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Implementation of Peer-Assisted Learning (PAL) as Remediation for Academic Underachievement in Anatomy for Medical Undergraduates

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ABSTRACT
Background: Academic underachievement in medical school is a cause for concern. This mixed methods experimental study aimed to elicit the factors responsible for below-par academic performance and to explore how Peer Assisted Learning (PAL) works as remediation.
Methods: Twenty-one students with low academic scores were included as PAL tutees, and eleven volunteers with above-average academic performance were enrolled as PAL tutors. Reasons for low academic scores were collected from tutees. After orientation sessions, three PAL sessions were conducted, and pre- and post-test scores were compared. Perceptions of tutors and tutees were elicited through focus group discussions and open surveys. Thematic analysis was carried out.
Results: Students with low scores attributed them to environmental and student factors. The academic performance of PAL tutees showed significant improvement. The three themes of the advantages of PAL were a safe learning environment, the acquisition of learning strategies, and the motivation of tutors. The challenges faced involved concept clarity, time allocation and social influence. Tutors ' derived themes highlighted positive experience, acquisition of soft skills, deeper learning, social network and collaborative learning.
Conclusion: PAL benefits learners who struggle academically by providing cognitive and social support and enabling self-efficacy despite the social discomfort perceived in being part of remediation.

Key-words: Academic underachievement, Anatomy, Peer Assisted Learning, Remedial measure

INTRODUCTION

Academic underachievement denotes that the learner's academic performance does not meet their academic potential [1]. Difficulty adapting to the various roles expected of a first-year medical student has been cited as the reason for academic underachievement [2]. Anatomy is perceived as a "difficult to learn" subject due to the voluminous information to be learnt, the inability to visualize structures and inherent curricular conjunctions [1]. Learners who face difficulties in Anatomy benefit from remedial measures [3]. Remedial measures are successful and encompass various design and implementation [4]. However, responses to remedial activities vary and may be perceived negatively [2].

While PAL has shown promising results in improving learners' academic performance, its effectiveness as a remedial measure warrants investigation. We hypothesized that learners who underperformed in Anatomy might require support in knowledge acquisition and learning skills and habits necessary for academic success in the maiden year of medical school, and PAL would benefit them therein. We undertook this study to identify the factors responsible for underachievement

and evaluate PAL's effectiveness on academic underperformance in Anatomy. We explored PAL's perceptions, opportunities and challenges using qualitative methods.

MATERIALS AND METHODS

This was an interventional analytical mixed methods study in medical education carried out among I-year medical students in the Department of Anatomy of a tertiary care teaching hospital in Tamil Nadu of Southern India between September and February of the academic year 2023-24.

Inclusion criteria- Based on purposive sampling, twenty-one students with scores below 40% participated. Students with below-average scores formed the tutee group (n=21). The average marks for the first two internal assessment exams in Anatomy were chosen as the defining criteria for academic performance. Average scores below the pass percentage (below 40%) were considered underachievement. Eleven students with scores of 80% and above, volunteered as direct peer tutors (n=11).

Exclusion criteria- There were no exclusions since the remedial activity was to be an intervention as part of academic support for learners unless any learner did not attend the academic or the PAL session.

Methodology- First, the factors responsible for academic underachievement in Anatomy were investigated. A pre-existing questionnaire [5] was used to identify the reasons for underachievement by collecting student responses under three main categories, namely student, environmental and family factors, using Likert scale items and open-ended questions. Content validity was checked and the questionnaire was pre-tested. The printed questionnaire was circulated to the participants. Data collection was anonymous. A PAL intervention was scheduled as a remedial activity after identifying the factors responsible for underachievement.

A faculty member trained Direct peer tutors before the PAL sessions about their specific roles and responsibilities. Two orientation sessions were conducted during the PAL sessions, where peer tutors discussed the subject content and strategies.

PAL tutees wrote a short test on the first week of lectures and practicals on lower limbs before the

beginning of the PAL intervention. The PAL sessions were held in the practical laboratories in four small groups, with tutors allotted to each group. Three PAL sessions were held, after which outcomes were assessed through quantitative and qualitative methods. After the session, a short test was conducted on a week's lecture topics. Scores of the internal assessments before and after PAL were compared. Perceptions of PAL were collected through an open-ended survey [6] from student tutors. A semi-structured focus group discussion was held for student tutees with advantages, challenges, experience of PAL and suggestions as sub-topics. Prompts and sub-questions were asked until data saturation. A facilitator, not part of the PAL orientation, was present while another investigator made field notes. Two independent investigators coded transcripts and a thematic analysis was carried out. The third investigator adjudicated any differences of opinion.

Statistical Analysis- Quantitative variables were summarised using mean and standard deviation. Short test and Internal assessment scores before and after the sessions were compared statistically using the paired t-test. A p-value of less than 0.005 was considered to be significant. SPSS version 21.0 (IBM®, US) was used for the analysis.

Ethical Approval- The study was conducted after obtaining ethical approval from the Institutional Review Board (IHEC/313/Anatomy/08/2023) and informed consent.

RESULTS

Demographic features- A total of 32 first-year medical undergraduates participated in the study. Of these, 21 showed academic underachievement and belonged to the tutee group, while 11 belonged to the student tutor group. There were 14 male and 18 female students. The average age of the students was 19 years (range 18 – 25 years).

Factors for underachievement- All PAL tutees returned the questionnaire (100% response rate). Learners attributed lower academic scores to student (20/21; 95%) and environmental factors (21/21; 100%) than family factors (5/21; 24%). The predominant student factor was difficulty coping with the three first-year subjects (Fig. 1).

Three learners felt that festival holidays close to the assessments were distracting. The predominant environmental factor was that PAL tutees could not manage their time efficiently. Learners could not manage the time for assessment preparation and completing the syllabus (Fig. 2).
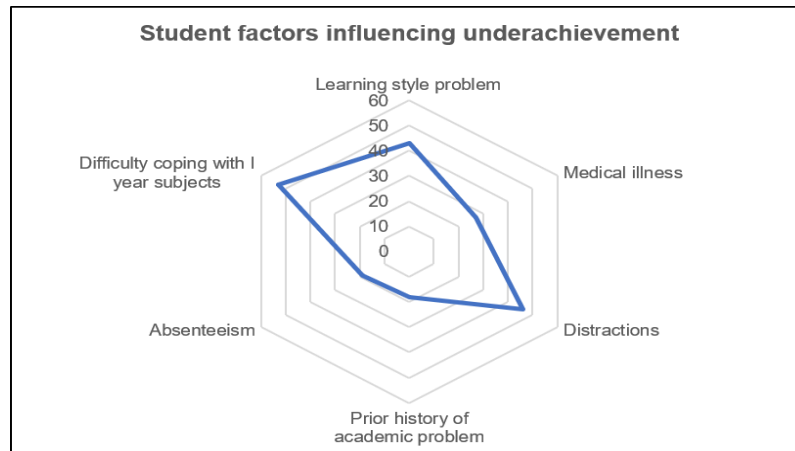

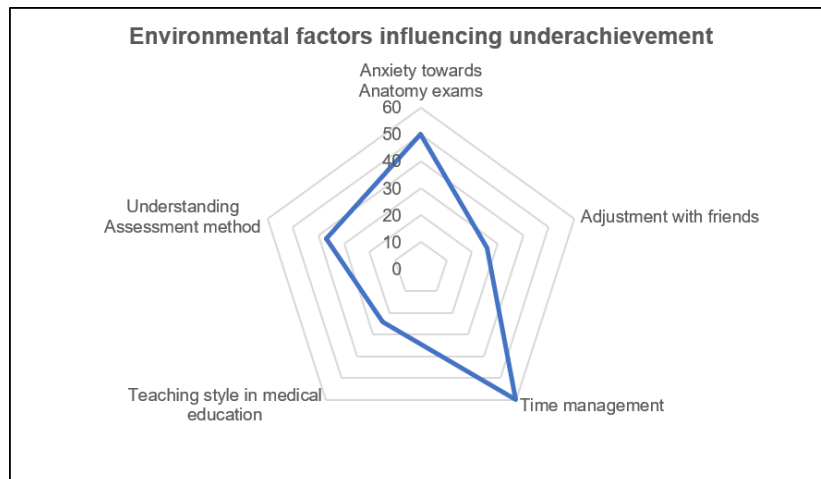**Fig. 1:** Summative Scores of agreement with statements of student factors

Fig. 2: Summative Scores of agreement with statements

They faced difficulties in answering the type of assessment appropriately, namely for multiple choice questions, essays, and short notes. Among 21 students, five reported family factors, with 3 students (14%) saying they had family issues (Fig. 3).
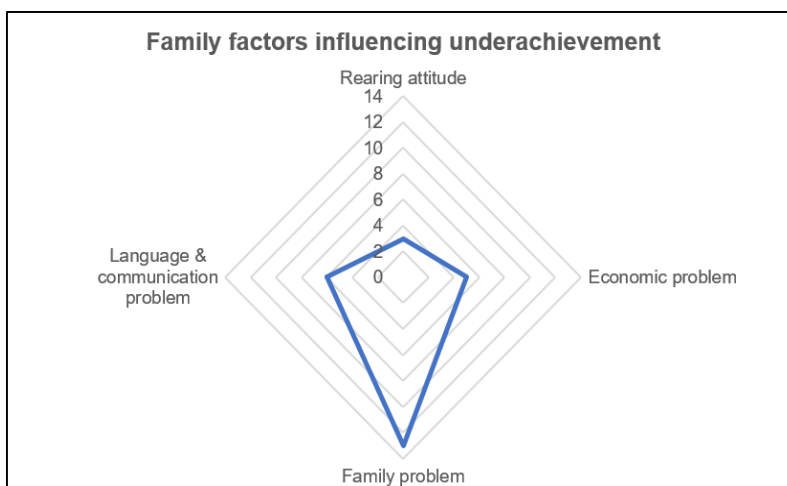

Fig. 3: Summative Scores of agreement with statements of family factors

Effectiveness of PAL in academic performance- Learner's performance improved after PAL. All the 21 students (100%) showed improvement in the short test scores. The results from the pre-test (Mean=5.98, SD=+1.48) and post-test (Mean=10.58, SD=+2.04) scores indicate improvement in academic performance with $p<.005$ (Fig. 4).
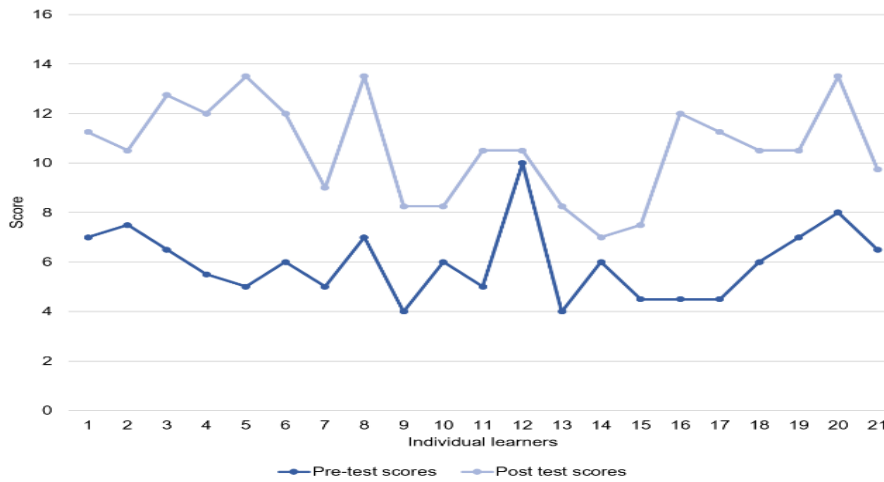

Fig. 4: Comparison of short test scores of PAL tutees before and after PAL intervention

The difference in mean scores in the Internal Assessments before (Mean= 24.83, SD=+3.53) and after (Mean=29.81, SD=+7.92) the PAL intervention indicates a statistically significant improvement (p=0.003). Among 21 students, 17 students showed improvement (81%), 1 student remained static (5%) and three students (14%) showed deterioration (Fig. 5).
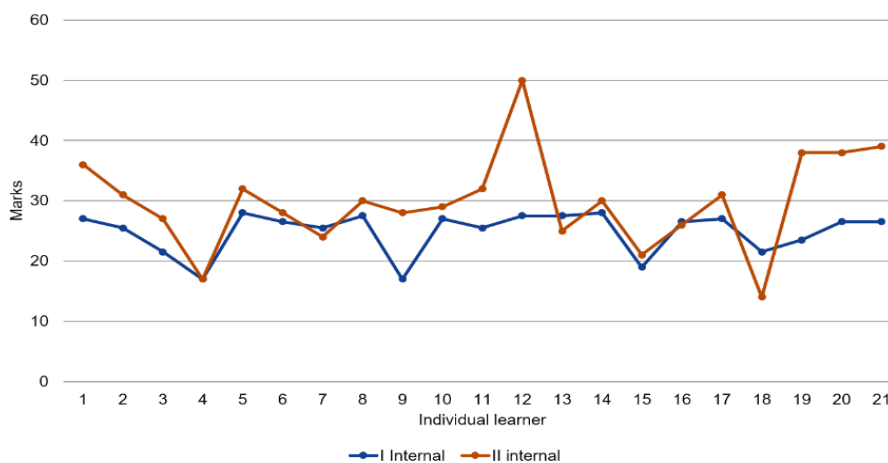

Fig. 5: Comparison of Internal Assessment scores of PAL tutees before and after PAL intervention

Perception among tutees- All tutees felt that PAL sessions were useful. They said the sessions were "helpful, memorable and joyful".

Advantages- Three main themes emerged regarding the advantages of PAL (Table 1). Students felt that they had a safe learning environment, gained learning improvement strategies and felt motivated under the influence of peer tutors. Learners described the learning experience as non-threatening, enjoyable and participatory. Learners said that communication was easier. They described tutors as accessible for repeat explanations and doubt clarification. Learners benefitted from the tutors by learning skills such as time management, answer presentation and assessment preparation strategies. They said that they understood various learning. The third theme was the motivation of the peer tutors themselves. Learners responded to the enthusiasm and efforts of the peer tutors during the PAL sessions. The 'way in which they taught' and their concern in teaching were seen as a positive influence.

Table 1: Themes derived from deductive thematic analysis of transcripts of Focus Group discussions among slow learners

Categories	Themes	Responses
Advantages	Safe learning environment	"…. felt free to discuss…." "….inhibition was not there…" " …I can ask for repeat discussion…" "…Language barrier was not a problem…" "…Joyful learning…" "…Got (to learn) some questions and memories…"
	Learning Improvement strategies	" …understood the learning style…" " …learning time management …" "… will negotiate the anxiety during exams…" "…got to know…style of reading…finish it fast…" "….presentation improvement…"
	Motivation of Peer Tutors	"…they want to teach (us) more…" ".. very interactive…"
Challenges	Complexity of concepts	"…Concepts little difficult…" "….Conceptualization…"
	Scheduling adequate time	"…finish (discussion of) particular topics on time" "…less duration for topics.."
	Social influence	"..peer pressure…" "…Singled out.."

Challenges- The challenges of PAL can be classified into three themes: complexity of concepts, time management, and social influence. Tutees said certain anatomical concepts were difficult to grasp and needed more clarification. Managing time for all the requisite topics alongside the routine class schedule was a problem. Learners felt they were being singled out for the intervention because of their academic performance.

Suggestions for improvement- Tutees suggested that topics could be divided into various sub-topics and more time could be allotted to PAL. Students wanted to learn strategies for presentation. They felt the need for clinical scenario-based and problem-based discussions and more training in answering multiple-choice questions.

Perceptions of peer tutors- The responses from the PAL tutors were categorised into five themes (Table 2). They were
 + Positive experience
 + Soft skills development (communication, leadership, planning and implementation skills)
 + Deep learning, continuous learning and learning reinforcement
 + Socialisation
 + Collaborative learning

Student tutors attributed feelings of achievement, excitement, accomplishment, altruism and happiness to the experience. Tutors said that they developed soft skills. The sessions provided a platform to overcome their shortcomings and to communicate effectively by being better listeners. The PAL sessions enabled them to develop leadership characteristics of goal setting, accountability and teamwork. Preparing for the PAL sessions made them evaluate the needs of learners, plan, prepare and implement teaching. Teaching their peers enabled deeper learning and allowed them to improve and reinforce learning better than would have been possible through routine learning. Tutors said that PAL helped them socialise with peers and that they formed strong positive relationships. PAL tutors came up with instances of collaborative learning. They said that 'both benefitted' and 'it was more like a discussion' and that PAL tutees shared 'new and unnoticed points'.

Table 2: Themes derived from deductive thematic analysis of transcripts of Open ended survey among peer tutors

Theme	Responses
Positive experience	"…Feel good while teaching…" "…rewarding experience…" "…Exciting, been a tutor in school, but it is difficult in college….quite challenging." "I feel happy when they answer correctly…" "….teach others and benefit ourselves…"
Soft Skills development	
Communication	"…overcome my little bit of stage fear…" "…Mutual listening program…" "Learning experience both ways. learned to talk and discuss the topic…" "…helped me talk to new people…" "…myself being an introvert, I can overcome my barrier to express my knowledge…"
Leadership	"I made sure that they visualise and correlate all the terms and concepts" "I'm approachable for learner (my opinion) and open to questions" "…taught me patience, to tolerate situations I haven't been through"
Planning and implementation	"…picking up the difficulty levels and delivering felt essential" "…prepare in advance for a particular event…" "I prepare the topics with utmost care." "..ideas on how to present paper--class interesting"
Deep learning, continuous learning & learning reinforcement	"…. I can learn the concept in a more detailed way…. makes me remember for a long time…" "…revising and grasping the topic way deeper than my normal study…" "…I'm open to corrections.." "…and also rectify my mistakes if anything while discussing…"
Socialization	"..good and friendly…" "…create a positive relationship…" "…new people than who I normally discuss with.."
Collaborative learning	"..revised the topic together…" "..learning experience both ways…" "..not like teaching and listening, more like group discussion.." "…they share new and unnoticed points…"

DISCUSSION

We conducted a single institution study on academic underachievement in Anatomy among I-year medical students to elicit reported reasons for the low academic scores. We later evaluated the effectiveness of peer-assisted learning and perceptions of tutors and tutees to PAL. We found that learners attributed their academic underperformance to environmental and student factors rather than family factors. A study on first-year students listed six main reasons for difficulty in learning [2]. Our study findings agree with what the authors termed "at capacity" which they described as the inability to adapt to the demands of a first-year medical student and reports of anxiety and depression. In our study, students

did not report wrong career choices, separation anxiety, or acute crises as a reason for underachievement. Learners from a pilot study on medical students reported the inability to cope with the heavy workload and reduced self–efficacy in time management [7].

PAL tutees significantly improved academic scores in both the short tests and the internal assessments. The meta-analysis, systematic reviews and other experimental studies on the effectiveness of PAL have reported better academic scores after the PAL intervention [8–10]. In Anatomy, near-peer tutoring has improved learners' academic performance in practical (dissections) and theory examinations [10,11]. Our study results are unique in that learners who were underachievers demonstrated improved academic performance in the short-term outcome. Our results indicate that peer-assisted learning has a beneficial role in remediation programs.

A pilot study among medical students reported that underachievers are less forthcoming with their difficulties and avoid measures that can help them [7]. The perception of PAL as beneficial by the tutees in the present study is notable since they are learners who had shown academic underachievement. The social congruence theory can explain why learners attribute a safe learning environment to PAL and the lack of hesitancy to seek help. The tutors are seen as non-threatening because they occupy similar social roles. Learners perceive peers as supportive and empathetic and find PAL beneficial because there is an opportunity for informal communication [12].

The second theme that explained the advantages of PAL was the practice of learning improvement strategies. This perceived improvement in self-efficacy and ability to cope with workload has been reported in radiology and final-year courses [13,14]. Near peer-assisted learning has been helpful in preparation for anatomy examinations [11]. This has been explained through the social and cognitive congruence theories [12]. The cognitive congruence theory underlies the finding that learners can learn from learners with similar knowledge bases. Hence, they are aware of the academic and non-academic difficulties.

PAL tutees were motivated by the efforts shown by tutors. Tutees felt obligated and encouraged to respond to the tutoring, learning and performing better. This agrees with previous studies [15], and enthusiasm and

commitment are listed among the key traits required of a peer tutor [16]. The three themes that emerged from the present study as challenges of PAL were the complexity of concepts, the scheduling of adequate time and social influence. One reason for this could be that in this study, PAL was administered by tutors of the same level. Studies that report a better understanding of concepts [14,17] often involve near-peer tutors a few years more advanced than the tutees.

Studies have noted the difficulty in organising and scheduling sessions within the busy routine [18]. An option is to foster informal, out-of-academic hour interactions that can contribute to PAL objectives [19]. A unique theme that tutees reported was the social pressure of being invited to participate in a remediation activity. Authors of a paper on guidelines for remediation mention the need for evidence on the impact of this negative bias [20]. This challenge is related to the remediation process; despite this, tutees concede that they find PAL useful and enjoyable.

The perceptions of PAL tutors could be classified under five themes. The entire experience of PAL was interpreted as a positive experience. PAL has been perceived as having a positive impact [6]. This positive perception results from the tutors' involvement in PAL, which leads to benefits catering to the satisfaction of the hierarchy of human needs as described by Maslow [21]. Authors have attributed the positive range of feelings associated with PAL to stimulation of the mesolimbic dopaminergic reward pathways in the brain [22]. The second theme was improved soft skills, encompassing three subthemes- Communication, leadership, planning and implementation. Soft skills development among tutors, including communication, leadership and teaching skills have been attributed to the enactment of PAL sessions [14,23]. The third theme was deep learning, continuous learning and learning reinforcement. PAL has been shown to foster higher-order thinking skills among learners [14,17]. Tutors are motivated to learn more in-depth and more than usual to teach [21]. Final-year students in a study found that PAL fostered deeper learning in Anatomy [24]. The fourth theme categorized the aspect of socialization among peers. While reporting the advantages of PAL, learners have talked about this feeling of community [25].

In this study, PAL tutees reported the fear of being singled out. The peer interaction in socialization might

have helped PAL tutees overcome the stigma of low academic scores. The fifth theme from tutor responses was collaborative learning. PAL tutors who participated in this study demonstrated perspicacity in viewing the sessions as a place of discussion and collaborative learning. Tutors felt that they were learning together and that the knowledge they gained was mutual due to the interaction. Other authors have mentioned this aspect of PAL [19]. Our study results are from a short-term evaluation of PAL for underachievers in Anatomy. We did not document any informal peer learning that took place. The long-term effects and work habits that were developed were not studied.

CONCLUSIONS

Findings from our students in our institution show that first-year learners of Anatomy attribute low academic scores to student and environmental factors. PAL improves academic performance among learners who show underachievement by providing a safe learning environment and acquiring learning strategies and motivation from peer tutors. This is despite the social isolation perceived as being part of remediation. We recommend incorporating PAL as a remedial measure to improve academic performance and help learn vital soft skills to cope with the cognitive challenges faced in the first year of medical school. Our results highlight that peer-assisted learning can help overcome the perceived stigma of peer pressure in students who need remediation. PAL enables learning and coping behaviours by creating a positive learning environment, socialisation, and reciprocal learning benefits which must be factored into the design of remediation programs.

Further research on the dynamics and benefits of near-peer teaching and reciprocal Peer-assisted learning might strengthen the case for PAL in attenuating academic underachievement in Anatomy.

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