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Original Article

Community Medicine Section

Impact of Mode of Curriculum on Knowledge and Attitudes of Medical Students towards Health Research

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ABSTRACT

Introduction: Equipping students with skills in medical research should be an integral part of medical education systems. This study is designed to gauge the difference in knowledge and attitudes towards health research between two sets of undergraduate medical students; those enrolled in the new Problem Based Learning (PBL) education system versus those of the conventional Lecture Based Learning (LBL) curricula.

Materials and Methods: From the 4th and 5th years of medical university students, 90 participants were recruited from the Aga Khan University (PBL group) and Dow University of Health Sciences (LBL group) and were presented with structured and pre-validated questionnaire. Responses obtained for knowledge and attitudes of each group were recorded on a scale and graduated in percentages to be compared statistically for differences to identify the effectiveness of each curriculum.

Results: The score on the knowledge scale for the PBL group was found to be 44.77% against the 31.55% of the LBL students (p-value<0.001). Furthermore, the mean attitude score of AKU students was 72.22% as opposed to the 56.11% of the DUHS participants (p-value<0.001).

Conclusion: The PBL group achieved significantly higher scores in all aspects than the LBL group, showing healthier attitudes towards health science research along with better knowledge. Hence, the apparent positive influence of PBL curricula on attitudes towards research may be helpful in improving research output of medical students in Pakistan.

Keywords: Lecture based learning, Medical education system, Problem based learning, Research output

INTRODUCTION

Medical students from many countries seldom pursue careers as researchers [1,2]. It has been identified in studies that involvement in health research as a medical student has been found to be strongly linked with research efforts after graduation [3,4]. Hence, it is imperative that positive attitudes towards scientific research and the importance of the need for critical thinking and sound reasoning skills should be fostered and developed from the first day of medical education [5]. It is unfortunate that the past 20 years have witnessed a decline in the number of health researchers leading to a growing need for physician scientists who can conduct basic health science research projects which itself underlines the importance of undergraduate medical students as research assistants [6]. Observing student research activities can aid in identifying capable researchers for the future; as a good research record during medical school is a predictor of long term academic success in medicine [7]. To justify this statement, a study conducted at the Medical School of the Dutch University of Groningen investigating the scientific output of students involved in extracurricular research compared to those without any prior research experience found that the individuals of the former group had on average published more articles(4 papers) than those from the latter group (1 paper) [4]. In fact, in light of this knowledge, many medical schools are now employing various new educational strategies such as addition of mandatory or elective research assignments, workshops on various aspects conducting different types of researches, etc. to existing curricula to kindle positive attitudes in students [8].

Keeping in line with the demands of modern medicine, educational systems worldwide focus more and more to equip medical students with appropriate knowledge and skills rather than just text book facts alone [9] and hence, are seeking to employ new and innovative curricular systems for learning. One such curricular framework is Problem Based Learning (PBL) alternate to the conventional Lecture Based Learning (LBL) which typically involves a faculty member delivering factual knowledge to a large body of students. To common interpretation, in a PBL, groups of students are presented with a proto-typical disease case encompassing the basic science and clinical aspects of a pathology usually relevant to the subject matter at that point in the curriculum. By this, PBLs aim to achieve integration of knowledge of all basic science subjects in context of the clinical picture by prompting students to self identify deficits in basic knowledge and construct appropriate learning outcomes, usually to be discussed as a group in the following sessions. The use of PBLs is gaining popularity by leaps and bounds globally [10].

AIM

In this study, to assess the impact of PBLs, we investigate differences in the level of knowledge and attitudes regarding scientific research between two groups of students from two renowned medical institutions of Karachi, Pakistan; The Aga Khan University (AKU) and Dow University of Health Science (DUHS). Curriculum taught at AKU is PBL system while DUHS follows the conventional LBL curriculum.

MATERIALS AND METHODS

The Aga Khan University was the pioneer of implementing PBL curriculum in Pakistan, admitting its first class under the new system in October 2002. Dow University of Health Sciences still follows the LBL education system. Here, we compare the difference in knowledge and attitudes towards scientific research between the contemporary students of the two medical schools.

Study Design and Sample

The subject population was chosen to be the two senior most classes in the colleges, namely medical students of the 4th and 5th years from the student body spread over 5 years keeping convenience sampling in mind.

A pilot study was conducted on 40 students from both the groups

(20 from each) who met the inclusion criteria to respond to the questionnaire. The collected data was statistically analysed and difference in the means of knowledge scores was obtained (3.31), which was used in sample size calculation for the final study. However, the data from these participants was not included in the final results.

Sample size was determined by using calculation tools available online at openepi.com for comparing two independent means obtained from each institute. The difference between their means was kept at 3.31 and variance was assumed to be 1.7 in each group. So, finally 90 participants were calculated to be required from each institute (AKU and DUHS) at a confidence interval of 95% and power of the test set at 80%.

Outcomes, Variables, Questionnaires and Data Collection

Participants' information were collected using an adapted version of a verified questionnaire developed by Vodopivec et al., [11]. The same adaption has been used previously in an another published study of a similar nature [12]. The questionnaire constituted of 3 individual sections on basis of questions regarding the participant's personal data, assessment of the student's knowledge and attitude towards scientific research during undergraduate education respectively. Demographic questions asked included the participants' age, sex, year of study and mode of learning (either PBL or LBL) at the institute they are enrolled in. The knowledge section compromised of 10 multiple choice questions assessing the knowledge of the student regarding science and research. Each participants' correct answers' percentage was calculated to be used as representative score for knowledge. In the attitude section of the questionnaire, 6 simple questions regarding the participants' research background and attitude towards research were asked, with each answer being scored on a scale of 0.0 to 10.0. Score from each answer was then totaled and transformed into a percentage for a cumulative attitude score.

Ninety questionnaires were distributed among students of both institutes after verbally confirming the student's year of education being either 4th or 5th and written informed consent for participation in the study was obtained from each participant. The participants were requested to return filled questionnaires within the week after which remnant of the forms was not followed up and assumed to be a no response. The study protocol was approved by Dow University of Health Sciences and permission was also obtained from Aga Khan University for data collection prior to study.

STATISTICAL ANALYSIS

Software used to perform data analysis was Statistical Package for Social Sciences 21.0 (SPSS, Inc., Chicago, IL, USA). After data entry was completed, the command for descriptive analysis was computed to obtain mean scores. Once means and proportions for scores in knowledge and attitudes were calculated, the Students t-test was applied to compare means for students of PBL with those of LBL system. To verify the extent of association between responses to questions gauging attitudes towards health research amongst subjects from the Aga Khan Medical College & DMC, Chi-square test was applied. If frequency was found to be less than 5 then the fisher exact test was applied. The results were expressed in terms of Frequencies and percentages, for whom means ± SD and p-values were recorded. The level of significance was set at <0.05 for all results.

RESULTS

A 100% response rate was observed. The mean age of the students in both the groups was 22.34 ± 1.96 which ranged from 20 to 26. Among LBL subjects, 78(86.7%) participants were females, while 49(54.4%) of the 90 PBL participants were females. However, the mean age between two groups did not differed significantly.

According to our results, the mean knowledge score of PBL students was 44.77%±13.08 in comparison with 31.55%±11.30 score of LBL students (p-value < 0.001)

Furthermore, the mean attitudes score of AKU students was 72.22%±16.19 as compared to 56.11%±28.53 of the LBL subjects (p-value < 0.001). [Table/Fig-1] illustrates the mean scores of PBL and LBL subjects in accordance with the year of medical education. [Table/Fig-2] depicts frequencies and percentages of knowledge questions for both the groups.

[Table/Fig-3] illustrates the responses obtained for attitude questions from both groups. It was evident that significant number of AKU students (PBL group) participated in research activity

	Year	No.	Knowledge Mean±SD	p-value	Attitude Mean±SD	p-value
AKU	4th Year	39	40.51±12.12	<0.001*	69.23±15.54	<0.001*
	5th Year	51	48.03±12.96		74.50±16.44	
DMC	4th Year	78	31.28±11.66		54.48±28.0	
	5th Year	12	33.33±8.87		66.66±30.97	

[Table/Fig-1]: illustrates the mean scores of PBL and LBL subjects in accordance with the year of medical education.
* Highly Significant

Knowledge Questions	Description of the Questions	AKU (PBL sudents)	DMC(LBL students)
Q1) How would you define scientific hypothesis	a proposed idea or thought	52 (57.8%)	48 (53%)
	an answer or solution to a question	3 (3.2%)	4 (04%)
	¶ an answer or solution to a question which has a capacity of verification or empirical demonstration	24 (26.7%)	20 (22%)
	logical deduction of the premises that may or may not be verified empirically	11 (12.2%)	18 (20%)
Q2) How would you define scientific theory	Speculation or assumption with no or insufficient evidence	3 (3.3%)	5 (06%)
	Scientific hypothesis that may be proven, but lacking evidence for verification	32 (35.3%)	33 (37%)
	Set of scientific knowledge on a given topic or area	9 (10%)	15 (17%)
	¶System of hypotheses logically connected to one another, with common background, some of which have been verified	46 (51.1%)	37 (41%)
Q3) How would you define scientific truth	the truth that will be reached through scientific research	60 (67.4%)	72 (80%)
	absolute truth	10 (11.2%)	9 (10%)
	¶ consensus of competent experts	16 (18%)	6 (07%)
	fact that can be found in the textbooks	2 (2.2%)	2 (02%)
	facts that your professors teach you	1 (1.1%)	1 (01%)
Q4) Essential characterstic of science is	¶ all scientific conclusions are temporary	20 (22.7%)	7 (08%)
	scientific theory cannot merely explain natural phenomena, but must somehow also exert influence upon them	12 (13.6%)	33 (37%)
	rather obvious scientific conclusion does not have to be testable	4 (4.5%)	4 (04%)
	an experiment is not an objective model of the nature but serves as an introduction into real research of natural phenom	47 (53.4%)	38 (42%)
	some natural phenomena need not be measured but it suffices that a researcher notices them on time	5 (5.7%)	8 (09%)
Q5) A scale from 1 to 5 is called	ratio scale	3 (3.3%)	17 (19%)
	nominal	18 (20%)	31 (34%)
	¶ ordinal	58 (65.2%)	20 (22%)
	interval	9 (10%)	8 (09%)
	it is not a scale	2 (2.2%)	14 (16%)

Knowledge Questions	Description of the Questions	AKU (PBL sudents)	DMC(LBL students)
Q6) Representativeness is a key characterstic of	scientific paper	2 (2.2%)	10 (11%)
	professional paper	0 (00%)	10 (11%)
	scientific research	10 (11.2%)	36 (40%)
	¶ sample	58 (65.2%)	22 (24%)
	population	19(21.3%)	12 (13%)
Q7)Medline is	the first and best known "on-line" medical journal	11 (12.2%)	37 (41%)
	international association of medical informaticians	4 (4.4%)	26 (29%)
	printed form of the Excerpta Medica	2 (2.2%)	3 (03%)
	abbreviation (acronym) that lists the parts of the research article	5 (5.6%)	10 (11%)
	¶ medical database	68 (75.6%)	14 (16%)
Q8) How to check the number of citations	author index of the MEDLINE database	22 (24.4%)	16 (18%)
	corporate index of the Science Citation Index database	0 (00%)	14 (16%)
	author index of the Current Contents database	4 (4.4%)	14 (16%)
	¶ citation index of the Science Citation Index database	57 (63.3%)	41 (46%)
	author index of the Science Citation Index database	7 (7.8%)	4 (04%)
Q9) The part of a scientific paper is	author's curriculum vitae	7 (7.8%)	13 (14%)
	letter to the editor enclosed with the paper	6 (6.7%)	10 (11%)
	description of the timeline	12 (13.3%)	13 (14%)
	¶ acknowledgment to persons who assisted you during the research	65 (72.2%)	53 (59%)
Q10) Includes everything in introduction except	clearly state why the research has been started	1 (1.1%)	6 (07%)
	do not explain textbook facts	17 (18.9%)	15 (17%)
	do not explain words from the title of the paper	11 (12.2%)	7 (08%)
	¶ make it longer rather than shorter	52 (57.8%)	49 (54%)
	clearly define the question to which your research aims to provide an answer	9 (10%)	13 (14%)

[Table/Fig-2]: Depicts frequencies and percentages of knowledge questions for both the groups.
¶- Correct answers

Comparison of responses to questions assessing attitude towards health research	Description	Mode of Curriculum		p-value
		PBL (AKU)	LBL (DMC)	
Do you feel confident in interpreting and writing research paper	No	10 (5.6%)	24 (13.3%)	0.019* Sig
	Yes, with assistance	66 (36.7%)	58 (32.2%)	
	Yes, without assistance	14 (7.8%)	8 (4.4%)	
Have you ever participated in a research project apart from mandatory project	yes	77 (42.8%)	36 (20%)	<0.001* Sig
	no	13 (7.2%)	54 (35%)	
Have you ever written a scientific paper	yes	68 (37.8%)	17 (9.4%)	<0.001* Sig
	no	22 (12.2%)	73 (40.6%)	
Do you think that undergraduate should in research project	yes	85 (47.2%)	67 (37.2%)	<0.001* Sig
	no	5 (2.8%)	23 (12.8%)	
Do you think that undergraduate can plan a research project and write a scientific paper	yes	84 (51.2%)	58 (35.4%)	<0.001* Sig
	no	4 (2.4%)	18 (11%)	
If yes encircle appropriate	only under supervision	66 (42.6%)	58 (37.4%)	0.420 In sig
	without supervision	19 (12.3%)	12 (7.7%)	

[Table/Fig-3]: Illustrates the responses obtained for attitude questions from both groups

(p-value < 0.001) and were more confident in interpreting and writing a research paper (p-value<0.001).

DISCUSSION

The present study highlights that the levels of knowledge and attitudes towards health research are significantly higher among the medical students enrolled in PBL curriculum in comparison with the medical students taught from LBL curriculum (conventional). The findings suggest, the favourable and encouraging influence of PBL curriculum, in ameliorating the knowledge and attitudes of medical students of Pakistan regarding health research activities. Previously, a similar Pakistani study has reported similar trends in relative knowledge towards health research on comparison between both educational curricula; improved attitudes were observed from the students recruited from PBL group [12]. This group of medical students was selected from the same medical college. Since, the participants were compared from different points in time, therefore the probability of inducing other biases was introduced. Moreover, another Pakistani study revealed a considerably better knowledge and attitudes towards health research among LBL subjects in comparison with PBL group [13]. The researcher in this study also recruited participants from the same medical university. However, the impact of 'year of study' was identified as the probable confounding element, since the subjects belonged to different years of medical education. The present study was conducted in a setting where participants for both the groups were selected from the same year (medical years four and five). However, by investigating two groups from different colleges, the one belonging to the private sector (PBL group) and other group associated with the public sector (LBL group), could have introduced other biases too. In a nutshell, it could be stated that this is one of the pioneer studies where medical students from two different colleges were investigated to determine the impact of curriculum they are taught on knowledge and attitudes towards health research.

Besides, the subjects recruited from AKU (PBL group) were taught about academic basics of research methodology, basic biostatics and epidemiology, introduction to SPSS and End Note and literature search on medical database like Medline during second year of their medical education under a four week research module. Moreover, students enrolled in PBL curriculum also get an opportunity to have small group interactive sessions at the end of their lecture, supervised by an experienced facilitator. Additionally, at the end of module each group of 10 students are assigned a research question to design a hypothetical research protocol, as a means of testing knowledge and skills acquired during the module. The group interactions, individual attention and regular participation offers a definite chance of learning and clarifying concepts comprehensively. However, the LBL curriculum is deprived of this facility and focuses on delivering of knowledge on basic sciences subjects through lectures during their initial years of medical education. This reason could be attributed to the significant difference in knowledge scores of two groups. Moreover, the knowledge scores of our PBL group are consistent with findings of Vodopivec et al., who tested a similar questionnaire on a group of Croatian medical students taught from a PBL curriculum [11] (44.7% vs. 44.0%).

It is anticipated that mandatory involvement in research projects tend to increase students knowledge and improves attitude towards health research [14]. Consequently, subjects from both the medical college conduct compulsory research project in the time period of three months during fourth year of medical education. During this phase, students participate in designing a research topic and its protocol, execution of their study design and research methodology by data collection and its analysis on statistical management softwares like SPSS and lastly they

perform manuscript writing and its detailed presentation. PBL curriculum largely focuses on enhancing student's knowledge with regards to practical life. As a result, they are permitted a substantial free time in their schedule in comparison with their LBL counterparts, which is aimed to be spent in productive approaches. Therefore, PBL subjects benefit from an adequate duration of time spent in research activities as opposed to LBL participants, which tends to engage students in rote learning. Apart from these differences, the background knowledge acquired as result of theoretical research activities accounts for significant difference in attitudes towards research activities between two groups. The outcomes are in line with the work of Hassaan et al., and Vernon DT et al., who has also endorsed the fact that PBL curriculum provides a favourable and research conducive environment [12,15]. Researchers have shown that compulsory as well as extracurricular research has a far reaching impact in molding student's later life towards research activities [4]. It is also evident from our study that a significant number of PBL subjects were involved in performing extracurricular research and were more confident in writing scientific manuscript as compared to LBL participants. Similarly, the number of students who have written scientific paper was significantly higher than that of the LBL group.

According to an audit report, held at students corner of Journal of Pakistan Medical Association, more than three quarters of articles are contributed by medical students of AKU (PBL group) [16]. This form of contribution is of utmost importance, as research on local health issues can be brought to public attention which leads to improvement in clinical practice in that specific area [17]. Moreover, healthy attitudes of PBL students are satisfactory for a developing country like Pakistan where physicians of early generations were rarely engaged in research activities. Furthermore, it is a known fact that the PBL system of education offers access to vast resources, which makes them more competent in acquiring information related to medical science [15]. Conversely, students of the LBL curriculum lack these facilities, which greatly influence their knowledge and attitudes towards research activities as indicated by our results.

Various studies were performed in other countries to determine the effectiveness of each curriculum in enhancing medical students' knowledge towards health research including command acquired on basic and clinical science. According to Okubo y et al., implementation of PBL curriculum has proven to be an excellent pattern in medical curriculum, which has helped young doctors to establish lifelong-learning skills and clinical competencies especially with regards to the social aspect as they have become good presenters, good at listening to others' point of view, pragmatic in approach, and eager in their instructional tasks [18]. Moreover, PBL curriculum is based upon group learning and discussion among them which leads tutors to effectively connect theory and medical practice during their lectures [19]. In another study conducted at Northern Border University, Arar, Kingdom of Saudi Arabia, it was revealed that instructors found PBL curriculum better than LBL curriculum. However, the students only highlighted syllabus content but did not appreciate any other benefit observed with PBL curriculum [20]. In a cross-sectional survey carried out at 2 medical colleges of Riyadh, more than half of participants were satisfied with the PBL curriculum implementation. However, 35% did not recommend adopting PBL curriculum [21]. The findings of our study suggest that PBL mode of education is efficacious in enhancing medical student's knowledge and attitudes towards health research in comparison with conventional mode of learning. The results are persuasive in implementing PBL curriculum in medical colleges of Pakistan and other developing countries in order to improve publication statistics associated with health research among young physicians. The present situation of health research in Pakistan is not satisfactory [22]. It is suggested that ameliorating health research activities among medical students will introduce development of evidence based medicine in Pakistan [12], which will eventually upgrade health care facilities. It is also suggested that researches on local health issues will not only lead to evidence based medicine but also introduce cost effective solutions in enhancing local clinical practice [23].

LIMITATION

The few limitations that must be considered while concluding results of our study are as follows:

- The two groups belonged to different medical colleges, experiencing different teaching faculty and teaching resources. PBL group was affiliated with private sector while LBL subjects belonged to public sector. Therefore, this methodology could have introduced selection bias.
- The study was performed at two medical colleges of Pakistan of the same city. Therefore, results could not be generalized to with the entire medical population of Pakistan.

Therefore, further longitudinal studies must be carried out in medical colleges all over the Pakistan to conclude valid solutions on issues of health research among young physicians. Moreover, elements such as financing, availability of research framework, increasing expenses of medical education, student loans and sufficient resources for research must also be investigated.

CONCLUSION

In conclusion, PBL subjects exhibited higher knowledge and healthier attitudes towards research activities than the LBL group. Therefore, a PBL curriculum must be adopted in order to improve research activities in Pakistan and other developing countries to address local health issues more efficiently.

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