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Structured Interactive Tutorials: An Innovative Approach to Student's Learning

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Abstract

Purpose: Tutorial classes as a method of small group teaching in medical education can serve as a powerful tool to encourage self-learning among medical students. In many medical colleges in India, there is a lack of student interaction and structural uniformity in the way tutorials are conducted. Therefore, the current study was taken up to compare traditional tutorials with structured interactive tutorials making use of the principles of active learning.

Methods: Tutorial classes in Physiology for 100 first year medical students were conducted first by traditional method and then by the structured interactive method using active learning technique of think, pair and share. Pre-test and post-test using validated multiple-choice questions and short answer questions were conducted before and after the tutorials. Feedback was collected from students using a validated Likert scale based questionnaire.

Results: Students scored significantly higher in the post-tests after both traditional and structured interactive tutorial method. However, the number of students scoring less in post-test or having equal scoring in pre- and post-test was more in case of traditional method. Analysis of feedback questionnaire showed that significant number of students felt the structured interactive method was better in terms of content, pace of presentation, ability to participate and understanding of the topic.

Conclusion: Structured interactive tutorials demonstrated better student participation and improved recall of information in more number of students. They also resulted in increased satisfaction among students regarding different aspects of the tutorials.

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Introduction

Tutorials have been introduced as a part of medical curriculum since 1964 (10). Since then, tutorials have embodied a major teaching learning strategy in basic sciences of medical education. It is widely researched for its effectiveness in learning outcomes (9). A tutorial when used as a part of the teaching learning process in medical education, is supposed to be more interactive and specific than a didactic lecture. Unfortunately, sometimes the tutorials become a continuation of didactic lectures with a lot of subjective variation in the way they are conducted by various tutors, without any structural uniformity and lack of participation among the students. There is increasing evidence of the importance of active learning in today's learning environment. Active learning is particularly focused on learning rather than teaching (1) and, by its nature, is student centered (7). Therefore, the current study was conducted to understand whether structuring the tutorials and incorporating the principles of active learning into them would encourage greater student interaction and help in better understanding of the topics.

Material and Methods

The study was conducted in the Department of Physiology, Lokmanya Tilak Municipal Medical College, Mumbai, India. Institutional Ethics Committee permission was taken before starting the study.

Participants

The participants of the study were 100 first year undergraduate medical students who were enrolled for the study after obtaining due consent.

Methodology

1. 2 topics for tutorials were chosen after focus group discussion with faculty in the department of Physiology–1. Transport across cell membrane, 2. Hemostasis. Tutorials were conducted in two modules after the selected topics were covered in didactic lectures.

2. Phase 1 :

    •   Tutorial classes on one of the selected topics (Transport across cell membrane) were conducted by tutors in traditional method. In this method the topic was allotted to each of the tutors and they were asked to pose questions to the students related to the topic and allow the students to try to answer them. Tutors were to explain concepts wherever they felt it was necessary. Students were divided into small groups of 10-12 students each for the traditional tutorials.

    •   Students were assessed with a pre-test having validated multiple choice questions and short answer questions on the selected topic before the tutorials. Post - test was conducted after the tutorials.

    •   At the end of each tutorial session, student feedback regarding content, pace and structure of tutorial, understanding of topics and satisfaction with the tutorial method, was taken on a Likert scale based validated questionnaire.

3. Training of tutors: Before the second phase of tutorials, tutors were trained in the structured interactive tutorial format. They were instructed through presentations and small group activities on the method of making the tutorials more interactive using the active learning technique of Think, pair and share. Tutors were trained to act as facilitators rather than instructors for the discussion. Also, they were introduced to the concept of structuring of the tutorials so that the selected topic could be covered within the specified timeline (1 hour), covering all the salient points. Multiple training sessions were taken to make the tutors comfortable in using the new tutorial method.

Format of Structured Interactive Tutorials (to be followed by tutors) –

Structured –

- Defining the specific learning objectives of the topic

- Structuring of content by classifying hierarchies-topics and sub-topics

- Identifying difficult terms and concepts which may require repetition

- Preparation of activities, images or handouts which may be required

- Allotment of time guidelines

- Summarization of salient points at the end.

Interactive –

'Think, pair and share' technique (6) with discussion :

- The instructor poses a question or prompt to the whole batch allowing them to think about it and if needed make a note about it, in about a minute (time depending on type of question)

- After a minute or so, the instructor asks each student to pair up with the student sitting adjacent to him/her and discuss about the question or prompt as a pair.

- After the students have discussed in pairs, the instructor then asks the pairs to share their opinions with the entire batch. The discussion is guided by the instructor to stay relevant to the topic, stick to timelines and encourage students to participate.

Phase 2 (Post-training)

- 100 students were divided into small groups (10-12 students per group). Tutorials on the second topic (Hemostasis) were conducted using the structured interactive format by trained tutors. Each group was made to sit in a semi-circle with tutor also being part of the semi-circle.

- Pre- test and post-test was conducted before and after the tutorial and student feedback was collected.

- The student feedback questionnaire was Likert scale based and had 12 items which included the following statements :

  1. I was made aware of the topic's aims and objectives.

  2. The teaching on the topic was well organised.

  3. The content of the topic was delivered at the right pace.

  4. I was satisfied with the presentation of the tutorial.

  5. I could actively participate in the discussions during the tutorial.

  6. The teaching method used for this topic helped me to understand the topic better.

  7. The teaching method used generated interest about the topic.

  8. I feel I will be able to retain the concepts well by this method.

  9. I felt well prepared for exams after this tutorial.

  10. I felt stressed during the tutorial.

  11. I felt that time was wasted during the tutorial.

  12. I would prefer this method of tutorial again next time.

Comparison of pre- and post-test scores of students for traditional and structured interactive tutorials and comparison of feedback of students regarding both types of tutorials was carried out using Wilcoxon's sign rank test.

Observations and Results

Though the post test scores were significantly more in both the methods, the structured interactive method showed a greater number of students improving on their previous score with a very less percent of students scoring less or equal marks in post-test. In comparison, it was seen that 21% of students couldn't improve on their post-test marks and 20% even scored less in the post-test after traditional tutorials.

Feedback questionnaire was analysed using Wilcoxon's sign rank test. Significant number of students found the structured interactive tutorials were better organised in terms of content, pace and presentation. Also, significant number of students felt they could actively participate in the discussions
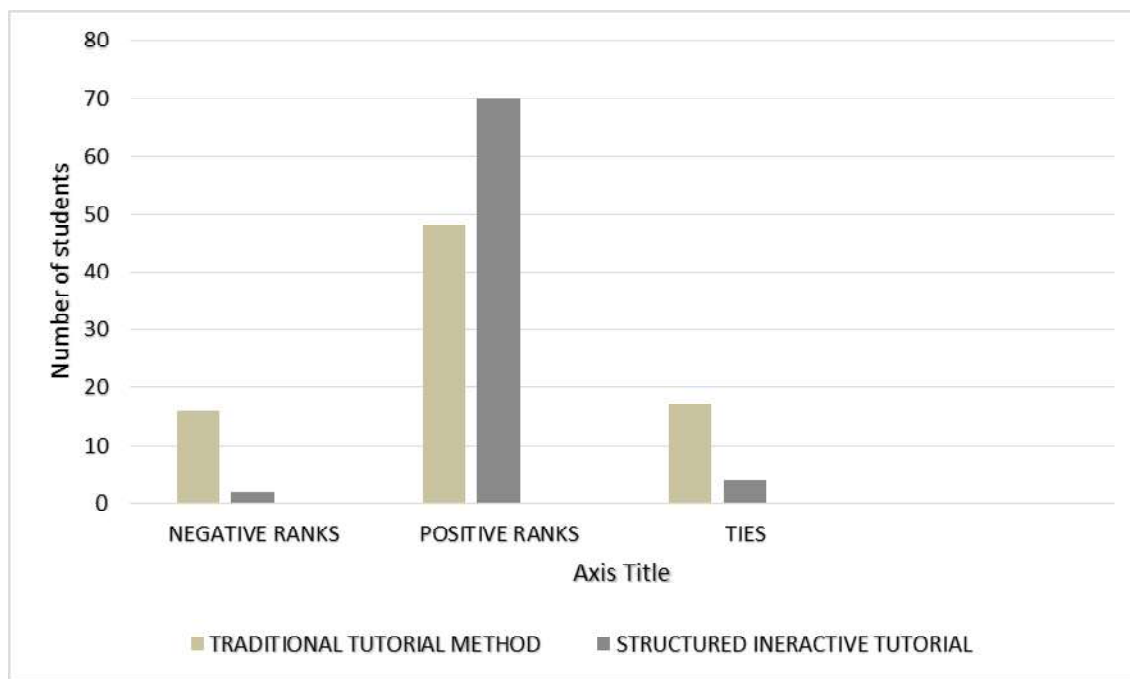
TABLE I : Comparison of pre-test and post-test scores by Wilcoxon's signed rank test.

	Traditional tutorial Post-test 1 - Pre-test 1	Structured interactive tutorial Post-test 2 - Pre-test 2
Z	−4.519[a]	−7.213[a]
Asymp. Sig. (2-tailed)	.000	.000

a. Based on negative ranks

Students scored significantly more in post-test after both traditional and Structured Interactive tutorial.

and could understand the topic better during the structured interactive tutorials. For evaluating negative attitude, 13% agreed to feeling stressed during the structured interactive tutorials as compared to 21% during the traditional tutorials.

Graph I : Comparison of pre-test and post-test scores in traditional tutorial and structured interactive tutorial.
Negative ranks: Students scoring less in post-test as compared to pre-test
Positive ranks: Students scoring more in post-test as compared to pre-test
Ties: Students scoring equal in post-test and pre-test

After traditional tutorials:
20% of students scored less in post-test than pre-test
21% of students scored same in both pre- test and post-test

After structured Interactive tutorials:
3% of students scored less in post-test than pre-test
5% of students scored same in both pre- test and post-test

TABLE II : Analysis of Feedback Questionnaire.

	Q1 Si - Q1T	Q2 Si - Q2T	Q3 Si - Q3T	Q4 Si - Q4T	Q5 Si - Q5T	Q6 Si - Q6T	Q7 Si - Q7T	Q8 Si - Q8T	Q9 Si - Q9T	Q10 Si - Q10T	Q11 Si - Q11T	Q12 Si - Q12T	Total Si - total T
Z	−2.950[a]	−3.318[a]	−3.619[a]	−4.414[a]	−3.357[a]	−3.158[a]	−1.608[a]	−1.854[a]	−3.240[a]	−1.321[a]	−.821[a]	−2.023[a]	−3.905[a]
Asymp. Sig. (2-tailed)	.003	.001	.000	.000	.001	.002	.108	.064	.001	.186	.411	.043	.000

Discussion

The current study demonstrates that tutorial classes conducted by the structured interactive method increased student participation and also resulted in better recall of information in most of the students.

ANNEXURE 1

Format of Structured Interactive Tutorial on Hemostasis

Specific Learning Objectives

1.   State the steps of hemostasis?
2.   Explain the physiological basis of vascular spasm.
3.   Describe the steps of formation of temporary hemostatic plug.
4.   Describe the formation of definitive clot – clotting factors, extrinsic pathway and intrinsic pathway of coagulation.
6.   Explain the anti-clotting mechanisms
7.   Describe the common disorders of hemostasis

Steps of Tutorial

10 students – divided into 5 pairs
Question 1 – What are the steps of hemostasis. Discuss steps upto formation of temporary hemostatic plug.
Think, pair and share – Time – 6 min
Discussion with whole group – 5 min
Question 2 – Discuss the steps of extrinsic pathway of coagulation with regulating factors.
Think, pair and share – time – 6 min (1 min self notes, 5 min with partner)
Discuss in entire group – 7 min
Question 3 – Discuss the steps of intrinsic pathway of coagulation with regulation.
Think, pair and share – time – 6 min
Discussion with whole group – 7 min
Question 4
Group 1 and 2 – why whole blood does not clot in vivo and anticlotting mechanisms
Group 3 – mechanism of action of common anticlotting drugs (heparin, coumarin derivatives)
Group 4 – Disorders of hemostasis (purpura, Hemophilia)
Time – 6 min
Discussion for 10 min

Summarisation by Teacher Emphasising Key Points

1.   3 steps of hemostasis – vasoconstriction
Formation of temporary hemostatic plug
Formation of definitive clot
2.   Final common steps of formation of definitive clot involves activation of Factor X, which along with activated factor V and calcium converts prothrombin to thrombin. Thrombin converts fibrinogen to fibrin monomers which then form a dense aggregate through covalent cross linkages with the help of activated factor XIII.
3.   Extrinsic pathway is activated by tissue thromboplastin and involves activated Factor VII, calcium and phospholipids.
4.   Intrinsic pathway is activated by exposure to collagen fibres during injury and involves activated factors XII, XI, IX and VIII in that order.
5.   Common anti-clotting mechanisms operating in vivo are –
a. Anti-thrombin III – protease inhibitor
b. Heparin – inhibits factors XI, X, XI, XII
c. Thrombin-thrombomodulin complex inactivates factors VII & V. It also inactivates inhibitor of tissue plasminogen factor and activates plasmin which can lyse.
6.   Commonly used anti-clotting agents are heparin and coumarin derivatives (warfarin, dicumarol). Coumarin derivatives inhibit action of vitamin K which vit. K dependent factors like- II, VII, IX, X.
7.   Hemophilia A is a sex linked coagulation disorder due to deficiency of factor VIII. Hemphilia B is due to deficiency of factor IX.

Two interesting observations noted in our study were,

1.   The number of students scoring less in post-test was more in case of traditional tutorials (21%) whereas it was only 3% after the completion of structured interactive tutorials. This may indicate that because of lack of structure, some students got confused during the traditional tutorials and therefore scored less in the post-test after these tutorials.

2.   Though structured and interactive tutorials was a new concept for students and all the students

participated in the discussion, less number of students felt stressed during the structured interactive tutorials as compared to traditional tutorials. This may be because the tutor was part of the group and played the role of a facilitator, encouraging students to participate instead of only instructing. This is corroborated in a study by James M. Kilgour et al, 2016, who have listed tutorial structure and facilitator role among the key factors affecting student satisfaction level. Mpofu et al. (1998) investigated which aspects of group dynamics are important in the students' and faculty perceptions. Students identified participation and communication as most important and tutors identified involvement of students as an important issue. Hendry et al. (2003) investigated which group problems were most commonly experienced by students and tutors and which problems hinder student learning. In the students' perception the following problems were assumed to hinder student learning most: dominant student, a disorganized tutorial process with haphazard discussion, and superficial study of the problem (just scratching the surface). Structured interactive tutorials seek to correct these problems by encouraging participation of all students in a group and making the tutorial process more organised.

In the current study, more number of students performed better in the post-test after structured interactive tutorials and students expressed better ability to participate in the discussion. This demonstrates that incorporating the think, pair and share technique with discussion as a method of active learning helped in the process of the structured interactive tutorials. Similar findings were also reported in other studies (Srivastava et al., Byrne et al, Saleh et al) which employed different methods to improve student participation and learning. Srivastava et al, 2014, found significant difference in the post-test scores by interactive method as compared to traditional method using interactive intragroup tutorials. Byrne B. et al, 2015, using interteaching as a method of active learning in their study, found that students achieved a reasonably high learning skill level by this method.

Saleh et al, 2013, compared didactic lectures with interactive sessions in small groups and found that students in interactive sessions, performed better. In the current study there was no significant difference in the feedback of students regarding the ability to retain to retain concepts (question 7) and preparedness for an examination (question 8) after the two tutorial methods. This may be because the post-test was administered immediately after the tutorials and students couldn't assess the effect the tutorials would have in the long run.

In India, the Medical Council of India emphasises "There must be enough experiences to be provided for self learning. The methods and techniques that would ensure this must become a part of teaching learning process." Therefore, the introduction of structured interactive tutorials will be a step towards making tutorials more effective and learner centred.

The study limitation was that tutorials were conducted on only two topics of physiology. The same could be repeated with multiple topics from physiology to further assess the effectiveness of the structured interactive tutorials.

Conclusion

Structuring the tutorials and using the active learning technique of think, pair and share, allowed students to interact and discuss amongst themselves as well as with the tutor in a guided manner which resulted in better performance of the students and better student satisfaction with the tutorial process.

Contributions of Authors:

Dr. Priyadarshini Mishra – conceived and designed research, preparation and validation of questionnaires, selection of topics, logistics of conducting tutorials, training of tutors, collection and analysis of data, drafted manuscript, edited and revised manuscript.

Dr. Momi Baruah: preparation and validation of questionnaires used, selection of topics logistics of conduct of tutorials, training of tutors, collection of

data, edited and revised manuscript.

Dr. Vrunda Kolte: selection of topics, logistics of conduct of tutorials, training of tutors, collection of data, edited and revised manuscript.

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