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Original research article

Teaching epidemiology and biostatistics using journal articles in Preventive Cardiology to medical undergraduates: A mixed problem based educational intervention study

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Abstract

Background: Many educators believe that skills in Epidemiology and Biostatistics are difficult to teach to medical students, as students may not learn the material effectively and often do not enjoy the courses that have been offered. In Mixed Problem Based Learning (PBL) problems are presented after some formal instruction. Therefore, the problem is not used to build understanding, but rather to tie in different bits of knowledge and act as a synthesis activity.

Objectives: To teach Epidemiological methods and Biostatistics to second year MBBS students by a mixed PBL method, to estimate students ability in applying this knowledge in interpretation of scientific studies and to measure students learning experience in this type of teaching learning method.

Materials and Methods: Classes were conducted on basic concepts of epidemiological methods and Biostatistics. Later standard journal articles in Preventive Cardiology were used to teach them how to apply the concepts learned in epidemiology and Biostatistics in interpretation of journal articles. An examination was conducted using Standard journal articles in Preventive Cardiology as problems. Feedback on the teaching learning process was collected using a student feedback form and learning experience questionnaire (LEQ).

Results: The mean test score percentage was 67.94 (23.5). The mean learning experience scores was 12.66 (1.48). The mean student feedback score was 11.96 (2.79). There was significant correlation between learning experience scores and student feedback scores. There was no significant correlation between test scores and learning experience scores and student feedback scores.

Conclusions: Majority of the students were capable of critiquing all the aspects of journal article. Students experienced higher level of comprehension of the subject, more involvement and Greater interest in topic. Majority of the students agreed that they learned a lot during this teaching sessions and wished more of the course would have been conducted in this format.

Keywords: Epidemiology, biostatistics, journal, articles, Preventive Cardiology problem-based learning

Introduction

With a focus on core competencies in medical education, there is increasing recognition of the importance for future physicians of learning epidemiology and biostatistics [1]. These disciplines can be likened to a "basic science" foundation for such important medical competencies as the practice of evidence-based medicine (EBM), population-based medicine, and preventive medicine, all recognized as skills essential for the physician [2].

However, many educators believe that skills in these areas are difficult to teach to medical students, as students may not learn the material effectively and often do not enjoy the courses that have been offered [3, 4]. The Association of American Medical Colleges (AAMC) states that population health is "best taught through examples and experiences, not courses [2]". Dyke *et al*. found that students were more enthusiastic about epidemiology and its relevance to their professional lives when the material was taught using a problem-based learning (PBL) format rather than a traditional lecture-based course [5].

The rapid growth in undergraduate public health education has offered training in epidemiology to an

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increasing number of undergraduate students. Epidemiology courses introduce undergraduate students to a population health perspective and provide opportunities for these students to build essential skills and competencies such as ethical reasoning, teamwork, comprehension of scientific methods, critical thinking, quantitative and information literacy, ability to analyze public health information, and effective writing and oral communication. Taking a varied approach and incorporating active learning and assessment strategies can help engage students in the material, improve comprehension of key concepts, and further develop key competencies [6].

There are two different types of PBL. The main difference is whether the PBL problem comes before or after instruction. In the original McMaster version of PBL, students were presented with a problem before any formal instruction had taken place. In trying to solve the problem, students learned about the topic. The PBL problem in this approach drives the learning (Woods, 1994) [7]. In the second version of PBL, problems are presented after some formal instruction. Therefore, the problem is not used to build understanding, but rather to tie in different bits of knowledge and act as a synthesis activity (Heller *et al*., 1992) [8]. Both approaches have proved to be effective, so it is left to the individual instructors to choose which is best suited for their classroom and institutional constraints.

Objectives

1. To teach Epidemiological methods and Biostatistics to second year MBBS students by a mixed PBL method.
2. To estimate students ability in applying this knowledge in interpretation of scientific studies.
3. To measure students learning experience in this type of teaching learning method.

Materials and Methods

Current study was conducted at Sri Venkateswara Institute of Medical Sciences (SVIMS), Sri Padmavathi Medical College for Women (SPMCW), affiliated to SVIMS University, Tirupati, Andhra Pradesh. The subjects of this study were second year Medical Graduates. There are 150 students in second year. All the 150 students were included in the study subject to informed consent. Those not consenting were not included in the study. The study is a Prospective educational intervention research study. The study was undertaken as part of project for completion of Advanced Course in Medical Education (ACME) course. The course is organized by Medical Council of India (MCI) through its regional centres. The regional centre is a MCI Nodal Centre for National Faculty Development located at Christian Medical College (CMC), Vellore. The project proposal and protocol were developed with the assistance from Medical Education Technology (METU), CMC, Vellore. The ethical clearance for the project proposal was obtained from Institutional Ethics Committee (IEC) of SVIMS University. Necessary permissions were obtained from the Head of the Department of Community Medicine and Dean of the Medical College.

Initially classes were conducted on basic concepts of epidemiological methods and Biostatistics for second year medical graduates. A written Informed consent was obtained from the students after explaining about the study. Later standard journal articles in Preventive Cardiology were used to teach them how to apply the concepts learned in epidemiology and Biostatistics in interpretation of journal articles. Feedback on the teaching learning process was collected using a student feedback form and learning experience questionnaire (LEQ). The student feedback form is in the form of five-point Likert type scale with five levels of agreeability starting from strongly disagree to strongly agree. The learning experience questionnaire was in the form of yes or no answers to the questions. Both the feedback form and LEQ are standard formats used in many educational research studies with high levels of internal consistency and low inter-ratter variability.

An examination was conducted after completion of the teaching learning process. Short answer type questions were used to assess the learning of the students. Standard journal articles in Preventive Cardiology were used as problems. Questions were related to interpretation of these articles. The questions were those which are used in journal clubs. The performance of the students was assessed basing on their answers to these questions. The answers were classified into three types as correct, partially correct and wrong based on the correctness of the answer. The scoring for the test answers was given as 0, 1,2 and -1 for not answered, partially answered, completely answered and wrongly answered respectively. The response to learning experience questionnaire was coded as 1 and 2 for no and yes responses respectively. The response to feedback was coded from 1 to 5 for completely disagree to Completely Agree respectively. The performance of the students in the examination, student feedback form and LEQ were analysed. The data obtained from these methods was categorical. The data was summarised using proportions and percentages for categorical data and mean (SD) for quantitative data. Chi-square goodness of fit model was used to analyse these proportions. Pearson Correlation was used to measure association between (Comparisons between) examination performance, student feedback form and LEQ (was done to assess the relation between student performance and student feedback. P value <0.05 was considered as statistically significant. IBM SPSS Statistics for Windows, Version 26.0 (Armonk, NY: IBM Corp) was used for analysis.

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Results

Out of the total 150 students in second year, 122 students attended the final problem-based test.

The test scores ranged from 7 to 45 (minimum to maximum) with mean 31.25 (0.98). The test score percentages ranged from 15.22 to 97.83 percentage (minimum to maximum) with mean 67.94 (23.5). The learning experience scores ranged from 7 to 14 (minimum to maximum) with mean 12.66 (1.48). The student feedback scores ranged from 3 to 15 (minimum to maximum) with mean 11.9 (2.79).

There was significant correlation between learning experience scores and student feedback scores with Pearson Correlation coefficient of 0.538 (p<0.001). (Figure 1) There was no significant correlation between test scores and learning experience scores with Pearson Correlation coefficient of 0.083 (p=0.365). (Figure 2) There was no significant correlation between test scores and student feedback scores with Pearson Correlation coefficient of 0.016 (p=0.859). (Figure 3)

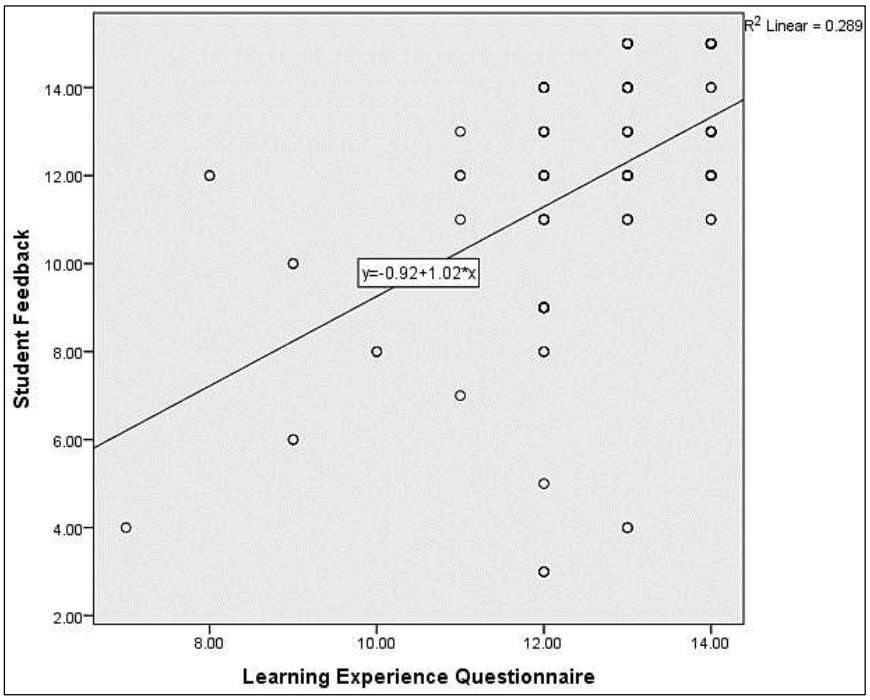

Fig 1: Correlation between learning experience scores and student feedback scores

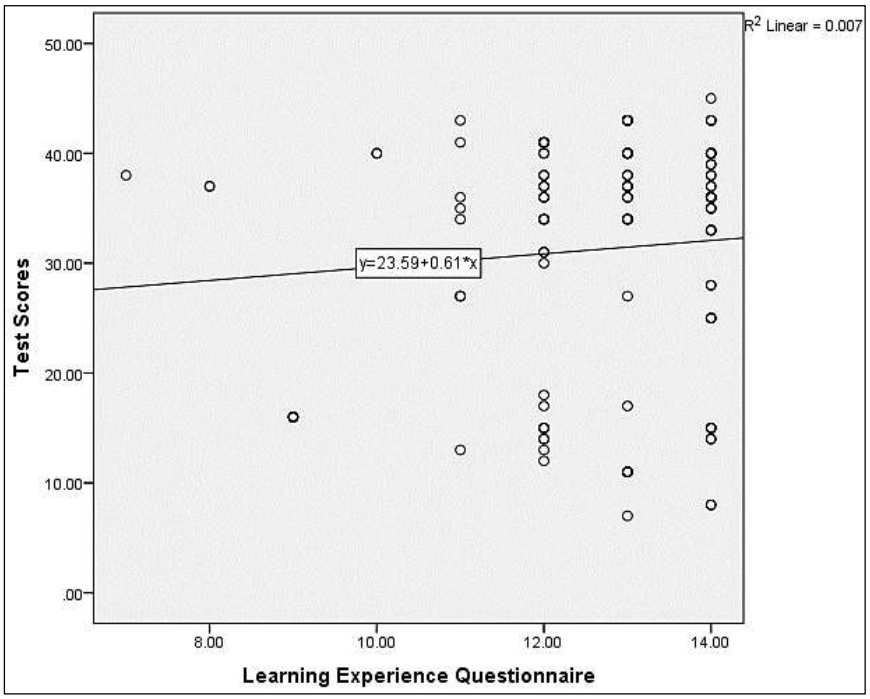

Fig 2: Correlation between test scores and learning experience scores

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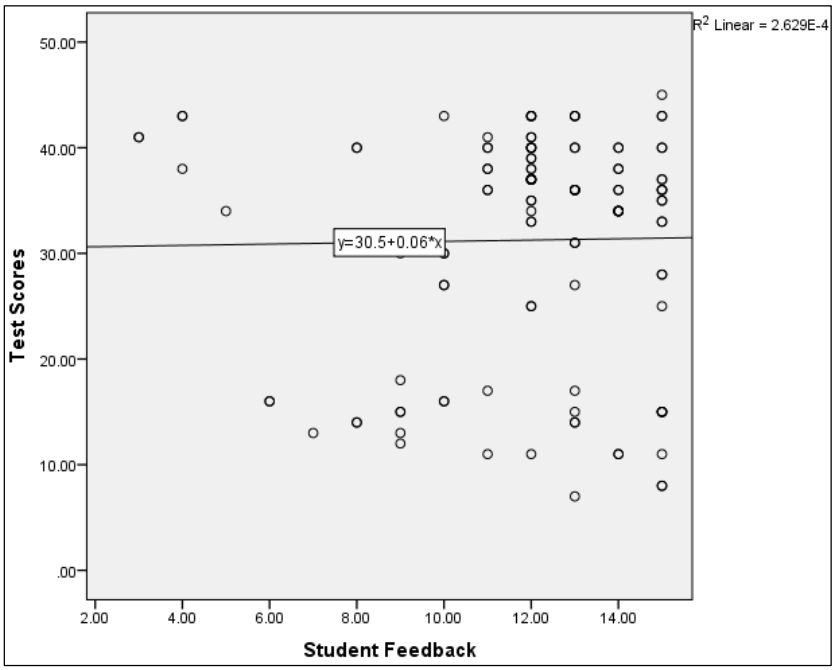

Fig 3: Correlation between test scores and student feedback scores

97.5% of students identified the results correctly followed by correct identification of Study's objective/hypothesis/question, Identifying Methodological approach, Relevance of this topic/question to Public Health, logical follow of conclusions from the design and results and Strengths & weaknesses of the study. Only 1.6% of the students could correctly identify the Generalizability of results. (Table 1)

Table 1: Students responses (in percentage) in final Assessment

Students responses	Correct	Not answered	Partially correct	Wrong
Study's objective/hypothesis/question	87.7	0	0	12.3
Rationale and relevance of the question	45.9	1.6	6.6	45.9
Relevance of this topic/question to Public Health	80.3	7.4	3.3	9
Identify Methodological approach	84.4	1.6	1.6	12.3
Results of the study	97.5	0	0	2.5
Strengths & weaknesses of the study	71.12	21.33	3.42	4.18
Generalizability of results	1.6	25.4	0.8	72.1
logical follow of conclusions from the design and results	79.5	12.3	0	8.2
Relation of results to current practice and how might they influence future practice	61.5	26.2	1.6	10.7
Total	67.72	10.65	1.92	19.69

Students significantly (p<0.001) experienced Higher level of comprehension of the subject, more involvement, Greater interest in topic followed by making them Self-confident, providing them with Great learning experience and Stronger intrinsic motivation. The teaching learning method could not significantly (p=0.873) Realize the leadership qualities in them. (Table 2)

Table 2: Students responses to Learning Experience on Teaching Learning method

Students responses	No	yes	P value
Higher level of comprehension of the subject	6.6	93.4	< 0.001
Self-confident	16.4	83.6	< 0.001
Realize the leadership qualities in me	50.8	49.2	0.873
Great learning experience	16.4	83.6	< 0.001
Stronger intrinsic motivation	22.1	77.9	< 0.001
Greater interest in topic	11.5	88.5	< 0.001
More involvement	11.5	88.5	< 0.001
Total	19.32857	80.67143	< 0.001

84.6% of the students slightly or completely agreed that they learned a lot during this teaching sessions. 76.2% of the students slightly or completely wished more of the course would have been conducted in this Format. 75.4% of the students slightly or completely agreed that this format is the best way for them to learn the material. (Table 3)

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Table 3: Students response to Feedback on the Teaching Learning method

Students responses	Completely disagree	Slightly disagree	Neither disagree nor Agree	Slightly Agree	Completely Agree	P value
I learned a lot during this teaching sessions	4.1	4.1	7.4	53.3	31.3	< 0.001
I wish more of the course would have been conducted in this Format	5.7	5.7	12.3	45.9	30.3	< 0.001
This format is the best way for me to learn the material	1.6	7.4	15.6	36.9	38.5	< 0.001
Total	3.8	5.73	11.77	45.37	33.37	< 0.001

Discussion

This study was intended to enable students to understand and apply the Epidemiological methods and Biostatistics for interpretation of scientific studies by teaching Epidemiological methods and Biostatistics to second year MBBS students by a mixed PBL method and measuring the student's ability in applying this knowledge in interpretation of scientific studies and students learning experience in this type of teaching learning method.

The mean test score was 31.25 (0.98). The mean test score percentage was 67.94 (23.5). The mean learning experience scores was 12.66 (1.48). The mean student feedback score was 11.96 (2.79). There was significant correlation between learning experience scores and student feedback scores. There was significant correlation between learning experience scores and student feedback scores [0.538 (p<0.001)]. There was no significant correlation between test scores and learning experience scores [0.083 (p=0.365)]. and student feedback scores [0.016 (p=0.859)].

Students significantly (p<0.001) experienced Higher level of comprehension of the subject, more involvement, Greater interest in topic followed by making them Self-confident, providing them with Great learning experience and Stronger intrinsic motivation. The teaching learning method could not significantly (p=0.873) Realize the leadership qualities in them.

84.6% of the students slightly or completely agreed that they learned a lot during this teaching sessions. 76.2% of the students slightly or completely wished more of the course would have been conducted in this Format. 75.4% of the students slightly or completely agreed that this format is the best way for them to learn the material.

The mean percentage of the test scores was 67.94 which is less compared to a study where the mean test score was 82% [1]. Students in that study were given relevant journal articles before one week of the test and the test included both short and long answer questions. While in this study relevant journal articles were not given prior to the test and the test included only short answer questions. The differences in the scoring could be attributed to the method of test conducted.

The mean student feedback score was 3.98(0.07) and Percentage of Slightly Agree or Completely Agree was 78.7%. In a similar study the mean overall course evaluation score of student responses was 3.96 (0.95) and agreed or strongly agreed at 76%. The results were similar in both the studies [9].

In this study 75.4 % of students agreed or strongly agreed that "This format is the best way for them to learn the material". Compared to a similar study where Seventy-eight percent agreed or strongly agreed with the statement "Overall, the course was a positive learning experience". The results in both the studies were very close. In a similar study a majority of students (97%) thought the material covered was moderately or greatly useful in helping to prepare them to carry out or interpret research in the future. A lower proportion (75%) felt the same was true for core statistical methods [1].

In this study 77.9% of the students felt that this method provided "Stronger intrinsic motivation" which was similar to a study where Students' narrative comments were reflected as ''Excellent, stimulating course" [1].

In a similar study there was no significant difference in performances on quizzes or exams between PBL and traditional students. Students using PBL reported a stronger grasp of epidemiologic principles, enjoyed working with a group, and, at the end of the course, were more enthusiastic about epidemiology and its professional relevance to them than were students in the traditional course. PBL students worked more steadily during the semester but spent only marginally more time on the epidemiology course overall [1].

A similar study found that the majority of students felt the course helped in some way to improve their ability to read, analyse, interpret and critique the medical literature and discuss how references to the medical literature can be integrated into clinical decision-making [10].

Conclusions

Majority of the students were capable of critiquing all the aspects of journal article. Only aspect where most of them failed is they could not generalize the results of the study. Students experienced higher level of comprehension of the subject, more involvement and Greater interest in topic. This method made them Self-confident, providing them with Great learning experience and Stronger intrinsic motivation. The teaching learning method could not realize the leadership qualities in them. Majority of the students agreed that they learned a lot during this teaching sessions, wished more of the course would have been conducted in this format and this format is the best way for them to learn the material.

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