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Outcome of Case-Based Learning in Non-Communicable Diseases for Third-Year Medical Students

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Abstract: This complete-enumeration, before-and-after study (without controls), was conducted on third-year medical students in Maharashtra, India. Traditional didactic lectures were delivered on eight non-communicable diseases/conditions mentioned in the University syllabus for the subject of Community Medicine. The pre-test, conducted after the traditional didactic lectures, comprised eight questions pertaining to these eight topics. For case-based learning, participating students (n=61) were randomly assigned, using lottery method, to two sub-groups comprising 30 and 31 students, respectively, to enable small-group discussion. The students in each sub-group were similarly exposed to case scenarios on all eight non-communicable diseases/conditions and the same facilitators jointly guided the discussion. An identical questionnaire was used for the pre- and post-tests. The scores from students in the two sub-groups were combined for analysing results of the pre- and post-tests. The outcome studied was the difference in cognitive domain scores after attending traditional didactic lectures (by pre-test) and case-based learning (by post-test). The mean correct scores (out of 80) in the post-test (51.61 ± 7.42) were significantly higher (Z=10.088; p<0.0001) than that in the pre-test (40.61 ± 4.18). Gender difference was statistically significant for questions on obesity (Z=2.622; p=0.0088) and blindness (Z=2.017; p=0.0434) in the pre-test, but there was no significant gender difference in the post-test scores. Though case-based learning significantly increased the cognitive domain scores in all eight topics, additional educational interventions would be required for some students who obtained low scores in the post-test.
Keywords: Case-based learning, Non-communicable diseases, Traditional didactic lectures.

INTRODUCTION

Since adults enthusiastically learn details that have direct relevance and practical applicability, principles of adult learning ought to be utilized while teaching medical students [1]. When the subject matter of the topic is linked to authentic contexts, medical students experience the essentiality of knowing the topic for future clinical practice [2]. Positive transfer of learning (application of knowledge across diverse circumstances, domains, and contexts) needs the activation of the learner's prior knowledge [3].

Case-based learning (CBL) is a discussion-based small-group learning technique that employs a guided inquiry method and provides more structure during small-group sessions. CBL enhances comprehension and acquisition of cognitive skills since learning is positioned within its context. In the Indian scenario, medical education is currently overwhelmed by focus on traditional didactic lectures (TDLs). CBL has been compared with the TDL format by various authors [4-11].

In CBL, the faculty creates scenarios (actual or hypothetical "trigger" cases) [2] to generate interest in a specific topic among small groups of students, who discuss these case scenarios and utilize the knowledge acquired from previously taught curricular content. This results in self-directed learning and application of their knowledge to the case scenario [12-17]. The teacher acts as a facilitator in the learning process rather than as a provider of knowledge. Case scenarios that extend over multiple topics enable the students to generate inter-concept linkages that boost retention of knowledge [15] and development of a holistic perspective [18]. CBL enhances reasoning skills and grasp of basic sciences, since learning is placed within the framework of a practical problem [19]. CBL has been shown to impart early clinical exposure, improve students' scores, enhance communication skills, stimulate the

students towards self-directed learning, help students to link clinical conditions to basic sciences and cultivate clinical reasoning skills [16]. Clinical reasoning is a method of determining a range of facets of health and disease of the patients [20] and for promoting clinical reasoning among the students, the teachers need to know the basic aspects of the clinical reasoning process and focus the instructions suitably [21].

An American study has reported that learners and faculty overwhelmingly preferred CBL (guided inquiry) over problem-based learning that involves open inquiry [22]. CBL has been found to be a feasible and an effective way to conduct inter-professional multidisciplinary health science education. [23] Students exposed to CBL were found to be more interactive during class; however they opined that the lecture method was more helpful in preparing for a written exam [11]. CBL is case-specific and is best carried out in a multidisciplinary context [24]. Since the packed medical curriculum necessitates efficient use of student and faculty time, the student-centred case-based learning (CBL) format offers an alternative learning model [22].

The objectives of the present study were to compare the cognitive domain scores of the participating third-year MBBS students after attending TDLs on non-communicable diseases/conditions (using a pre-CBL test) with that after using CBL as the educational intervention (using an identical post-CBL test).

MATERIALS AND METHODS

The complete-enumeration, before-and-after type of study (without controls), was conducted between July and September 2017 at Rajiv Gandhi Medical College in Kalwa, Thane, located about 30 kilometres from Mumbai city in the state of Maharashtra in Western India. This medical college has an intake capacity of 60 students per year for the Bachelor of Medicine and Bachelor of Surgery (MBBS) course. After obtaining approval from the Institutional Ethics Committee of Rajiv Gandhi Medical College for conducting the study, the purpose of the study was explained to third-year MBBS students. Written informed consent was taken from students (n=61) who were willing to participate in the study.

TDLs were delivered on all eight non-communicable diseases/conditions mentioned in the syllabus prescribed by the Maharashtra University of Health Sciences for the Community Medicine course – ischaemic heart disease, hypertension, cerebro-vascular accident (stroke), rheumatic heart disease, diabetes mellitus, obesity, blindness and cancer. The pre-test, conducted after the TDLs, comprised eight questions (ten marks per question) pertaining to these eight topics. The total marks obtainable were 80.

For CBL, participating students were randomly assigned (using lottery method) to two sub-groups comprising 30 and 31 students, respectively, to enable small-group discussion. The students in each sub-group were similarly exposed to case scenarios on all eight non-communicable diseases/conditions (mentioned above) and the same facilitators (both authors) jointly guided the discussion. The post-test was conducted after CBL using a questionnaire that was the same as that used for the pre-test. The scores from students in the two sub-groups were combined for analysing results of the pre- and post-tests. The outcome studied was the difference in cognitive domain scores after attending TDL (by pre-test) and CBL (by post-test).

The pre-test and post-test scores were tabulated and statistically analysed using EpiInfo Version 7.0 (public domain software package from the Centers for Disease Control and Prevention, Atlanta, GA, USA). Continuous data were presented as Mean and Standard Deviation (SD). 95% Confidence interval (CI) was stated as: {Mean-(1.96)*Standard Error)} – {Mean + (1.96)* Standard Error)}. The standard error of difference between two means was calculated. Statistical significance was determined at $p<0.05$.

RESULTS AND DISCUSSION

In the present study, the likely effects of confounding variables would cancel out since all the 61 students were jointly exposed to two subject experts (facilitators) for CBL and took identical pre-and post-tests. The mean score has been reported to be higher in student examination results when facilitated by subject-expert tutors [25]. CBL transforms the teacher into a facilitator who can mingle among the students and get acquainted with them on a more personal level [17]. The facilitators ought to activate discussion and encourage student participation in the CBL format [26].

Student-wise scores

The mean correct responses in the post-test were significantly higher than that in the pre-test (Table-1).

Table-1: Mean scores (out of 80) in pre- and post-tests

Parameter	Pre-test (n=61)	Post-test (n=61)
Mean	40.61	51.61
SD	4.18	7.42
95% CI	39.56 - 41.66	49.75 - 53.47
Z value	10.088	
p value	<0.0001*	

SD = Standard deviation; CI = Confidence interval
* Statistically significant

Similar results have also reported by other studies [27-33]. A single post-test after CBL has been found adequate and learning was retained even after six months [13]. Learning retention is the ability to sustain the acquired knowledge so that it may be retrieved and utilized when required later and to enable retrieval, the training sessions should utilize several contexts and situations in order to establish retrieval "hooks" [34]. Factors, such as, complexity of the task, time limits, stress, individual aptitude, and amount of original learning determine retention of learning [35].

Gender-wise scores

Though males obtained higher maximum, third quartile, median, first quartile, and minimum scores in the pre-test (Fig-1), the gender difference was statistically significant only for questions on obesity (Z=2.622; p=0.0088) and blindness (Z=2.017; p=0.0434). In the post-test, male students had a higher maximum score, but the third quartile, median, first quartile, and minimum score was marginally higher for female students (Fig-1). The gender differences were not significant for post-test scores.

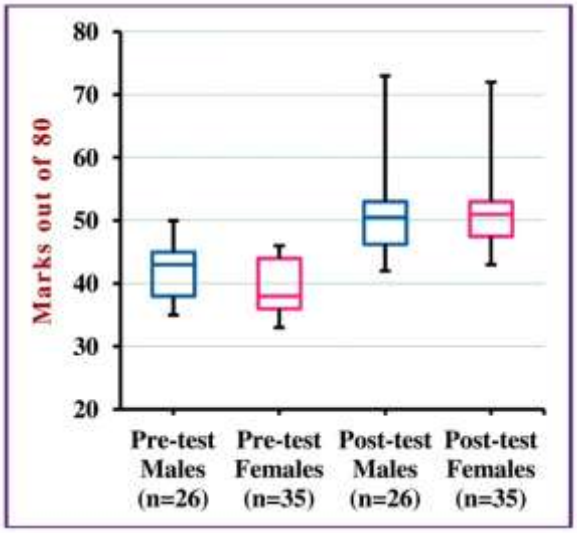

Fig-1: Box-and-whisker plot of gender-wise scores

Several studies [36-41] have revealed gender differences in learning styles. Teachers who are knowledgeable about the diversity of learning styles can augment student motivation and performance by creating suitable learning approaches to match the learning style preferences of students [42].

Topic-wise scores

In the pre-test, the maximum, third quartile, median, first quartile, and minimum scores were higher for cardio-vascular accidents, rheumatic heart disease, diabetes mellitus and blindness (Fig-2).

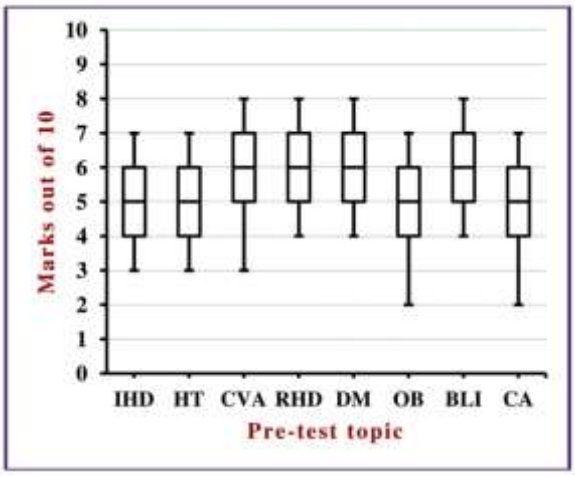

Fig-2: Box-and-whisker plot of pre-test scores

IHD = Ischemic heart disease; HT = Hypertension; CVA = Cerebro-vascular accident; RHD = Rheumatic heart disease; DM = Diabetes mellitus; OB = Obesity; BLI = Blindness; CA = Cancer

In the post-test, the maximum scores were higher for ischaemic heart disease, rheumatic heart disease and blindness (Fig-3). Additional educational interventions would be required for some students who had obtained low scores in the post-test because the prevalence of these non-communicable diseases is increasing in developing countries, including India.

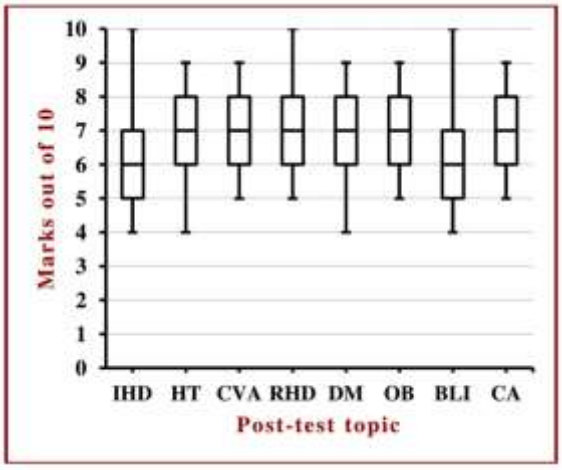

Fig-3: Box-and-whisker plot of post-test scores

IHD = Ischemic heart disease; HT = Hypertension; CVA = Cerebro-vascular accident; RHD = Rheumatic heart disease; DM = Diabetes mellitus; OB = Obesity; BLI = Blindness; CA = Cancer

CBL generates improvement in learning and retention [7, 8, 11] and allows students to explore real or virtual situations and enables them to comprehend complicated issues and analyse them more effectively [43]. Once a reasonable "depth" of knowledge is attained, numerous "interconnected mental models" are created [45] and the students are able to generalize their knowledge to a broad range of contexts and to apply it in practical settings [44]. During CBL, students discuss and give valid justifications for various probable diagnoses and investigations. Since these discussions help students recognize the consequences of ordering unwarranted and expensive investigations in resource-poor settings, their application of knowledge would also extend to the affective domain [13].

LIMITATIONS

Limitations of the present study were that it was conducted on one batch of 61 third-year medical students using eight randomly selected case scenarios from university-prescribed syllabus topics.

CONCLUSION

Though case-based learning significantly increased the cognitive domain scores in all eight topics, additional educational interventions would be required for some students who obtained low scores in the post-test. Gender difference was statistically significant only for two questions in the pre-test but not significant for post-test scores.

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