

## Knowledge scores in annual and modular curriculum among medical students from Karachi, Pakistan

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### Abstract

**Objective:** To compare the knowledge scores of basic medical subjects in annual versus modular system among undergraduate medical students.

**Methods:** A cross-sectional survey was conducted on 4th year undergraduate medical students of annual and modular system of Liaquat National Medical College, Pakistan. Study was conducted from 30th November 2017 to 1st June 2018 for a total of 6 months. Sample size was calculated to be 82 students. The data was collected using a structured questionnaire. The student's t-test was applied to compare the mean difference of knowledge scores between the two groups.

**Results:** Students in modular system retained better knowledge of anatomy as compared to annual students. However, the annual system students retained higher knowledge in subjects of community medicine and pharmacology. Mean knowledge score among students for annual system was  $12.98 \pm 2.92$  and semester system was  $13.1 \pm 3.03$ . There was no significant difference observed in overall mean knowledge scores between the two groups ( $p=0.85$ ).

**Conclusion:** Students in the annual system scored higher in pharmacology and community medicine. This highlighted the need to address the issues of time allocation and implementation strategies for the subjects in the new system. There was no difference between overall knowledge scores in each group, hence, it would be inappropriate to conclude that one system is superior to the other.

**Keywords:** Knowledge retention, Annual system, Modular system, Basic science, Knowledge scores.

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### Introduction

Medical education, with time has witnessed a radical shift from the traditional lecture-based learning to a more integrated conceptual learning. Previously, medical colleges were following a traditional annual system, a teacher-based educational system, with students receiving lectures in a passive mode. In this system, all the basic medical science subjects were taught separately and assessments were made in the form of annual examinations.<sup>1</sup> The integrated modular system (used interchangeably with semester system), on the contrary, involves combining knowledge, skills, attitudes and values in subject areas and connecting components of the curriculum in a relevant manner by both students and teachers.<sup>2</sup>

The need for change in the curriculum emerged owing to the significance of knowledge of basic science subjects. The value of basic science knowledge has long been researched and studies have shown that basic science knowledge is important to make better clinical

decisions<sup>3,4</sup> and to better retain key signs and symptoms of clinical diseases.<sup>5</sup> It has also been found that diagnostic reasoning is better learned when basic knowledge is integrated with clinical knowledge.<sup>6</sup> Thus, in order to have good clinical knowledge, strong and sustainable basic knowledge is a pre-requisite.<sup>7</sup>

Studies have affirmed a positive correlation with regards to loss of basic knowledge with time.<sup>8,9</sup> This knowledge loss has no association with marks obtained by students in their final exams.<sup>10</sup>

Previous studies conducted in the area revealed benefit of modular system to annual system. Students trained in integrated modular system seemed to make a more accurate clinical diagnosis while dealing with patients as part of their subsequent educational training.<sup>11</sup> They also develop greater subject interest, better studying practices and develop independent thinking and problem-solving attributes.<sup>12,13</sup> The difficulty of integrated modular system seems to be the lack of in-depth learning with more focus on conceptual learning.<sup>14</sup>

In Pakistan, medical universities have also updated their curriculum in order to stay abreast with the constant advancements in medical healthcare. Even though,

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modular integrated system seems better than the annual system,<sup>15</sup> however, faculty and students have found it difficult to adapt to this new system. Students studying in the new system have faced problems of lower grades, poor time management and lack of mentors as compared to the traditional system.<sup>16-18</sup>

Although, research has revealed that the new integrated system has several advantages in building concepts of medical students, but at the same time, there is superficial learning of individual basic science subjects. The main issue to be assessed is whether students are retaining more information in the new system (modular) or in the old system (annual). Retention of basic sciences knowledge is imperative so that students could resort to critical thinking and thus make the best clinical decisions. Therefore, the aim of this study was to compare the retention of medical knowledge of senior medical students in annual and modular system in the subjects of basic medical sciences.

## Methodology

It was a cross-sectional study conducted from 30th November 2017 to 1st June 2018 for a total of six months, at Liaquat National Medical College (LNMC) Karachi, Pakistan.

This study included fourth year MBBS students undertaking annual and modular system at LNMC. The reason for two separate systems was that there was a change in university affiliation. The earlier annual system affiliation was with 'Karachi University', whereas the recent modular system affiliation was with 'Jinnah Sindh Medical University (JSMU)'. This was the last batch in annual system and the subsequent batches were of newer modular system. The new modular system of JSMU had a faster pace as compared to annual system of Karachi University. So only during that year, we had two simultaneous 4th year MBBS batches.

The sample size for comparing two means was calculated using Open-Epi software,<sup>19</sup> with 80% power of test, 95% confidence interval, and mean knowledge score of  $3.2 \pm 0.8$  in one group versus  $2.7 \pm 0.8$  in the other group.<sup>20</sup> The largest sample size calculated was 82 students, 41 in each group. Stratified random sampling technique was applied to recruit participants in our study considering annual and modular system as two strata and each 4th year MBBS student belonged to only one of these strata. The dependent variable was retention of basic medical sciences and independent variable included age, gender, education etc. The inclusion criteria included students of fourth year MBBS (both genders) enrolled in modular and annual system. Exclusion criteria included students that

did not give consent for the research and those who were repeating academic year.

A structured questionnaire was used to obtain medical knowledge from both groups of students. The questionnaire consisted of socio-demographics and multiple-choice questions from basic medical sciences. The questions were selected from subjects of Embryology, Histology, Gross Anatomy, Physiology, Pharmacology, Biochemistry and Community Medicine. The multiple-choice questions were adopted from standard international books. Study groups were asked to gather in two separate lecture halls simultaneously to fill the questionnaires. Completion of questionnaire took approximately 20 minutes. After the filled questionnaires were collected, 41 questionnaires from each group were randomly selected using computer generated random sampling technique. The participants were given full assurance that the data will be used only for research purposes, without exposing their identity in any respect.

Data was analyzed using software SPSS version 21. Descriptive statistics of socio-demographic variables was computed as frequency with percentages and mean with standard deviation. The student's t-test was applied to compare the mean difference of knowledge scores between the annual and modular groups. The p-value of 0.05 was considered statistically significant. To collect data, participants were required to give written consent for participation in the study. Ethical Review Committee approval was also taken from Liaquat National Medical College and Hospital for the study.

## Results

Table-1 shows the sociodemographic characteristics of medical students. The overall mean age of fourth-year medical students was  $22 \pm 0.91$  years. The mean age of students in annual system was  $22.37 \pm 0.94$  years versus  $21.68 \pm 0.75$  years for modular students. Males and females in annual system were 11 (26.8%) and 30 (73.2%), respectively, while in modular system 13 (31.7%) students were male and 28 (68.3%) were females. Majority of students among both groups did schooling under local examination boards; 31 (75.6%) in annual group and 36 (87.8%) in modular group. The percentage of students passing GCE (O-levels) was 10 (24.4%) among annual system group and 5 (12.2%) from modular system group. The daily study frequency was found to be 8 (19.5%) for annual and 13 (31.7%) for modular system.

Table-2 shows the comparison of mean knowledge scores for each basic medical science subject between annual examination system group and modular examination system group. There was a significant difference of

**Table-1:** Socio-demographic characteristics of the medical students, Liaquat National Medical College Karachi.

| Variables                                     | Frequency   | Percentages |
|---|-------------|-------------|
| Mean age (SD)*                                | 22.06 ±0.91 |             |
| <b>Education system</b>                       |             |             |
| Annual  | 41          | 50          |
| Modular                                       | 41          | 50          |
| <b>Gender</b>                                 |             |             |
| Male  | 24          | 29.3        |
| Female  | 58          | 70.7        |
| <b>Schooling</b>                              |             |             |
| Cambridge                                     | 15          | 18.3        |
| Matriculation                                 | 67          | 81.7        |
| <b>High school/12th grade</b>                 |             |             |
| Cambridge                                     | 8           | 9.7         |
| Secondary school                              | 74          | 90.2        |
| <b>Frequency of self-study (n=41 annual)</b>  |             |             |
| Daily   | 8           | 19.5        |
| Weekly  | 20          | 48.8        |
| Monthly                                       | 5           | 12.2        |
| Yearly  | 2           | 4.9         |
| Near exam date                                | 6           | 14.6        |
| <b>Frequency of self-study (n=41 modular)</b> |             |             |
| Daily   | 13          | 31.7        |
| Weekly  | 23          | 56.1        |
| Monthly                                       | 1           | 2.4         |
| Yearly  | 0           | 0           |
| Near exam date                                | 4           | 9.8         |

\*SD = Standard deviation.

**Table-2:** Knowledge scores of medical students in annual and modular system, Liaquat National Medical College Karachi.

| Subjects           | Knowledge score (annual system) Mean (SD) | Knowledge score (modular system) Mean (SD) | p-value |
|--------------------|---|--|---------|
| Anatomy            | 4.41 (1.41)                               | 5.59 (1.62)                                | <0.001  |
| Physiology         | 1.88 (1.05)                               | 2.20 (0.78)                                | 0.12    |
| Biochemistry       | 1.56 (0.95)                               | 1.27 (0.89)                                | 0.15    |
| Pharmacology       | 1.66 (0.91)                               | 1.07 (0.87)                                | 0.004   |
| Community medicine | 3.46 (0.09)                               | 3.00 (1.11)                                | 0.047   |

\*SD = Standard deviation.

between both groups for subjects of anatomy, pharmacology and community medicine. The students in modular system retained significantly better knowledge of anatomy as compared to annual system students. On the other hand, annual system students retained higher knowledge for subjects of community medicine and pharmacology. There was no significant difference of knowledge scores between the groups for subjects of physiology and biochemistry.

**Table-3:** Preferred textbooks.

| Subject            | System  | Long textbook Frequency (%) | Long and short Frequency (%) | Short textbook Frequency (%) |
|--------------------|---------|-----------------------------|------------------------------|------------------------------|
| Anatomy            | Annual  | 11 (26.8)                   | 15 (36.6)                    | 15 (36.6)                    |
|                    | Modular | 21 (51.2)                   | 12 (29.3)                    | 8 (19.5)                     |
| Physiology         | Annual  | 36 (87.8)                   | 4 (9.8)                      | 1 (2.4)                      |
|                    | Modular | 33 (80.5)                   | 3 (7.3)                      | 5 (12.2)                     |
| Biochemistry       | Annual  | 28 (68.3)                   | 12 (29.3)                    | 1 (2.4)                      |
|                    | Modular | 20 (48.8)                   | 20 (48.8)                    | 1 (2.4)                      |
| Community Medicine | Annual  | 37 (90.2)                   | 4 (9.8)                      | 0 (0)                        |
|                    | Modular | 24 (58.5)                   | 17 (41.5)                    | 0 (0)                        |
| Pharmacology       | Annual  | 24 (58.5)                   | 15 (36.6)                    | 2 (4.9)                      |
|                    | Modular | 37 (90.2)                   | 4 (9.8)                      | 0 (0)                        |

Table-3 shows preferred textbooks that the students used to study. For subjects of community medicine, pharmacology, biochemistry and physiology, 79 (96.3%) students studied from long and short textbooks. However, in subject of anatomy, 21 (51.2%) modular system students studied from long textbooks, whereas only 11 (26.8%) annual system students studied from long textbooks. In subject of Pharmacology, 10 (24.4%) of annual students preferred studying from two long textbooks as compared to 2 (4.9%) in modular system.

## Discussion

The core of medical learning is based on the fact that retention of delivered medical knowledge among students should be effectively utilised in the future for clinical practice. The question of how important basic sciences are to clinical practice has remained unanswered. Substantial research has been done on this topic. Our study was aimed at finding any significant difference between systems of education in relation to retention of basic medical subjects. No significant difference in knowledge retention was found between the two groups. However, annual system retained more of pharmacology and community medicine whereas modular retained more of anatomy.

A research done in 2006<sup>7</sup> concluded that there was a significant deterioration in retention of basic science knowledge over the years. One of the reasons provided was that students in clinical years did not think that remembering basic concepts was important and so focused their energies on remembering clinical concepts. On the other hand, students in pre-clinical years focused on basic concepts and scored higher on basic concepts because that was part of their current curriculum. This pattern of studying has also been seen in our research. Students focus studying and remembering subjects and concepts that are part of their current curriculum. Annual

system students scored higher in pharmacology and community medicine, as these subjects were part of their recent curriculum for that year. They scored lower in anatomy as that subject had been covered two years back in their second year.

One of the reasons why annual system retained more of pharmacology and community medicine could be that these subjects are studied in a lot of detail. An entire year (3rd year) was spent for these subjects giving students more time. In contrast, semester students only study these subjects in sections and perhaps don't have enough time for each. A second reason could be a problem in the implementation of new curriculum. This has been mentioned in a study conducted in 2012 where faculty members were worried that modular curriculum will only allow for superficial learning as adequate time is not given to each subject.<sup>14</sup> In that study, it was also mentioned that perhaps superficial learning could also stem from not accurately implementing integrated curriculum as opposed to a problem in structuring of the curriculum.

A study done in Pakistan revealed that modular students scored lower in subject of pharmacology as compared to annual students.<sup>17</sup> The reason explored in that study was improper implementation of modular system. This could be a reason for semester students not obtaining higher overall knowledge score as compared to annual students.

Learning and teaching subject of anatomy has remained a constant research question. With the advent of systemic integrated system and shift away from dissecting cadavers, there has been a fear of retention of this volatile, yet vital subject. A study analyzing learning approaches students use, found that they preferred superficial learning of facts rather than focusing on deep learning and understanding.<sup>21</sup> Our study found that students in modular system scored higher in anatomy. Although this subject was not taught to modular students in a lot of detail, perhaps it was taught in a manner that promoted deeper learning and allowed for more subject integration.

When we assessed preferred books, it was interesting to note that in subject of anatomy, 21 (51.2%) of modular group students studied from long textbooks, whereas only 11 (26.8%) of annual group students studied from long textbooks. Perhaps this could also be one of the reasons for higher scores than annual students in this subject.

Interestingly, it was noted that for subject of community medicine and pharmacology, 80 out of 82 (> 90%) students preferred studying from either long textbooks or a combination of long and short textbooks. However, in subject of pharmacology, it was also noted that a higher

frequency of students (n=10, 24.4%) preferred using 2 long textbooks as opposed to modular students (n=2, 4.9%). This could have contributed to higher mean score of annual students.

With regards to studying frequency, students in modular system studied more regularly than annual system students. This was because students in modular system had more frequent exams, which required studying on a regular basis. The percentage of students that studied closer to exam date was higher in annual system as having one major exam at the end of the year, perhaps relaxed them and encouraged cramming.

## Conclusion

Students in annual system scored higher in pharmacology and community medicine. This highlights the need to address the issues of time allocation and implementation strategies for the subjects in the new system. On the other hand, students in modular system scored higher in anatomy. There was no difference between overall knowledge scores in each group; hence, it would be inappropriate to conclude that one system is superior to the other.

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## References

1. Harden RM. The integration ladder: a tool for curriculum planning and evaluation. *Med Educ.* 2000; 34:551-7.
2. Education A. Primary programs framework for teaching and learning (kindergarten to grade 3) Curriculum integration: Making connections. Alberta, Canada; 2007.
3. Woods NN, Neville AJ, Levinson AJ, Howey EH, Oczkowski WJ, Norman GR. The value of basic science in clinical diagnosis. *Acad Med.* 2006; 81:S124-7.
4. Krasne S, Stevens CD. Does basic science knowledge correlate with clinical reasoning in assessments of first-year medical students? *Procedia Soc Behav Sci.* 2000; 2:1287-94.
5. Woods NN, Brooks LR, Norman GR. The value of basic science in clinical diagnosis: creating coherence among signs and symptoms. *Med Educ.* 2005; 39:107-12.
6. De Bruin AB, Schmidt HG, Rikers RM. The role of basic science knowledge and clinical knowledge in diagnostic reasoning: a structural equation modeling approach. *Acad Med.* 2005; 80:765-73.
7. Lazić E, Dujmović J, Hren D. Retention of basic sciences knowledge at clinical years of medical curriculum. *Croat Med J.* 2006; 47:882-7.
8. Ling YU, Swanson DB, Holtzman K, Bucak SD. Retention of basic science information by senior medical students. *Acad Med.* 2008; 83:S82-5.
9. Wilhelmsson N, Bolander-Laksov K, Dahlgren LO, Hult H, Nilsson, G, Ponzer S, et al. Long-term understanding of basic science knowledge in senior medical students. *Int J Med Educ.* 2013; 4:193-7.

10. D'Eon MF. Knowledge loss of medical students on first year basic science courses at the University of Saskatchewan. *BMC Med Educ.* 2006; 6:5.
  11. Schmidt HH, Machiels-Bongaerts M, Hermans HH, Ten Cate O, Venekamp R, Boshuizen HH. The development of diagnostic competence: A comparison between a problem-based, an integrated, and a conventional medical curriculum. *Acad Med.* 1996; 71:658-64.
  12. Haranath PS. Integrated teaching in medicine-Indian scene. *Indian J Pharmacol.* 2013; 45:1-3.
  13. Shah V, Jain UJ. The effectiveness of integrated teaching over traditional teaching in third MBBS students. *Int J Med Sci Public Health.* 2016; 5:1430-3.
  14. Hasan Z, Sequeira R. Challenges of teaching physiology in an integrated system-based curriculum. *Can Med Educ J.* 2012; 3:e73-6.
  15. Rehman R, Iqbal A, Syed S, Kamran A. Evaluation of integrated learning program of undergraduate medical students. *Pak J Physiol.* 2011; 7:37-41.
  16. Rahim A, Iqbal K. parameters assessed for quality and management of modular system by the students of first and second year MBBS. *Khyber Med Univ J.* 2013; 5:86-90.
  17. Ahmed T, Abrar N, Shuja F, Malik U. Traditional to modular, system-based learning: our first experience. *Rawal Med J.* 2010; 35:78-81.
  18. Sadiq N, Aurangzeb W, Farooq A, Rauf S, Salman S. A call for mentoring of medical students in the backdrop of integrated curriculum. *J Ayub Med Coll Abbottabad.* 2013; 25:74-7.
  19. Dean AG, Sullivan KM, Soe MM. *Open Source Epidemiologic Statistics for Public Health, Version 3.01.* [Online] [Cited 2020 August 02]. Available from: URL: [http://: www.OpenEpi.com](http://www.OpenEpi.com),
  20. Faisal R, Khalil-ur-Rehman BS, Shinwari L. Problem-based learning in comparison with lecture-based learning among medical students. *J Pak Med Assoc.* 2016; 66:650-3.
  21. Pandey P, Zimitat C. Medical students' learning of anatomy: memorisation, understanding and visualization. *Med Educ.* 2007; 41:7-14.
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