

RESEARCH ARTICLE

Introduction and evaluation of a creative pedagogical tool in pharmacology: Autobiography of drugs

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ABSTRACT

Background: Pharmacology teaching in undergraduate medical curriculum in India is primarily drug centered and stresses on imparting more of factual information. Teaching and learning skills would be better developed by incorporation of active learning during large group and small group sessions. **Aim and Objectives:** The current study reports the perceptions of introducing a learner centric activity, autobiography of drugs in pharmacology in large group. **Materials and Methods:** Session on “Autobiography of drugs” was introduced as an active teaching-learning module in pharmacology classroom. Important characteristics of drugs were presented as drug autobiography. Subsequently, students had to identify the drug giving justification. Perceptions of students regarding module were documented with the help of Likert scale. **Results:** Out of 153 students 112 participated. Majority gave positive reviews regarding the activity. About 94.70% students found the concept interesting. Above 80% students enjoyed learning by this method and agreed that it fosters creativity while learning. About 74.10% found this as an interactive, learner centered activity. About 62.50% students found the session engaging. About 71.00–75.90% students felt that autobiographies were informative and designed in structured manner. Overall rating in respect to quality, content and usefulness of activity on Likert scale was 4.06 (0.77). **Conclusions:** Autobiography of drugs was taken as an interesting active teaching-learning module by students. Need of the hour is to involve medical students in active learning activities which foster greater learner engagement, interaction, and promote life-long learning.


KEY WORDS: Autobiography of Drugs; Teaching – Learning; Pharmacology

INTRODUCTION

Medical education in global context has evolved over a period of time and so in India. With changing community needs, educational advancements and technological revolutions, we

need to update the method of imparting knowledge and skills to the students.^[1] Conventional medical education focused more on “*sage on the stage model*” as compare to Competency Based Medical Education model that emphasizes on “*guide by the side*” model.^[1]

Medical students in 2nd year are studying a total of four main subjects one of them being pharmacology. Although pharmacology is one of the essential subjects in medical curriculum, students often find difficulty in engaging themselves in classroom monotony.^[2,3] In addition, they find it challenging to memorize pharmacology as they find that facts often evaporate with the wink of the eye.^[4]

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Besides this, current teaching-learning strategies in pharmacology follow teacher centered approach. More focus is on imparting factual information. In fact for better understanding of the content self-learning and critical thinking is more important.^[5] Thus, among the many challenges educators face today is the need to make teaching-learning process captivating, interesting, creative^[6,7] engaging, and conceptual. All this blended together fosters active learning.^[8,9] Making teaching-learning interesting require a multi-pronged approach by teacher. One of the approaches can be exposing students to active learning strategies and innovative pedagogical tools in the subject.^[10]

There are literature reports of using a few effective learning strategies in Pharmacology classrooms.^[7,11,12] Using interesting concepts like autobiography of drugs in pharmacology classrooms can help meet certain challenges of educators in the current era.

Concept of Autobiography of Drugs

Concept of autobiography of drugs is actually derived from a book titled: *The genome: Autobiography of Species* in 23 Chapters which is a brilliant and inspiring story of 23 pairs of chromosomes.^[13] The approach revolves around personification of medicines.^[14] “Autobiography of drugs” consist of description of the given drug, in a kind of story/a narrative focusing on different aspects on life of drug, for example, relevant history of a particular drug in terms of its development and existence, mechanism of action, pharmacokinetic, uses, and adverse reactions. Following this, students have to identify the drug giving justification. Adding quotes related to history of drug discovery and action of drugs imparts uniqueness to drug description. This in-turn foments high engagement among medical students and at the same time adds a pinch of creativity in the instructional mode. The idea of conducting and experiencing “Autobiography of drugs” as one of the active pedagogical tool in pharmacology sessions at our college was first of its kind.

Undergraduate as well as postgraduate medical teachers can take initiative to prepare brief Autobiographies of drugs (word limit 100/150/250/more than 250 words) and make use of them in multiple ways, as follows:

- For set induction before starting a lesson plan
- Use in between an ongoing lecture to break the academic monotony
- Use at end of lecture, as a method to recall/identify drugs taught in lecture, i.e., by designing questions in form of autobiography of drugs
- As questions/triggers during revision/tutorials in pharmacology.

MATERIALS AND METHODS

The present study was conducted in second M.B.B.S. students w.e.f. August 8, 2017, during a 2½ hour pharmacology class

at one of the western medical colleges, in India, after approval of Institutional Review Board. Preparation of how to go about the activity needed a lot of planning and dedicated efforts from pharmacology teachers as well as students.

One month before start of activity, brief autobiographies of drugs were designed and framed by pharmacology teachers. For framing autobiographies, teachers chose ten to eleven common drugs from core topics which have already been covered in past, for example, celiprolol, aspirin, rofecoxib, alteplase, amlodipine, thyroxine, clomiphene citrate, raloxifene, sodium valproate, pantoprazole, and tetracyclines. Each autobiography consisted of 100–250 words and was designed using authentic textbooks and reputed journals.^[15] In addition, the content was internally as well as externally validated for its appropriateness. Particular drug descriptions were presented as “Drug Autobiography.” Following which students had to identify the drug giving justification. Session was conducted as a part of revision in large group. In the drug description, there were hidden clues for the main question, i.e., “Who am I”? Furthermore, some triggers were added as an extension to main question as mentioned in example shown in supplementary file.

One week before conduction of study, students were informed that drugs from core pharmacology topics will be revised using an active teaching-learning tool. They were also instructed to take a note of topics which will be covered in the session, i.e., cardiovascular drugs, nonsteroidal anti-inflammatory drugs, fibrinolytics, hormones, antiepileptic drugs, proton pump inhibitors, and antimicrobials. Topics were displayed on pharmacology bulletin board, as well as through a common WhatsApp portal for convenience. Time allotted for the activity was 2½ hour. At the start of activity, the students were briefed about the aims and objectives of the study. Students were also sensitized on meaning of terms such as “Active Teaching-Learning,^[8]” “Creativity in Teaching,^[16]” “Student engagement^[17]” and “Student centric activities,^[8]” and “Deep understanding/Conceptual Understanding.^[18]”

Written informed consent was obtained from each participating student. On the day of activity first, the entire batch in large classroom was divided in ten groups. Various drug autobiographies pertaining to topics displayed earlier were exhibited, one by one, on large screen with the help of liquid crystal display. Each autobiography (with name of drug concealed) was displayed on screen for 6–8 min. Following this each group of students had to identify the drugs/group with the help of discussion among themselves. At the same time teacher also facilitated the students, discussing the “how” and “why” of answers, to ensure proper learning, thus acting as a “guide by side” rather than “sage by the stage.”^[11] A total of ten such sessions of autobiographies were conducted in a time span of 2 hour for all ten groups. One such example of autobiography is displayed in submitted supplementary file.

In the remaining half an hour, perception of students was obtained using validated feedback Google forms. Feedback form consisted of 23 items. Students were instructed to select the responses to a 20 item questionnaire questions as “Strongly Disagree,” “Disagree,” “Neutral,” “Agree,” Or “Strongly Agree.” To assign numerical values to the responses, as mentioned above “Strongly Disagree” was graded as 1, “Disagree” as 2, “Neutral” as 3, “Agree” as 4, and “Strongly Agree” as 5. For all the above-mentioned questions, responses were presented in number and proportions. Average score for each statement was calculated. Two open-ended questions were also included in the feedback form about their perception of strength and weakness of activity conducted. While the final question in feedback form was about the overall rating of activity on five point scale (1=Poor, and 5= excellent).

RESULTS

Out of 153 students, 112 second year medical students participated in the study and provided their feedback, as depicted in Figure 1.

Perceptions of the students for the conducted session on “Autobiography of drugs” on Likert scale are presented in Table 1.

- Answers to the open-ended questions, for example, What was good about this activity? We received answers like: “It was creative, interesting, interactive” “triggers imagination,” “helps in better retention of facts,” and that it has changed their perception regarding pharmacology learning.

- Answers to the question how this activity can be made better:
We received answers such as “it is better if we include less detail especially in regard to historical aspects of drug,” “prepare such autobiographies for other drugs too,” “organize competitions to generate interest in subject among students,” and including such exercises after every lecture.” At the same time, some students confessed that they lack creativity and for them it can be difficult to imbibe or learn pharmacology in this way.
- Average overall rating on 1–5 Likert scale was 4.06 (0.77) with, minimum score of 2 and maximum 5.

Table 2 depicts the perceived strength and weakness of conducted activity

DISCUSSION

Creating a classroom environment where students are actively learning, can create boundless rewards and benefits such as reinforcement of course content, and enhanced student self-esteem promotion of conceptual learning.^[19] For any topic to be made interesting teachers need to first make the contents interesting, herein 94.70% students found this concept interesting. While in terms of active teaching-learning 74.10% students opined that this method promotes group discussions, interactivity and learner centeredness, 84.20% students enjoyed the entire learning process and 82% agreed that this activity enhances creative component while teaching and learning. In addition, more than 75% students felt that this method helps in easy recall and better retention

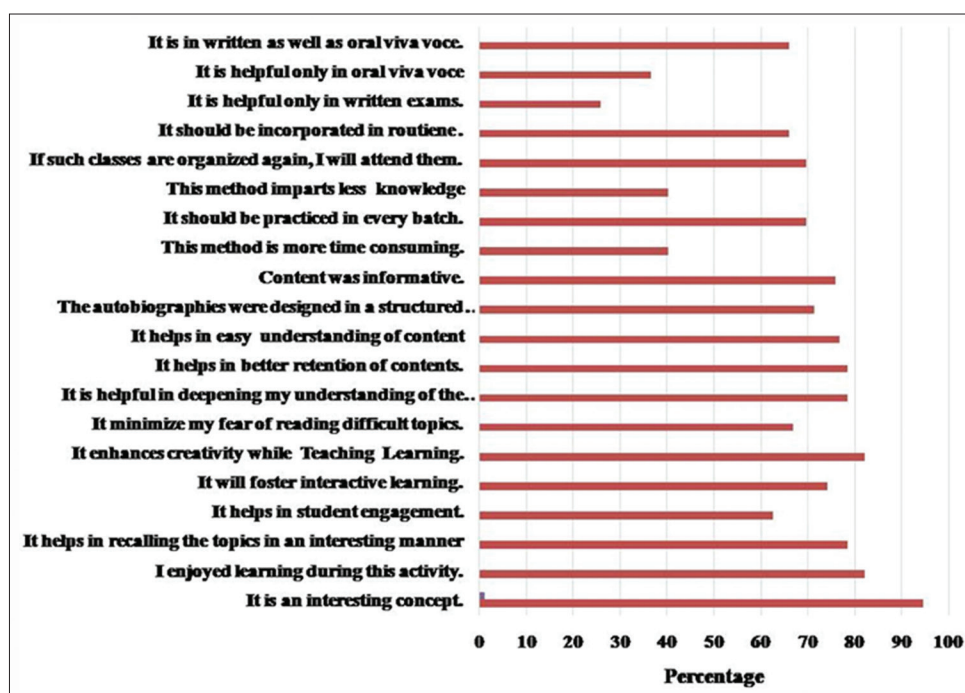


Figure 1: Agreement of students to the statements in feedback form

Table 1: Response to the statements in feedback form. (In absolute numbers and %)

Statements	Strongly disagree		Disagree		Neutral		Agree		Strongly agree		Score
	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)	Mean (SD)
It is an interesting concept	0	0	1	0.9	5	4.5	76	67.9	30	26.8	4.2 (0.6)
I enjoyed learning during this activity	8	7.1	1	0.9	11	9.8	76	67.9	16	14.3	3.8 (0.9)
It helps in recalling the topics in an interesting manner	11	9.8	0	0.0	13	11.6	74	66.1	14	12.5	3.7 (1)
It fosters student engagement	10	8.9	7	6.3	25	22.3	59	52.7	11	9.8	3.5 (1.1)
It will fosters interactive learning	5	4.5	1	0.9	23	20.5	70	62.5	13	11.6	3.8 (0.8)
It enhances creativity while teaching-learning	6	5.4	1	0.9	13	11.6	71	63.4	21	18.8	3.9 (0.9)
It minimizes fear of reading difficult topics	7	6.3	7	6.3	23	20.5	64	57.1	11	9.8	3.6 (1)
It is helpful in understanding the depth and breadth of drug characteristics	10	8.9	1	0.9	13	11.6	73	65.2	15	13.4	3.7 (1)
It helps in better retention of contents	5	4.5	3	2.7	16	14.3	68	60.7	20	17.9	3.9 (0.9)
It helps in easy understanding of content	9	8.0	3	2.7	14	12.5	68	60.7	18	16.1	3.7 (1)
The autobiographies were designed in a structured manner	3	2.7	4	3.6	25	22.3	67	59.8	13	11.6	3.7 (0.8)
Content was informative	5	4.5	0	0.0	22	19.6	71	63.4	14	12.5	3.8 (0.8)
This method is more time consuming and gives little knowledge	18	16.1	21	18.8	28	25.0	41	36.6	4	3.6	2.9 (1.2)
It should be practiced in every batch	9	8.0	5	4.5	20	17.9	61	54.5	17	15.2	3.6 (1.1)
It should be practiced in every subject	13	11.6	12	10.7	25	22.3	48	42.9	14	12.5	3.3 (1.2)
If such classes are organized again, I will attend them	6	5.4	2	1.8	26	23.2	60	53.6	18	16.1	3.7 (0.9)
It should be incorporated in our day-to-day teaching	5	4.5	6	5.4	27	24.1	58	51.8	16	14.3	3.7 (0.9)
It is helpful only in written exams	17	15.2	30	26.8	36	32.1	21	18.8	8	7.1	2.8 (1.1)
It is helpful only in oral viva voce	14	12.5	19	17.0	38	33.9	33	29.5	8	7.1	3.0 (1.1)
It is in written as well as oral viva voce	9	8.0	4	3.6	25	22.3	59	52.7	15	13.4	3.6 (1)

Table 2: Perceived strength and weakness of conducted activity

Theme	Strength	Weakness/areas which need improvement
Content	Interesting	Less details about history and reduce size of autobiographies
Conduct	Creative, Interactive	Can be included at the end of every lecture for a rapid recall or at start as a trigger in set induction for lesson plan Students want it through website and social media too.
Learning	Better retention of facts Triggers imagination	Some students find it difficult to learn this way
Other	Changed perception toward Pharmacology	Students who prefer rote learning and traditional methods do not enjoy such activities All topics cannot be covered by this method This method is time consuming in terms of planning and execution both.

in an interesting manner. At the same time, they opined, that this method has contributed to improved understanding of characteristics. In terms of student engagement, 62.50% students felt that it encouraged engagement, while 66% agreed that such activities alleviate the fear of reading difficult topics. Interestingly, 69.70% wanted it to be practiced in every batch. About 66.01% students felt it would help them in both written and oral viva-voce pharmacology exams. About 75.90% students appreciated the content of autobiographies informative 71.04% considered autobiographies to be designed in a structured manner.

In the given study, 94.70% students found the concept of autobiography of drugs interesting. About 84.20% students enjoyed the learning process and 82% agreed that this activity enhances creative component in teaching-learning. This is in synchrony with a study conducted by Joshi and Ganjiwale^[20] wherein 92% students agreed that this method generated more fun and interest in learning.

In terms of active teaching-learning, 74.10% students in our study opined that this method promotes group discussions,

interactivity, and learner centeredness. This is in line with one of the studies conducted by Tripathi *et al.*,^[21] wherein 78% students agreed that such activities enhance full participation among students and 77% students stated the method to be interactive. This suggests that group discussions as a trigger for interaction, team work, and high engagement activity. This helps value opportunities for peer-peer and peer-instructor interaction. In addition, more than 75% students felt that this method helps in easy recall and better retention in an interesting manner. While 78.60% opined, that this method has contributed to improved understanding of characteristics. On the contrary study by Joshi and Ganjiwala^[20] reports that 87% students felt that this method of teaching-learning helped them to understand and remember specific information and ideas effectively. This supports the fact that students need tools to help retain knowledge for longer periods and easily identify materials that are more difficult to learn.^[22] About 92% students expressed that it helped them improve their foundational knowledge. While in study by Tripathi *et al.*,^[21] 77% students responded that this method imparts good understanding. Besides this, 73% students stated that they could draw conclusions in groups and arrive at correct answer. This stresses the importance of group discussions as an impetus to create space to check prior understanding and knowledge levels. In our study, in terms of student engagement, 62.50% students felt that it encouraged engagement. Study conducted by Bernard^[17] reveals the benefits of student engagement for deep learning, while 66.90% agreed that such activities alleviate the fear of reading difficult topics. This is supported by a study conducted by Cooper *et al.*,^[23] which emphasizes on minimizing fear and anxiety among students who practice active learning in classrooms. Interestingly, in our study, we found 69.70% students wanted such activities to be organized and practiced in every batch. On the contrary Joshi and Ganjiwale study^[20] reports that the majority of students (87%) wished this to be a frequent way of teaching-learning as it helped to increase individual thinking and student engagement in class.

In spite of the fact that more than 75% students in our study felt that this activity helps in recalling the topics, deepens the understanding of the drug and helps in better retention, only 66.1% students stated that such activities are helpful in oral as well as written exams while surprisingly in Tripathi *et al.* study,^[21] only 38% students felt that this teaching technique will be helpful for scoring well in exams. Decline in response could be attributed to the pattern of theory assessment which mainly caters to prototype questions in the form of short and long answer questions that focus on direct recall only. About 40.2% students found the method time consuming, which was also agreed upon by Joshi and Ganjiwale study.^[20] In our study, 75.90% students appreciated the content of autobiographies. About 62–64% students in Tripathi *et al.* study^[21] felt that such active teaching techniques are helpful for students and that newer teaching methods are necessary in subject of pharmacology. In context to this, a recent review

on status of educational research in India^[24] states that apart from various other teaching methods used in pharmacology, “Autobiography of drugs” is one of the useful tools in subject of pharmacology. In addition, they stated that this module helps in generating enthusiasm, engaging students, sustaining interest, better recall, and revising pharmacology in an enjoyable way, respectively. Along with this, pharmacology teachers can think of using this as an assessment tool too. The brief autobiography of drug can be put in stem of multiple choice questions with single best response. Autobiography can also be given as a vignette and relevant questions can be asked like we do in modified essay questions. At the end of the didactic lecture, quick assessment can also be done using autobiography.

Limitations of the Study

Since different instructional methods have diverse roles, each has their merits and demerits. Limitations of the study were as follows:

- Because the objective of the study was only to find perception and readiness to accept the newer method by medical students, we did not consider a control group for any comparison
- Such methods of teaching are not a standalone method or replacement for lectures
- In addition, the method demands more time in terms of planning and execution both.

CONCLUSIONS

Among the numerous roles that educators play in medical classrooms, some important qualities such as building curiosity and interest in the subject need a special mention. Blending autobiographies of drugs in the content offers multiple benefits which are not visible in traditional teaching. Although in pharmacology such researches are in nascent stage, similar researches need to be conducted by pharmacology teachers to validate its utility.

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SUPPLEMENTARY

EXAMPLE OF AN AUTOBIOGRAPHY OF DRUG

I grew up in hands of a competent pharmaceutical i.e. ACER. Today I am celebrating my 36th anniversary as I was patented in the year 1973 and approved for medical use in 1982. This milestone got me thinking about my peculiarity both in Pharmacology as well as clinical application. Although, all my congeners have been used in almost all cardiac diseases like Hypertension, Congestive Cardiac Failure, Ischemic heart disease unfortunately they all have a propensity to worsen bronchial asthma, depression and left ventricular function. But! I take pride in stating that I have been formulated in such a way that I do not exacerbate asthma. Interestingly I am the only agent of my class who is having mixed agonist antagonist property. Simultaneously I can also boast of having some special features like possessing Nitric Oxide donor property and potentially benefit patients suffering with vascular Ehlers–Danlos Syndrome (EDS). In 2015, the U.S. Food and Drug Administration (FDA) granted me the designation of orphan drug for the treatment of EDS.

Any guesses: Who am I? (Main question).

Trigger Question: What is the Full Form of SAM?

Selective Adrenoceptor Modulator (SAM)

Trigger Question: Can You Justify How do I Help Patients of EDS?

Answer: Celiprolol. A Unique Selective Adrenoceptor Modulator.

Celiprolol is a β -blocker with a unique pharmacologic profile: it is a β_1 -adrenoceptor antagonist with partial β_2 agonist activity. Given this combination of effects, Celiprolol may be better described as a selective adrenoceptor modulator. It has antihypertensive and antianginal properties and is indicated for those uses in various countries globally.

Can You Throw Some Light on How do I Help Patients of EDS?

Vascular Ehlers-Danlos Syndrome is a hereditary connective tissue disorder caused by mutations in the collagen type III gene (*COL3A1*), which leads to a loss of tissue integrity in many organ systems. Because of defective collagen synthesis, patients with vascular Ehlers-Danlos Syndrome have weakened blood vessels which are prone to dissection or rupture resulting in serious morbidity and sometimes mortality. The definite treatment involves urgent surgical repair. However, Celiprolol has unique property: it is a β_1 -blocker with partial β_2 agonist activity. By negative inotropic and chronotropic effect, Celiprolol may reduce the velocity and force produced by blood column on collagen fibers within the intima of the arterial wall and prevents the possible rupture of the blood vessels. So it may be of benefit in patients with vascular type Ehlers–Danlos syndrome.