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Perceived Relevance of Case Based Learning among 1st and 2nd Year MBBS Students of Basic Medical Sciences

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Author`s Contribution

[1,2]Substantial contributions to the conception or design of the work; or the acquisition,[3,4]Active participation in active methodology, [5,7]analysis, or interpretation of data for the work, [1,2,6]Drafting the work or revising it critically for important intellectual content

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ABSTRACT

Objectives: To determine which demographical factors tend to influence the relevance of Anatomy, Physiology and Biochemistry among 1st and 2nd year undergraduate MBBS students.

Methodology: This cross-sectional analytical study was carried out on 1st and 2nd year undergraduate medical students at Al-Tibri Medical College for period of six months. Self-design questionnaire was distributed to students after pilot testing. Questionnaire was distributed to students via Google Forms. Students willing to participate were included voluntarily without any repercussions. SPSS version 22.0 was used for data analysis. Chi-square test was applied to test computed scores of perceived relevance of CBL with demographics. P<0.05 was considered statistically significant.

Results: Mean age of students in 1st and 2nd year was 19.76 ± 2.41 and 20.61 ± 2.79 years. In total there were 83 males and 97 females included in the study. 139 students had studied high school from Intermediate Board while 41 had done A levels or Aga Khan Board. The highest rating on Likert scale was observed in question whether CBL should be integrated into the curriculum more extensively (4.02 ± 0.78) and followed up by diversity of cases in CBL helps me understand various clinical conditions better (3.96 ± 0.86).

Conclusion: Highest qualification in terms of Intermediate and A levels significantly affected student's responses to the relevance of CBL. However age and gender did have a significant impact in some aspects of CBL.

Keywords: Basic Medical Sciences, Case Based Learning, Integrated Curriculum, Modern Teaching Methods.

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Introduction

The present medical education's paradigm is frequently called upon into questioning on demands for continuously improving the quality as well as quantity of medical graduates.[1] Optimization of basic medical science integration in undergraduate education, eventually with clinical practice is one of the areas under continuous scrutiny. [2]

In order to make competent and scientifically sound decisions clinically, medical students ought to retain their knowledge from pre-clinical phases during their year medical undergraduate years. [3] Published data has shown that rates of failure on board certification and certifying examinations were substantially linked with assessment of the retained knowledge of basic sciences during early years of medical school. [4]

A research by D'Eon et al reported significant loss of knowledge amongst medical students of neuro-anatomy,

immunology and physiology after re-testing them ten months later mainly due to lack of integration with clinical sciences. [5] Likewise another study found in declining of examinee performances dramatically in biochemistry, which was followed up by poor performances in pharmacology and microbiology when appearing for United States Medical Licensing Examination (USMLE) Step 1, when compared with USMLE Step 2. [6]

Reinforcement of the learning materials has been reported to demonstrate significant gains in anatomy, pathology and physiology during patient care during clerkships.[7] A study reported that if the gained knowledge is not linked directly, be applicable or relevant to contexts clinically, it tends to be lost rather swiftly.[8] It is recommended that in order to prevent loss of extensive knowledge, any information provided to the students ought to be relevant. The relevance of subject matter perceived aids in facilitating retention of knowledge as well as in application of that knowledge, whilst any lacking in relevancy is lined to converse effect.[9]

A research evaluating critical factors of education which contributed to undergraduate medical education outcomes concluded that variations exist in terms of the type, amount as well as methods used for teaching and learning of biosciences within programs of medical schools.[10] Research has also shown demographical factors like student's age, gender, ethnicity, language background all to have influences of the academic performances and retention of knowledge. A few studies have observed that female and more mature students tend to have higher academic achievement when compared with males and younger colleagues respectively.[11] Nonetheless, inconsistencies in results regarding the relation of such factors with academic success have been reported. Consequently, the influence of such factors on retention of basic knowledge of science must be explored further.[12]

Case Based Learning (CBL), an educational paradigm wherein knowledge of basic sciences is integrated with clinical sciences.[13] When students start exploring tangents in a CBL, a facilitator uses questions to guide the students back towards main learning objectives. Therefore CBL makes use of a guided inquiry based method for integration of basic and clinical sciences. Since its process tends to foster deductive reasoning, it can be predicted to improve student's knowledge integration with clinical scenarios.[14] In addition, the students tend to have advance preparation for the session, helping to make a schema before coming to the session. CBL further proponents have argued that it aids in focusing students' onto key points in a clinical case, encourages structured approaches for solving of clinical problems, thereby instilling clinical reasoning right from the get go.[15]

Al-Tibri Medical College Karachi has a five year undergraduate CBL curriculum that encircles integration both vertically and horizontally of basic and clinical knowledge. As student's year of undergraduate medical education increase (from 1st year to final year), an increase in the number of CBLs and clinical rotations take place. The students are taught systemic-based modular foundations of medicine in the first two years, providing and early opportunity for developing clinical and communication skills.

CBL's value lies in exploitation of the basic capacity of human to learn from stories. CBL is known for its student-centered structured approach for collaborative learning which helps in integration of both knowledge and skills. CBL aids in ensuring that the newly acquired information is consolidated by way of its application in real life settings and through discussions. Through the integrated approach, student is required to gather the required information and in accordance with relevancy and importance, prioritize and filter the irrelevant information. Therefore, we hypothesize that the applicability and relevancy of CBL in integrating basic sciences with clinical will foster retention of the gained knowledge when students reach clerkship. Through a cross sectional study design, the objective of this research was to:

To determine which demographical factors tend to influence the relevance of Anatomy, Physiology and Biochemistry among 1st and 2nd year undergraduate MBBS students.

Methodology

This cross-sectional observational study using non-probability convenient sampling was carried out by inviting all 1st and 2nd year MBBS students (n=200) for a period of six months (May 2022 to October 2022). The reason behind including 1st and 2nd year undergraduate students was to infer whether CBL is effective to enhance the critical thinking, understanding, engagement, problem-solving ability and overall learning experience. For informing them about the study, face to face cohort announcement was made for encouraging participation. Students were given assurance that no adverse academic

repercussion will be accounted for non-participation. Data collection was done one month prior to students going on leave for annual examination preparation for avoiding the confounding effects of students studying for summative examinations (October 2022). Ethical approval was taken from the Institutional Review Board of Al-Tibri Medical College Karachi [Approval Number-ATMC/IERC/11th (01-2022)/15].

After ethical approval from the IRB of ATMC, self-designed questionnaire was distributed to students after pilot testing using 10 % of the total student population in 1st and 2nd year MBBS (i.e. 20 students, which were not included in the actual results of the study) and the questionnaire was also pilot-tested from Faculty of Department of Community Medicine (Head of Department, one Professor and two Associate Professors). The reliability of the questionnaire came out to be 0.81, therefore deemed fit to use.

Demographical data included roll no, gender, age, highest level of previous qualification (A levels, intermediate, any other degree/diploma/certification etc.). Participation was voluntary and verbal consent was sought from each student. The survey was carried out on Google forms in order to ensure maximum participation and minimize disruptions to students' schedules. Students responded to ten statements using 5-point Likert scale. At the end of questionnaire, open ended responses were taken to provide qualitative feedback on strength and weakness of CBL and suggestions for improvement.

For analysis of data, Statistical Package for Social Sciences (SPSS) version 22.0 was used. Prior to calculating descriptive statistics, normality of data was measured using Shapiro-Wilk test after which descriptive statistics were presented as mean and standard deviation for continuous variables and frequency and percentages for nominal data. Descriptive statistics included age, gender and academic year.

Inferential statistics included applying chi-square test to the computed scores of perceived relevance of CBL among students of basic medical sciences with demographics (age, gender, year of study and last highest qualification) of the students. P-value of <0.05 was kept as statistically significant.

Results

The baseline demographic characteristics of the 180 participants, including age, gender, and educational background, are summarized in Table I. The sample comprised both first- and second-year students with comparable distributions across key variables.

Table I: Baseline demographics of participants included in the study (n=180)

Variable		1st Year	2nd Year
Age (Mean ±SD)		19.76 ± 2.41	20.61 ± 2.79
Gender	Male	31 (38.75 %)	36 (45 %)
	Female	49 (61.25 %)	44 (55 %)
Education	Intermediate	68 (85 %)	71 (88.75 %)
	A levels	12 (15 %)	09 (11.25 %)

The participants (n=180) generally responded positively to the role of Case-Based Learning (CBL) across various domains, with most mean ratings ranging from 3.5 to 4.0. Highest ratings were observed for statements regarding curriculum integration, case diversity, and overall engagement. Relatively lower scores were noted for confidence building and the real-world relevance of cases. Detailed mean responses are presented in Table II.

Table II: Mean response of participants to relevance of CBL (n=180)

Question	Mean Rating + SD
CBL helps me understand core concepts better than traditional lectures	3.92 ± 0.82
CBL enhances my critical thinking skills	3.74 ± 1.18
CBL improves my problem-solving abilities	3.56 ± 1.13
CBL makes the learning process more engaging	3.93 ± 0.89
CBL helps me integrate knowledge from different subjects effectively	3.77 ± 1.07
I feel more confident in my knowledge after participating in CBL sessions	3.37 ± 1.09
CBL encourages collaboration and teamwork among students	3.78 ± 1.14
The cases discussed in CBL sessions are relevant to real-world medical scenarios	2.98 ± 1.44
CBL sessions are well-organized and effectively facilitated by the instructors.	3.93 ± 0.82
CBL should be integrated into the curriculum more extensively	4.02 ± 0.78
CBL helps me retain information longer compared to traditional learning methods.	3.92 ± 1
The diversity of cases in CBL helps me understand various clinical conditions better.	3.96 ± 0.86
CBL sessions improve my ability to apply theoretical knowledge to practical scenarios	3.72 ± 1.07
CBL sessions enhance my ability to communicate effectively with peers and instructors.	3.49 ± 1.23
The feedback provided during CBL sessions is helpful for my learning.	3.52 ± 1.13
CBL encourages me to engage in self-directed learning and research	3.81 ± 0.95
CBL sessions make complex medical concepts easier to understand.	3.74 ± 1.02

CBL has improved my ability to work under pressure and manage time effectively.	3.82 ± 1.01
The interactive nature of CBL helps me stay focused and motivated during sessions.	3.73 ± 0.92
CBL has positively impacted my overall academic performance (Lifelong learning)	3.87 ± 1.12

Cross-tabulation of demographic variables with the perceived relevance of CBL revealed several statistically significant associations ($p < 0.05$), particularly with year of study and highest qualification. Notably, the year of study showed significant associations with 9 out of 20 questions, while highest qualification was significant in 10 items. Gender and age showed fewer significant relationships, with only a few responses reaching statistical significance. Detailed p-values are presented in Table III.

Table III: Cross tabulation of various demographic factors to perceived relevance of CBL (n=180)

Questions	P-values (Pearson Chi-Square Test Applied)			
	Age	Gender	Year of Study	Highest Qualification
Q 1.	0.55	0.42	0.68	**0.005***
Q 2.	0.24	0.09	0.75	**0.01***
Q 3.	0.20	0.19	0.84	**0.03***
Q 4.	0.60	0.19	0.09	**0.05***
Q 5.	0.34	**0.008***	0.40	0.66
Q 6.	0.39	0.82	0.09	**0.01***
Q 7.	0.42	0.35	**0.04***	0.33
Q 8.	0.51	0.89	0.59	0.51
Q 9.	0.75	0.81	0.81	**0.05***
Q 10.	0.63	0.61	0.56	**0.05***
Q 11.	0.44	0.37	**<0.001***	**0.03***
Q 12.	0.55	0.78	0.26	0.49
Q 13.	0.71	0.86	**0.001***	**<0.001***
Q 14.	0.44	0.46	**0.005***	0.77
Q 15.	0.85	0.87	0.60	**0.02***
Q 16.	0.33	0.75	**0.001***	**0.03***
Q 17.	**0.03***	0.52	**0.007***	0.14
Q 18.	**0.04***	0.52	**<0.001***	**0.03***
Q 19.	0.81	0.86	**0.03***	0.53
Q 20.	0.20	0.37	**0.01***	0.75

Discussion

The study showed that students are able to draw their attention towards a teaching method which is not only informative, interesting, clinically oriented but able to make them achieve better marks for students in assessments and examinations.[16] The demographic profile of the participants shows a balanced gender distribution and similar educational backgrounds among first and second-year students. This demographic pattern is consistent with other studies in medical education, which often report a higher proportion of female students and an age range typical of undergraduate medical programs. Such consistency allows for broader generalization of the findings across similar student cohorts.[17]

Positive responses to CBL, particularly regarding its impact on understanding core concepts, enhancing critical thinking, improving problem-solving skills, and increasing engagement, align with existing research. Previous studies have consistently found that CBL boosts cognitive skills and student engagement more effectively than traditional lectures.[18]. For instance, Hoppe MK highlighted that CBL promotes deep learning and the application of theoretical knowledge to practical situations, which is supported by the high ratings for knowledge integration and application in this study.[19]

The study's findings that CBL increases student confidence and promotes collaboration are supported by other research highlighting the collaborative benefits of CBL. James et al. observed that CBL creates a collaborative learning environment that encourages peer interaction and teamwork.[20] The current study's results, which indicate that CBL sessions are relevant to real-world medical scenarios and improve communication skills, echo the positive outcomes noted in earlier studies on the practical and interactive benefits of CBL[21]

High ratings for the organization and facilitation of CBL sessions suggest effective implementation, which is crucial for CBL's success.[22] Literature indicates that well-organized CBL sessions, guided by skilled facilitators, significantly enhance the learning experience. This highlights the importance of faculty training and structured session planning in CBL.[23]

Strong agreement on the need for greater integration of CBL into the curriculum reflects a growing trend in medical education. Studies advocate incorporating CBL and other active learning strategies alongside traditional teaching methods, citing improved student outcomes and satisfaction.[24]

Cross-tabulation analysis shows significant associations between demographic factors and the perceived relevance of CBL, particularly regarding age, year of study, and highest qualification. These findings align with literature suggesting students' perceptions of and benefits from CBL can vary based on their academic maturity and prior educational experiences. For example, advanced students might view CBL differently compared to those in the early stages of their education due to their increased

exposure to clinical scenarios and problem-solving activities.[25]

A study by Weidenbusch et al., showed that CBL significantly enhances clinical reasoning and diagnostic skills among medical students, supporting the current study's findings on improved problem-solving and critical thinking.[26]

A research by Raza et al., reported higher student engagement and motivation with CBL methods, which is reflected in the positive ratings for engagement and motivation in the current study.[27] Gholami et al. found that students participating in CBL reported greater confidence and better retention of information, similar to the current findings on confidence and long-term retention benefits.[28]

In summary, the study's findings are well-supported by the broader literature on CBL in medical education. The consistency of these results with other research underscores the effectiveness of CBL in enhancing various educational outcomes, including critical thinking, problem-solving, engagement, and knowledge retention.[18] The demographic insights and cross-tabulation results further enrich our understanding of how different student groups perceive and benefit from CBL, offering valuable guidance for optimizing its implementation in medical curricula.

Conclusion

The results of the study showed that previous highest qualification in terms of Intermediate and A levels significantly affected students responses to the relevance of CBL. However age and gender did have a significant impact in some aspects of CBL. Further multi-centered and higher sample size researches are needed to enlighten the findings reported in this research.

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