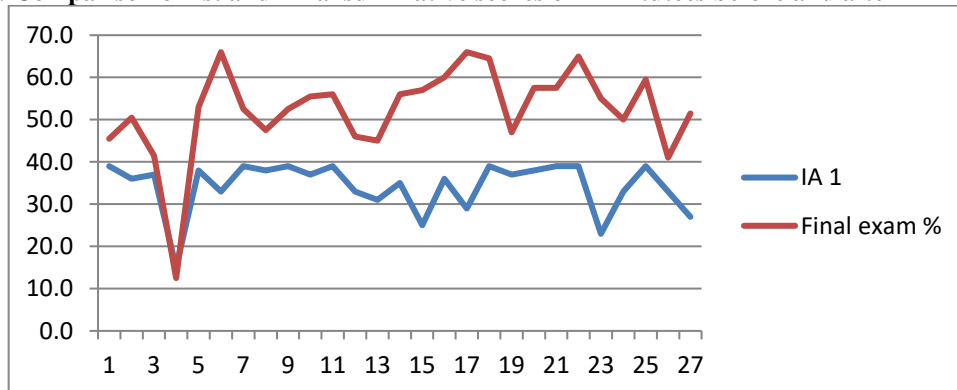


Table 1: Paired Samples Statistics

		Mean (n=27)	Std. Deviation	Std. Error Mean
Pair 1	First IA	34.29	5.98	1.15
	Second IA	46.33	11.97	2.30
Pair 2	First IA	34.29	5.98	1.15
	Prefinal assessment	51.48	9.65	1.85
Pair 3	First IA	34.29	5.98	1.15
	Final summative examination	52.51	10.59	2.03

One tutee with a score of 33% in the first IA secured 83, 76 and 66% in the 2nd Internal Assessment (IA), Pre-final and Final Summative examination, respectively. The lowest score of a tutee was 15% in 1st IA, and no significant change in academic performance was observed.

A one-way repeated measured analysis of variance (ANOVA) was conducted to evaluate the null hypothesis that there is no change in marks of slow learners even after using peer-assisted remedial teaching ($n = 27$). The results of the ANOVA indicated a significant effect, Wilks' Lambda = 0.194, $F(3, 24) = 33.24$, $p < 0.005$, $\eta^2 = 0.80$. Thus, there is substantial evidence to reject the null hypothesis.

Follow-up comparisons indicated that the pairwise difference between Biochemistry Marks obtained in the First IA and Marks obtained in the Second IA, Prefinal assessment, and Final summative examination was significant (Table 2, $p < 0.05$). There was a substantial increase in scores over time, suggesting that peer-assisted remedial teaching effectively increased the scores of slow learners.

Table 2. Pairwise Comparisons between Biochemistry Marks obtained in First IA and Marks obtained in Second IA, Pre-final, and Final Examination

Marks in Biochemistry in (A)	Marks in Biochemistry in (B)	Mean Difference (A-B)	Std. Error	p value
First IA	Second IA	-12.037(*)	2.264	0.000
	Prefinal assessment	-17.185(*)	1.730	0.000
	Final summative examination	-18.222(*)	1.780	0.000

***The mean difference is significant at the 0.05 level**

Focused Group Discussion was conducted with the peer tutors and tutee groups separately. The tutor group felt adequately prepared to tutor the tutees. Still, some tutors suggested that peer-to-peer learning could be converted to group learning or a faculty-assisted session for more challenging topics. Most of the tutors felt that their teaching approach was practical, and they learned how to teach better each session. The tutors indicated that the sessions were more like collaborative learning sessions, wherein they also benefitted from teaching and understanding concepts more deeply. Some difficulties were highlighted, like the inability to tutor during ill health leave, ave periods, or unscheduled holidays. The tutees were satisfied with the sessions and said they felt more confident and that it was easy to understand the topics in peer tutoring. They said the teaching quality was good and helpful in understanding complex concepts. Some tutees felt that the learning environment was positive and they could be involved with advanced learners for healthy academic discussions in different forums, too.

5. DISCUSSION

This study analyzed the effectiveness of Peer Assisted Learning for remedial coaching amongst first-year medical students who were slow learners with peer-to-peer tutoring as the strategy wherein the peer tutee was the slow learner, and the peer tutor was an advanced learner from the same academic year.

Our study found that peer-assisted remedial teaching had a significant, practical impact on increasing academic performance amongst peer tutees, providing reassurance of its effectiveness. (Table no 2)

Peer learning, a supportive and confidence-boosting method, refers to attaining skills and knowledge through practical help and assistance from counterparts matched in age and academic year⁵.

There are various types of peer tutoring. For example, near-peer tutoring (NPT) is wherein the tutor is a senior and more ahead in learning than the tutee. Reciprocal Peer tutoring, in which students of the same academic year interchange their roles as tutor and tutee, and peer-to-peer tutoring, wherein advanced learners are designated tutors, and those needing help or slow learners are designated tutees⁶. In our study, we employed peer-to-peer tutoring also called as one to one peer tutoring.

Our study was in accordance with the study by Oluwafolakemi Grace Ala, where it was indicated that peer-assisted learning tends to three essential components of student requirement - enriching learning, a strong support system and a feeling of fellowship⁷.

Students joining medical college go through umpteen numbers of issues as there is a transition from school to a professional course. Most of them move away from home to live in hostels for the first time; there is a change in the curriculum, and added to that are tonnes of expectations from self as well as parents and society to do well in their course and become successful Doctors. As was noted in the study by Aled Picton et al. on why students struggle in the first year, some more reasons quoted are feeling like taking up the wrong course, mental health issues etc. Hence, in such a scenario, Peer-assisted learning is a welcome relief for numerous students⁸.

'The act of facilitating a correction for trainees who started on the journey toward becoming a physician but have moved off course' refers to Remediation in medical education. Remediation is required for students with academic difficulties in the course to ensure good standards for future physicians⁹.

Although there are numerous papers on peer teaching and learning for remedial education, it is unclear whether the same is practiced fully. This paper was not only an effort to tell our medical education society about the study but also to encourage us to take up Peer Assisted Remedial Teaching as a full-time technique for remedial teaching. The logic behind

executing peer learning is that it proffers knowledge to learners on their intellectual level in a congenial and secure educational space, which in turn helps students to interact with each other, get inspired positively and enhances their inner drive to learn more, as noted in the focused group discussions with the tutors and tutees. As peer tutors, it prepares them to be good educators in their future role as physicians¹⁰.

Limitations of this study were that some topics were too complex to be taught by tutors and understood by tutees. Also, it was noticed that an advanced learner does not need to be excellent in teaching and communication. According to Adele Shenoy et al., in situations where there is inexperience in course content, additional reinforcement methods need to be used⁶. In our setup, when feedback was taken from tutors and tutees at regular intervals, three such instances were noted wherein difficulty in understanding particular topics from the tutor was voiced out. In such cases, the facilitator helped in teaching concepts to the peer learner and helped the peer tutor to increase their teaching acumen then and there. Instances like unscheduled holidays, ill health were noticed wherein tutoring in person was difficult. In such times, in the future E, Peer Tutoring could be tried.

Peer-to-peer teaching, a method that provides a supportive and secure environment, also indirectly serves as a peer mentor. It was noticed that peer tutees found a safe place and person to discuss their issues, if any, enhancing their confidence and self-motivation. A study by Kassab et al. found that PBL sessions in hematology, conducted as student-led small group sessions, were efficient due to a relaxed learning environment and mutual rapport between tutor /tutee couple¹¹.

Hence, peer-assisted remedial teaching can be a dominant learning adjuvant for slow learners along with mainstream faculty-directed medical education.

According to a review article by Cleland J. et al., various studies done on techniques for remedial teaching utilize before and after studies with small sample sizes, which are short term and hence cannot differentiate the productiveness of the intervention or the other effects like the Hawthorne effect. The present study negates this limitation as Peer Assisted Remedial Teaching was assessed throughout the academic year with supervision by faculty¹².

As discussed by Kalet A. et al., in their study on Remediation in medical education, they highlight that the way Remediation is done in a particular institution reflects that institution's academic culture.⁸ Hence, the best must be done for the same. It should be flexible and tailored based on the faculty availability, infrastructure, etc. Peer-Assisted Remedial Teaching provides a perfect methodology to accommodate the learner's perspective and the development of peer tutors as future medical teachers. This teaching-learning technique needs to be well framed and uniform throughout the year, along with diligent supervision by faculty. Regular feedback from Tutors and tutors is necessary for successfully implementing Peer-assisted Remedial Teaching.

6. CONCLUSION

This study analyzed the effectiveness of peer-to-peer tutoring for peer-assisted remedial teaching amongst slow learners of first-year MBBS in biochemistry. This study showed that PART has promising potential as a valuable tool for enhancing slow learners' academic performance and confidence in medical education. It was found that Peer-to-peer tutoring or One-to-one peer-assisted remedial teaching is a valuable pedagogical approach that fosters a collaborative, personalized learning environment for medical students. While students appreciate the increased understanding and academic performance gains resulting from peer support, there are areas for improvement, such as standardizing tutor quality, optimizing scheduling and e peer tutoring. Addressing these challenges can enhance the effectiveness of peer-assisted learning and further enrich the educational experience for medical students.

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