

Reverse teaching- A strategy for undergraduate medical education in pathology

Hari Kumar Darnal^{1*}, Hematram Yadav², Sowmya Ramakrishnappa³, Barani Karikalan⁴

^{1,2}Professor, ^{3,4}Lecturer, ^{1,4}Dept. of Pathology, ^{2,3}Dept. of Community Medicine, ¹⁻³Mahsa University, Bandar Saujana Putra, 42610 Jenjarom, Selangor, Malaysia, ⁴Perdana University, MARDI Complex Jalan MAEPS Perdana, 43400 Seri Kembangan, Selangor, Malaysia

***Corresponding Author: Hari Kumar Darnal**

Email: hkdarnal891@gmail.com

Received: 23rd November, 2018

Accepted: 7th January, 2019

Abstract

Objectives: The purpose of this study was to explore the effectiveness of reverse teaching in learning the basic medical sciences in undergraduate pathology course.

Materials and Methods: Study design was interventional case –control. Participants were 150 first year medical students of University of MAHSA, Malaysia 2017-18. We used quantitative content analysis in pre and post teaching sessions and a delayed test score after 5 months. This result was compared with control group who were exposed to traditional pathology teaching.

Results: There was no significant difference in the pre test scores between control group and test group (independent sample t – test, $t = -0.836$, $p=0.404$). There was a significant increase in the test scores between the two groups for the immediate post- test (independent sample t – test, $t = -23.705$, $p<0.001$), test group performed much better when compared to control group. A significant difference in the test scores between the two groups was noticed in the delayed post- test after 5months (independent sample t – test, $t = -6.440$, $p<0.001$), test group performed slightly better than the control group.

Conclusion: Reverse teaching based on clinical scenarios has significantly increased score compared to control group ($P<0.001$ vs $P>0.072$).

Keywords: Backward class room, Flip class, Inverted teaching, Marketing class, Integration.

Introduction

The central role of science in medical education is fundamental and indisputable.¹ It is essential that the medical students understand the principles of basic sciences and appreciation role of translational research in basic sciences to uplift the quality of life. The *science* of medicine is the basis of paradigm shift in integrative medical education.² In most medical schools in Malaysia, a modified hybrid integrated curricula has been adopted in which the undergraduate pathology course is taught in first two years together with other basic science subjects. The whole gamut of teaching-learning process is primarily based on traditional lecture format catering to large cohort of students. This is followed by pathology-practical and tutorial classes in different time slots. Students are expected to connect the theory-knowledge taught in the lecture classes with the gross and histological features shown in the practical and tutorials. This naturally creates a wide gap in the students' understanding of the basic pathophysiological mechanism behind the disease process. This leads to serious difficulty for students in understanding and providing the correct responses for a particular clinical scenario in the integrated summative assessment.³ there is an obvious disconnect in teaching and assessment.

Further, over the years pathology has advanced as highly complex diagnostic discipline involved in personalized targeted therapeutics for patient care. Highly complex clinical medicine has been incorporated in teaching and assessment of pathology. This created a context of disinterest on the part of students in understanding the complex underlying biochemical basis of the disease

process or learning about the histological or molecular diagnostic criteria of the disease.⁴ According to traditional pathology teaching, more emphasis is given on the gross and microscopic histological changes related to a particular disease. There is no attempt on discussion on the molecular or biochemical changes responsible for a particular clinical case scenario. Further there no attempt to create space in the tight teaching schedule in preclinical basic science course to expose the students in such exercise. These clinical case scenarios can be best discussed by involving students to take part actively in reverse teaching sessions. This is what this research attempted do.

Of late much attention is targeted towards reverse teaching as tool of integrated medical education. These studies have focused on the application of digital technology rather than exploring the students' knowledge on a particular topic.⁵ This lacuna in teaching and assessment system is realized by many medical educationists who have devised their own innovation and conceptualization in their field of specialization leading to many innovative teaching and learning methods that have been described and incorporated successfully into the medical education curriculum leading to better outcome. One such important breakthrough is integration of pre-clinical and clinical subjects for better understanding of the disease process. It is usually done in separate sessions in the pre-clinical years where clinical students and clinical lecturers are invited to share the applied part of the basic science knowledge that is being taught to pre-clinical students in their current medical curriculum. This vertical integration is highly appreciated by our students. The above method was found to be very

successful and stimulating for the students in some Universities.⁵⁻⁷

Clinical case-scenarios have been used in pre-clinical years for the purpose of making the students understand basic pathophysiological mechanism of disease better. It also seems to make students understand applied aspects of basic science that is to be used in their future practice. One of the ways where clinical case scenarios are used is concept map made by computer software based on case scenario. The concept maps gave relevant clinical information needed for the understanding of basic pathophysiological mechanism involved. Studies have shown increased student satisfaction and agreed on the ease of understanding core pathophysiological concepts using case specific model based concept maps.^{7,8}

The aim of this study is to determine effectiveness of reverse teaching and compare it with the traditional mode of pathology teaching.

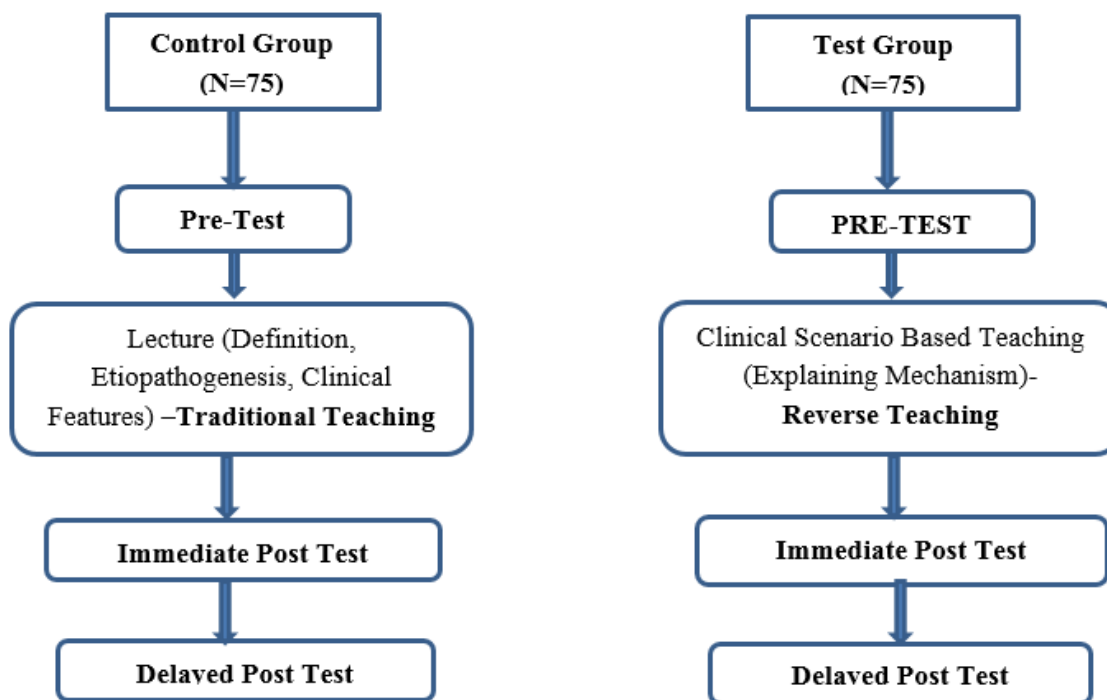
Materials and Methods

A study was conducted among 150 MBBS students (Year 1) at MAHSA University to teach pathology using clinical scenarios (test group) and another group (control group) to teach pathology in the traditional method. The students were randomized into a control group (n=75) and test group (n=75) via digital selection using their registration numbers. Informed consent was obtained from both group of students. The study was designed to explore

the impact of using clinical cases to teach pathology on students’ knowledge, skills and attitude with teaching pathology the traditional way. A pre-test was administered to both the groups; using a vetted questionnaire consisting of 30 extended matching questions (EMQ) on inflammation and healing. The questionnaire was validated.

1. Group 1 or the study group (test group) underwent one hour teaching by 1(DHK) on reverse teaching based on the same 30 clinical scenarios tested in pre-test.
2. Group 2 or the control group was given the same theoretical teaching on the same topic in conventional method (classroom teaching without actual clinical exposure) by another tutor.
3. After one hour of teaching both groups were re-tested on the same 30 EMQ
4. Both groups were post-tested after 5 months to assess their retention of information.
5. Both groups were again taught on same topic (inflammation) according to school schedule.
6. Feedback of test group who underwent reverse teaching were taken and analyzed.
7. The students’ performance was compared between the two groups by unpaired Student’s t-test whereas marks of the pre and post-tests for the same group were compared by paired t–test. Everywhere $p < 0.05$ was considered to be significant. The statistical software used was Microsoft excel and SPSS, version 18.

The following sequence of events were followed in this study



Results

There were 150 students divided into 2 groups. There was no significant difference in the pre test scores between control group and test group (independent sample t – test, $t = -0.836$, $p = 0.404$). The initial knowledge of both groups on the concerned topic was not significant and almost at similar level. Table 1 also shows that there was a significant increase in the test scores between the two groups for the immediate post- test (independent sample t – test, $t = -23.705$, $p < 0.001$), test group performed very much better when compared to control group. When the assessment was done after 5 months for both the groups there was a significant difference in the test scores between the two groups in the delayed post- test (independent sample t – test, $t = -6.440$, $p < 0.001$), but still test group performed slightly better than the control group. (Table 1)

A written student feedback evaluation was done among the test group and it was found that 38 (52%) of 75 students, agreed that clinical scenario was useful in remembering the pathophysiological mechanism and about 44 (60%) of them felt that clinical scenario helped them in better understanding of the pathophysiological mechanism and it should replace the traditional method of teaching as they felt it was better than the traditional method of teaching.

Table 1: Mean score of the control and test group after a pre-test, immediate test and post- test after 5 months

Test	Groups	n	Mean	Standard Deviation (S.D)	p value
Pre-test	Control	75	6.53	2.71	0.107
	Test	75	7.28	2.92	
Immediate Post-test	Control	75	9.72	3.79	<0.001
	Test	75	25.53	4.36	
Delayed Post-test (5 months)	Control	75	13.03	4.06	< 0.001
	Test	75	18.20	5.65	

Pre and post-test of control and test group with their means standard deviation and p value

Discussion

Basic science is an essential component in clinical practice and it should be implemented across the entire undergraduate medical education experience. It helps to develop a foundation in science, developing discipline and sharpens the students' thinking skills, logical reasoning, critical appraisal, problem solving, decision making and creativity.¹ Many newer innovations in medical education have included teaching of pathophysiological mechanism involved in many clinical case scenarios.

A certain amount of prior basic science knowledge is essential for such analysis. Explanations of the clinical scenarios are easily delivered if students have these basic knowledge but students find it extremely difficult to grasp these basic science subjects without any correlation or encore. Such correlation can be easily established if clinical cases are included in theory teaching.

We had a hypothesis that clinical scenarios based teaching will increase their interest in patients who may

come with these scenarios and score higher in response to various pathophysiological questionnaire options.

Our experience in other institution also highlight that 30 to 40% of these questions on basic pathological reaction of body to various stimuli can be correctly identified and answered correctly by our students without any prior explanation. Active participation by the students in such format of teaching naturally keep them engaged and stimulate them to think critically, and try to analyze laboratory data and come to few likely possibilities which further can be narrowed to one possible diagnosis. In this regard it must be mentioned repeated exposure and repeated mental analysis definitely improve each students' performance. However the pressure of examination and promotion to next stage put extra-ordinary pressure on all students to learn rather the tricks to pass examination than learn the science behind the science of medical education.

It points to 2 pertinent questions i.e why there was loss of information leading lower score at 5 months interval assessment in the test group who were taught in reverse method. Possible explanation could inadequate or unsatisfactory scenario discussion and unsatisfactory answers or students were overwhelmed by simultaneous information overload over a short period of time and did not have time to re-examine the exercise discussed in this research project on acute inflammation.

We would like point out that this point that acute inflammation and healing is not a very easy topic for year one students to discuss in case base scenarios and trying to explain the biochemical sciences behind it. However small percentage (<5%) of students had 100% correct score on post-test in test group even after 5 months' hiatus. After the immediate post-test, the whole class was re-exposed according the school rooster once again to traditional lecture on acute inflammation. That should reinforce their knowledge on the topic.

At 5 months interval we recollected all students' responses on inflammation on post-test and control group and analyzed which did not find any significant findings. So our research shows significant improvement in students' performance in immediate post-test but not in long term performance after 5 months. A revisit or revision by self at monthly/ quarterly basis could reinforce their sciences behind the science.

Conclusion

The results of the present study showed that first year medical students who participated in a Reverse teaching of pathology had better scores compared to students who were taught the conventional approach in pathology. The test group students had better knowledge during 1 month after the teaching as well as 5 months later. Hence we recommend that suitable changes in preclinical teaching methodology in pathology and adequate adjustment in time slot for qualitative improvement in our students' performance and understanding of the science behind the clinical presentations.

Limitation of the study

The students in the control group did not benefit from the intervention as only the test groups benefited. It would have been ideal to have a cross over study so that all the students would have benefited. However we conducted whole class session on the same topic later on the course. The overall scores of the control group could have been influenced by the test group as they are in the same class. (Hawthorne effect).

Acknowledgement

We would like to acknowledge the MAHSA University for allowing us to carry out the research and all the staff and students who helped in collecting the data. We especially thank our colleagues in the department of pathology and community medicine for their involvement and help in the research.

The study was approved by the ethical committee of the MAHSA.

University dated 11/10/2017 (RMC/EC08/2017). The data was analyzed using SPSS version 19. A p value less than 0.05 ($p < 0.05$) was considered statistically significant for all the tests done in the study.

Conflict of Interest: None.

References

1. Finnerty, Edward P; Chauvin, Sheila; Bonaminio, Giulia; Andrews, Mark; Carroll, Robert; Pangaro, Louis; Flexner Revisited: The role and value of the Basic Sciences in Medical Education. *Acad Med* 2010;85(2):349-55.
2. Association of American Medical Colleges. Contemporary Issues in Medicine: Basic Science and Clinical Research. Available (https://services.aamc.org/Publications/index.cfm?fuseaction=Product.displayForm&prd_id=201&prv_id=242). Accessed March 19, 2008.
3. Mazaher Ramezani, Mina Samadi, Afshin Alshin, Masound Sadeghi: Evaluation of academic motivation in medical students of basic and clinical stages in Kermanshah University of Medical Science during 2015-2016: a review of *Iran Stud Med Sci* <http://www.researchgate.net/publication/322049832>.
4. Damjanov I. Teaching of pathology at more than one level. *Hum Pathol (Internet)* 2005;36(2):135-8. available from <http://www.ncbi.nlm.nih.gov/pubmed/15754289>.
5. Bang Nguyen, Xiaoyu Yu, Arnold Japutra, Xiaoyu Yu, Cheng-Hao Steve Chen: Reverse teaching: Exploring student perceptions of "flip teaching" Shanghai University, P.R. China yuxiaoyu@shu.edu.cn Article first published online: November 26, 2015; Issue published: March 1, 2016 <https://doi.org/10.1177/1469787415616727>.
6. Holden JT, Westfall P: Learning style: Implications for instructions for Instructional Design. *Int J Instructions, Technol distance Learn* 2011;8(6) <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4896243>.
7. Sudha Jasmine Rajan, Tripti Meriel Jacob, and Sowmya Sathyendra. Vertical integration of basic science in final year of medical education. *Int J Appl Basic Med Res* 2016;6(3):182-5.
8. Anna Eisenstein, Lev Vaisman, MASc, Hillary Johnston-Cox et al. Integration of Basic Science and Clinical Medicine: The Innovative Approach of the Cadaver Biopsy Project at the Boston University School of Medicine. *Acad Med* 2014;89(1):50-3.
9. Anto'nio B. Rendas, Marta Fonseca, and Patricia Rosado Pinto. Toward meaningful learning in undergraduate medical education using concept maps in a PBL pathophysiology course. *Adv Physiol Educ* 2006;30:23-29.
10. Philip CT, Unruh KP, Lachman N, Pawlina W. An explorative learning approach to teaching clinical anatomy using student generated content. *Anat Sci Educ* 2008;1(3):106-10.

How to cite this article: Darnal HK, Hematram Y, Ramakrishnappa S, Karikalan B. Reverse teaching- A strategy for undergraduate medical education in pathology. *Indian J Pathol Oncol* 2019;6(2):233-6.