Effectiveness of Remedial Teaching for Improving the Academic Performance of Poorly Performing Phase 1 Medical Students in Biochemistry Discipline at Government Medical College, Kozhikode, Kerala

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ABSTRACT

BACKGROUND

Remedial teaching is an educational programme for increasing the academic performance of poorly performing students in a curriculum. Remedial teaching is finding specific learning difficulties in low achieving learners who are lagging behind in academics and providing them with necessary support and guidance to bring their academic performance closer to the required standard and to prevent them from occurring in future.

METHODS

This quasi-experimental study was conducted among first year medical students at Government Medical College, Kozhikode, Kerala from December 2019 to February 2020. All the sixty-four students who scored less than 50 % of marks in Biochemistry first internal examination were identified as poor performers. They were divided in to two groups, A and B, each consisting of thirty-two students by simple random method. The study skills of group A and group B students were assessed using study skills assessment questionnaire. They were also assessed on non-academic problems that affect their studies through open-ended interviews. Both the group students received academic support that included conceptual learning, logical thinking, reasoning skills and answering methods. In addition, group A students were given remedial teaching comprising study skills training, counselling sessions and motivation classes. At the end of eight weeks, a summative assessment was conducted for both the groups. A four-point Likert scale feedback questionnaire on remedial teaching was collected from group A students. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 16.

RESULTS

The mean mark of group A that received remedial teaching was significantly higher ($P < 0.0001$) than group B. The difference in mean marks between pre-test and post-test in group A was statistically significant ($P < 0.0001$).

CONCLUSIONS

Remedial teaching sessions are effective for improving the academic performance of poorly performing students in the subject of Biochemistry.

KEYWORDS

Remedial Teaching, Academic Support; Study Skills; Counselling; Motivation

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BACKGROUND

There is an absolute necessity to implement various methods for the improvement of poorly performing students in academics and one such method is remedial teaching. Remedial teaching is finding specific learning difficulties in low achieving learners who are lagging behind in academics and providing them with necessary support and guidance to bring their academic performance closer to the required standard and to prevent them from occurring in future.[1-3] It is important that these students receive specific and adequate training in order to achieve and excel like other students who are good in academics. Even though placing a student under remedial teaching program has a negative connotation they are definitely beneficial to the slow learners.[4] An increased percentage of students who pass in their exams motivate the teachers, alleviate the stress of parents, and also increase the reputation of the institution. Remedial education would help in producing a competent medical graduate who would render good service to the society.

In remedial teaching, the modifications only at the level of academic support may not produce the desired result unless the issues pertaining to study skills and other non-academic factors are identified and rectified in those students. These measures would help the students to concentrate in their studies with confidence which will increase their academic performance. There is no standardized assessment for finding deficiency among poor learners.[5] The academic tools for remedial education also vary from small group discussions, development of personal learning plans, learner driven remediation strategies, counselling sessions and academic mentoring.[6] In this study, the remedial teaching programme was given to the students as study skills training, counselling sessions for providing solutions to non-academic problems and motivation classes.

Objectives

1. To study the effectiveness of remedial teaching for improving the academic performance of poorly performing phase 1 medical students in Biochemistry.
2. To assess the feedback about remedial teaching method among phase I medical students.

METHODS

This is a quasi-experimental study conducted from December 2019 to February 2020 at Department of Biochemistry, Government Medical College, Kozhikode, Kerala. Phase I medical students belonging to 2019 - 2020 regular batch who had scored less than 50 % of marks in Biochemistry first internal examination were included.

Inclusion Criteria

All the sixty-four phase I medical students who scored less than 50 % of marks in Biochemistry first internal examination were included in the study.

Exclusion Criteria

Students who were absent during the classes were excluded from the study.

The study was conducted in the Department of Biochemistry, Government Medical College, Kozhikode, Kerala after obtaining approval from scientific committee and ethical committee of the institute. Poor performers in Biochemistry among phase I medical students were identified as those who scored less than 50 % of marks in first internal examination. All the sixty-four students who failed were willing to be included in the study and informed consent was obtained. They were divided in to two groups, A and B, each consisting of thirty-two students by simple random method. The lecture classes covering the syllabus of first internal examination were scheduled for both the groups together after their regular class hours. These classes were conducted one day in a week for eight weeks and the topics included metabolism of carbohydrates, proteins, haem and enzymology. Both the groups received academic support that included conceptual learning, logical thinking, reasoning skills and answering methods.[7]

The study skills of group A and group B students were assessed using study skills assessment questionnaire developed by University of Houston-Clear Lake counselling service, United States of America.[8] The study skills assessment questionnaire consists of eight sections on time management and procrastination, concentration and memory, study aids and notes taking, test strategies and test anxiety, organising and processing information, motivation and attitude, reading and selecting main idea and writing.

There were eight questions in each section and the participant has to choose the response from graded multiple options like always (4 marks), usually (3 marks), sometimes (2 marks) or never (1 mark). The total score from each section was summed up and the degree of study skills were marked as good (above 28 marks), average (21 to 28 marks) and poor (less than or equal to 20 marks). These scores were collected for questions from all the eight sections. Both the group students were also assessed on non-academic problems that affect their studies through open-ended interviews and the responses were recorded, spread and gathered through excel sheet.

The group A students were given remedial teaching sessions after their regular classes that included study skills training, counselling sessions and motivation classes. After assessing the study skills questionnaire from students, the study skills support training was provided on methods to stop procrastination, management of time, concentration tips, memory boosting suggestions, strategies for test planning, reducing anxiety, team learning, tips on reading, notes taking and utilising study aids.[7,9]

During counselling sessions, the non-academic problems that affect their studies was discussed individually and the solutions to rectify them were suggested. The motivations classes were conducted to build the confidence of students.

At the end of eight weeks, a summative assessment covering the topics of first internal exam was conducted for

both the groups. The questions were prepared with the same difficulty index as that of first internal examination. A four-point Likert scale feedback questionnaire on remedial teaching was collected from group A students. After the study, the remedial teaching sessions were also conducted for group B students.

Statistical Analysis

The statistical analysis was performed using SPSS version 16.0 software. The mean post-test scores of group A and group B were analysed using independent t-test. The mean pre-test and post-test scores of group A were analysed using paired t-test. Qualitative data on study skills assessment were analysed by chi-square test. The p value less than 0.05 was considered statistically significant.

RESULTS

Both groups were academically comparable before the intervention. The mean marks of pre-test in group A and group B were 38.3 ± 9.1 and 39.2 ± 6.9 respectively and the difference in mean marks between them before the intervention was not statistically significant (P = 0.653). The mean marks of post-test in group A and group B were 77.5 ± 7.6 and 33.9 ± 13.8 respectively. The mean mark of group A was significantly higher than B (p < 0.0001) after the intervention by independent-*t* test. (Table 1). The mean marks of pre-test and post-test in group A were 38.3 ± 9.1 and 77.5 ± 7.6 respectively. Group A students gained marks between 14.25 and 64.5 with a mean gain of 39.2 and SD ±10.8. The difference in the mean marks was statistically significant (p < 0.0001) by paired *t*-test. (Table 2).

The mean marks of pre-test and post-test in group B were 39.2 ± 6.9 and 33.9 ± 13.8 respectively. Among group B, students only gained 9 marks in the post-test between 4 and 39 with mean gain of 14.5 marks while 23 of them lost marks between 0.75 and 32.5 with mean loss of 13.1 marks. (Table 1). On the study skill assessment of students in group A, out of 32 students, 30 (94 %) found difficulty to manage time and admitted that they procrastinate, 21 (66 %) lacked concentration and had problem in memory retention, 23 (72 %) had problem in taking notes and using study aids, 22 (69 %) found difficulty in planning test strategies and had test anxiety, 17 (53 %) had issues in organising and processing information, 20 (63 %) had low motivation and poor attitude, 24 (75 %) had difficulty in reading and selecting main idea and 17 (53 %) had issues in writing. (Figure 1).

On the study skill assessment of students in group B, out of 32 students, 29 (91 %) found difficulty to manage time and admitted that they procrastinate, 22 (69 %) lacked concentration and had problem in memory retention, 24 (75 %) had problem in taking notes and using study aids, 22 (69 %) found difficulty in planning test strategies and had test anxiety, 18 (56 %) had issues in organising and processing information, 21 (66 %) had low motivation and poor attitude, 23 (72 %) had difficulty in reading and selecting main idea and 16 (50 %) had issues in writing. (Figure 2).

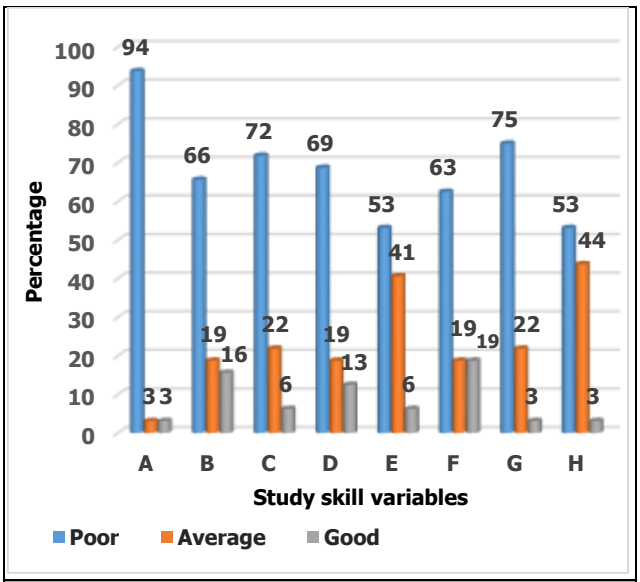

Figure 1. Study Skills Assessment of Group A Students

A: Time management & procrastination; B: Concentration & memory; C: Study aids & notes taking; D: Test strategies & test anxiety; E: Organising & processing; F: Motivation & attitude; G: Reading & selecting main ideas; H: Writing

	Group (n = 32)	Mean ± SD	P Value
Pre-test marks	A	38.3 ± 9.1	0.653
	B	39.2 ± 6.9	
Post-test marks	A	77.5 ± 7.6	< 0.0001
	B	33.9± 13.8	

Table 1. Mean Pre-Test and Post-Test Marks of Group A and Group B (Independent t-Test)

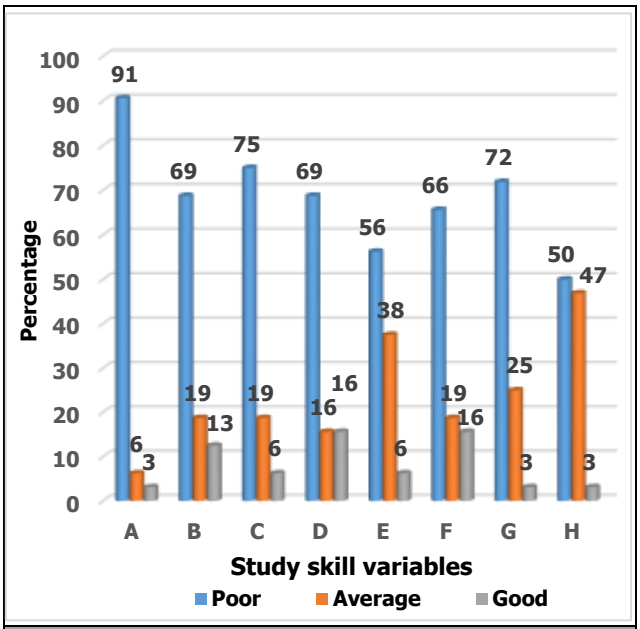

Figure 2. Study Skills Assessment of Group B Students

A: Time management & procrastination; B: Concentration & memory; C: Study aids & notes taking; D: Test strategies & test anxiety; E: Organising & processing; F: Motivation & attitude; G: Reading & selecting main ideas; H: Writing

Both the group students were comparable in their study skills assessment. However, the outcome (P > 0.05) is not statistically significant for all the eight study skill variables in the questionnaire. (Table 3).

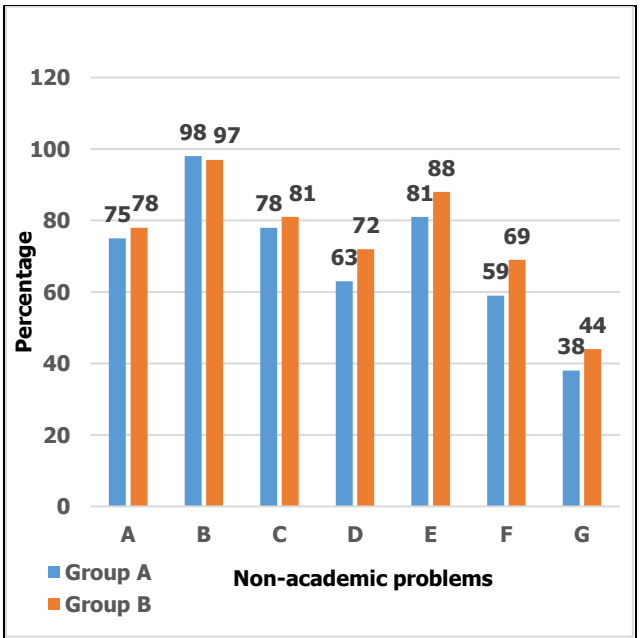

Figure 3. Non-Academic Problems that Affect Studies in Group A and Group B Students

A: Addiction to social media; B: Inability in adapting to hostel life; C: Lack of mentor support; D: Language problem; E: Low confidence; F: Over involvement in extra curricular activites; G: Peer pressure

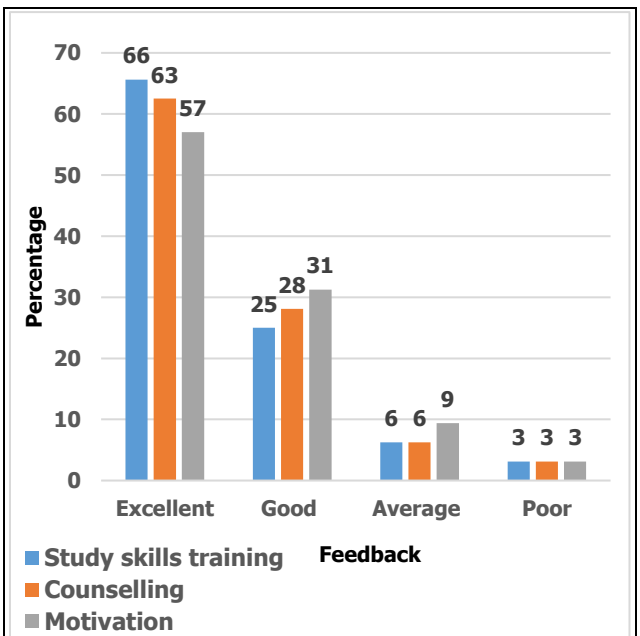

Figure 4. Feedback on Remedial Teaching Method in Four-Point Likert Scale

Group (n = 32)	Pre-Test Mean ± SD	Post-Test Mean ± SD	Gain in Knowledge	P Value
A	38.3 ± 9.1	77.5 ± 7.6	39.2 ± 10.8	< 0.0001

Table 2. Mean Pre-Test and Post-Test Marks in Group A (Paired t-Test)

Sl. No.	Factors	Group A (%)	Group B (%)
1	Time management & procrastination	94	91
2	Concentration & memory	66	69
3	Study aids & notes taking	72	75
4	Test strategies & test anxiety	69	69
5	Organizing & processing	53	56
6	Motivation & attitude	63	66
7	Reading & selecting main ideas	75	72
8	Writing	53	50

Table 3. Comparison of Poor Degree in Study Skill Assessment Questionnaire among Both the Groups

Sl. No.	Statements	Response
1	I arrive at classes and other meetings on time.	
2	I devote sufficient study time to each of my courses.	
3	I schedule definite times and outline specific goals for my study time.	
4	I prepare a "to do" list daily.	
5	I avoid activities which tend to interfere with my planned schedule.	
6	I use prime time when I am most alert for study.	
7	At the beginning of the term, I make up daily activity and study schedules.	
8	I begin major course assignments well in advance.	
9	I have the "study-place habit," that is, merely being at a certain place at a certain time means time to study.	
10	I study in a place free from auditory and visual distractions.	
11	I find that I am able to concentrate - that is, give undivided attention to the task for at least 20 minutes.	
12	I am confident with the level of concentration I am able to maintain.	
13	I have an accurate understanding of the material I wish to remember.	
14	I learn with the intention of remembering.	
15	I practice the materials I am learning by reciting out loud.	
16	I recall readily those things which I have studied.	
17	While I am taking notes, I think about how I will use them later.	
18	I understand the lecture and classroom discussion while I am taking notes.	
19	I organize my notes in some meaningful manner (such as outline format).	
20	I review and edit my notes systematically.	
21	I take notes on supplementary reading materials.	
22	I have a system for marking textbooks.	
23	When reading, I mark or underline parts I think are important.	
24	I write notes in the book while I read.	
25	I try to find out what the exam will cover and how the exam is to be graded.	
26	I feel confident that I am prepared for the exam.	
27	I try to imagine possible test questions during my preparation for an exam.	
28	I take time to understand the exam questions before starting to answer.	
29	I follow directions carefully when taking an exam.	
30	I usually get a good night's rest prior to a scheduled exam.	
31	I am calmly able to recall what I know during an exam.	
32	I understand the structure of different types of tests, and am able to prepare for each type.	
33	When reading, I can distinguish readily between important and unimportant points.	
34	I break assignments into manageable parts.	
35	I maintain a critical attitude during my study - thinking before accepting or rejecting.	
36	I relate material learned in one course to materials of other courses.	
37	I try to organize facts in a systematic way.	
38	I use questions to better organize and understand the material I am studying.	
39	I try to find the best method to do a given job.	
41	I sit near the front of the class if possible.	
42	I am alert in classes.	
43	I ask the instructor questions when clarification is needed.	
44	I volunteer answers to questions posed by instructors in the class.	
45	I participate in meaningful class discussions.	
46	I attend class regularly.	
47	I take the initiative in group activities.	
48	I use a study method which helps me develop an interest in the material to be studied.	
49	I survey each chapter before I begin reading.	
50	I follow the writer's organization to increase meaning.	
51	I review reading material several times during a semester.	
52	When learning a unit of material, I summarize it in my own words.	
53	I am comfortable with my reading rate.	
54	I look up parts I don't understand.	
55	I am satisfied with my reading ability.	
56	I focus on the main point while reading.	
57	I find that I am able to express my thoughts well in writing.	
58	I write rough drafts quickly and spontaneously from notes.	
59	I put aside a written assignment for a day or so, then rewrite it.	
60	I review my writing for grammatical errors.	
61	I have someone else read my written work and consider their suggestions for improved writing.	
62	I am comfortable using library resources for research.	
63	I am able to narrow a topic for an essay, research paper, etc.	
64	I allow sufficient time to collect information, organize material, and write the assignment.	

Study Skills Assessment Questionnaire

The most common non-academic problems that affect studies in both group A and group B students were inability in adapting to hostel life (98 % and 97 % respectively), low confidence (81 % and 88 % respectively), lack of mentor support (78 % and 81 % respectively), addiction to social media (75 % and 78 % respectively), language problems (63 % and 72 % respectively), over involvement in extra-curricular activities (59 % and 69 % respectively) and peer pressure (38 % and 44 % respectively). (Figure 3).

In the four-point Likert scale feedback for remedial teaching method collected from the students who received remedial education, 66 % responded excellent for study skills training, 63 % responded excellent for counselling sessions and 57 % responded excellent for motivation classes. (Figure 4).

DISCUSSION

In our study, both the groups were comparable academically and in assessment of study skills before the intervention. The difference in mean pre-test marks among both the groups was not statistically significant ($p = 0.653$). On comparison of poor score in study skill assessment questionnaire, there was no statistical significance ($p > 0.05$) for all the eight variables among both groups. Through academic support the students were given guidance about understanding the topic conceptually and remembering them by applying reasoning and logical thinking. The academic performance of the students increased significantly in one group when the classes for academic support were combined with remedial teaching sessions.

In our study, we used study skills training, counselling sessions and motivation classes as intervention tools for remedial teaching.

The study skills that were taught helped in correction of faulty study habits, memory retention, effective time management and planning active participation in interactive classes and to overcome anxiety. In counselling sessions, the non-academic problems that affect their studies were discussed and the feasible solutions to rectify them were suggested which helped the students to concentrate in their academics.

The motivation sessions boosted the confidence of students. All these remedial measures enhanced the post-test score significantly. The results of this study are comparable to many such similar studies which stressed the need for remedial teaching sessions in medical education.

Misra et al. in their study had stressed that remedial education should consist of counselling and mentoring which can effectively lead to good academic results. They also emphasized that remedial measures should be started earlier in the carrier of students which will help in achieving better academic performance.[10] In our study, the first-year students were the participants and the various study skills that were taught would help them to carry it forward to the subsequent years. Similar observation was made by Warburton et al. and they too stressed that remedial education should have standardized assessment process to identify slow learners early in their carrier and such remedial tools should be targeted and specific for the students.[11] They conducted their study at the University of Pennsylvania, where resident learners in the department of medicine who were below the standards were referred to the Early Intervention Remediation Committee (EIRC). This committee developed comprehensive assessment and remediation program for 4 % of students (14 of a total 342) for two years. The most common problems observed were in organisation and efficiency, medical knowledge, clinical reasoning, and psychosocial issues. All the students completed their remediation program with good results. In our study, the assessment questionnaire regarding study skills and open-ended interviews on non-academic problems helped in specific and targeted remedial approach.

In his study, Mysorekar enrolled 73 students who scored less than 30 % in pathology first internal exam to attend sessions on study skills and counselling.[12] After six months, the evaluation was done and paired t-test revealed significant improvement in the academic performance of students who participated in the counselling sessions ($p < 0.001$), whereas there was no statistically significant difference in 10 students ($p = 0.54$) who did not attend remedial sessions. Moon et al. conducted a four-week deliberate practice based clinical performance remediation course at Seoul National University College of Medicine.[13] The remedial programme which was conducted for 74 students out of 620 who had deficit in medical knowledge, clinical and communication skills produced good results. While the average total OSCE T-score of the remediation group improved to 45.85 from 36.54, the total T-score in the control group ($n = 546$) decreased from 51.79 to 50.54.

In their study, Guerrasio et al. had 151 referrals for remediation program at University of Colorado School of Medicine.[14] Through a standardized assessment process clinical reasoning deficit was identified in 53 students. A ten-step clinical reasoning and remediation program was implemented for these learners. While fifty-one of the 53 (96 %) passed the post remediation reassessment, thirty-eight (72 %) learners graduated from their original program or continued to practice in good standing. Myung et al. conducted their study on 147 students who had applied for third clinical performance examination at Seoul National University College of Medicine.[15] Out of them, 18 students who had deficits in history taking, physical examination, clinical reasoning and physician-patient interaction were enrolled for six-week remediation program. On re-evaluation the remediation group had better scores in all categories when compared with the control group.

In the study conducted by Visconti et al.[16] residents were found eligible for focused board intervention remediation program based on poor score in American Board of Emergency medicine written examinations.[16] The remedial programme had individualized education plans, containing self-study audio review lectures with short answer examinations. In the subsequent written qualifying examination, the pass rate of 16 students who did not attend remediation program was only 44 %, whereas it was 100 % for the 10 residents who attended the program. Guerrasio et al. in their study observed that in remediation program more time for interaction between faculty and the students

were required especially when the deficit is observed in clinical reasoning and mental well-being ($p < 0.001$ and $p = 0.03$ respectively) and that decreased odds of probation by 3.1 % and negative outcomes by 2.6 %.[17] In our study, counselling sessions helped in more faculty-student interaction.

There was good reception for remedial sessions in our study which was evident from the feedback collected from students. In an earlier study conducted by Moon et al. out of 74 students, 61 students gave the post-remedial program feedback as generally satisfied (4.14/5.0) and would recommend the program to their juniors (4.23/5.0).[13] Similar observation was also found in the study by Myung et al. where students in their post program evaluation questionnaire gave the feedback that remedial course was helpful in improving their clinical skills.[15]

In our study, the study skills assessment questionnaire from the students revealed poor time management and procrastination as an important determinant for poor score in exams. Naik et al. in their study had observed that lack of effective time management would lead to demotivation and low confidence among students causing anxiety and poor academic performance.[18] The study conducted by De Paola et al. on procrastination and academic success in Italian undergraduates, stated that procrastination can have negative influence on the academic performance of students and so he emphasized that remedial programs should aim at helping students who have tendency to procrastinate.[19] Among the non-academic factors affecting studies, students responded as inability in adapting to hostel life, low confidence and lack of mentor support as the most common reasons for decreased academic performance. Nimmons et al. in their review on medical student mentoring programmes observed that attainment of clinical knowledge and skills, personal and professional development, socialization of the profession and development of communication skills were potential benefits of mentoring.[20] In the study conducted by Fricke et al. it was observed that mentorship programme not only enhanced the career of the mentees but also helped them to actively engage in research activities and more research output for the institution.[21]

CONCLUSIONS

Remedial teaching sessions are effective in increasing the academic performance of poorly performing students in the subject of Biochemistry. Remedial measures like study skills training, counselling sessions and motivation classes had good feedback among students. Considering its impact on the performance of students and in developing their competence, remedial teaching should be necessarily implemented in medical education curriculum.

Limitations of This Study

The limitations of this study are that the findings may be context specific or specific for the subject of Biochemistry. This study was conducted in one medical college and also in limited area of medical education curriculum. Even though this study and earlier studies on remedial education show a statistically significant improvement in academic performance of students, they are not implemented in all medical institutions. Decreased human resources, poor participation of students and more time consumption may be the reasons for the same. There is also lack of standardized and universally accepted remedial teaching methods. Hence, there is greater need for further research regarding this academic tool that would help in assessment of students and implementation of targeted remedial measures to them. Multicentric studies covering large areas of the curriculum of longer duration globally will throw more light on its effectiveness in medical education.

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