

Concept learning through question framing in Pharmacology

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ABSTRACT

Background: Framing questions is a skill that requires expertise, knowledge, guidance and mentoring. It provides structure for deep learning, critical thinking and also promotes interaction and communication. Objective of this study is to analyze the question framing skills of fifth semester medical students on a 'must know' area in Pharmacology.

Methods: A cross-sectional study was done in the Department of Pharmacology of a Government Medical College in Central Kerala. After briefing about the study, each of the participants was instructed to frame a question which were collected after 15 minutes. The data on different aspects of questions was analysed by Statistical Package for the Social Sciences 16.

Results: Total 130 students, 79 females and 51 males participated in this study. 7 questions were incomplete and excluded from further analysis. From the rest 123 properly framed questions, 106(86.2%) were correct, 10(8.1%) were partially correct and 7(5.7%) incorrect with regards to the task assigned. In this study knowledge as well as application was tested in 50.4% questions, comprehension in 21.1% and application alone in 22.8%. The knowledge dimension tested was factual in 91(74%) and conceptual in 32(26%). Non-hierarchical classification showed 96(78%) convergent and 27(22%) divergent.

Conclusions: In this study majority of the participants framed direct short answer questions which reflects factual knowledge indicating their lower-level cognition. Critical thinking and procurement of higher level cognition can be attained by directing them to frame the right question especially in medical education.

Keywords: Concept learning, Cognition dimension, Critical thinking, Innovative learning, Knowledge dimension, Question framing

INTRODUCTION

Asking good question is an art. Organization of scientific data into facts requires questioning and reasoning by intellectual exploration.¹ Framing flawless questions requires expertise, knowledge, guidance and mentoring. Socratic questioning which probes the validity of an assumption is advocated as a powerful modern-day teaching-learning method.² When used tactically, questioning ensures dynamic participation in deep learning.³ Fact based questions are good for building confidence and assessing knowledge of novice learners. Questioning can help students in comprehending a concept enticing them to search for rational conclusions rather than resorting to learning by rote. Learning to ask the right

question the right way makes question framing a precious teaching-learning-assessment tool.⁴ This study was done with an aim to analyze the question framing skills of fifth semester medical students on a 'must know' area in Pharmacology.

METHODS

This was a cross-sectional study done in the Department of Pharmacology of a Government Medical College in Central Kerala during a pharmacology session in November 2017. Since there were no ethical issues the clearance from Ethics Committee was not sought. All students who were willing to participate in the study were included after getting informed consent. The use of

“adrenaline in anaphylactic shock” was chosen as the “must know” area in this study. During a Pharmacology Lecture hour, the study participants were briefed on the same by the Principal Investigator. After completing the session each of the participants was instructed to frame a question which would close on to the answer “Adrenaline 0.5 milligram Intramuscular Statim”. After 15 minutes the questions were collected. The questions were reviewed, and data were entered in a structured proforma by the investigators. Apart from age and gender the 10 parameters studied were completeness, correctness, structure, clinically oriented or not, case based or not, mention of symptoms correctly if case based, type-essay or short answer question (SAQ), Nonhierarchical classification- convergent /divergent, Cognition dimension - Knowledge/Comprehension/Application/Analysis/Synthesis/ Evaluation and Knowledge Dimension-Factual/ Conceptual. The incomplete questions were excluded from further analysis. The data was sorted, coded and entered into Statistical Package for the Social Science (SPSS) software version 16 (SPSS Inc, Chicago, USA). Descriptive data were expressed using frequencies and percentages. Chi square analysis was done to find any influence of gender on the nonhierarchical classification, the knowledge dimension and the cognition dimension.

RESULTS

Out of the 149 students in fifth semester in the institution 130 students willingly participated in this innovative teaching-learning process. Of the 130 participants, 79 (60.8%) were females and 51 (39.2%) were males as shown in Figure 1. The mean age of the participants was 20.16±0.69 years, age range was 19 to 25 years. Even though all 130 (100%) participants attempted framing a suitable question 7(5.4%) were incomplete as they had only the stem of a case based question and hence excluded from further analysis.

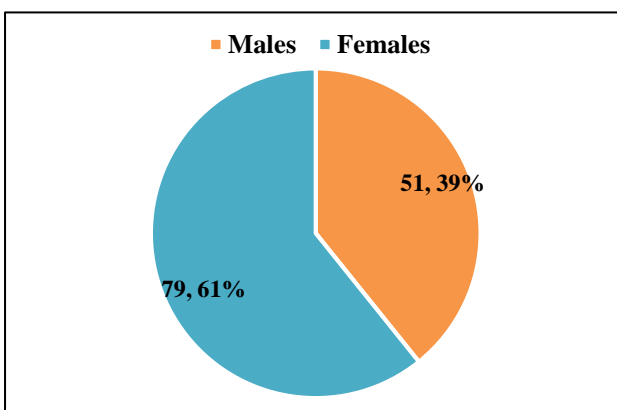


Figure 1: Gender-wise distribution of participants.

Of the 123 properly framed questions, 106 (86.2%) were correct, 10 (8.1%) were partially correct and 7 (5.7%) incorrect with regards to the task assigned. None of the questions were structured. Of the 49 (39.8%) clinically oriented questions 32 (26%) were case based and

mentioned the symptoms of the patient in the scenario correctly as shown in Table 1.

Table 1: Profile of framed questions which were complete.

Type	n (%)
Clinically oriented	
No	74(60.2)
Yes	49(39.8)
Case based	
No	91(74)
Yes	32(26)
Symptoms mentioned	
No	93(75.6)
Yes	30(24.4)
Appropriate for the task assigned	
Incorrect	7(5.7)
Partially correct	10(8.1)
Correct	106(86.2)
Type	
Essay	27(22)
Short Answer Question	96(78)
Knowledge dimension	
Conceptual	32(26)
Factual	91(74)
Non-hierarchical classification	
Convergent	96(78)
Divergent	27(22)

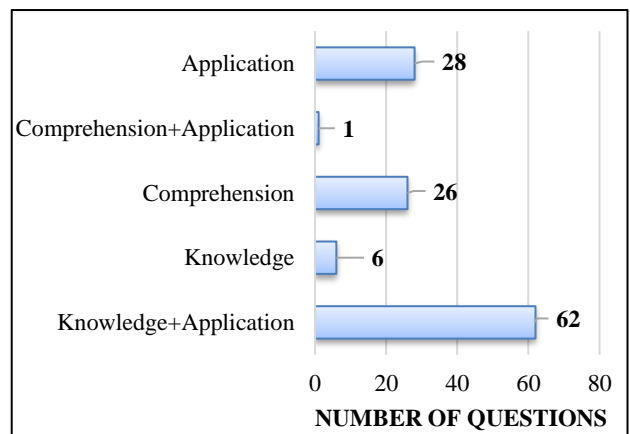


Figure 2: Classification of questions based on cognition level.

About 27 (22%) were essay type and the rest were 96(78%) were short answer questions. About 78% were convergent and the rest divergent. The knowledge dimension tested was factual in 91 (74%) and conceptual in 32 (26%). The cognitive dimension tested was both knowledge and application in 62(50.4%) questions, comprehension in 26 (21.1%), application alone in 28(22.8%) as shown in Figure 2. Gender wise there was no statistically significant difference in the knowledge dimension (chi square=2.142, p=0.14) or cognition

dimension (chi square=2.35, p=0.79) or nonhierarchical classification as convergent or divergent questions (chi

square=0.94, p=0.33). Table 2 summarizes a sample of different types of questions framed by the participants.

Table 2: Sample questions framed by participants.

Question	Structured	Clinically oriented	Case based	Symptoms mentioned	Essay/SAQ	Knowledge dimension	Cognition dimension	Non hierarchical
1. What is the drug of choice of anaphylaxis? What is the dose and route of administration?	No	No	No	No	SAQ	Factual	Knowledge+ Application	Convergent
2. A 40 year old woman came with complains of cough, fever and expectoration for 2 days. The patient was examined and diagnosed as upper respiratory tract infection. Drug Amoxicillin 500mg TDS was prescribed. On taking the patient experienced hypotension, bradycardia and went on to shock. What will you do?	No	Yes	Yes	Yes	Essay	Conceptual	Comprehension	Divergent
3. A patient who took paracetamol showed hypersensitivity reactions. which is the drug of choice, route and dosage?	No	Yes	No	No	SAQ	Factual	Knowledge+ Application	Convergent
4. A 25 year old male presented to the casualty with hypersensitivity to pollen. What is the drug of choice?	No	Yes	No	No	SAQ	Factual	Application	Convergent
5. A patient presents with anaphylactic shock. What is the dose of adrenaline to be administered to the patient who weighs 50 kg?	No	No	No	No	SAQ	Factual	Knowledge	Convergent
6. Explain the treatment to be given to a patient with anaphylactic shock? Or How will you manage anaphylactic shock?	No	No	No	No	Essay	Conceptual	Comprehension	Divergent

DISCUSSION

Questioning is one of the many teaching-learning stratagems thought to expedite the development of analytical expertise which is essential in medical education.⁵ Teachers ask questions to assess the learner, to sustain the interaction in an interesting way and to generate discussions comprehensively exploring the subject.³ Bloom's taxonomy of learning consists of six domains of cognition; knowledge, comprehension and application domains at the lower-order and analysis, synthesis and evaluation domains at the higher-order.⁶ Student initiated questions are deemed to be of the higher order.⁷ This research work was done as a part of innovative learning session in pharmacology in a Government Medical College in Central Kerala. Similar publications among medical undergraduates is sparse.

Adrenaline is a life-saving drug acting on both α and β receptors with potent vasoconstrictor and cardiac stimulant actions.⁸ Secreted from the adrenal medulla it functions as hormone under physiologic conditions. It is used in the emergency management of complete heart block and cardiac arrest during resuscitation. Adrenaline is an effective haemostatic agent used topically in nasal packs for epistaxis or in gingival string for gingivectomy. It is combined with some local anaesthetics to prolong the duration of nerve block, to reduce the total dose of local anaesthetic and to reduce its toxicity in a dose of 1:200,000. Widespread experimental and clinical experience with use of adrenaline in anaphylaxis support

it as the agent of choice in anaphylaxis in a dose of 0.3-0.5 mg (0.3-0.5 ml of 1:1000 solution) intramuscularly. EpiPen (epinephrine in an autoinjector for self-administration) is recommended for patients at risk for insect sting hypersensitivity, food allergies or other anaphylaxis. In this study the students were asked to frame a question which would fetch the answer "Adrenaline 0.5mg 1:1000 intramuscularly." The questions were then evaluated on a ten-point criteria.

Of the 130 participants 7 were excluded as they had written only the clinical scenario related to anaphylaxis with no subsequent questions and hence incomplete. Of the 123 complete questions 8.1% mentioned some symptoms of anaphylaxis incorrectly and hence were partially correct and 5.7% framed the questions incorrectly as they had asked wrong questions like "treatment for hypotension during surgery" or "treatment of dapsone syndrome." Dapsone syndrome is a rare dose independent adverse effect reported with dapsone use. It is a delayed hypersensitivity reaction which can occur after several weeks to up to six months after treatment initiation. The management involves prompt discontinuation of the offender, systemic steroids (prednisolone 1mg/kg/day oral or methylprednisolone intravenous) with supportive care.⁹ Based on the Dreyfus model of skill acquisition classified the learners into novice who function by using limited knowledge system without clinical milieu, advanced beginners with expanded gamut of clinical rules with some clinical contact, competent when they use rules of thumb and are in the process of getting devoted in patient care and

proficient who show increasing initiative in patient care with intuitive clinical reasoning based on their previously gained clinical experience.^{10,11} Structured questions are closed end questions and both essay questions and short answer questions can be structured. They help candidates construct their own answer and yet encourage sufficient precision for answers and reflect participatory teaching and self-directed learning.¹² In this study, none of the questions were structured. By the fifth semester of medical education in India the students receive one and a half years of clinical exposure and help them to correlate the concepts in Pharmacology. The clinical pharmacology exercises like patient oriented problem solving exercises generate clinical orientation pertaining to the treatment of disease in correlation with the pharmacological concepts.¹³ Case-based learning have been well-implemented into the undergraduate curriculum with due stress on active learning during seminars and other innovative sessions.¹⁴ In this study, 39.8% were clinically oriented questions mentioning a history of hypersensitivity either following a drug administration or food intake or pollen exposure. About 26% were case based questions which described the clinical scenario with symptoms in detail.

Essay questions challenge students to create a response rather than to simply select a response and they reveal students' abilities to reason, create, analyze, synthesize, and evaluate.¹⁵ Focused essay questions help to assess the depth of learning whereas less-focused essay questions are apt to gauge the breadth of learning within a subject. Short-answer questions (SAQs) may be open-ended or closed and require students to create an answer and test the lower levels of the cognitive domain, mainly knowledge, comprehension, and some application. Divergent questions are open, might elicit numerous responses and permits the probe into an assortment of outlook encouraging dialogue while convergent questions congregate into a single or narrow list of best answers encouraging succinct response.³ In this research (27)22% framed questions were essay type and the rest 96(78%) were short answer questions. Similarly 22% were divergent in nature and 78% were convergent type questions.

Anderson and Krathwohl described Knowledge dimensions as factual, conceptual, procedural and metacognitive on the basis of which questions may be classified.¹⁶ Factual questions extract information from reliable sources. They demonstrate understanding, prompt analysis or evaluate work of others. Conceptual questions seeks justification based on underlying principles or theories. Procedural questions gathers well established methods of information and metacognitive questions require articulation of a cognitive strategy required to complete a task.¹⁶In our study,74% were factual and the rest conceptual questions. Classification of question based on cognition dimension was proposed by Bloom.⁶ In this study knowledge as well as application was tested in 50.4% questions, comprehension in 21.1% and application alone in 22.8%. The cognition level tested was low.

Lower-level cognitive questions do not effectively stimulate critical thinking.¹⁷ The majority of participants (nursing students and tutors) framed factual questions at low-level aimed at seeking yes/no responses.¹⁸ Gender wise there was no statistically significant difference in the knowledge dimension, cognition dimension or nonhierarchical classification of the questions framed.

CONCLUSION

In this study majority of the participants framed direct short answer questions which elicited succinct response in the form of factual knowledge testing the lower-level cognition to accomplish the task assigned to them. However, critical thinking is a fundamental competency expected in medical profession to handle unique and uncertain situations. Medical undergraduates should be trained to judge a clinical scenario at a higher cognition level and should be lured into asking questions which require analysis, evaluation and synthesis rather than mere recall.

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