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Original Research Article

Comprehensive analysis of theory exam question papers of 2nd MBBS Pharmacology subject in Rajiv Gandhi University of Health Sciences, Karnataka, India

Nagaraja Prasad Sai*

Department of Pharmacology, Shivamogga Institute of Medical, Sciences,Shimoga, Karnataka, India

*Correspondence to:
Dr. Nagaraja Prasad Sai,
Email:drnagarajaprasad24@
gmail.com

ABSTRACT

Background: Assessment is the backbone of curriculum development and an important component of medical education. Written exams are frequently used in medical education and question papers are important instruments of assessment of medical education. The present study is summative question paper based analysis study where the content validity, level of cognition, cognitive domains, marks distribution and time weightage in theory question papers were analyzed.
Methods: Retrospective analysis of II MBBS pharmacology question papers (n=18) of RGUHS, Bengaluru from the year 2010 to 2018 was done. The data was analyzed according to modified Blooms levels of taxonomy, cognitive domains, areas of importance and weightage given to different topics in Paper 1 and 2 in comparison to university syllabus and with regard to time allotted in university syllabus.
Results: Analysis of question papers revealed that topics like GIT, respiratory system, uterine drugs, antiseptics and disinfectants, immunosuppressant were consistently underrepresented in question papers. Also, majority of questions (68.06%) did not have any verbs associated with Blooms level of taxonomy and hence did not meet criteria of standard question paper. Comparison of time allocation to weightage of topics in syllabus revealed no significant variations in percentage distribution.
Conclusions: Assessment in medical education should not be used merely for classification, grading and certification rather it should become an instrument for promoting growth of knowledge. For this the university should frame standard blueprint for question paper setters and the question paper setters should follow those guidelines strictly and ensure that weightage given for different topics is maintained.

Keywords: Cognitive domain, Content validity, Question paper, Summative assessment, Undergraduate Curriculum (MBBS)

INTRODUCTION

Learning is the acquisition of knowledge or skills through study, experience or being taught. Domains of learning help teacher to construct lessons. Various domains of learning have been described, these include cognitive domain (Benjamin Bloom, 1956) affective domain (David Krathwohl, 1964) and psychomotor domain (Anita J Harrow, 1972). Although all domains of learning are important, cognitive domain has been widely used or applied to evaluate the student in exams. Benjamin Bloom had classified various levels of cognition into knowledge, comprehension, application, analysis, synthesis and evaluation.[1] Assessment is an important component of medical education. Traditional assessment methods have used summative exams in the form of written, viva voce and practical exams.[2,3] Assessment of learning forms a very important aspect of student education. It is the curriculum that defines assessment and different tools have been used by assessors for assessing various domains

of learning.[4] Written theory exams are one of the ways to assess students learning. These written examinations consist of theory question papers consisting of long essays, short essays and short answers. The verbs used in these questions can be used to grade these questions according to modified Blooms taxonomy of learning into level 1, level 2 and level 3.[4]

Question paper is the most commonly used instrument of assessment. A proper assessment method is one that is valid, reliable, objective and feasible. Validity of a test is the degree to which a test measures what it is supposed to measure.[5,6] Validity can be further divided into content validity, construct validity, construct validity, predictive and face validity.[5,6] An assessment method should include at a minimum at least content and construct validity[7,8] because other measures of validity are more difficult to determine. Content validity is commonly used method in assessment. Content validity refers to the extent to which a test actually measures the intended content area.[5,9] Content validity should always be assessed regardless of the type of assessment as it relates to measures of academic achievement.

Framing of questions should be valid and preferably assess all levels of cognition. Framing a question paper with a correct or proper balance of questions with adequate content validity is the first priority of any written assessment. Written examinations are still the most widely used tool of assessment. Hence the present study was undertaken to analyze the theory exam question papers of pharmacology subject in RGUHS with regard to coverage of domains of learning, content validity of question papers and weightage given to different subdivisions of pharmacology in comparison to the time allocated to them in the University syllabus.

METHODS

The present study is a retrospective study Analyzing theory exam question papers of RGUHS. Pharmacology question papers of RGUHS from the year 2009 to 2018 were included for analysis in the present study. Each year two exams are conducted in RGUHS, one in June/July and another in December/January. Each exam has two question papers of 100 marks in pharmacology (Paper1 and 2). So, a total of 18 question papers each of 100 marks weightage were included for analysis in the present study.

The pharmacology subject question paper of the RGUHS has 22 question consisting of two main questions each of 10 marks weightage (10x2=20marks). Ten short essays each of five marks weightage (5x10=50 marks) and ten short answers each of three marks weightage (3x10=30 marks), so a total of 396 questions were analyzed in the present study. They were analyzed based on distribution of questions into must know, desirable to know and nice to know areas. Also, they were analyzed based on comparison of distribution of topics in question papers to

university prescribed syllabus. Each question was also evaluated according to modified Blooms hierarchy of cognitive learning the verbs used in these question were analyzed and grouped into various levels as follows: level 1, level 2 and level [3] with level 1 comprising knowledge, level 2 comprising of comprehension and application and level 3 comprising analysis, synthesis and evaluation. Level 3 questions are the most important for assessment for learning.

RESULTS

Analysis of question papers according to modified Blooms levels of cognitive domains revealed that 2.27% of question teste factual recall (level 1), 29.17% tested interpretation (level 2) and 0.5% tested critical evaluation (level 3). 68.06% of question did not belong to any of the cognitive domain creating ambiguity Table 1 and figure 1.

Comparison of weightage of marks to different topics revealed the following: in paper 1, general pharmacology weightage given was 16.39% (university recommended weightage 15%), CNS+Local anesthetics+NSAIDs weightage was 27.84% (university recommended weightage 25%), and ANS weightage was 21.06% (university recommended weightage 25%) CVS weightage 18% (university recommended weightage 20%), blood shock diuretics and antidiuretics weightage was 16% university recommended was 15%) Table 2, 3 and 4, Figure 2.

In paper 2, chemotherapy weightage was 44% (university recommended 40%) endocrines weightage was 233.06% (university recommended 20%) GIT weightage 9.6% (university recommended 10%), autacoids weightage 5.61% (university recommended 10%), respiratory system chelating agents gout and rheumatoid agents immunosuppressant's weightage was 12% (university recommended 10%) vitamins enzymes drugs acting on uterus, antiseptics and disinfectants weightage was 5.4% (university recommended 10%) Table 5 and 6, figure 3.

About 0.7% of questions form paper 2 were asked in paper 1. Some topics like NSAIDs, antiseptics and disinfectants, vaccines, vitamins and enzymes were not consistently asked in university question papers leading to students neglecting these topics in exam preparations.

Also, distribution of marks was observed to be nearly in proportion to the lecture time allocated to these topics as seen in table 3 and 4, figure 2 and 3. Comparison of distribution of topics revealed that in paper 1, 93.23% belonged to must know category while 6.78% questions belonged to desirable to know category.

In paper 2, 89.67% of question were from must to know and 10.33% were from desirable to know category. None of the questions asked belonged to nice to know areas (Table 7).

Table 1: Modified Bloom's levels of cognitive domain based on verbs used in question papers.

Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Define	Discuss	Compute	Distinguish	Diagnose	Evaluate
List	Describe	Demonstrate	Analyze	Purpose	Compare
Recall	Explain	Illustrate	Differentiate	Design	Assess
Name	Identify	Operate	Compare	Manage	Justify
Recognize	Translate	Perform	Contrast	Hypothesize	Judge
State	Restate	Interpret	Contrast	Summarize	Appraise
Repeat	Recognize	Apply	Categorize	Compose	Rate
Record	Express	Employ	Appraise	Plan	Revise
Label	Locate	Use	Calculate	Formulate	Score
Diagnose	Report	Practice	Test	Arrange	Select
Tell	Schedule	Diagram	Criticize	Choose	Judge
Transform	Sketch	Inspect	Assemble	Estimate	Recommend
Convert	Prepare	Question	Collect	Measure	Critique
Distinguish	Modify	Relate	Construct	Argue	Justify
Estimate	Predict	Solve	Create	Decide	
Extrapolate	Examine	Prepare	Organize	Create	
Manage	Classify	modify	criticize	Invent	
Deduce	Invent			Develop	
outline	generate				

Table 2: Division of pharmacology syllabus in Paper 1 and 2 according to RGUHS syllabus.

Paper 1 - Topics	Paper 2 - Topics
General Pharmacology(GP)	Chemotherapy
Central Nervous System (CNS)+ Local Anesthetics (LA)+ NSAIDs	Endocrines
Autonomic Nervous System(ANS)	Drugs acting on Gastrointestinal tract(GIT)
Cardiovascular System(CVS)	Autacoids
Blood, Shock, Diuretics and Antidiuretics.	Respiratory system(RS), chelating agents, immunosuppressant's, Drugs in gout and rheumatoid arthritis (RA), Drugs acting on uterus, Vitamins, enzymes, antiseptics and disinfectants.

Table 3: Paper 1: Marks, Percentage marks, Time (hrs) and percentage time allotted to topics in RGUHS.

Topic	Marks allotted by university	% Marks asked in university Qp	Time (Hrs)	% Time
General Pharmacology	15	16.39	12	17.39
CNS + LA + NSAIDs	25	27.84	20	28.99
ANS	25	21.06	15	21.74
CVS	20	18	13	18.84
Blood, Shock, diuretics and antidiuretics	15	16	9	13.04
TOTAL	100	100	69	100

DISCUSSION

Assessment is one of the important aspect of medical education. It is mentioned that "assessment is the tool that wags the curriculum dog".[10] Assessment is "any formal or purported action to obtain information about the competence and performance of the student".[11] The four most important attributes of a good assessment method are validity, reliability, acceptability and consequences of assessment.[12] The validity of an assessment is the extent to which it actually measures what it is supposed to measure. Construct irrevalance variance (CIV) and to a lesser extent construct under representation (CU) can cause major problems in assessment of validity.[13,14]

Content reliability is one of the easily measurable forms of validity. In the present study analysis of content of question papers revealed that CNS (27.84%), chemotherapy (44%) and endocrines (23.06%) received much greater weightage in theory question papers while

question from autacoids (5.61%), GIT (9.6%), drugs acting on uterus, antiseptics and disinfectants vitamins enzymes (5.4%) were consistently underrepresented in theory question exams and leading to inadequate knowledge about some important areas of practical importance among MBBS students. Analysis of university syllabus revealed that time allocation and marks division to various topics has been clearly described or presented in RGUHS which was not seen in other Universities as described in studies done by Robin G et al, and Srabani B et al.[2,15]

Table 4: Paper 1, marks distribution year wise and total average percentage.

Topic	Dec 2018	June 2018	Dec 2017	June 2017	Dec 2016	June 2016	Dec 2015	June 2015	Dec 2014	June 2014	Dec 2013	June 2013	Dec 2012	June 2012	Dec 2011	June 2011	Dec 2010	June 2010	Total %
GP	13	21	19	15	15	13	15	16	15	16	11	16	16	15	14	16	36	18	16.39
CNS, LA NSAIDs	29	21	29	26	29	29	29	23	31	39	31	21	28	26	28	31	28	23	27.84
ANS, SMR etc	24	26	26	32	24	19	19	23	18	13	21	27	24	19	23	11	9	21	21.06
CVS	21	11	10	11	16	18	22	24	21	17	19	13	14	24	21	21	16	23	18
Blood, Shock	8	21	8	11	8	16	10	14	6	5	8	8	10	13	14	8	3	9	16
Diuretic antidiuretics	5	0	5	5	8	5	5	0	8	5	10	15	8	3	0	10	8	6	

Table 5: Paper 2, Marks, Percentage Marks, Time (hrs) and Percentage time allotted to topics in RGUHS.

Topic	Marks allotted in university	% Marks asked from university Qp	Time (Hrs)	% Time
Chemotherapy	40	44	25	40.98
Endocrines	20	23.06	15	24.59
GIT	10	9.6	05	8.2
Autacoids	10	5.61	06	9.84
Resp. system, chelating agents, immunosuppressant's, Drugs Acting in gout and RA.	10	12	07	11.48
Drugs acting on uterus, Vitamins, enzymes, antiseptics and disinfectants	10	5.4	03	4.91
Total	100	100	61	100

Table 6: Paper 2, marks distribution year wise and total average percentage.

Topic	Dec 18	June 18	Dec 17	June 17	Dec 16	June 16	Dec 15	June 15	Dec 14	June 14	Dec 13	June 13	Dec 12	June 12	Dec 11	June 11	Dec 10	June 10	Total %
Chemotherapy	42	38	42	39	41	39	49	42	42	47	39	46	50	41	50	45	41	60	44
Endocrines	25	23	24	25	29	21	21	16	21	31	23	18	21	36	29	39	18	20	23.06
GIT	13	14	11	11	8	11	11	19	5	6	8	10	5	5	10	8	11	6	9.6
Autacoids	6	8	5	8	8	8	3	0	10	5	8	6	8	0	0	3	10	5	5.61
Resp system	8	6	5	8	3	5	5	5	3	3	0	0	0	5	5	5	3	3	
Chelating agents, immunosuppressant's	3	3	0	3	3	5	3	8	3	3	11	6	8	5	3	0	6	0	12
Gout+RA	0	0	5	3	0	3	3	0	13	0	8	6	0	5	0	5	3	0	
Vit+enzymes	0	0	3	0	3	3	0	0	3	0	0	5	0	3	3	0	8	1	
Uterine drugs	3	5	0	0	5	5	5	0	0	5	3	3	5	0	0	0	0	4	5.4
Antiseptics, disinfectants	0	3	0	3	0	0	0	5	0	0	0	0	3	0	0	0	0	1	
vaccines	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Table 7: Percentage of questions asked from Must Know, desirable to know and nice to know areas in RGUHS pharmacology question papers.

Year	Term		Must know	Desirable to know	Nice to know
2018	December	Paper 1	94	6	0
		Paper 2	94	6	0
	June	Paper 1	82	18	0
		Paper 2	89	11	0
2017	December	Paper 1	89	11	0
		Paper 2	92	8	0
	June	Paper 1	84	16	0
		Paper 2	94	6	0
2016	December	Paper 1	100	0	0
		Paper 2	89	11	0
	June	Paper 1	95	5	0
		Paper 2	89	11	0
2015	December	Paper 1	92	8	0
		Paper 2	92	8	0
	June	Paper 1	100	0	0
		Paper 2	86	14	0
2014	December	Paper 1	97	3	0
		Paper 2	86	14	0
	June	Paper 1	100	0	0
		Paper 2	94	6	0
2013	December	Paper 1	100	0	0
		Paper 2	89	11	0
	June	Paper 1	100	0	0
		Paper 2	92	8	0
2012	December	Paper 1	95	5	0
		Paper 2	89	11	0
	June	Paper 1	95	5	0
		Paper 2	87	13	0
2011	December	Paper 1	90	10	0
		Paper 2	92	8	0
	June	Paper 1	89	11	0
		Paper 2	83	17	0
2010	December	Paper 1	90	10	0
		Paper 2	97	3	0
	June	Paper 1	86	14	0
		Paper 2	80	20	0
Total (%)		Paper 1	93.23	6.78	0
		Paper 2	89.69	10.33	0

Analysis of question papers according to modified Blooms levels of taxonomy revealed 2.27% of question were of Level 1, 29.17% were of level 2 and only 0.5% of questions were of level 3 while nearly 68.06% of questions did not belong to any level of Blooms taxonomy. These findings are similar to another study done by Vinod K et al, which have found nearly 67% of questions did not belong to any cognitive domain.[8] Adequate coverage of course content is very important to improve validity of assessment. Any inadequacy in coverage of course content leads to improper content validity of question papers. Analysis of question papers according to must know,

desirable to know, good to know areas revealed that in paper 1, 93.23% were from must know while in paper 2, 89.67% of questions were from must know areas and only 6.78% of question from paper 1 and 10.33% of questions from paper 2 belonged to desirable to know areas.

None of the questions were from nice to know areas. This is not according to MCI guidelines which recommend that the ratio of 'must know, may know and desirable to know should be 6:3:1 on a 10 point scale". However, our study results correlate with earlier studies done by Khuteja NK et al, where in their study 83.88% of questions were asked
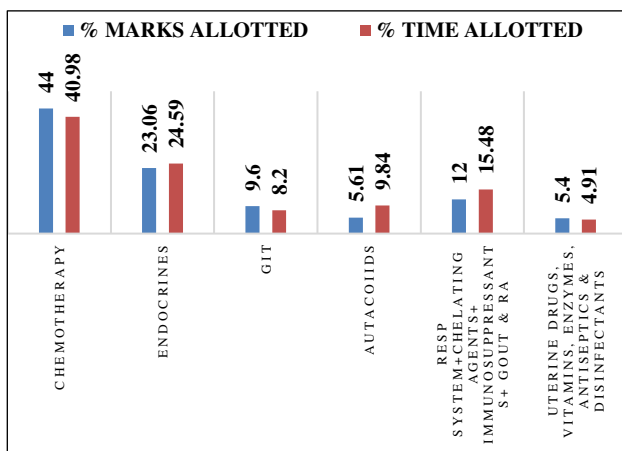
from must know area, 8.07% from nice to know area and 7.90% form desirable to know areas.[16]
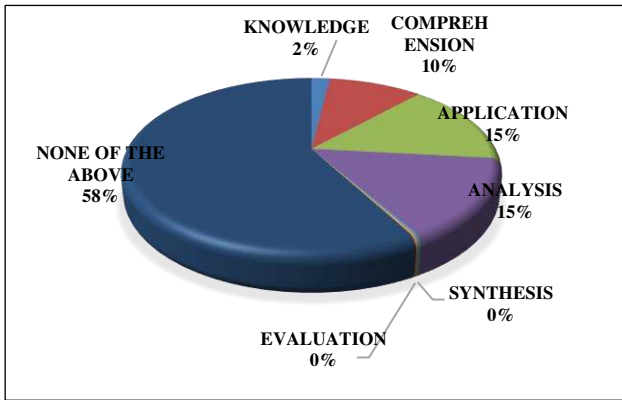
Figure 1: Percentage distribution of verbs asked in question papers according to the various levels of bloom's taxonomy.
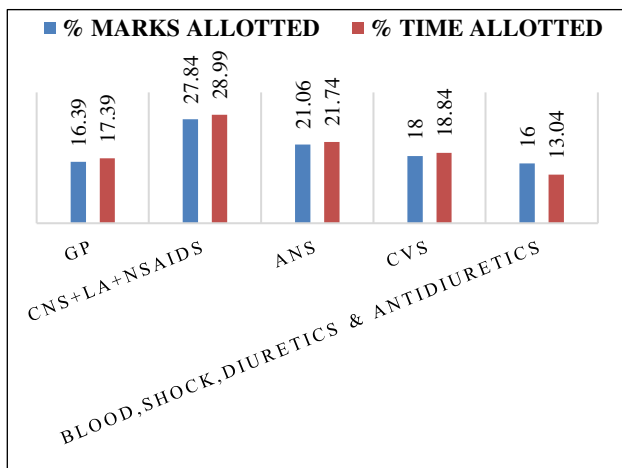
Figure 2: BAR graph comparing % of marks allotted with % of lecture time (hrs) allotted for various topics in pharmacology paper 1.

Figure 3: BAR graph comparing % of marks allotted with % of lecture time (hrs) allotted for various topics in pharmacology paper 2.

Test blueprinting and table of specifications or the specifications grid are efficient methods to improve the learning objectives and content validity of question papers and these should be included for framing the question papers by the university examiners.[17-19]

CONCLUSION

In conclusion, assessment should include both formative and summative assessment with more emphasis being given now a days on formative type of assessments. Equal weightage to all subject areas having practical importance should be ensured and questions which are of not much clinical significance should not be given much importance in the MBBS question papers so as to lessen the students burden of giving importance to rare topics. Assessment should not be done merely for grading and certification rather it should become an instrument for enhancing the growth of knowledge of the student.

Most of the question papers analyzed in this study adhered to the guidelines prescribed in RGUHS with some variation in weightage given to topics like GIT, autacoids etc. The importance of these topics in enhancing the practical knowledge of the student must be recognized and due weightage should be given to these topics in every question paper.

On the other hand these topics can also be given weightage in the practical exams but due procedures and protocols must be put in place so that those topics which are not given covered in theory question papers should be given due importance in practical and viva voce examinations and the student should be made aware of these aspects so that they do not neglect these minor topic which are of equal importance with regards to gaining medical knowledge.

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