

Effectiveness of Flipped Class Room Approach as a Teaching Methodology in Anatomy for Early Clinical Exposure Modules for First-Year Medical Students – An Interventional Study

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ABSTRACT

Background: The National Medical Commission (NMC) of India has rolled out the competency based undergraduate medical curriculum in the year 2019 where there is more emphasis on integration of basic and clinical sciences, early clinical exposure (ECE) and clinical competence and skills. To achieve this it is essential to work on higher forms of cognitive work. Hence it reckons for the change in the teaching–learning methodology currently in practice. Thus we introduced a innovative teaching methodology such as flipped class room (FCR) methodology among first year medical graduates for early clinical exposure modules in anatomy.

Materials and methods: This interventional study was conducted among the 1st year MBBS students of Sree Balaji Medical College & Hospital (2019–2020 academic year). The ECE modules were taught using both traditional lectures and FCR methodology. Pre and post tests were conducted for both the methodology. A comparative analysis of FCR teaching method with lecture based session was done by obtaining the scores of the students. A Structured questionnaire to assess the learner’s perception about FCR teaching methodology was obtained from the participants. The Results were analyzed using microsoft excel and SPSS software version 23. Evaluation of teaching tool was done by using Kirkpatrick model

Results: Repeated measures Anova was applied and there was a significant difference within the two methodology and the interaction effect was also significant with P value 0.001. Although both methods show increase in mean from pre to post test the mean increase in flipped class method is more than the lecture. Spearman’s correlation was done which showed there is a significant relationship between both the methods with p value 0.001 correlation co-efficient r was 0.377. Overall Response to FCR method received higher rating.

Conclusion: FCR methodology creates the opportunity to meet the needs of students through various instructional activities. There is a positive reinforcement and improvement in the student’s performance.

KEY WORDS: Early Clinical Exposure, flipped classroom, Anatomy, student’s perception, traditional class.

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INTRODUCTION

Anatomy is one of the basic science discipline and the foundation for the training of future doctors. The National Medical Commission (NMC) the regulatory board for medical education in India has rolled out the competency based undergraduate medical curriculum in the year 2019 where there is more emphasis on integration of basic and clinical sciences, early clinical exposure (ECE) and clinical competence and skills, to achieve this it is essential to work on higher forms of cognitive work such as application, analysis, synthesis and evaluation of knowledge gained. Hence it reckons for the change in the teaching–learning methodology currently in practice. According to Bloom’s revised taxonomy, in traditional methodology of lecture sessions, the students are able to achieve only lower level of cognitive work like acquiring knowledge component alone [1]. The flipped classroom (FCR) approach enables instructor-led time to be dedicated to integration and critical thinking exercises, while students learn foundational material outside of class via online videos and learning assignments [2].

The flipped classroom (FCR) method encompasses two major elements. The first element involves delivering the lecture outside the classroom in the form of giving study materials, which can be of any format using electronic means [3]. The format can be varied from a slide presentation, video demonstration and evidence based website links. The second element of flipping the classroom includes problem based learning (PBL) and discussions, which reaches the next level of learning outcomes [4].

This leads to the application of knowledge, resulting in critical thinking. This can be achieved by more active learning opportunities for students in small groups, which increases one to one interaction between the student and the teacher [5].

This also paves way to the concept of self directed learning, where students become more responsible than the facilitator. In the flipped class, the students will be in more

active mode by spending most of the time in the practical application of the knowledge they gain [2]. The total duration allotted by NMC for ECE module of anatomy is 30 hours out of which 18 hours is for theory sessions and 12 hours is for hospital visit. The FCR methodology can be an alternate model that facilitates student centered learning and increases comprehensive thinking, by learning the subject at the individual’s pace and time. Thus we introduced flipped class room approach as a teaching methodology in anatomy for the theoretical sessions of ECE for first year medical undergraduates.

METHODOLOGY

The Study was conducted in Department of Anatomy of Sree Balaji Medical College & Hospital, Chennai. 218 students of first year MBBS (2019-2020 academic year) participated in the study. The study commenced after receiving informed consent from all the student participants and after obtaining Institutional Ethical Committee clearance. A total of 6 topics for the theory ECE module were chosen for the study. 3 topics (brachial plexus injury, inguinal hernia and varicose veins) for FCR teaching method and 3 topics for traditional lecture method (coronary artery disease, prolapse of uterus and Bell’s palsy) were taken. Pre and post test was conducted for both the methods of teaching. Problem based short answer question was asked in the internal assessment and in order to assess the practical application of the knowledge gained, OSPE charts was introduced in practical assessment. A comparative analysis of FCR teaching method with lecture based session was done by obtaining the scores of the students. A Structured questionnaire to assess the learner’s perception about FCR teaching methodology was also obtained from the participants. The Results were analyzed using microsoft excel and SPSS software version 23. Evaluation of teaching tool was done by using Kirkpatrick model

Level 1 (reaction): student’s perception on flipped class teaching was analyzed Student feed back (structured questionnaire)

Level 2 (learning): student’s learning was

assessed by Pre test and post test MCQ Internal assessment performance (Theory & practical)

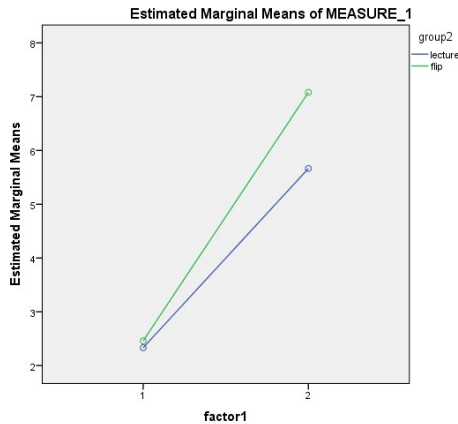
OBSERVATION AND RESULTS

Repeated measures ANOVA was applied to find the difference between and within 2 groups (2 methods). There was a significant difference within the group and the interaction effect was also significant with P value

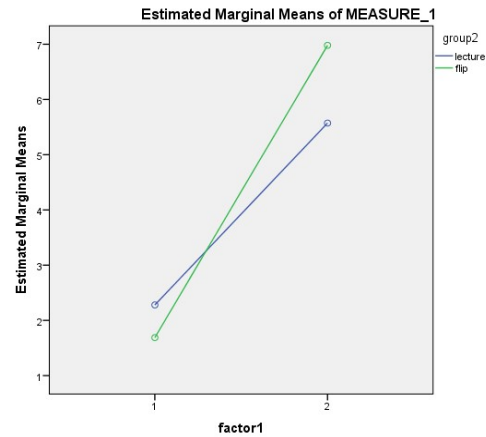
0.001 Although both methods show increase in mean from pre to post test the mean increase in flipped class method is more than the lecture based session.

Spearman’s correlation: There is a significant relationship between both the methods with p value 0.001 correlation co-efficient $r = 0.377$ for both method.

PROFILE PLOT

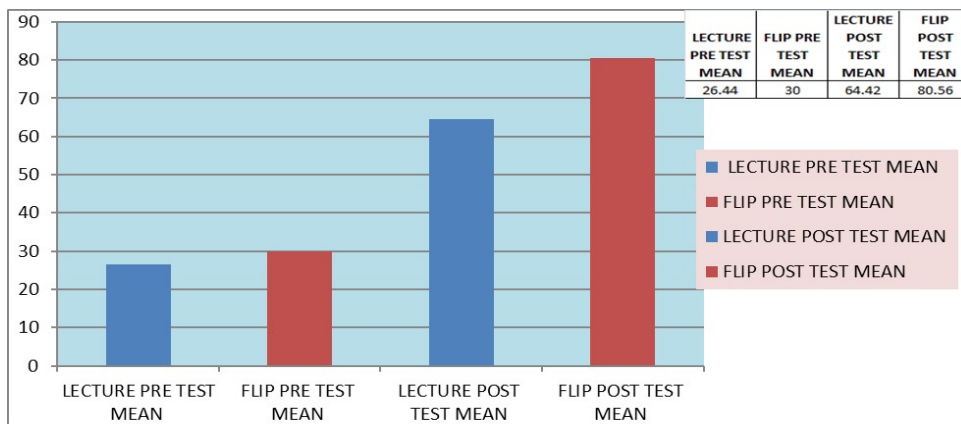


PROFILE PLOT

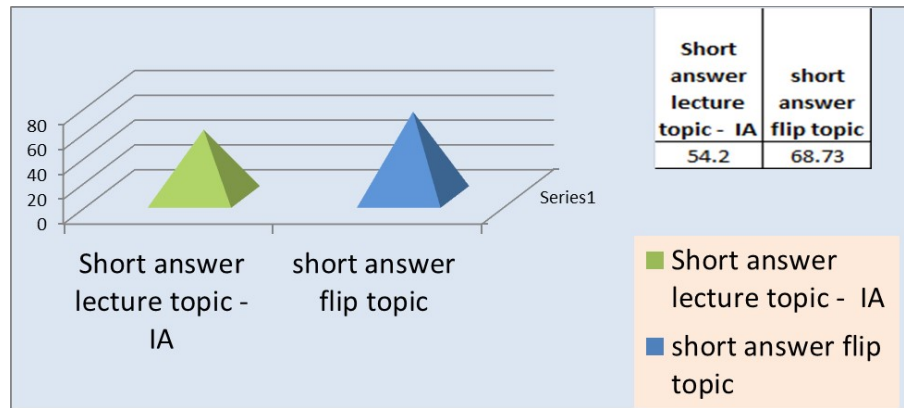


Correlations		shortl	shortf	lec1	flip1
shortl	Correlation Coefficient	1	.377**	.420**	.401**
	Sig. (2-tailed)	.	0	0	0
	N	250	250	250	250
shortf	Correlation Coefficient	.377**	1	.369**	.353**
	Sig. (2-tailed)	0	.	0	0
	N	250	250	250	250
lec1	Correlation Coefficient	.420**	.369**	1	.537**
	Sig. (2-tailed)	0	0	.	0
	N	250	250	250	250
flip1	Correlation Coefficient	.401**	.353**	.537**	1
	Sig. (2-tailed)	0	0	0	.
	N	250	250	250	250

Spearman's rho

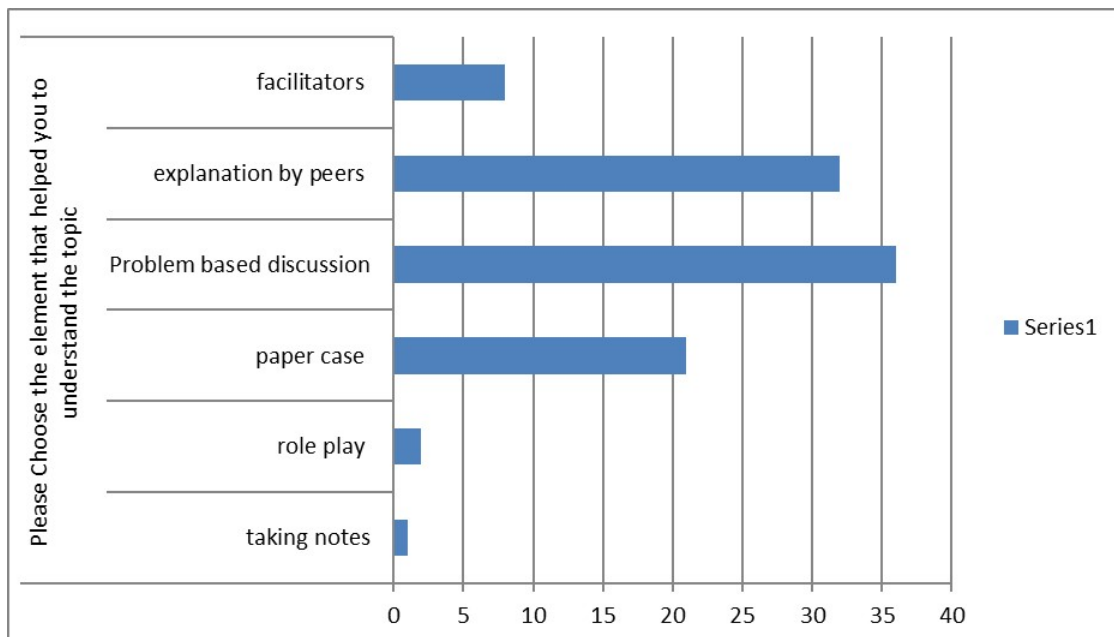
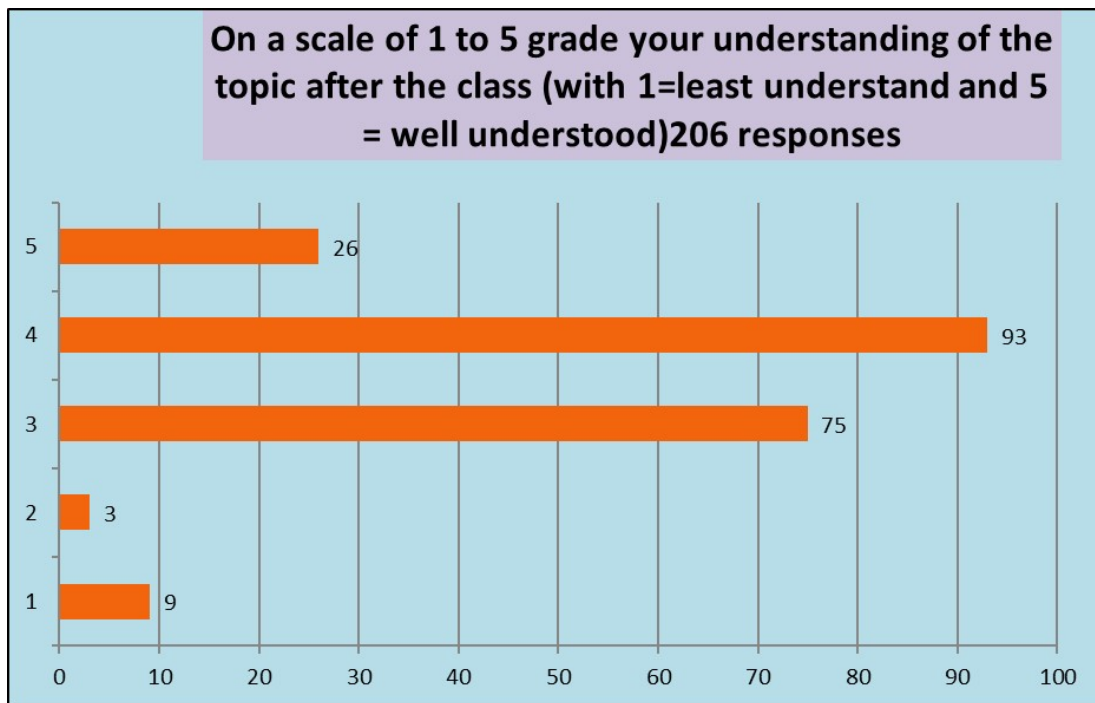


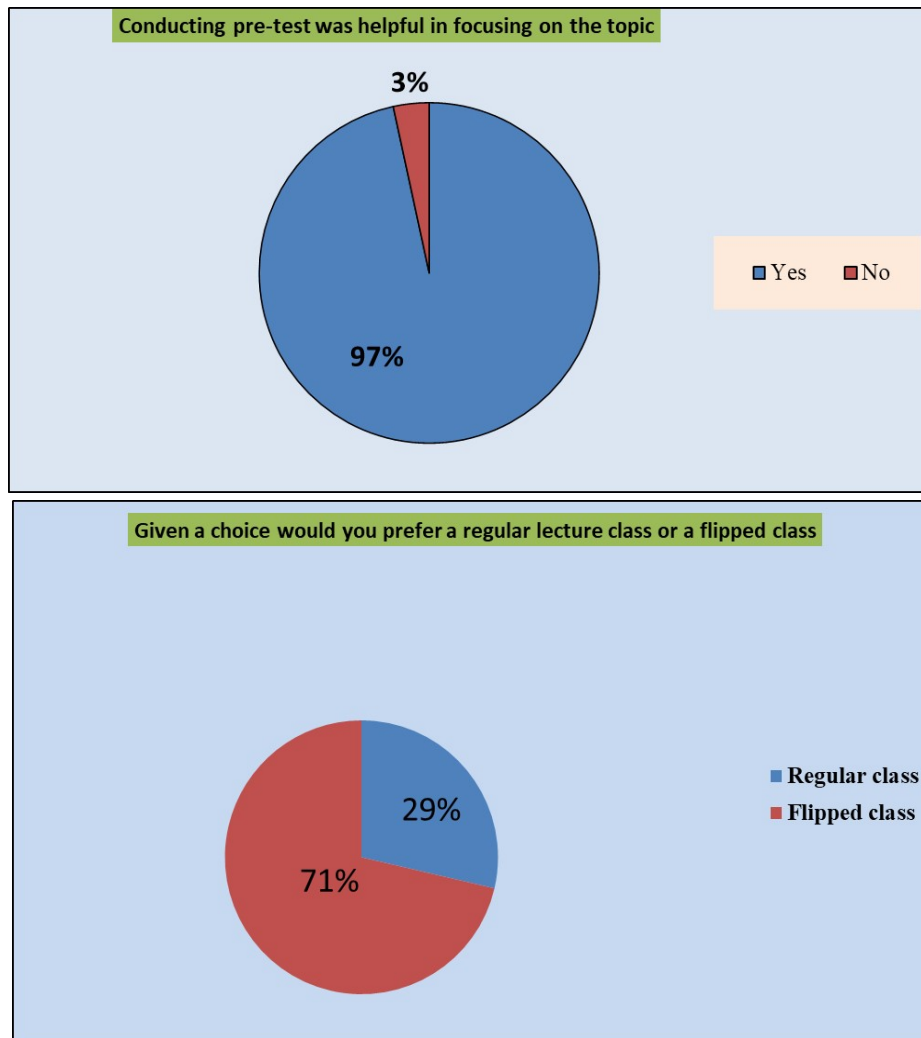
Comparative graphical representation depicting the mean scores of pre test and post obtained by students for both the methods



Comparative graphical representation depicting the scores obtained by students for problem based short answer questions for both the methods.

Student’s perception on flipped class





Early clinical exposure (ECE) is a teaching-learning methodology which fosters the exposure of medical students to the patients as early as the first year of medical college [6]. The NMC has allotted 18 hours for theoretical sessions of ECE in anatomy which can be challenging for medical educators. Understanding of clinical anatomy topics and their relevant clinical features can be overwhelming for first year medical graduates. The traditional method of teaching clinical concepts for ECE modules in anatomy usually involved showing videos of clinical presentation of cases and lecturing of anatomical correlation of clinical presentation of cases by the assigned faculty. However we used FCR method where the students are already pre prepared with the anatomical basis of the clinical case scenario and the class room hours is utilized only for discussion in small groups, role play of the case presentation, discussions of variation in the clinical case presentation and reinforcement of the anatomical core aspects

of the case presentation. This promotes active participation of the students and the faculties are only facilitators.

The ECE program in the MBBS curriculum rolled out by NMC tries to create an opportunity for students to learn first year subjects with clinical application. Learning of basic sciences in correlation or linking to a clinical context can definitely improve student's motivation to learn and increase retention. Using innovative techniques in the teaching methodology like FCR method can be rewarding in such context. The student centered approach employed in FCR fosters the development of lifelong learning skills [7].

FCR utilizes active learning, engaging students in two aspects, namely, doing things and thinking about the things they are doing [8].

In the present study, the overall student's performance was greater in FCR when compared to that of traditional lecture sessions, thus it reflects the influence of the

two teaching methodologies on the learning of the students. Tune et al. compared the effectiveness of a traditional lecture with modified FCR for cardiovascular, respiratory, and renal physiology for 1st year medical students at Indiana University and found the latter to be effective comparatively [9]. Based on Kolb's four styles of learning, it was found that flipped sessions were more effective than the traditional method. [10] In our study, students found FCR to be beneficial by being student friendly and reported that they were able to understand the basic concepts and that the FCR methodology promoted team based learning. Students also appreciated that the problem based discussion and role play done in FCR method enhanced their critical thinking thereby improved their understanding of core concepts of anatomy. Students also reported that they prefer more FCR based anatomical teaching sessions for ECE modules in the future, thus giving anatomy teachers more options in teaching methods that are different from the routine lecturing sessions. Similar to our study, the use of FCR method in various other disciplines and student's perceptions about this approach have been reported to be having a beneficial effect among students. [11-13]

Literature has also analyzed and states the negative impacts of FCR models. The results revealed that working or the study time for the students outside the class was comparatively more. The students resist learning topics on their own [14]. Angadi et al. revealed that student's scores have shown effective improvement, however students found the new approach to be overwhelming and intimidating [4].

Self motivation of the students also plays a major role in reading the pre class study materials. The negative impact of FCR can be overcome by identifying the student's readiness level for e Learning, self directed learning and increasing their motivation. Constant encouragement and guidance by the facilitators can motivate the student community helping them to overcome the challenges of small group discussion. Moreover, the small groups created within the students make them

more active and provide an opportunity for an one on one interaction within the group. This way, peer pressure becomes indirectly beneficial in improving the necessity of learning before the class. Nothing will replace seeing a patient; clinical experience and human interaction for the ECE module however owing to the practical difficulties of mobilizing large group of students on regular basis to an hospital setup the NMC has allotted 18 hours in anatomy for the theoretical sessions of ECE. Studies have shown the positive outcomes of ECE on medical graduates but clear guidelines as to how to conduct it, has not been given. Clinical experience by students is most essential for the future practice of medicine. However, by pushing students to learn essential medical knowledge and build skills and abilities beyond information recall, the flipped classroom represents a promising modality in medical education [15].

CONCLUSION

Our study demonstrates a successful implementation of FCR methodology in undergraduate medical students for teaching theoretical sessions of ECE modules in anatomy based on both improvement in student's performance and positive feedback. Adaptation of newer teaching methodology is necessary to meet the new curricular reforms and the demands of NMC of India. We strongly believe that our study would help the academicians to remodel their teaching methods by providing valuable insights. The present study is limited to assess the effectiveness of FCR methodology for ECE modules in anatomy sessions alone in 1st year MBBS students. Future studies are needed to implement the same in other subjects of the MBBS curriculum.

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REFERENCES

- [1]. Brame CJ. Flipping the classroom. In: Brame CJ, editor. Science Teaching Essentials. Edition 1. Academic Press: United States 2019. p. 121-32.
- [2]. Arnold Garza S, Towson University, Albert S, Cook Library. The flipped classroom teaching model and its use for information literacy instruction. *Comm Info Lit* 2014;8:7.
- [3]. Shinaberger L. Components of a flipped classroom influencing student success in an undergraduate business statistics course. *J Stat Educ* 2017;25:122-30.
- [4]. Angadi NB, Kavi A, Shetty K, Hashilkar NK. Effectiveness of flipped classroom as a teaching-learning method among undergraduate medical students – An interventional study. *Educ Health Promot* 2019;8:211.
- [5]. Bassir SH, Sadr Eshkevari P, Amirikhorheh S, Karimbux NY. Problem based learning in dental education: A systematic review of the literature. *J Dent Educ* 2014;78:98-109.
- [6]. Al-Saadi T, Al-Sharqi A, Al Kharosi AS, Alshaqsi M, Al Badi M, Al-Kalbani T. Early clinical exposure during medical school: Omani medical students and interns experience. *Educ Health Prof* 2020;3:77-81.
- [7]. Belfi LM, Bartolotta RJ, Giambone AE, Davi C, Min RJ. “Flipping” the introductory clerkship in radiology: Impact on medical student performance and perceptions. *Acad Radiol* 2015;22:794-801.
- [8]. Hartikainen S, Rintala H, Pylväs L, Nokelainen P. The concept of active learning and the measurement of learning outcomes: A review of research in engineering higher education. *Edu Sci* 2019;9:276.
- [9]. Tune JD, Sturek M, Basile DP. Flipped classroom model improves graduate student performance in cardiovascular, respiratory, and renal physiology. *Adv Physiol Educ* 2013;37:316-20.
- [10]. Rajprasath R, Kumar VD, Murugan M, Goriparthi BP, Devi R. Evaluating the effectiveness of integrating radiological and cross sectional anatomy in first year medical students A randomized, crossover study. *J Educ Health Promot* 2020;9:16.
- [11]. Veronese C, Richards JB, Pernar L, Sullivan AM, Schwartzstein RM. A randomized pilot study of the use of concept maps to enhance problem based learning among first year medical students. *Medical Teacher* 2013;35:e1478-84.
- [12]. Belfi LM, Bartolotta RJ, Giambone AE, Davi C, Min RJ. “Flipping” the introductory clerkship in radiology: Impact on medical student performance and perceptions. *Acad Radiol* 2015;22:794-801.
- [13]. Hartikainen S, Rintala H, Pylväs L, Nokelainen P. The concept of active learning and the measurement of learning outcomes: A review of research in engineering higher education. *Edu Sci* 2019;9:276.
- [14]. Tshibwabwa ET, Cannon J, Rice J, Kawooya MG, Sanii R, Mallin R. Integrating ultrasound teaching into preclinical problem based learning. *J Clin Imaging Sci* 2016;6: 38.
- [15]. Williams DE. The Future of Medical Education/ : Flipping the Classroom and Education Technology. 2016;14–5.

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