



Enrich Pharmacy Students' Conceptual and Applied Understanding of Acid- Base Concepts by a Blended Teaching Model

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Research Article

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Abstract

Pharmacy students in the last semester have received repeated and often in-depth exposure to acid-base chemistry. Yet, despite having covered this essential content in inorganic, organic, biochemistry, and pharmaceuticals courses, students often demonstrate an inability to work competently and confidently with acid-base chemistry principles. The ability to predict the behavior of organic acids and bases in solution is paramount to the comprehensive understanding of drug action that all pharmacists are expected to have. It is therefore essential that pharmacy educators identify teaching and learning strategies that foster a true and lasting comprehension of this critical and omnipresent aspect of drug behavior *in vivo* and *in vitro* and the main theoretical physico-chemical and technical skills learnt. Moreover, the students should be able to connect these concepts to their professional daily role in the industry, in bio-analytical, formulation, analytical, clinical practice and in the research and development of new drugs and formulations.

Keywords: Blended teaching, Blended learning (BL), Traditional didactic learning (TDL).

Introduction

In India pharmaceutical education comes under the technical courses and it is important for pharmacy students that they become technically skilled and professionally trained in each subject of pharmacy. The most commonly used teaching system used in

pharmaceutical education system is conventional lecture method. The traditional method is helpful to teachers and lecturers to save the time since prepared data available in books. Most of the students even though fail to answer the simple questions not because of their lack of knowledge but because of their application of knowledge.

There are lots of basic concepts in pharmaceutical subject which are needed to be elaborated with day to day examples. The complexity of medicine has already progressed beyond the ability of the teachers to teach everything that students would need to know [1, 2].

In traditional didactic teaching method the topic covered in the lecture is available in textbooks so most of the students behave like a passive audience and most of the students attend lecture because attendance is mandatory according to college and university norms [3].

It is compulsory for pharmacy student that he should undergo practical training for a specified period in medicine shop and in pharmaceutical industry for D. Pharm and B. Pharm curriculum respectively to get well acquainted with all the practical aspects, therapeutical application of the pharmaceutical subjects. As far as practical approach is concerned, every student should get that orientation to develop the required professional skills. Although we have many industries and pharmaceutical shops to avail the facilities but many students fail to render the same due to some undefined limitation. But in blended teaching method the students learn the basic concept of the topic along with their practical application and examples which are in use at job place.

The current research study infancies on the acid base concept in various subjects in pharmacy. Here in pharmaceutical the Blended teaching method is the concept of teaching basic topic along with the practical and conceptual application of the topic as applicable.

Blended learning focuses on optimizing achievement of learning objectives by applying the "right" learning technologies to match the "right" personal learning style to transfer the "right" skills to the "right" person at the "right" time[4,5]. The blended teaching integrate traditional teaching activity, pedagogically valuable manner; and Blended courses replace a portion (institutionally defined). Embedded in this definition are the following principles:



- We are focusing on the learning objective rather than the method of delivery
- Many different personal learning styles need to be supported to reach broad audiences
- Each of us brings different knowledge into the learning experience
- In many cases, the most effective learning strategy is "just-what-I-need, just-in-time" [6].

The purpose of this study was two folds. Firstly, to develop a blended teaching model (BL) in a form of lesson on acid-base concept of physical- chemical properties of drug and secondly to determine whether the BL model of the professional applications of acid-base concept in the theoretical and experimental activities of the course would increase their interest and long time retention of the main concepts discussed.

This study was performed in the Pharmaceutical course of the Gurunanak College of Pharmacy, Nagpur.

Methodology

Background/settings:

The study was carried out in the Pharmaceutics Department of Gurunanak College of Pharmacy under RTM Nagpur University. This department teaches all the subject of undergraduate pharmacy course and post graduate pharmacy course related to pharmaceutics.

Experimental Methods:

1. Lesson development
2. Demonstration of lesson
3. Questionnaire

Participants and study design:

The student cohort for this investigation comprised of 60 final year undergraduate and post graduate students of pharmacy at Gurunanak College of Pharmacy. Deliberate efforts were made to ensure that the topic selected i.e. acid- base concept, for this study should contain tremendous pharmaceutical applications. The students have already studied the concept taught by the corresponding teachers who have used didactic lecture pattern under various subject heads.

The lecture on acid base concept using BL method was delivered by the lecturer belonging to Pharmaceutics specialization. The lecture session was started with a questionnaire as given in (Table 1) to analyze the retention of acid base concept by the students. In the next stage, the BL lesson on acid base concept was demonstrated to the students.

The lecture covered the application of Henderson-Hasselbalch equation, its interpretation and calculation. Feedback from students on BL teaching method was taken to actually judge the significance of the method in

the form of some questions. Students were asked to give the answers in the form of different options

1. Strongly agree,
2. Agree,
3. No opinion/confused,
4. Disagree,
5. Strongly disagree

The different questions are as follows:

- Q.1. BL is more effective in fulfilling learning objectives.
- Q.2. BL gives better factual knowledge of topic (acid- base concept).
- Q.3. BL promotes better student participation in the learning process.
- Q.4. BL would promote student's reflective/critical thinking and reasoning of physical- chemical principles of drug.
- Q.5. BL is more interesting and provides more learning fun.
- Q.6. More BL sessions should be organized.
- Q.7. What in your opinion is the main disadvantage (if any) of BL?

Results & Discussion

Statistical analysis:

Statistical analysis was carried out and all the values were taken in percent. As shown in figure 1, it was observed that most of the students were unable to give the answers of the simple questions. 82 percent students knew about the acid base concept and the subject in which they studied the concept but failed to attempt the question related to its applicability.

The students participated enthusiastically and helped in collecting the necessary data.

The preliminary questionnaire comprised of simple questions related to acid base concept. It was observed that only few students were able to answer correctly. The data can be seen in table 1.

Figure 2 demonstrates the responses to the questionnaire on second session of study BL Teaching method. 78 percent of the students declared that BL gives better factual knowledge of Acid Base when compared to TDL (Traditional didactic lecture) and an overwhelming majority of the students (85%) perceived that BL promotes better student participation in the learning



process as compared to TDL. Indeed 82% of the respondents even strongly agreed to this assertion.

Table 1: Questionnaire at the starting of the research study for students


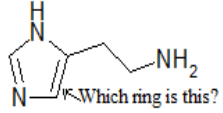
Q.1	List the subjects in which you have encountered the concept of Acid- Base.
Q.2	Can you recall the Handerson- Haselbach equation for weak acid or weak base. If yes write.
Q.3	Identify the structure as acid or base. And if possible the probable pKa. 
Q.4	The following structure belongs to which class of drug. Whether it is base.
Q.5	 <p>Which ring is this?</p>
Q.6	Label the amines in the above structure as 1 ^o , 2 ^o , 3 ^o . And the possible pKa values.
Q.7	Can you tell at the following pH of the GIT – which proton will be released first. <p>pH = 1 pH = 5.8 pH = 7.4</p>
Q.8	A pharmaceutical molecule with antifungal properties is only active when deprotonated and negatively charged (A ⁻). The protonated state (HA) is inactive. If the pKa of this drug is 10.0. (a) Calculate the ratio of protonated to deprotonated compound at physiological pH (7.4). (b) Is this drug likely to be a useful pharmaceutical agent?

Table 2: Percent analysis of questionnaire of BL teaching method and TDL method

Question no.	Q.1	Q.2	Q.3	Q.4	Q.5	Q.6
Strongly Agree	65	82	50	45	50	57
Agree	33	13	43	50	45	38
No opinion/ Confused	0	3	5	3	5	5
Disagree	2	0	2	0	0	0
Strongly disagree	0	2	0	2	0	0

Table 3: Percent analysis analysis of retention of acid base concept by the students

Question no.	Q.1	Q.2	Q.3	Q.4	Q.5	Q.6	Q.7	Q.8
Correct	82	28	5	10	53	47	0	3
Partly Correct	10	12	62	67	0	17	0	20
Wrong	3	21	23	15	40	3	38	17
Unattempted	5	39	10	8	7	33	62	60

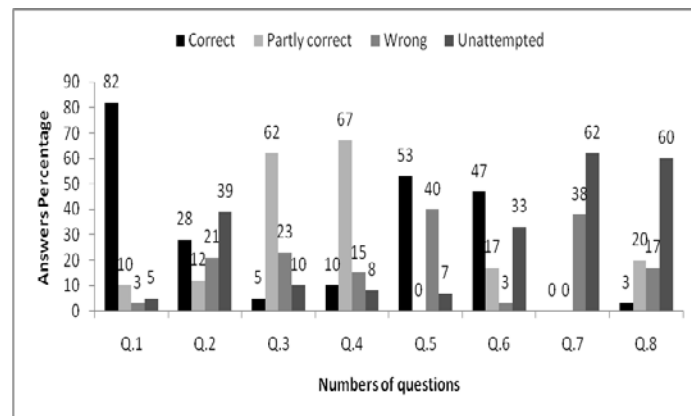


Figure 1: Analysis of retention of acid base concept by the students

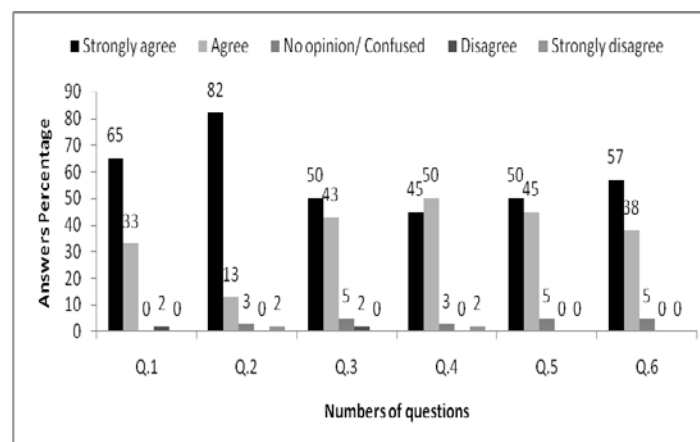


Figure 2: Analysis of BL teaching method and TDL method questionnaire

Conclusion

The result of our study showed that, undergraduate and post graduate students demonstrated as well as believed that, BL was effective and more beneficial than a traditional teaching regimen as an Acid Base Concept. With this feedback provided by the students, we feel that, BL Teaching model could have a role in Pharmaceutical colleges.



Future prospective: The research study is carried over only Acid-Base concept, there are many topics in which further such research study possible. Not only for pharmaceuticals but also this study is applicable to all technical branches.

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AUTHORS' CONTRIBUTIONS

Authors contributed equally to all aspects of the study.

PEER REVIEW

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CONFLICTS OF INTEREST

The authors declare that they have no competing interests