RESEARCH ARTICLE

INDIAN MEDICAL POSTGRADUATE ENTRANCE EXAMINATIONS AND LEARNING OUTCOMES

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ARTICLE INFO	ABSTRACT

Background: Assessment methods drive students' learning significantly. Quality of learning depends mainly on the evaluation method. If evaluation method assesses only the surface learning, students tend to concentrate their learning at that level. If examination is focused on higher order thinking skills, it motivates students' as well as teachers for higher order learning. We aim to assess our evaluation system for the selection of postgraduates to know their influence on our teaching learning process in the field of medicine. The objective is to evaluate the extent to which Indian Medical Postgraduate entrance examinations assess the different levels of cognitive domain in Biochemistry.
Methodology: Biochemistry MCQs appeared in AIPGMEE, DNB, AIIMS, JIPMER entrance examinations for the selection of postgraduates in medical course over the last decade were analyzed and categorized based on the level of cognitive domain they were evaluating. Percentage of MCQs assessing knowledge (L1), comprehension (L2), application (L3), analysis (L4), synthesis (L5) and evaluation (L6) in each year in every entrance examination and the trend of biochemistry question setting in each entrance exam was studied.
Results: It has been found that evaluation is mainly focused on lowest (most fundamental) level of learning in all the entrance examinations. Number of L1 questions was significantly higher in all exams. But MCQs assessing L2, L3 and L4 appeared in AIIMS and AIPGMEE in statistically insignificant number.
Conclusion: As the main focus of postgraduate entrance exams is recall type of learning, it demotivates students from deep and strategic learning. Creative thinking, reasoning powers are not encouraged in the post-graduation aspirants. Modification of the evaluation method, by asking more number of application and analytical questions can motivate post-graduation aspirants as well as undergraduates to practice higher order learning skills.

INTRODUCTION

The medical post graduate entrance examination has at least two functions, selective function and an educational one. First and the foremost, this exam provides guarantee to society that suitable candidates are selected for the training program that delivers competent doctors. It identifies students who are unfit to practice, so that they can be prevented from doing harm, and to select competent doctors who are ready for further practice and training. With regard to the educational function, the requirement to write this examination at the end of undergraduate training means that students revise and recapitulate what they have learned throughout the course, a process which leads to a more integrated understanding of the knowledge and skills they have acquired. The outcome of the entrance examination is to predict whether a student will be competent to take further training. The process should prevent false negative as well as false positive results. That is, it should be reliable and valid. In postgraduate examinations there is little

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to equal the scrutiny that is given to a multiple choice question. This form of examination has become widespread and generally accepted over the past 20 years. There are various medical postgraduate entrance examinations conducted in India to select competent doctors for further training. AIPGMEE is conducted at the All India level once a year, which involves 300 questions for 3 hours. All India Institute of Medical Sciences (AIIMS) conducts PG entrance exam twice a year, in the months of March and November, which includes 200 questions for three hours. Diplomat of National Board conducts primary entrance examination to select students for postgraduate courses. Exam will be held twice a year, in the months of June and December. Examination includes 250 questions to be answered in three hours. Jawaharlal Nehru Postgraduate institute of Medical education & Research (JIPMER) conducts postgraduate entrance examination every year which involves 250 questions for the duration of three hours.

Objectives

1. Primary objective of this project is to analyze and categorize MCQs in Biochemistry that appeared in various

All India level post graduate Entrance Examinations for the selection of postgraduates in to questions that assess different levels of cognitive domain, that is knowledge, comprehension, application, analysis, synthesis and evaluation over ten years.

2. Guide the postgraduate aspirants to focus on the level of Biochemistry learning by showing the trend in this subject over a decade

Secondary objective:

3. To highlight the importance of deep and strategic learning of Biochemistry in undergraduate students.

MATERIALS AND METHODS

Biochemistry multiple choice questions appeared between 2003-2012inthe postgraduate entrance examinations were categorized on the basis of their learning objectives. All India Post Graduate Entrance Examination (AIPGMEE) papers from 2003-2010, AIIMS papers of 2003-2012, DNB primary 2003-2012 and JIPMER question papers between2006-2013 were analyzed. Questions in each year are categorized in to questions with the objectives assessing the different levels of cognitive domain of Bloom, that is knowledge, comprehension, application, analysis, evaluation and synthesis in to L1-L6 respectively (Krathwohl *et al.,* 1964). The pattern of biochemistry questions over past few years was studied. Questions were taken from standard postgraduate entrance books.

L1: Questions set to test Knowledge, identifies recall memory.
L2:Comprehension questions, assess understanding, interprets the meaning of an idea.
L3:Application questions, test the application of previously acquired knowledge
L4: Analysis questions recognize unstated assumptions.
L5:Evaluation questions test ability to judge the worth of material against stated criteria
L6:Synthesis questions assess ability to put together the separate ideas to form new whole

Statistical Analysis

Descriptive statistics was used to calculate the percentage of MCQs appeared in each level in the examinations and to categorize the data.

Kruskal-Wallis (Non parametric test) was applied to compare the statistical significance within questions of various levels in each exam.

RESULTS

Percentages of MCQs belonging to various levels of cognitive domain in postgraduate entrance examinations, DNB, AIIMS, AIPGMEE and JIPMER are given in Table 1 and 2 respectively. In AIIMS postgraduate entrance examination, number of L1 questions were significantly high as compared to L2 questions. Very high statistical significance was noted in number of L1 questions as compared to L3 and L4. L2 questions were framed in significantly high number as compared to L3. (Table 3) In AIPGMEE, number of L1 questions were significantly high compared to L3 and L4,but the level of significance was more when compared to L3. (Table 4) In JIPMER exam, number of L1 questions were more as compared to L2MCQS,but was statistically insignificant. (Table 5) In DNB exam, L1 questions appeared in significantly high number compared to L2 questions. (Table 6) From the above findings it is evident that lowest level of learning is given importance in all the four entrance examinations. But to at least to some extent, understanding of the concept, application and analyzing capability were evaluated in AIIMS,AIPGMEE as compared to the other entrance examinations (Table 7).

Table 2. Percentage of MCQs belonging to L1-L2 in JIPMER PG Exam; 2006-2013

Year	JIPMER	
	L-1	L-2
2006	80	20
2007	71	29
2008	78	12
2009	86	14
2010	89	11
2011	74	26
2012	75	25
2013	60	40

Table 3. Comparison of the percentages of different levels questions of AIIMS PG Entrance exam

Sl . No	Comparison	Mean Rank Difference	P value
1	Level-1 vs. Level-2	22.917	<0.01 **
2	Level-1 vs. Level-3	42.250	<0.001***
3	Level-1 vs. Level-4	38.056	<0.001***
4	Level-2 vs. Level-3	19.333	<0.05*
5	Level-2 vs. Level-4	15.139	>0.05
6	Level-3 vs. Level-4	-4.194	<0.05

* significant
** highly significant
*** very highly significant

Table 1. Percentage of MCQs belonging to L1-L4

Year	DNB Primary		AIIMS				AIPGMEE			
	L-1	L-2	L-1	L-2	L-3	L-4	L-1	L-2	L-3	L-4
2003	84	16	64	21	15	-	93	7	-	-
2004	88	12	89	21	-	-	65	15	5	15
2005	88	12	74	21	-	5	80	20	-	-
2006	86	14	60	10	20	10	64	20	4	12
2007	90	10	92	5	-	3	65	6	-	29
2008	90	10	42	40	6	12	85	8	-	7
2009	79	21	75	20	-	5	58	21	-	21
2010	77	13	57	29	-	14	90	10	-	-
2011	96	4	58	25	-	17				
2012	87	13	88	12	-	-				

Table 4. Comparison of the percentages of different levels questions of AIPGMEE

Sl . No	Comparison	Mean Rank difference	AIPGMEE (P value)
1	Level-1 vs. Level-2	11.313	>0.05
2	Level-1 vs. Level-3	22.125	<0.001***
3	Level-1 vs. Level-4	14.563	<0.05*
4	Level-2 vs. Level-3	10.813	>0.05
5	Level-2 vs. Level-4	3.250	>0.05
6	Level-3 vs. Level-4	-7.563	>0.05

* significant
*** very highly significant

Table 5. Comparison of questions in L1 and L2 in JIPMER PG Entrance examination

Sl . No	Comparison	Mean Rank Difference	(P value)
1	Level-1 vs. Level-2	8.000	>0.05

Table 6. Comparison of questions in L1 and L2 in DNB Entrance examination

Sl . No	Comparison	JIPMER (P value)	DNB (P value)
1	Level-1 vs. Level-2	15.571	<0.05*

* significant

Statistical analysis was also performed within various levels of questions in four exams (AIIMS, AIPGMEE, JIPMER and DNB) by applying the Kruskel Wallis non parametric test. It has been found that there was a statistically significant difference in the level 4 questions of the above mentioned exams. Although there was a difference in other level questions they were not statistically significant the results were shown in Table 5.

Table 7. Comparison of questions among all exams

Sl . No	Comparison	Mean Rank Difference	(P value)
1	DNB vs. JIPMER	0.000	>0.05
2	DNB vs. AIPGMEE	-8.800	>0.05
3	DNB vs. AIIMS	-9.200	<0.05*
4	JIPMER vs. AIPGMEE	-8.800	>0.05
5	JIPMER vs. AIIMS	-9.200	<0.05*
6	AIPGMEE vs. AIIMS	-0.4000	>0.05

* Significant

DISCUSSION

From our findings it is evident that mainly the lowest(most fundamental) level of learning was assessed in all the four entrance examinations. But to some extent, understanding of the concept, application and analyzing capability were evaluated in AIIMS, AIPGMEE as compared to the other entrance examinations (Table 7). These MCQs on higher order thinking skills differentiate competent students from average students. In DNB and JIPMER postgraduate entrance examinations application and analysis questions were minimum. Comprehension was assessed along with knowledge in JIPMER exam. Students feel that basic science subjects, especially biochemistry is not important for their medicine practice in future. They consider biochemistry as just

chemistry, a subject consisting of cycles and pathways. They fail to correlate the subject with its clinical aspects in spite of repeatedly conducting case based learning. They learn the subject superficially so that they can answer recall type of questions that appear in university examinations as well as postgraduate entrance examinations. They end biochemistry at the lowest level or the most fundamental level of Bloom's taxonomy of learning. To understand the basis of various metabolic and genetic disorders, the subject needs to be learnt at depth. For diagnosing diseases analysis of biochemical parameters is essential. The application of biochemistry knowledge in the diagnosis and treatment of different disorders is vital to practice medicine. The synthesis of knowledge has to happen to bring new approach into therapeutics. This awareness has to be cultured in to students' mind. The importance of attaining higher order thinking skills in Biochemistry has to be convinced to them.

This results of this analysis suggest that pattern of our evaluation method might have a negative impact on student learning. The results of this study might convey the message to the students that deep and strategic learning of biochemistry is not an essential step to be ranked high in the postgraduate entrance examinations. This might discourage the postgraduate aspirants to focus on the subject in depth. This study is unique as no such published data is available to the best of our knowledge to compare with our results. Assessment practices will add significant value to students' learning. Quality of learning is driven mainly by the evaluation method. If evaluation method assesses only the surface learning, students tend to concentrate their learning at that level. The learning outcomes represent a broader set of expectations about what students should acquire from their studies. This will affect not only teaching in higher education, but also the assessment of students' learning. Assessment methods and assessment criteria must be related to the aims of students' learning and crucial for assessment is to decide what is to be assessed (Hager and Gonczi 1994). Furthermore, assessment does not only *measure* learning, but also *directs* student learning (Havnes 2004) because the assessment system defines what is worth learning. Havnes' study shows an impact of examinations on learning, but also a similar backwash effect on teaching, textbooks and other learning material. Examinations play a major role in defining what is dominant. When non-assessable activities compete with assessable activities for students' time, assessable activities win (Heywood 1989; Biggs 1999; Toohey 2002). Not assessing significant aspects of the course sends a particular message tostudents. For students, the real curriculum is what is assessed in examinations. Assessment must be about things that matter, and everything which we believe matters, should be assessed (Toohey 2002).

Students have been found to differ in the quality of their learning when instructed to focus either on factual details or on the assessment of evidence (Biggs 1979). Furthermore, research has reported that changes in assessment methods have been found to influence medical students to alter their study activities (Scouller 1994). As methods of assessment drive learning in medicine and as well as in other disciplines (Wass 2001).

Examinations drive students' learning; this law describes one of the strongest relationships in education. Students wish academic success, which is defined by examinations, and students will therefore do anything to maximize their chance of success (usually with the least effort in order to cope with competing interests). The argument that students will repeat and integrate their knowledge and skills as a result of preparing for the entrance examination is a valid one. However, the strength of this argument depends on the relevance of what they prepare and that will depend on the quality of the examination in relation to its objectives. The fact that higher levels of the competence pyramid are not adequately represented in examinations show that the optimum relation between quality and objectives is hard to achieve. By asking higher order thinking skills (HOTS), students are forced for creative and critical thinking. They are capable and mature enough to develop problem solving skills as they are exposed both to intellectual and problem solving skills. But unfortunately our post graduate entrance examinations focus more on recall or remembering of facts.

To certain extent, L3 and L4 MCQs were framed in AIIMS and AIPGMEE, these two exams are motivating exams for cultivating HOTS. From our statistical analysis it is evident that other two entrance exams emphasize on the lower level intellectual skill, that is recall type of learning. This fact demotivates students from deep and strategic learning. Creative thinking, reasoning power is not encouraged in the post graduation aspirants. It sends message to the paper setters to get alert regarding evaluation of learning outcomes as evaluation method drives the learning process as well.

Effectiveness of the project

Post-graduation aspirants were addressed regarding the issue. Results were discussed with the undergraduate students to motivate them for higher level of learning. Higher order intellectual skills were given importance while teaching undergraduates as well.

Outcome of the study

I. Examination board can be alerted and advocating the question setters to start implementing this approach while setting the questions for competitive examinations, in order to improve the quality of doctors.
II. Postgraduate aspirants will be able to critically focus on the learning and learning outcomes.
III. Teachers can stress more on higher level of learning.
IV. Undergraduates can give importance to deep and strategic learning.

Conclusion

Weight age given to biochemistry was minimum compared to other subjects in all the entrance examinations and the questions were of recall type. Questions belonging to higher levels of cognitive domain were significantly low. It suggests a need for the improvement in the selection method which demands not only the memory but the application of fact, ability to reason and judgment, decision-making. Message conveyed is improper evaluation method demotivates students as well as teachers. Evaluators have to realize that assessment drives learning. Similar studies need to be done in other disciplines of medicine to arrive at a collective decision.

Acknowledgment

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