



Teaching Learning of Biochemistry in undergraduate medical curriculum: Perceptions and Opinions of Medical Students.

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ARTICLE INFO

Received : 11/09/2012
Accepted : 26/11/2012
Published : 01/06/2013

KEYWORD

Teaching learning
Medical education
Student feedback
Biochemistry

ABSTRACT

Introduction: Biochemistry is one of the important basic science subjects that are taught in the pre-clinical phase of the undergraduate medical curriculum. Very little is known about the students' perceptions towards improving the teaching learning process of biochemistry. **Methods:** Data was analysed from 139 feedback forms of a questionnaire study from second year students of a medical college in India (n=139 of 157 students). The self administered questionnaire contained 36 items which were related to liking the subject of biochemistry, rating of the different topics (difficulty in learning) and the effectiveness of teaching methods. **Results:** Majority (57%) of the students liked the subject of biochemistry. Metabolisms and molecular biology were difficult topics to learn. Practical exercises, lectures, exams, and other methods have been found by majority of the students to be the excellent or very good methods, for effectively teaching biochemistry. Opinion by students was suggesting a clear mandate in several issues such as, usefulness of biochemistry practicals, learning minute details of biochemical reactions, and a clinician teaching the interpretation of lab investigations. Majority of them have perceived that the subject of biochemistry can be covered meaningfully within a year. **Conclusions:** Students perceive the usefulness of teaching methods and the varying difficulties in learning different topics in biochemistry. Teaching learning process in biochemistry can be improved, by understanding students' perceptions.

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Introduction

By the application of the knowledge of biochemistry, doctors have progressed to greater heights in the management of many illnesses. Biochemistry is a basic science subject which is taught in the first phase of the undergraduate medical curriculum, across the globe. There can always be an improvement in teaching learning process, which could be planned after experiments, and by assessing and evaluating the teaching learning process.

Experiments by use of single or multiple tools for teaching medical biochemistry, in addition to conventional teaching, have been found to be useful (1-3). Assessing and evaluating the quality of teaching and its impact on student learning could be done by using several strategies. Student's feedback is the most common, easier, economical and valid method in obtaining data towards it. Teachers, as well as the students would benefit by the feedback (4). Information obtained by means of student ratings can be used to improve the course in future years and to identify the topics of interest; the aim is to provide effective medical education (5). There is a challenge for teachers to ensure that the knowledge is retained long enough to help them in clinical practice; core basic science knowledge is lost during the clinical years of medical studies (6). Studies which ascertain the medical students' like or dislike are useful for other reasons too (7).

Students' perceptions about the subject, different topics within the subject and different teaching methodologies in learning this subject, and their suggestions has not been adequately reported in the recent times.

Method

Two batches of second year students of a private university medical college in India, who had successfully passed the subject of biochemistry, were taken up for this study. The students of both the batches were similarly exposed to various methods of teaching in biochemistry. The teaching module was composed of mainly

didactic lectures (twice a week), tutorials (once a week), and practical classes (once a week), based on a pre-formatted time table. Integrated teaching with other departments, group discussions between students, viva voce on small topics, session/ term exams, problem based learning, symposium by multiple faculties and preparatory exam were the other methods which have been experienced by the participant students in biochemistry and other departments.

A self administered questionnaire containing 36 items was developed (Table 1). Ethical approval was sought and gained from the institutional ethics committee. The questionnaire was given to 157 students, all of whom were studying in 2nd year. After explaining about the study, the feedback was obtained from only those who consented. The students were asked to comment on only those items for which they could answer, and skip other items in the questionnaire.

Result

Of 157 questionnaires distributed, 139 students responded giving 88% response rate. Among the 139 response sheets, the first question was the only one which was responded by all the students. Fifty seven percent of the students liked the subject of biochemistry (Figure 1).

With regard to the level of difficulty in learning the major topics that are taught in biochemistry curriculum, 76% of the students felt that nutrition is either very easy or easy to learn, 67% felt that clinical biochemistry is either very easy or easy to learn and 61% felt that chemistries is either very easy or easy to learn. Sixty percent felt that metabolisms is either not so easy or difficult or very difficult to learn. Fifty one percent felt that molecular biology is either not so easy or difficult or very difficult to learn (Figure 2).

Practical exercises, lectures, internally assessing session/ term ending exams, preparatory exams, group discussions, problem based learning, viva voce on small topics and interactive tutorial classes have been found by majority of the students to be the excellent or very good

methods for effectively teaching biochemistry, from 'final exam' or futuristic 'clinical practice' point of view. (Figure 3- 4).

More than 80% of the students felt that biochemistry practicals are useful. Similarly, they felt that minute details of biochemical reactions are useful in medical practice and a clinician should teach interpretation of lab investigations. Fifty four percent of the students disagreed that studying the chemical structure of molecules is necessary. Majority of the students wanted the faculty to teach respective metabolisms after their chemistries, instead of first teaching all the chemistries. Students favoured integrated teaching with clinical subjects, more than any other subject. Majority of them have perceived that the subject of biochemistry can be covered meaningfully within a year (Figure 5).

Discussion

In the present study, student's perceptions about their experiences of their learning of biochemistry during the first year of study in a private university medical college were documented. Very less is published on the students' perceptions about biochemistry (8-9). Biochemistry is currently being taught for a period of 1 year in medical colleges of India, where the curriculum is prescribed by the medical council of India. However, the students' perceptions about the issues that are discussed in this article are unlikely to differ significantly with other countries, even in case of a longer duration of the course or in case of a differing curriculum.

The reason for selecting the second year students of the medical college is, they have recently passed the subject of biochemistry successfully. They are in the best position to respond compared to the first year's who have not yet experienced all the items in the questionnaire; the senior counterparts who might have forgotten their experience.

The students were found divided about their general perception about biochemistry. Those

who 'like' biochemistry outnumbered others. About one third of the students neither liked nor disliked the subject. In an earlier report, some of the earlier students mention that biochemistry was "dry" and "uninspiring" (10). The perception of dislike or a neutral perception could be due to the inherent nature of biochemistry, as well as to the lacunae in present curriculum towards making it a student friendly curriculum.

Level of difficulty in learning different topics:

Metabolisms and molecular biology are difficult topics to learn as per this study. The reason for facing difficulty with these topics could be inherent to the nature of these topics, which include several complex pathways to be learnt. Therefore, more emphasis needs to be given to these topics whenever teaching learning process in biochemistry could be modified. Their relevance beyond being an abstract academic exercise for scoring few marks, is difficult to perceive by the students. The learning of biochemistry needs an in-depth thought process, to relate it to the practice of medicine. If the syllabus is overloaded with irrelevant facts, especially in the difficult topics, it might be detrimental to students' learning (3).

Teaching learning methods in biochemistry:

Teaching methods such as practical exercises, lectures, exams, group discussions, and problem based learning were found to be popular in the students' mind as very useful. This matches earlier studies (11-12). Medical curriculum in its conventional way has been giving chance for too many lectures in biochemistry has been a complaint (10). The present study is putting it down to some extent given the fact that that lectures have been found useful by the majority of students. All the teaching methods have been rated as good or above by majority of the students. Every method will have its disadvantages, but when used appropriately, could find better ratings by the students.

Opinion on other issues:

Majority of the students wanted clinicians to teach interpretation of laboratory investigations, which is reported earlier as well (13). This could be because of the fact that the students perceive difference in content expertise between clinicians and non-clinicians (13). A clinician explaining some of the concepts with his personal experience is what the students might be looking for, in learning of clinical biochemistry.

Students' acceptance of integrated teaching is for understanding common aspects between biochemistry and other subjects. This is also reported in an earlier study (14). The students perceive that integration could give them an edge in learning process.

Most of the students felt that studying the chemical structure of molecules was unnecessary. However, the students were of the opinion that minute details of biochemical reactions were important. This matches with an earlier report (8). Chemical structures of molecules might be unnecessary because they serve little in medical practice. Minute details of biochemistry are important for better understanding of the biochemical and pathophysiological aspects of a disease such as those having acid base imbalance, enzyme deficiency etc.

Students feel that teaching respective metabolisms after their chemistries is better than teaching all chemistries followed by metabolisms. This would probably make it easier for them to learn because of the continuity.

Biochemical experiments are an essential part of the undergraduate medical curriculum. It has been demonstrated in an earlier study that biochemical experiments are valuable (15). The students of this study also considered that the practicals were helpful for learning more theoretical aspects and for imparting skills. Most of all, it was viewed as an effort to keep them stimulated and interested in biochemistry.

The duration of one year to teach biochemistry is sufficient according to majority of the students. The current plan of action towards achieving the objectives of the curriculum is not perceived as 'in hurry' by the students. This remark by students is worth considering, especially by those medical schools who teach biochemistry for a longer duration.

Conclusion

Students perceive the usefulness of various teaching methods. They perceive varying difficulties in learning different topics in biochemistry. Students are eager to welcome clinicians for teaching interpretation of laboratory investigations. Many students might look at this subject, as a subject they like, if the teaching learning process could be made more meaningful and student friendly. The opinions of the students could be considered as suggestions towards achieving this objective. Further studies on validating the students' suggestions will be useful to the teaching learning community.

Reference

1. Sé AB, Passos RM, Ono AH, Hermes-Lima M. The use of multiple tools for teaching medical biochemistry. *Adv Physiol Educ.* 2008 Mar;32(1):38-46.
2. Passos RM, Sé AB, Wolff VL, Nobrega YK, Hermes-Lima M. Pizza and pasta help students learn metabolism. *Adv Physiol Educ.* 2006 Jun;30(2):89-93.
3. Luthra K, Das N. Problem based learning as a curricular strategy for medical undergraduates: a tutor's experience. *J Med Syst.* 1998 Dec;22(6):421-430.
4. Hamid Y, Mahmood S. Understanding constructive feedback: a commitment between teachers and students for academic and professional development. *J Pak Med Assoc.* 2010 Mar;60(3):224-227.
5. Lata H, Walia L, Gupta V. Student feedback on teaching and evaluation methodology in physiology. *South East Asian J Med Educ.* 2008;2:31-37.
6. Lazić E, Dujmović J, Hren D. Retention of basic sciences knowledge at clinical years of

- medical curriculum. *Croat Med J*. 2006 Dec;47(6):882-887.
7. Sanya EO, Ayodele OE, Olanrewaju TO. Interest in neurology during medical clerkship in three Nigerian medical schools. *BMC Med Educ*. 2010 May 20;10:36.
 8. Mishra V, Kumar S, Siwach V, Sharma NK, Angral R, Mujumdar A, Sharma AK. Need for bringing in a change in biochemistry curriculum to make it clinically oriented? *J Assoc Physicians India*. 2000 Jun;48(6):635-638.
 9. Minasian-Batmanian LC, Lingard J, Prosser M. Differences in students' perceptions of learning compulsory foundation biochemistry in the health sciences professions. *Adv Health Sci Educ Theory Pract*. 2005 Nov;10(4):279-290.
 10. Watmough S, O'Sullivan H, Taylor D. Graduates from a traditional medical curriculum evaluate the effectiveness of their medical curriculum through interviews. *BMC Med Educ*. 2009 Oct 26;9:64.
 11. Bobby Z, Koner BC, Sen SK, Renuka P, Nandakumar DN, Nandeeshha H, Das V, Goswami K, Sathiamoorthy R. Small group discussion followed by presentation as a revision exercise at the end of a teaching module in biochemistry. *Natl Med J India*. 2004 Jan-Feb;17(1):36-38.
 12. Ghosh S. Combination of didactic lectures and case-oriented problem-solving tutorials toward better learning: perceptions of students from a conventional medical curriculum. *Adv Physiol Educ*. 2007 Jun;31(2):193-197.
 13. Stevenson FT, Bowe CM, Gandour-Edwards R, Kumari VG. Paired basic science and clinical problem-based learning faculty teaching side by side: do students evaluate them differently? *Med Educ*. 2005 Feb;39(2):194-201.
 14. Ghosh S, Pandya HV. Implementation of Integrated Learning Program in neurosciences during first year of traditional medical course: perception of students and faculty. *BMC Med Educ*. 2008 Sep 24;8:44.
 15. Cronholm T, Hoog J, Martenson D. Student attitudes towards laboratory exercises in medical biochemistry. *Med Teacher*. 2000;22:30-33.

Table 1. Perceptions and opinions towards improving teaching learning of biochemistry

1. Did you like the subject of Biochemistry (BC)? **Yes/ No/ Neutral**

level of difficulty in learning BC

2. Chemistries: **V. Easy/ Easy/ Not So Easy/ Difficult/ V. Difficult**
 3. Metabolisms: **V. Easy/ Easy/ Not So Easy/ Difficult/ V. Difficult**
 4. Molecular Biology: **V. Easy/ Easy/ Not So Easy/ Difficult/ V. Difficult**
 5. Nutrition: **V. Easy/ Easy/ Not So Easy/ Difficult/ V. Difficult**
 6. Clinical BC: **V. Easy/ Easy/ Not So Easy/ Difficult/ V. Difficult**

Effective way of teaching BC, from 'final exam' point of view.

Excellent (E)/ V.Good (VG)/ Good (G)/ Average (A)/ Poor (P)/ V.Poor (VP)

7. Lecture by faculty: **E or VG/ G/ A/ P/ VP**
 8. Tutorials/ Interactive class, by faculty: **E or VG/ G/ A/ P/ VP**
 9. Symposium prepared by multiple faculty: **E or VG/ G/ A/ P/ VP**
 10. Group Discussions between students: **E or VG/ G/ A/ P/ VP**
 11. Written monthly class tests on small topics: **E or VG/ G/ A/ P/ VP**
 12. Viva voce on small topics, once a month: **E or VG/ G/ A/ P/ VP**
 13. Problem based learning: **E or VG/ G/ A/ P/ VP**
 14. Internal assessment (Session/ term) exams: **E or VG/ G/ A/ P/ VP**
 15. Preparatory Exam **E or VG/ G/ A/ P/ VP**
 16. Practical exercises by students **E or VG/ G/ A/ P/ VP**

Effective method of teaching BC, from futuristic 'clinical practice' point of view

Excellent (E)/ V.Good (VG)/ Good (G)/ Average (A)/ Poor (P)/ V.Poor (VP)

17. Lecture by faculty: **E or VG/ G/ A/ P/ VP**
 18. Tutorials/ Interactive class, by faculty: **E or VG/ G/ A/ P/ VP**
 19. Symposium prepared by multiple faculty: **E or VG/ G/ A/ P/ VP**
 20. Group Discussions between students: **E or VG/ G/ A/ P/ VP**
 21. Written monthly class tests on small topics: **E or VG/ G/ A/ P/ VP**
 22. Viva voce on small topics, once a month: **E or VG/ G/ A/ P/ VP**
 23. Problem based learning: **E or VG/ G/ A/ P/ VP**
 24. Internal assessment (Session/ term) exams: **E or VG/ G/ A/ P/ VP**
 25. Preparatory Exam **E or VG/ G/ A/ P/ VP**

Opinions

26. Minute details of biochemical reactions, are useful in Medical Practice: **Yes/No**
 27. Studying the chemical structure of molecules is necessary: **Yes/No**
 28. Is it better to teach respective metabolisms after their chemistries instead of first teaching all the chemistries: **Yes/No**
 29. Integrated teaching with 1st year subjects is useful: **Yes/No**
 30. Integrated teaching with Pathology is useful: **Yes/No**
 31. Integrated teaching with Clinical subjects is useful: **Yes/No**
 32. Whether it is possible to cover BC, meaningfully, in 12 months? **Yes/No**
 33. BC practicals are useful in imparting practical skills: **Yes/No**
 34. BC practicals are useful in learning related theory aspects **Yes/No**
 35. BC practicals are useful in keeping interested and are stimulating to learn **Yes/No**
 36. Should a clinician teach interpretation of lab investigations? **Yes/No**

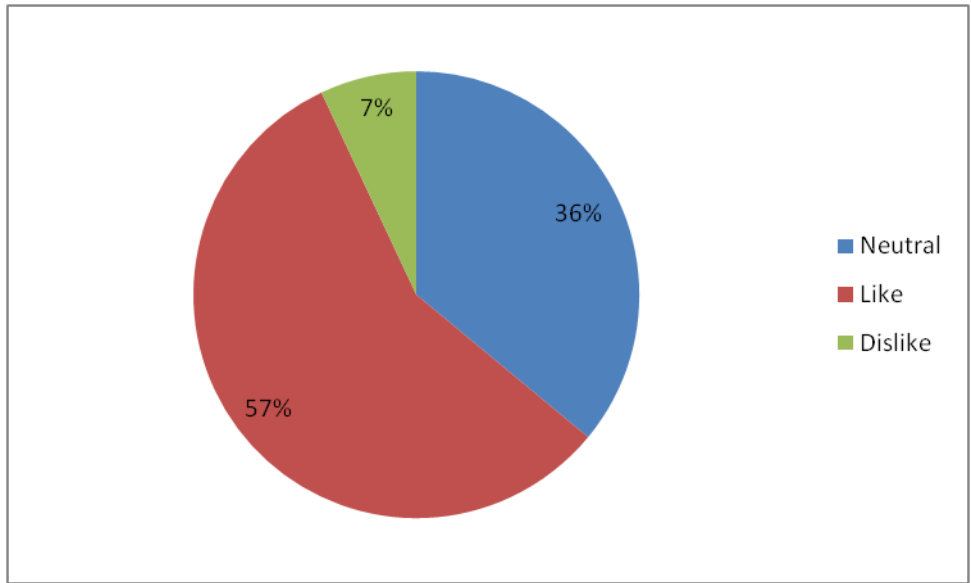


Figure 1: 'Like' for biochemistry

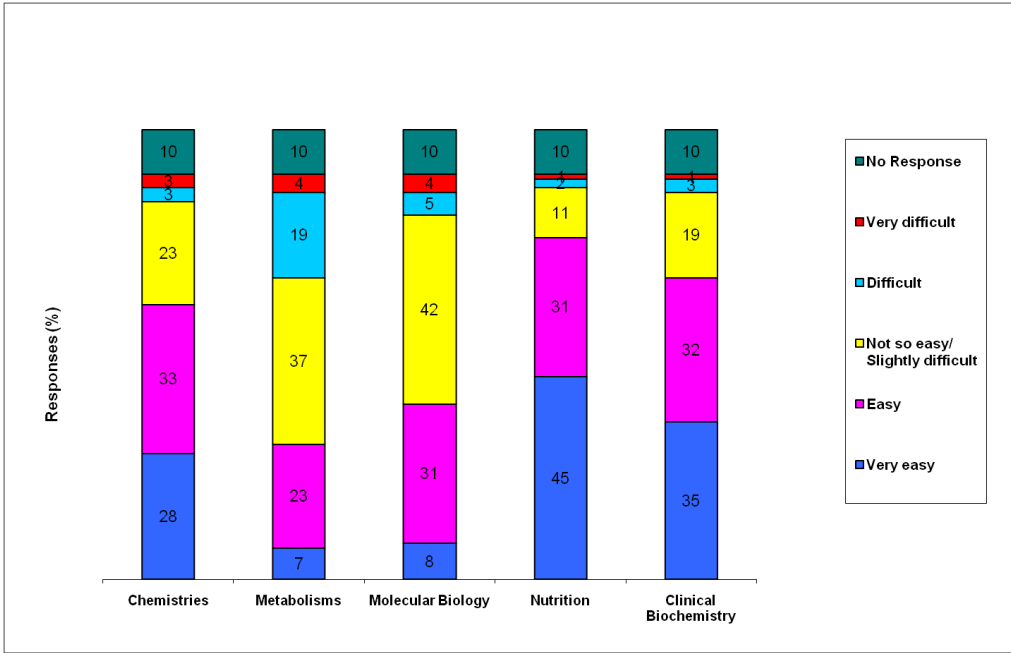


Figure 2: Level of difficulty in learning Biochemistry

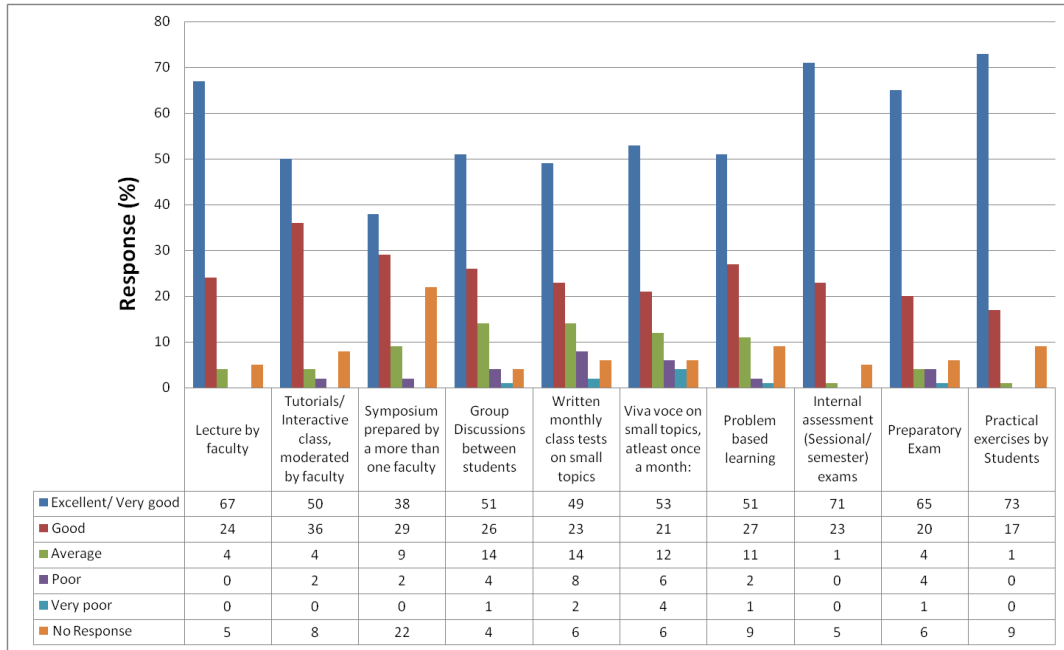


Figure 3: Effective teaching learning method for 'final exam'

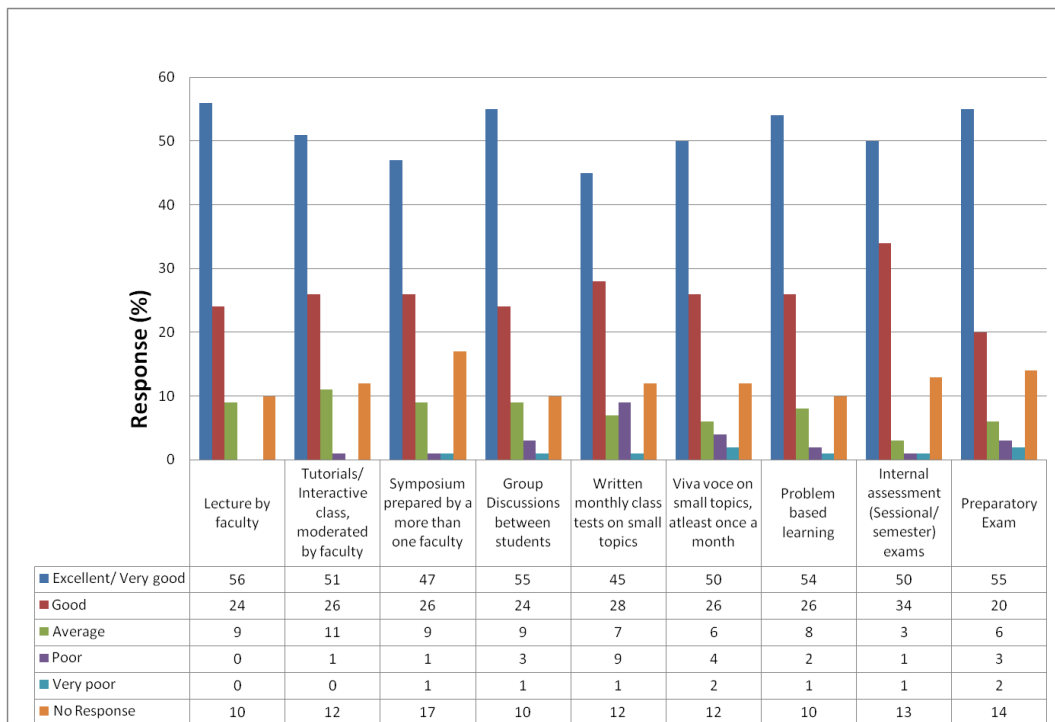


Figure 4: Effective teaching learning method for 'Clinical practice'

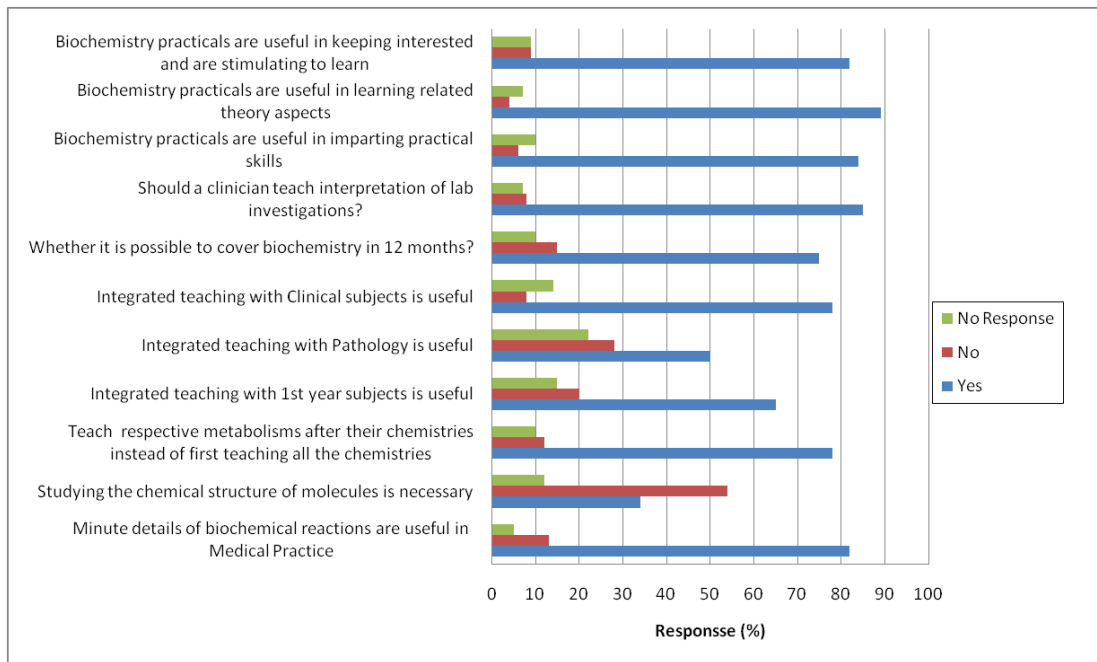


Figure 5: Other opinions about teaching learning in biochemistry