

## Effectiveness of Project based learning in teaching microbiology to undergraduate medical students.

Dr. Alka B. Nerurkar<sup>1</sup>, Dr. Jatin V. Dhanani<sup>2</sup>

<sup>1</sup>Department of Microbiology, GMERS Medical College, Valsad.

<sup>2</sup>Department of Pharmacology, GMERS Medical College, Valsad.

---

### **Abstract:**

**Background:** In the present medical education curriculum in India, pre and para-clinical subject are taught away from the hospital setting. It results into making the subject clinically irrelevant as students fail to understand its utility in clinical practice.

**Objective:** Develop an understanding of application of Microbiology as a clinical subject in hospital thus creating interest in the subject.

**Methodology:** A didactic lecture on 'Biomedical waste Management' was conducted for batch of 139 students of II<sup>nd</sup> MBBS. The batch was divided in two groups Gp I(Test) of 70 & Gp II(control) of 69 students. Gp I (N=70) was further subdivided in five sub groups of 14 students each (Sub Gp A, B, C, D & E). They were assigned locations in the hospital namely Operation theatre, Medicine ward, Surgical ward, ICU's and Out Patient Department. Allocated time was 2 weeks. The project report was presented. It was followed by an interactive session and discussion on practical relevance of the project & its observations recorded. Appropriate statistical analysis carried out.

**Result:** 80 % student's agreed that application based learning projects in microbiology can create an interest in the subject and will help them in future clinical work and practice. 88.5% agreed they enjoyed writing the project.

**Conclusion:** The present study signifies the need of application based learning in Microbiology for II<sup>nd</sup> MBBS students. 75% students have retained knowledge in post test.

**Keywords:** Medical Education, project based learning, clinical application based learning, pre and paraclinical subject

---

### I. Introduction

Medical curriculum in India is structured in such a way that, large part of it contains teaching through didactic theoretical lectures. Also in most of the medical schools, Pre-and paraclinical subjects are taught away from the hospital setting. This monotonous type of teaching and learning takes away the interest of the students from the subject. Also in some study, students have pressed out the need for clinical application based learning to understand the role of microbiology in clinical circumstances. [1] In vision 2015, given by the Medical Council of India, more emphasis given to the active learning through newer teaching learning methods which involve student's participation. [2] Active learning enhances learning and thus generally improves the quality of medical education. [3]

Microbiology is a para-clinical subject, which is taught in II<sup>nd</sup> year of MBBS. According to current curriculum microbiology is mainly taught in classroom setting and very less exposure to clinical application and hospital based real life situations. It makes subject very insipid and students do not understand the utilization of subject during their actual practice. Clinical application based learning involves clinical projects that incorporate 'complex tasks, based on challenging questions or problems that involve students in design, problem-solving, decision-making, or investigative activities; give students the opportunity to work relatively autonomously over extended periods of time; and culminate in realistic products or presentations'. [4] The effort toward developing active learning was based on meaningful learning which ensures understanding and applying concepts rather than memorizing only which is rote learning.[5] Meaningful learning involves the acquisition of "useful" knowledge so that it can be accessed from different starting points and has to correlate with previous knowledge with multiple representations.

### II. Materials and methodology

It was an interventional educational research. Before starting the study, permission from institutional ethics committee was taken. For the study, faculties of microbiology department were oriented about hospital based project work with objectives of the study which covering principles, and methodology of projects. Help of the faculties also taken in selection of topics from microbiology subject and methods to evaluate them. The final topic for hospital based project selected was "Management of Biomedical Waste in the hospital".

A session was conducted with an initial introduction of hospital project with its concept, methodology, importance and plan of evaluation plan was given to a whole batch of 139 students of second year of MBBS. A topic for the project work was discussed with the students. Then the whole batch was divided in two groups, with group 1 containing 70 students (Test group) and group 2 containing 69 students (Control group). By draw system the group 1 was assigned in to hospital based learning while group 2 was assigned in to traditional method of learning, which was a control group.

Before starting the study the knowledge of students to the topic i.e. “management of biomedical waste in the hospital” was evaluated. The control group (group 2) was taught the topic “management of biomedical waste in the hospital” as traditional method as didactic lecture and practical class. While the test group (total 70) was divided into five subgroups of 14 students each. Each subgroup was given a site of hospital where generation of biomedical waste occurs like operation theatre, medicine ward, surgical ward, ICU’s and Out Patient Department. Each subgroup was assigned a faculty of microbiology department to guide the work. The team of students had to visit the site they were assigned, for two week time period with 2 hours a week time period and observe about the biomedical waste management by the medical and paramedical staff. They were given a predesigned form according to that the students have to narrate the information from the medical and paramedical staff. They could consult their guide any time in between for guidance. Before starting the hospital based project they were given some theoretical knowledge to strengthen the basic knowledge about the topic. After two weeks’ time the members of each team had to submit the report in individual to the guided faculty. The presentation of the report by the team leader followed by discussion of the practical usefulness of the outcome and sharing of experiences of students assign in group 1 was done in front of the whole class to enrich the others.

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 questionnaires was used to collect the perceptions of the students towards the whole process. 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.

### **III. Result:**

Total 139 students were included in the study and they divided in two groups, group I and II. At the beginning of this hospital project, the knowledge of students about the management of biomedical waste was evaluated for both Group I and II. It was found that they were at the same level of knowledge and understanding of ‘Biomedical waste Management’. After intervention i.e. teaching traditionally to group II and teaching through hospital based project, there was a remarkable improvement in the results of Group I (88-100%) in comparison to group II(44-81%) with  $p < 0.01$ . (Table 1) As per the data shown in the table, the knowledge of students of Group II is deteriorated rather than improvement.

Student’s feedback:

Nearly 80 % students enjoyed doing the project work in the hospital and that this concept of Application based learning could form a part of Ind MBBS curriculum. 78.5% students agreed to the fact that they enjoyed working as a team. (table 2) Also majority of students found that the support from hospital staff and guidance by teacher was good. 88.5 % student’s agreed that project writing has provided them a good experience in future studies. As seen in figure 1 and 2, nearly 80 % student’s agreed that such projects in microbiology can create an interest in the subject, understand the subject better and help them perform better in the clinical course. Also it would help them in future clinical work and practice.

### **IV. Discussion:**

It has always remained a challenge for faculties in microbiology, during teaching, to make it interesting and catch the student’s interest.(1,schaeter M) [6] The students perceive microbiology as a clinically irrelevant subject and they fail to understand its importance in a clinical setting. For a undergraduate medical student sound knowledge of the subject along with its applications in a clinical setting is extremely important.(Neame RL).[7] It would train them in managing patients with a wide range of diseases along with its etiological microbe and also make them understand the body’s response to these agents and effective ways to tackle them. The importance of microbiology as a clinical subject cannot be undermined.

Comparison of the knowledge of the topic before and after intervention, shows that there was drastic improvement in the students of group who were involved in the hospital based project work. While in the group of students from control group there was no improvement. Rather some of the students’ performance deteriorated. It might be because without use or application of the knowledge it washes away. Clinical

application based learning gives students a more “integrated” understanding of the concepts and knowledge they learn, while also equipping them with practical skills they can apply throughout their lives.

Also majority of the students from the group assigned in hospital based project gave the feedback, that they enjoyed the project, and such project increases the interest in the subject. It is evident from this study that student’s exposure in a clinical setting gives them a better understanding of the subject and generates an interest in them. Study done by Singh S et al, (2011) in microbiology department, and Deb T et al, (2013) in pharmacology department, also found the same responses and feedback from the students of their institute. [8,9] They found that it improves student engagement in learning, increase their interest in what is being taught, strengthen their motivation to learn, and make learning experiences more relevant and meaningful. However, many teachers does not have the time or specialized training required and also it is more difficult for teachers to monitor and assess what students have learned. However all these difficulties will remain at the initiation phase only. Once all staff get trained and students get acclimatized to this clinical project based teaching and learning, the staff and students enjoy the teaching and learning. The lacunae in current medical education system in our country is that it does not encourage and satisfy the medical undergraduates and prepare them for clinical practice showing the lack of clinical relevance while teaching the para-clinical subjects. The present study clearly signifies the need of project based learning in Microbiology.

### References

- [1]. Saha R, Das Shukla, Kaur IR. Towards the innovation for microbiology curriculum change: Students’ perception. J Indian Med Assoc 2012;110:563- 6.
- [2]. Medical Council of India- Vision 2015. New Delhi: MCI, 2011.
- [3]. Bhadra UK. Medical education in India: Current issues and challenges. J Indian Med Assoc 2013;111:84- 5.
- [4]. Karaman S, Celik S. An exploratory study on the perspectives of prospective computer teachers following project-based learning. International Journal of Technology & Design education.2008;18(2):203-15.
- [5]. Cheryl AE. Promoting student-centered learning in experiential education. Journal of Experiential Education. 2004;27(2)141-60.
- [6]. Singh S, Singh P, Trivedi S. Application Based Learning Through Hospital Projects For Teaching Microbiology To Medical Students. NJIRM 2011;2(3):11-16.
- [7]. Deb T, Singh R, Mukhopadhyay K. Students’ perception and practice in learning basic pharmacology through a ‘Project Based Learning’ programme. IJRRMS 2013;3(2):28-31.

### Tables and Figures:

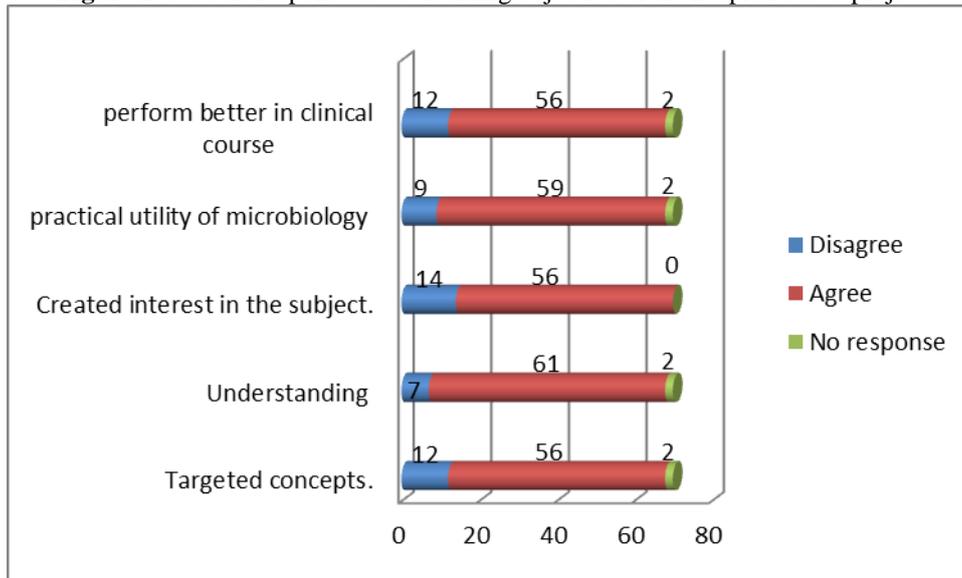
**Table1:** Comparison and Analysis of students of both groups about knowledge of the topic before and after intervention

Question	Correctly answered Pre Test		P value	Correctly answered Post Test		P value
	Group I (N=70)	Group II (N=69)		Group I (N=70)	Group II (N=69)	
What is Biomedical Waste?	58 (82.8%)	59 (85.4%)	0.66	66 (94.2%)	49 (71.0%)	0.0002
Which parts of the hospital generate Bio medical Waste?	62 (88.5%)	60 (86.9 %)	0.77	100 ( % )	51 (73.8 %)	0.000004
What are the the different categories of Biomedical waste you know?	59 (84.2%)	59 (85.4 %)	0.84	64 (91.31%)	41 (59.4 %)	0.00001
What is the color coding for segregation of Biomedical Waste?	62 (88.5%)	63 (91.2 %)	0.29	68 (97.1%)	56 (81.1%)	0.002
What are personal safety devices?	55 (78.5%)	57 (82.5%)	0.54	66 (94.2 %)	45 (65.2 %)	0.0001
How is BMW transported?	48 (68.5%)	44 (63.7%)	0.54	62 (88.5 %)	46 (66.6%)	0.001
What are the different modalities available for disposal of BMW?	47 (67.11%)	51 (73.8%)	0.38	62 (88.5 %)	31 ( 44.9%)	0.000001
Is there any specific logo / label for Bio Hazardwaste ?	53 ( 75.6%)	52 (75.3 %)	0.96	100 (%)	43 (62.3%)	0.000001
Where is the BMW collection centre at our hospital?	38 (54.2 %)	35 (50.7%)	0.67	100 (%)	34 (48 %)	0.00001

**Table 2 :** Students perception on the project

Sr No	Question	Response (n=70)	
		Yes	No
2	Support from hospital staff	46	24
3	Guidance	59	11
4	Enjoy	55	15
5	Writing	62	08

**Figure 1:** Student response about learning objective of the hospital based project



**Figure 2:** Student's reaction to the process of hospital project (n=70)

