

Application Based Learning Through Hospital Projects For Teaching Microbiology To Medical Students.

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Abstracts: Microbiology in spite of being a crucial subject for understanding the basic principles with their application in infectious disease fails to impress the undergraduate medical students probably because they are taught the subject in isolation without much clinical context. To help students learn important concepts of microbiology by shifting the focus from didactic classroom setting to the patient care setting, we introduced hospital projects focusing on selected concepts of microbiology. The students (n=103) in their 2nd phase of MBBS studying para-clinical subjects were randomly divided in test and control groups. Test group was sent to the hospital with specific objectives for a defined duration. The difference in the level of understanding and knowledge in the selected topics for both the groups was judged by pre and post test. Perception of faculty and students towards the whole process was collected through feedback questionnaires, framed with a four point scale as per the Kirkpatrick's evaluation model. The test group (average pre-test score 9.64 to post-test score 16.28) showed a remarkable improvement in the understanding and knowledge of topics in comparison to the control group (average pre-test score 10.12 to post-test score 12.5). This was highly significant (P value <0.001) by statistical analysis (paired T test). The process of sending the students to hospital for strengthening of the important microbiology concept is a novel idea. Students appreciated the process as they could understand the practical significance and relevance of the theory taught to them in classrooms. Time constraint was perceived as a major limiting factor. [Suman Singh et al. NJIRM 2011; 2(3) : 1-7]

Key Words: Microbiology, Hospital based projects, Undergraduate Medical Education.

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Introduction: Microbiology is taught across a wide variety of both medical and non medical fields. It has been a challenge to make the subject catch student's interest and attention¹. To make the students appreciate and understand the utility of the subject a large variety of techniques, both in and outside the class room have been tried as described by Beni H I et al and Meilander T T et al^{2,3}. For a medical undergraduate student, sound knowledge of the subject with an understanding of the principles and their application in clinical context is crucial⁴. It can equip them with skills in effectively managing the patients with whole range of infectious disease as they would understand the microbes, the body's response and the ways to control them better⁵.

Microbiology is taught in 2nd MBBS as a para-clinical subject, usually in classrooms with very little exposure to the application and practices in real life situations in hospital, of the theory of principles being taught. This makes the subject dry and clinically irrelevant as students fail to understand the utility of the subject in clinical

practice. To make the students realize significance of the subject as clinically relevant efforts have been made in different areas^{1-3,6}. Projects are known to keep students engaged and promote active learning⁷. Keeping this in mind and to help students in shifting the focus from class room, predominantly didactic learning to inquiry based learning by observations, experience, and reflection in hospital environment we introduced an innovative hospital based project work, so as to ensure that students learn the basic concepts of microbiology by critical thinking, team work and are able to apply the knowledge in clinical practice. The main objectives of hospital based projects were-

- Improved learning of targeted microbiology concepts.
- Develop an understanding of the application of microbiology as a clinical subject in the patient care setting.
- Create interest in the subject.
- Foster team work with development of group dynamics
- Exposure to project planning tools.

The intervention was also expected to help in faculty development, to enable it to acquire a new role of project guide, which is substantially different from that of a conventional medical teacher.

Material and Methods: After seeking clearance from the institutional ethics committee, teachers of microbiology department were oriented to hospital based project work by a series of interactive meetings, covering principles and methodology of projects, selection of topics and methods to evaluate them.

An initial introduction of hospital projects with its concept, methodology and evaluation plan was given to a batch of 103 students in the fourth semester of second year of MBBS in the year 2008. Topics for the project work were selected and discussed with the students. The whole batch of students was divided into two groups, i.e. A (n=53) and B (n=50) and assigned as control and test group through lottery system. Group A (n=53) was not given any hospital project and continued to learn microbiology without any change. They served as control. Group B (n=50) was sent to hospital as the test group. This was done for the purpose of evaluation of the impact of the intervention planned. A cross over was done after evaluation to take care of ethical issues.

Two important aspects of microbiology theory with maximum application in clinical practice identified as project titles were "Sterilization and Disinfection practices in various locations in hospital" and "Collection and transportation of clinical specimens for microbiological investigations especially for culture and antimicrobial sensitivity".

The test group was further divided into two sub groups with 25 students each and assigned the above selected topics. Each sub group was divided into teams of two or three students per team randomly. One student was selected as their leader, by the team members and was made responsible for overall progression of the work. Each team was assigned a faculty to guide the work. We have six faculties in microbiology and each had 3-4 teams of students with similar topics for guidance. Different locations in the hospital e.g.

medical ward, surgical ward, ICUs, operation theaters etc were allocated to each team where they would complete their projects. The students were made free from the department for at least two hours per week, and instructed to complete the work in a maximum duration of six-eight weeks. The work began with a phase of theoretical preparedness where the students were expected to strengthen their background knowledge of the selected topic. Formats for collection of data during hospital visits were prepared and they were required to go to the hospital, visit wards, operation theaters, and laboratories, check medical records or take interview of hospital personals as per the activity required to fulfill the objectives of the work.

After project assignment, the students were expected to meet the faculty guide for discussions, usually once a week or more if required by the students or the guide, until the work was completed and a project report was prepared.

The work was presented in the whole class in the end followed by discussion on practical usefulness of outcome along with sharing of the experience. The whole process of hospital projects was undertaken with the ongoing teaching program of microbiology without affecting teaching learning process of other subjects.

The evaluation was targeted to assess the educational value of the project along with the understanding of the targeted microbiology concepts both in theory and practice by the students. Evaluation of the knowledge and understanding of the targeted concepts gained through project work was done by giving a pre and post test to both control and test group. Differences in their scores would reflect the impact of intervention. The results were compared by using both paired and unpaired T test for statistical significance.

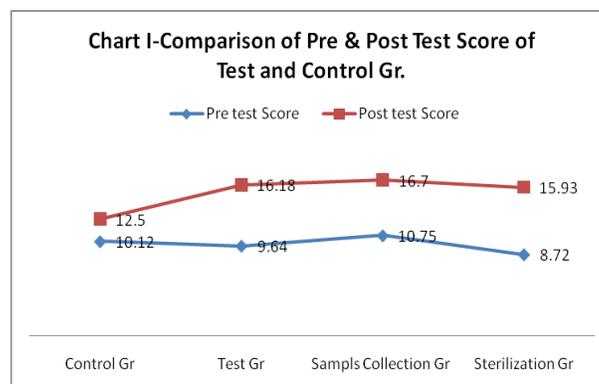
A semi structured feedback questionnaire was used to collect the perceptions of the students towards the whole process. The questionnaire was framed with a five point scale as per the Kirkpatrick's evaluation model. This was meant to provide information on the overall process and

effectiveness of hospital based project work. The students' responses also reflected the interest created in the subject with overall advantage, disadvantages, constraints faced and utility of learning through the hospital based projects.

Results: As is seen in chart-I, in the beginning of the hospital projects, both the groups i.e. project group and control group were at the same level of knowledge and understanding of the selected microbiology concepts with the pretest average scores of 9.64 ± 4.55 and 10.12 ± 2.57 respectively.

The difference in the scores was not found to be significant statistically (p -value-0.327 by unpaired T test). After implementation of the project, when the average scores of the project and control group were compared, there was remarkable improvement in the average scores of project group, from 9.64 ± 4.55 to 16.28 ± 4.22 . The group

which was not sent to hospital also showed some improvement in the average scores, from 10.12 ± 2.57 to 12.5 ± 2.42 .



The difference in the scores of two groups was highly significant statistically (p value < 0.001) indicating the positive impact of intervention in the students learning and understanding of the concepts.

Table 1 : Response about student's reaction to the process of hospital project(n=50)

No	Response question	Students Response (n=50)					Total
		Strongly disagree	Disagree	Agree	Strongly agree	Non responders	
1	Did you like and enjoy the project work?	6 (12)	7 (14)	24 (48)	12 (24)	1 (2)	50
2	Did you consider the project work relevant?	5 (10)	9 (18)	23 (46)	12 (24)	1 (2)	50
3	Did you understand the concept of the project work?	2 (4)	7 (14)	26 (52)	14 (28)	1(2)	50
4	Do you think hospital project has helped in creating interest in the subject of microbiology?	8 (16)	9 (18)	15 (30)	17 (34)	1(2)	50
5	Was it a good use of your time?	7 (14)	16 (32)	17 (34)	9 (18)	1(2)	50
6	Are you satisfied with the level of your participation?	5 (10)	8 (16)	19 (38)	18 (36)	0	50
7	Are you satisfied with the level of effort by department of microbiology that was required to make the most of the learning through project work?	2 (4)	3 (6)	9 (18)	35 (70)	1(2)	50
8	Are you satisfied with the level of support from the hospital staff?	10 (20)	15 (30)	15 (30)	9 (18)	1(2)	50
9	Are you satisfied with the level of support from your team members?	2 (4)	7 (14)	18 (36)	22 (44)	1(2)	50
10	Do you think it is practically feasible concept that can be applied at UG level?	9(18)	9(18)	19(38)	12(24)	1(2)	50
	Overall response of the students-	56(112)	90(180)	185(370)	160(320)	9(18)	500

* Figures in parentheses indicate the percentage of responses

Table 2 : Students' response of the hospital based project with regard to the learning objectives (n=50)

	Response question	Students Response(n=50)					Total
		Strongly disagree	Disagree	Agree	Strongly agree	Non responders	
1	Improved learning of targeted microbiology concepts.	6 (12)	11 (22)	18 (36)	12 (24)	3 (6)	50
2	Develop an understanding of the application of microbiology as a clinical subject in the patient care setting.	06 (12)	06 (12)	23 (46)	13 (26)	2 (4)	50
3	Created interest in the subject.	08 (16)	13 (26)	18 (36)	08 (16)	3 (6)	50
4	Foster team work with development of group dynamics	03 (6)	06 (12)	23 (46)	14 (28)	4 (8)	50
5	Orientation to project planning tools	5 (10)	10 (20)	23 (46)	09 (18)	3 (6)	50
6	You are capable of better application of microbiology concepts learned through projects	07 (14)	08 (16)	18 (36)	14 (28)	3 (6)	50
	Overall response of the students-	35 (70)	54 (108)	123(146)	70(140)	18(36)	300

* Figures in parentheses indicate the percentage of responses

Table 3 : Some other aspects of Feedback analysis

Responses question	Response	Students response (out of 50)
1. Opinion regarding the selection of the topics	Very useful and highly relevant	10 (20%)
	Useful and relevant	35(72%)
	Useless and irrelevant	4(8%)
2 Do you think the visits to various sections of the hospital helped you to know more about the practical utility of microbiology theory taught in the class rooms and would help you in your Postgraduate studies?	Not really; I can know later on.	5(10%)
	Nice to know; but it's not necessary	15(30%)
	Yes, very useful	27(54%)
3 Do you think this type of work will help you to perform better in University exam	Yes	24(48%)
	No	22(44%)
4 Do you think this type of work will help you to perform better in later days of your clinical course	Yes	34(68%)
	No	13(26%)
5 Other views shared by the students:		
	<ul style="list-style-type: none"> • Congratulations to the microbiology department. • Excellent projects. • Enjoyed the work. • Better response is required from the hospital staff. • Should be given in internship or during laboratory posting. 	

* Figures in parentheses indicates the percentage of responses

Some improvement in the scores of control group could be due to a number of other factors which have influence on students learning through other

sources like peer group learning by which students do acquire knowledge and understanding. When inter-group comparisons were made and analysed

by paired T test, highly significant difference was observed in the pre and post test results of the test groups also.

When effort was made to understand the perception of students towards the whole process through feedback form, as shown in table no. 1-3, it became evident that students enjoyed the process of learning in a hospital environment. It was very interesting to note that only 48% of the students felt that this kind of process could help them perform better in university examinations which is more focused on assessing theoretical knowledge but 68% of students felt that this kind of work would help them perform better later in their clinical practice which requires clear understanding of the concepts and their use. Majority of students (62%) felt that, this was a practically feasible concept and can be implemented for undergraduates as a regular feature as it made the subject interesting. Most of the students could understand the practical significance and relevance of theory taught to them in classrooms but found it difficult to manage time. Need for more motivation and support from hospital staff was also conveyed.

The response table was validated for internal consistency and reliability by Cronbach's alpha score of 0.82.

Students found the process well planned, useful and relevant that could help them perform better later in their clinical practice. The major constraint faced by them was that of time & lack of motivation in the hospital staff.

Discussion: As evident from the study "Preparation for clinical practice: the survey of medical students' and graduates' perceptions of the effectiveness of their medical school curriculum" by Eyal L, Cohen R, the current day medical education system has failed to satisfy the medical students in their perceived preparation for clinical practice⁸.

The most important deficiency identified is lack of clinical relevance in study of preclinical subjects. The need to reform the system of medical education has been identified and accepted

universally though the ways of reform are in the evolving stage and would continue to evolve. All over the world medical curriculum is undergoing a radical change keeping in mind the factual information overload and relevance of the information for medical students¹.

Significance of microbiology as a subject of clinical importance can not be denied along with the fact that medical students even after spending months in learning microbiology at undergraduate level fail to use it in clinical practice to the desired expectations⁵. The students perceived responses to learning in a patient care setting along with the objective evidence of knowledge gain in our study are supportive to the fact that exposure to the clinical environment acts as a stimulus to appreciate and understand the subject as clinically relevant, interesting and important⁹.

Conclusion: Thus the idea and process of sending the undergraduate medical students to a clinical setting in hospital for strengthening of the important microbiology concept is an innovative idea and has been implemented successfully. The efforts in the form of hospital projects can form a link between theory and practice of microbiology. This is likely to help prepare the students for future academic and professional challenges as is also made evident from the students own perception of becoming capable of performing better in later days of clinical practice.

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