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Impact of Multidisciplinary project-based learning among second MBBS students

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Abstract

Background: *Multidisciplinary Project-based learning promotes integration among the various subject disciplines and presents an expanded view of the subject matter. Project-based learning involves completing complex tasks that typically result in a realistic product, event, or presentation to an audience. Critical thinking is enhanced, as students search for information on a topic in great depth to create their project. Project based learning increases their confidence level, enhances creativity, communication skills, collection of information, analytical and presentation skills. While working as a team they have a preview on group dynamics and team building among themselves during project designing. There is paucity of data about the impact of multidisciplinary project-based learning in the field of medical education. This study was undertaken to study the impact of multidisciplinary project-based learning among second MBBS students.*

Material and Methods: *The study was approved by the institutional ethics committee. After obtaining informed consent from the students, a Multiple choice-based pretest on the 12 topics chosen for the projects was given. The topic was then allotted to the groups, the students discussed with their group facilitators and created their project and presented on the project day. The post test was given after the presentation. Feedback was obtained from the students and the facilitators. The response was collected in a feedback Questionnaire on a five- point Likert scale. All the data were entered in Excel sheet and statistical analysis was done using SPSS software.*

Results: *The average marks scored in the pretest and post-test were 17.65 and 29.31 respectively. The mean difference test was 11.655 with 66.04% improvement in the score. The students opined that the project-based learning strategy was very interesting, enhanced their ability, activated their prior knowledge, helped them to elaborate and organize their knowledge.*

Conclusion: *The students and facilitators considered project-based learning as an interesting method for learning. Project-based learning, made the integration of different disciplines into reality. Self-directed learning was promoted. The students worked together as a team effectively*

Keywords: *Project-based learning; Integration; Feedback; self directed learning; knowledge; skill.*

Introduction

The concept of project-based learning is "Learning by doing"[1]. Project-based learning involves completing complex tasks that typically result in a realistic product, event, or presentation to an audience. The multidisciplinary approach integrates

and draws together knowledge, skills, attitudes and values across subject areas to develop a more powerful understanding of key ideas.

Multidisciplinary Project-based approach promotes an expanded view of the subject matter. This is a student-centered learning strategy where students take ownership over their learning and are motivated to complete a given task.[1,2].

Critical thinking is enhanced, as students search for information on a topic in great depth to create their project. Project based learning increases their confidence level, enhances creativity, communication skills, collection of information, analytical and presentation skills. While working as a team they have a preview on group dynamics and team building among themselves during project designing[1]. There is paucity of data about the impact of multidisciplinary project-based learning in the field of medical education[1-4]. Therefore, this study is undertaken to study the impact of multidisciplinary project-based learning among second year MBBS students.

This study was undertaken to study the impact of project-based learning among second year MBBS students in a Medical college in South India by evaluating the effect of multidisciplinary project-based learning among second MBBS students and to assess the feedback from students and facilitators.

Materials and Methods

The study involved the second year MBBS students. The approval of the institutional ethics committee was obtained for the study. Permission from Dean, Head of the departments of Pathology, Pharmacology, Microbiology and Forensic medicine was also obtained.

Institutional Ethicscommittee Ref. No: IEC-NI/18/APR/64/24

Type of Study: Quasi interventional study

Study Setting: University Teaching Hospital

Study Population: Second year MBBS students after obtaining Informed consent

Study Period: 3 months (May-July 2018)

Methods

The students were divided into 12 group according to their roll numbers, with 20-21 students in each group. Each group had 3-4 facilitators who were from the paraclinical departments. The sensitization and introduction of the Project based learning was given one month prior to the project day presentation. Twelve topics belonging to the core competencies were chosen, 3 from each of the paraclinical department such as Pathology, Pharmacology, Microbiology and Forensic medicine. The topics were: Amoebiasis, Anaphylaxis, Biomedical waste management, Carcinoma of the urinary bladder, Child abuse, Malaria, Mercy killing, Myocardial infarction, Plague, Substance abuse, Systemic lupus erythematosus and Thalassemia major. A sensitization session was conducted for the students and the facilitators regarding the project-based learning.

After obtaining the informed consent from the students, a Multiple choice-based pretest with 40 questions with each question carrying one mark on the above 12 topics chosen for the projects was given. Each group was allotted one topic from the chosen list of topics. The students discussed with their facilitators for planning the execution of their group project. Each group created their project in form of models, charts, posters, role plays on the allotted topic. The groups presented their project to the panel of judges, faculty, and the students of the other groups on the project presentation day. The post test was given after the presentation.

Feedback: Feedback was obtained from the students regarding the project day with a questionnaire relating to factors such as strategy of the project-based learning, project-based learning process, knowledge and skills, resource preparation, and attitude. Feedback from faculty was also obtained concerning project day concept, project preparation process, teamwork of the group. The response was collected in a feedback Questionnaire on a five- point Likert scale.

All the data were entered in Excel sheet and statistical analysis was done using SPSS software.

The pretest and post test scores were compared using Wilcoxon signed rank test. The feedback obtained was analysed and the frequencies were calculated. Factor analysis was done for the finding out the most important variables which caused an impact among the students.

Results

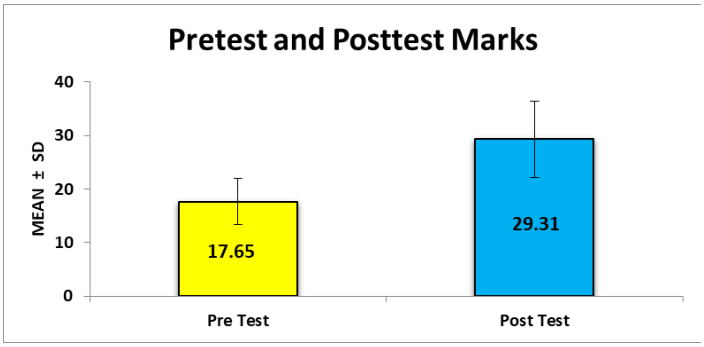
A total of 244 students gave informed consent and took part in the study.

Pretest and post-test

The average marks scored in the pretest was 17.65 (SD 4.27) . The post test mean score was 29.31 (SD 7.13). The mean score in the pre test and post test is depicted in figure-1. The mean difference of the post test and pre test was 11.655 with 66.04% improvement in the score .

The Wilcoxon signed-rank test showed that the project based learning had a significant change in the marks scored bythe students in the post test when compared to the pre test score (Z = -13.112, p = 0.000).

Figure -1 : Comparison of Pre test and Post test marks of the students



Students feedback

Table-1 shows the frequency and percentages of the responses of the students to the feedback questionnaire

Five major factors were included in the questionnaire relating to the process of the project - based learning strategy: learning process, acquision of Knowledge and skills, resource preparation, teamwork, attitude and organization of the project based learning. The frequency and the percentage of the various responses from the students are presented in table -1. The students had agreed or strongly agreed for most of the parameters in the questionnaire.

Factor analysis was done to find out the most important parameter which played an important role in each group of factors .In the project-based learning process, the students felt that the project-based learning strategy was remarkably interesting. Regarding the knowledge and skills gained, the student`s opinion was that the project-based learning activated their prior knowledge and helped them to elaborate and organize the knowledge. The ability of the students to work as a team was enhanced. Among the 3 parameters, concerning the project day preparations, the students have opined that the program was well planned and organized. The factor analysis and significant parameters is shown in table - 2

The significant parameter which influenced among each factor are:

- **Project based learning process**: The project-based learning strategy is interesting
- **Acquision of Knowledge and skill**: project-based learning activated my prior knowledge and helped me to elaborate and organize my knowledge
- **Resource preparation**
- **Team work and attitude**: My ability to work as a team was enhanced
- **Organisation of Project based learning:** The program was well planned and well organized

The feedback obtained from the faculty was also analysed. The faculty felt that the project-based learning strategy was very interesting and students acquired a deeper knowledge and worked efficiently as a team. The frequency and the percentage of the feedback analysis of the faculty is shown in table-3

Table -1: Analysis of the feedback given by the students.

Number of students: 244

S.No	Parameter	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Project based learning preparations						
1.	Prior information was given to us about the time, place and format of the project day	136 (55.7%)	102 (41.8%)	3 (1.2%)	2 (0.8%)	1 (0.4%)
2.	The venue for project day was conducive	116 (47.5%)	123 (50.4%)	5 (2%)	-	-
3.	The program was well planned and well organized	110 (45.1%)	118 (48.4%)	12 (4.9%)	3 (1.2%)	1 (0.4%)
Project based learning process						
4.	The objectives of the project-based learning were defined	105 (43%)	123 (50.4%)	9(3.7%)	5(2%)	2 (0.8%)
5.	The Project based learning strategy is interesting	101 (41.4%)	116 (47.5%)	18(7.4%)	7 (2.9%)	2 (0.8%)
6.	The topics chosen were interesting.	75 (30.7%)	132 (54.1%)	19(7.8%)	12 (4.9%)	6(2.5%)
7.	The project day sensitization sessions provided sufficient time for planning our project.	65 (26.6%)	130 (53.3%)	26(10.7 %)	19 (7.8%)	4 (1.6%)
8.	The facilitators facilitated my learning	90 (36.9%)	118 (48.4%)	26 (10.7%)	8 (3.3%)	2 (0.8%)
9.	The project discussions were effective, interactive and encouraged further learning	88 (36.1%)	123 (50.4%)	22 (9%)	8 (3.3%)	3 (1.2%)
10.	Feedback regarding our project has been given to us	93 (38.1%)	113 (46.3%)	29 (11.9%)	7 (2.9%)	2 (0.8%)
11.	Will you recommend this project-based learning as learning method to your peers	100 (41%)	115 (47.1%)	20 (8.2%)	5 (2%)	4 (1.6%)
Knowledge and skills						
12.	Project based learning facilitated Integration between pre, para and clinical subjects	93 (38.1%)	124 (50.8%)	19 (7.8%)	6 (2.5%)	2 (0.8%)
13.	Knowledge is organized around problem rather than disciplines	88 (36.1%)	124 (50.8%)	26 (10.7%)	5 (2%)	1 (0.4%)
14.	Project based learning activated my prior knowledge and helped me to elaborate and organize my knowledge	80 (32.8%)	136 (55.7%)	22 (9%)	4 (1.6%)	2 (0.8%)
15.	The knowledge gained is more than it would be by conventional teaching	96(39.3 %)	106 (43.4%)	27 (11.1%)	13 (5.3%)	2(0.8%)
16.	My ability to speak in front of people was enhanced	104 (42.6%)	110 (45.1%)	22 (9%)	6 (2.5%)	2 (0.8%)
17.	Increases ability to manage the time effectively	95 (38.9%)	119 (48.8%)	19 (7.8%)	8 (3.3%)	3 (1.2%)
Resource preparation						
18.	As a learner I became an active processor of information	96 (39.3%)	120 (49.2%)	22 (9%)	5 (2%)	1 (0.4%)
19.	Project based learning enhances the ability to find the information using the internet/library	101 (41.4%)	129 (52.9%)	8 (3.3%)	4 (1.6%)	2 (0.8%)
Team work and Attitude						
20.	Enhances the practice of cooperative and collaborative learning	104 (42.6%)	122 (50%)	7 (2.9%)	9 (3.7%)	2 (0.8%)
21.	My ability to work as a team was enhanced	110 (45.1%)	110 (45.1%)	14 (5.7%0	2 (0.8%)	8 (3.3%)
22.	Project based learning converted me from passive to active learner	93 (38.1%)	109 (44.7%)	29 (11.9%)	9 (3.7%)	4 (1.6%)
23.	Developed a healthy competition between the groups	98 (40.2%)	120 (49.2%)	15 (6.1%)	7 (2.9%)	4 (1.6%)

Table-2: Factor analysis of the Students feedback

Project based learning process	**Component**
The objectives of the project-based learning were defined	0.738
The Project based learning strategy is interesting	**0.805**
The topics chosen were interesting.	0.685
The project day sensitization sessions provided sufficient time for planning our project.	0.709
The facilitators facilitated my learning	0.766
The project discussions were effective, interactive, and encouraged further learning	0.720
Feedback regarding our project has been given to us	0.665
Will you recommend this project-based learning as learning method to your peers	0.751
Knowledge and skills	
Project based learning facilitated Integration between pre, para and clinical subjects	0.744
Knowledge is organized around problem rather than disciplines	0.810
Project based learning activated my prior knowledge and helped me to elaborate and organize my knowledge	**0.851**
The knowledge gained is more than it would be by conventional teaching	0.742
My ability to speak in front of people was enhanced	0.758
Increases ability to manage the time effectively	0.769
Resource preparation	
As a learner I became an active processor of information	0.854
Project based learning enhances the ability to find the information using the internet/library	0.854
Team Work and Attitude	
Enhances the practice of cooperative and collaborative learning	0.818
My ability to work as a team was enhanced	**0.845**
Project based learning converted me from passive to active learner	0.820
Developed a healthy competition between the groups	0.826
Project based learning preparations	
Prior information was given to us about the time, place and format of the project day	0.747
The venue for project day was conducive	0.829
The program was well planned and well organized	**0.885**

Table-3 Analysis of the feedback given by the Facilitators

Number of facilitators: 37

S.No	Parameter	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Project based learning process						
1.	The Project based learning strategy is interesting	27 (73%)	10 (27%)	0	0	0
2.	The objectives of the project based learning were met	26 (70.3%)	11 (29.7%)	0	0	0
3.	The topics chosen were interesting.	28 (75.7%)	9 (24.3%)	0	0	0
4.	The project day sensitization sessions provided sufficient time for planning of the projects	22 (59.5%)	14 (37.8%)	0	1 (2.7%)	0
5.	Project based learning converted the students from passive to active learners	26 (70.3%)	11 (29.7%)	0	0	0
6.	Develops the competence and confidence in self-directed learning	26 (70.3%)	10 (27%)	1 (2.7%)	0	0

7.	Project based learning facilitated Integration between pre, para clinical subjects	26 (70.3%)	9 (24.3%)	2 (5.4%)	0	0
8.	The venue for project day was conducive	31 (83.7%)	6 (16.2%)	0	0	0
9.	The program was well planned and well organized	30 (81.1%)	6 (16.2%)	1 (2.7%)	0	0
10.	Developed a healthy competition between the groups	28 (75.7%)	7 (18.9%)	1 (2.7%)	1 (2.7%)	0
11.	Will you recommend this project-based learning as learning method to your peers	31 (83.7%)	6 (16.2%)	0	0	0
Knowledge /skill						
12.	The project-based learning successfully integrated the learning elements of individuals disciplines	26 (70.3%)	11 (29.7%)	0	0	0
13.	Students become aware of their areas of strength and weakness	22 (59.5%)	13 (35.1%)	1 (2.7%)	1 (2.7%)	0
14.	As a learner the students, became an active processor of information	23 (62.1%)	13 (35.1%)	1 (2.7%)	0	0
15.	Project based learning enhances the student`s ability to find the information using the internet/library	26 (70.3%)	11 (29.7%)	0	0	0
16.	The student`s ability to speak in front of people was enhanced	28 (75.7%)	9 (24.3%)	0	0	0
17.	Increases ability to manage the time effectively	20 (54.1%)	17 (45.9%)	0	0	0
18.	Knowledge is organized around problem rather than disciplines	26 (70.3%)	11 (29.7%)	0	0	0
19.	Project based learning activated the student`s prior knowledge and helped them to elaborate and organize their knowledge	23 (62.1%)	13 (35.1%)	1 (2.7%)	0	0
Team work and attitude						
20.	Enhances the practice of cooperative and collaborative learning	28 (75.7%)	9 (24.3%)	0	0	0
21.	The students work efficiently as a team	26 (70.3%)	10 (27%)	1 (2.7%)	0	0
22.	Project based learning enabled the students to establish a concrete action plan to achieve the learning goals	26 (70.3%)	11 (29.7%)	0	0	0
23.	Group dynamics was good	25 (67.6%)	12 (32.4%)	0	0	0

Discussion

In traditional teaching, students passively receive information from the teacher and internalize it through memorisation. Students' inactivity in traditional teacher centered classes would make them exhausted that consequently would decrease their concentration and learning which finally would result in their absence from the classroom. For an undergraduate medical student sound knowledge of the subject along with its applications in a clinical setting is extremely important. It would train them in managing patients with a wide range of diseases and also make them understand the body's response to these disease and effective ways to tackle them [4].

Nowadays a deluge of techniques are available to increase interest of students in learning. Concepts such as independent learning, flexibility in learning, critical thinking and problem solving are newer methods of learning. Creative activity does not generally play a substantial part in medical education, but is of considerable importance.

Collaborative project-based learning adopts a multidisciplinary approach using real world problems to bringing together knowledge and skills. The key components of effective project-based learning are: central to the curriculum, organized around driving questions that lead students to encounter central concepts or principles, focused on a constructive investigation that involves inquiry and knowledge building, authentic and student-

driven as students are responsible for designing and managing their work[3,4]. In Kilpatrick's view, projects had four phases: purposing, planning, executing, and judging. Kilpatric has classified the project method in four types namely, Constructive, Artistic, Problem-Solving, Group-Work[5].

According to Shapiro J et al, in recent years, medical education has initiated the application of reflective practices among medical student which can be in the form of written exercises, but may include the use of other creative media. Use of reflective writing and creative projects in preclinical and clinical medical education suggests that students utilise such assignments to improve their knowledge and clinical skills, explore relational issues, practice self-directed learning , team work and professional development[6,7,8].

In this study, comparison of the MCQ test score before and after the project-based learning, showed that there was a remarkable improvement. Previous Studies have shown that project-based learning has a positive impact on students as learning by doing helps them to organize the knowledge[1,3,4].

Each team presented their project with posters, charts, models and the role play which were very innovative and creative. The analysis of the feedback from the students revealed that the students felt that the project-based learning strategy was interesting, and they became active learners. Students found that the project-based learning process was useful and helped them to correlate the theoretical aspects with their clinical implications. Similar observations were reported by two other studies from India[7,8]. Project-based learning, made the integration of different disciplines into reality as the knowledge was organized around the problem rather than the disciplines and thereby motivated higher-order thinking tasks such as analysis, synthesis, and evaluation. The study also revealed that the development of their models stimulates, enlightens and educates the constructors, and provides a teaching resource. Thus active participation in project-based education results in students being more intrinsically motivated, show conceptual understanding and culminate in realistic products or presentations[1,2].

We also found that self-directed learning was promoted by this learning method as the students gathered the relevant information from the specialty experts, books, journal and internet. The students worked together as a team effectively.

The analysis of the feedback from 37 facilitators revealed that the project-based learning brought out the creativity and enhanced the learning process among the students. The facilitators felt that the group dynamics among the students was very good and this encouraged collaborative and cooperative learning and ultimately helped the students to achieve a shared goal.Key to project-based learning is the skilled teacher guiding the student through the process such that the student takes as much ownership as possible over each step so as to provide an interesting learning experience. In this sense, the responsibility of the teacher is to build bonds between students.

There are some limitations of the study as we did not directly compare the traditional lecture classes with the Project based learning initiative. Yet, the study is important in showing how the innovative teaching learning methods can make a subject more interesting and appealing to medical students and enabling better understanding of key concepts. Hence Project based learning should be encouraged in routine teaching learning process.

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