

A Proposed Undergraduate Cardiology Curriculum using Active Teaching Model at Cairo University Hospitals (An Active Teaching Cardiology Curriculum)

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ABSTRACT

Introduction: This project is a course intended to be an introduction to basic clinical cardiology for final year undergraduate medical students. The course is already ongoing, yet it is being delivered in a lecture format that is limited by the inherited low retention rate characteristic to this teaching model.

Aim: This project aims at transforming the lecture based curriculum into a more modern, interactive, learner driven teaching model.

Patients and Methods: The course content will be delivered at Cairo university hospitals and will be divided into three main parts, each will be delivered in five sessions. Basic clinical skills including blood pressure measurement and local cardiac examination of valvular heart disease patients will utilize the Peyton's model for procedural teaching, ECG interpretation will utilize the flipped classroom model and finally common cardiac emergencies, for which we will utilize a case-based collaborative learning method. A verbal approval has been obtained from the department head and we will start recruiting the team of trainers who will be responsible for implementing this course. We will need to set one or two training sessions for the attending staff to orient them on why and how we are modifying the current teaching method. I foresee some resistance from some of the team members who are familiar with the current methods of teaching and believe it is effective and need not be changed, but I believe the planned orientation sessions can help break the ice and highlight the importance of modern teaching methods. Another important limitation is the number of students, we currently receive around 150 students per rotation which is a number that would require large number of staff members particularly for small group teaching sessions, this limitation would require planning at the faculty administration level targeting reduction of the number of students per rotation. Finally, this project is intended to follow a stepwise approach, starting off with the ECG part to test its feasibility.

Key Words: Active teaching, cardiology curriculum, case based collaborative learning, flipped classroom, peyton's model for procedural teaching.

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INTRODUCTION

This project is a course intended to be an introduction to basic clinical cardiology for final year undergraduate medical students. The course is already ongoing, yet it is being delivered in a lecture format that is limited by the inherited low retention rate characteristic to this teaching model. This project aims at transforming the lecture based curriculum into a more modern, interactive, learner driven teaching model. The author of this publication believes that this proposal can act as a cornerstone in the transfer process of undergraduate and postgraduate teaching at Cairo university, from the traditional lecture based model to a more effective active teaching model. This project was submitted to the Harvard T2T Egypt course that was held in 2020 as part of the joint cooperation between the Egyptian ministry of health and Harvard school of medicine. This

capstone project was selected among the top 20 achievers from 800 candidates.

PATIENTS AND METHODS:

Goals and objectives:

The goal of this course is to introduce undergraduate students to the basic Cardiology curriculum. This will be achieved through distinct objectives that all participants will be expected to achieve at the end of the course. The objectives are designed to follow the S.M.A.R.T acronym which stands for Specific, Measurable, Attainable, Relevant and Time bound. These objectives are as follows:

1. Measurement of arterial blood pressure.
2. Recognize the auscultatory findings of mitral and aortic valve disease.
3. Demonstrate a 5-step approach to interpret two surface electrocardiograms, one of ischemic heart disease and the other of a cardiac arrhythmia.
4. Describe the difference of character of chest pain in ischemic heart disease vs aortic dissection.
5. Develop an algorithm, based on symptoms and clinical signs and basic investigations, that differentiate different cardiac emergencies namely acute coronary syndrome, acute heart failure, pulmonary embolism and aortic dissection.

The Cardiology department, Faculty of medicine, Cairo university, receives undergraduate medical students in regular rotations during their final year. Each group would spend 3 weeks rotation in the cardiology department followed by an assessment exam and there is already a functioning lecture based curriculum (Fig. 1). The major limitation of this model is the inherited limitation of lecture based education programs which is lack of long term retention [1], this is reflected in suboptimal performance in the assessments after the course and most importantly in the skills retained to those learners as interns, which is just few months following these rotations. Also, because the lecture-based model is the least that involves the learner needs and his intrinsic motivation, based on the adult learning theory [2], I have noted that if attending the lecture is left to the discretion of the learners without regulations related to absence, a significance percentage of them would opt to leave the lecture regardless the educational and communication skills of the lecturer. I don't believe that a needs assessment for a new model of teaching e.g flipped classroom, case based collaborative learning etc... had ever been performed in our hospital, but I strongly believe that it is needed and I would plan to send out a survey for our students to confirm my observations and try to get a sense on whether switching to a more learner involved teaching model would be more desired and thus results in more motivation and eventually adherence and better learning outcomes.

Time allocated: this course curriculum runs over a period of three weeks, five teaching sessions per week and each session is of two hours duration followed by an assessment session.

Venue: the course will be held at the Cardiology department of Cairo university hospitals, we would need to utilize a medium sized teaching hall, the intensive care for bedside clinical review of common cardiac emergencies and one of the wards for bedside training on how to measure blood pressure and perform local cardiac examination for

patients with valvular heart disease. In case the lockdown related to the Covid-19 pandemic persisted or restarted, the teaching sessions will be scheduled using one of the online video conference platforms (zoom or cisco-webex).

Content: will be classified into three main groups

• **Group 1:** Arterial blood pressure measurement and local cardiac examination of patients with valvular heart disease (5 sessions)

Session 1: Arterial blood pressure measurement

Session 2: Mitral Valve disease

Session 3: Aortic valve disease

Session 4: Multi-valvular affection

Session 5: Multivalvular affection practice session

• **Group 2:** ECG interpretation (5 sessions)

Session 1: Normal ECG and heart rate calculation

Session 2: Chamber enlargement

Session 3: Ischemic heart disease

Session 4: Conduction block

Session 5: Arrhythmias

• **Group 3:** Common cardiac emergencies (5 sessions)

Session 1: Acute coronary syndrome

Session 2: Acute heart failure

Session 3: Acute Aortic dissection

Session 4: Acute pulmonary embolism

Session 5: Differential diagnosis of acute chest pain

Trainers: this course would require the collaboration of a group of faculty members. Each of the three above groups will be assigned to a team consisting of a full professor, 2 associate professors, 4 lecturers and 4 assistant lecturers. One or more orientation sessions will be performed to the trainers to orient them on why and how we will proceed with modifying the current teaching method. The orientation session will discuss the merits of using active teaching methods in increasing students' retention rates and the evidence that support superiority of active teaching models over traditional learning methods. It will also ensure familiarity of staff members with active teachings and methods of how to perform objective assessment of

students including the criteria of effective Multiple choice questions examination (MCQs) and how to conduct an objective structured clinical examination (OSCE).

Methods:

Group 1:

The method used in this group will mainly depends on flipped class room model [3] and Peyton's model for procedural teaching [4] where students will be asked to review Macleod's clinical examination book chapter corresponding to the topic being discussed as a prework, they will receive a link to online videos demonstrating the pathophysiology of the valve lesion being addressed and the pitfalls of blood pressure measurements in its corresponding session, the team of lecturers and assistant lecturers of this group will be responsible for recording the online videos, we will make sure that the online videos contain interpolated tests to reduce mind wandering and improve retention rates. Students will also be asked to download the heart murmur lite app (free app) available in the App store and play store to be able to practice listening to different cardiac murmurs (this will be particularly important if the sessions had to be performed online as a result of the Covid-19 lockdown). During the sessions, which will be conducted in the ward of the Cardiology department on actual patients, they will be asked to follow the four steps of Peyton's model (Demonstration, deconstruction, Comprehension and performance).

Group 2:

This group will depend on a flipped classroom model where students will receive short 5 minutes demonstration videos describing the pertinent teaching points according to the topic of each session, the team of lecturers and assistant lecturers of this group will be responsible for recording the online videos in the same format as the previous group. Students will also receive five 12-lead surface electrocardiograms to review and write a short comment on as a prework and on the day of the session each student, in a small group session, will be asked to present one ECG that he finds interesting and the staff member will pass on a couple of ECGs for each group for discussion. At the end of each session, a quiz ECG will be handed out for discussion in the next session.

Group 3:

In this group, a case-based collaborative learning approach will be adopted [5]. Prework will be send out before hand in the form of a review article addressing the topic of the session that needs to be reviewed. A short MCQ assessment addressing the topic will be send via email and asked to be returned prior to the session. In the session, two case-based clinical scenarios will be presented, the class will be divided into small groups who will be asked

to discuss together open ended questions related to the case and then one student off each group would be asked to present the result of their discussion. The last session will be held in the ICU, on the bed side of patients presenting with acute cardiac emergencies where each group of students get to listen to history and examine patients with different cardiac emergencies, as deemed appropriate according to their clinical situation. This last session will be waived if the COVID lockdown persisted or restarted and will be replaced by an online session during which students will listen to pre-recorded short videos of three controlled subjects narrating the presenting symptoms of different types of cardiac emergencies. Each group will be asked to construct their own algorithm based on symptoms, clinical signs and basic investigations for patients presenting with acute chest pain/shortness of breath to help reach a final diagnosis of the different causes of acute chest pain/shortness of breath.

Implementation:

The department head has been approached verbally and a copy of this proposal was sent to him explaining the advantages of modifying the current teaching methods. The project will be performed at Cairo university hospitals that already has a structured educational program. This projects entails modification of the undergraduate cardiology curriculum and thus it is feasible and would only require approvals and training of the responsible staff members. I believe that to insure sustainability of this change, it has to be done through the faculty administration and the change has to be consolidated through solid written approved protocols. The current project is based on evidence from several education research, theories and teaching techniques that have proven significance in reducing mind wondering and improving retention rates, including: flipped classroom format, Peyton's model for procedural teaching, case based collaborative and interpolated testing.

Assessment:

Learner assessment:

Formal assessment of the knowledge and skills of the learners at the end of the course utilizing MCQs format and OSCE [6] format for assessing the clinical skills. MCQs will be pulled out from a previously constructed MCQs bank. The OSCE will be prepared by a committee composed of a professor and an associate professor from each of the three groups. Six stations will be prepared, two by each group. Group 1 will prepare a station for measuring the blood pressure and another for auscultating a patient with mitral stenosis, group 2 will prepare two ECGs one showing anterior wall myocardial infarction and the other showing ventricular tachycardia and group 3 will prepare a station for history taking from a patient who presented with acute aortic dissection, operated upon and is currently stable and the last station is for counselling a post

myocardial infarction patient regarding smoking, level of activity and resuming sexual life after his heart attack.

Program assessment:

I'm planning to compare those grades with grades of comparable previous groups to assess whether the modification resulted in objective improvement of the students' performance. Also I believe that sending out another survey after the new modifications assessing the students' satisfaction and comparing it to the original needs assessment survey would be beneficial. Also comparing non-obligatory attendance rates before and after the modification can be beneficial for giving us an idea on how valuable the modifications are.

Challenges:

There may be resistance to change from some of the team members who are familiar with the current methods of teaching and believe it is effective and need not be changed but I believe the planned orientation sessions can help break the ice and highlight the importance of modern teaching methods.

Another important limitation is the number of students, we currently receive around 150 students per rotation which is a number that would require large number of staff members particular for the small group teaching sessions, this limitation would require planning at the faculty administration level targeting reduction of the number of students per rotation.

Frequently the sustainability of a certain project depends on the administration, I believe that there is a risk that with a change in the administration, the implementation of the change may fade. Again the best way to do that is through contacting the faculty administration and consolidating the change through solid written approved protocols.

In terms of cost, I have made sure when designing this course not to resort to fancy expensive technology that could be unavailable or result in undue delay due to cost issues. We will depend on resources that are readily available and actual patients rather than simulation models for this particular reason. In terms of time, I believe the step that could consume sometime is the making of the online material namely the videos, selecting relatively large team should overcome this limitation.

In case the lockdown persisted or restarted, this will negatively affect the demonstration of physical signs but this is a global situation that we have to deal with given the safety of our students and staff members, these negative effects will be ameliorated through the online demonstration videos, the heart sounds lite app and the use of controlled subjects during the online sessions.

Date			Topic
1.	Sunday	18/12	Course orientation and cardiac investigation
2.	Monday	19/12	Mitral regurgitation
3.		19/12	Mitral stenosis
4.	Tuesday	20/12	Clinical cases- قسم ٢٣
5.	Wednesday	21/12	Aortic stenosis
6.		21/12	Aortic regurgitation
7.	Thursday	22/12	Diagnosis of Heart failure and Cardiomyopathy
8.		22/12	ECC workshop 1
9.	Sunday	25/12	Treatment of Heart failure and Cardiomyopathy
10.			ECC workshop 2
11.	Monday	26/12	Clinical cases- قسم ٢٣
12.	Tuesday	27/12	Ischemic heart disease Management of stable angina
13.		27/12	Cardiac emergency (aortic dissection, PE)
14.	Wednesday	28/12	ECC workshop 3
15.		28/12	Ischemic heart disease Acute coronary syndrome
16.	Thursday	29/12	Cardiac emergency (AMI, Tamponade, Shock)
17.		29/12	ECC workshop 4
18.	Sunday	1/1	Management of endocarditis
19.		1/1	Hypertension
20.	Monday	2/1	Management of Arrhythmia
21.	Tuesday	3/1	Clinical cases- قسم ٢٣
22.	Wednesday	4/1	Miscellaneous cases and course evaluation
23.	Thursday	5/1	Examination

Fig. 1: Schedule of the currently available course curriculum in one of the rotations.

DISCUSSION

Several studies confirmed the superiority of active teaching methods over traditional lecture-based models, however, to our knowledge none of these studies was conducted in Egypt or the Arab world.

In a study by Sawatsky and colleagues, the investigators studied engagement, immediate knowledge achievement and long term knowledge retention in 69 internal medicine residents during noon conference in a prospective controlled study comparing active teaching formal versus traditional lecture based format. The investigators found an improvement in engagement using the active teaching model (4.78 vs. 3.80, $P < 0.01$) and improvement in initial

knowledge achievement (overall absolute score increase of 11%, $P = 0.04$) and a trend toward improvement in long-term knowledge retention [7].

Wong and colleagues studied an intervention group of 101 first-year pharmacy students, who took a cardiac arrhythmia class with the flipped teaching method. Their examination scores were compared to a spring 2011 control group of 105 first-year students who took the class with traditional teaching methods. An online survey was conducted to assess student feedback from the intervention group. The mean examination scores of the intervention group were significantly higher than the mean examination scores of the control group for the cardiac arrhythmia classes in pharmacology (with $89.6 \pm 2.0\%$ vs $56.8 \pm 2.2\%$, respectively) and therapeutics ($89.2 \pm 1.4\%$ vs $73.7 \pm 2.1\%$, respectively). The survey indicated higher student satisfaction for flipped classes with highly rated learning objectives, recordings, and in-class activities [8].

Montassier *et al* conducted a prospective, randomized, controlled, noninferiority study among 98 fifth-year medical students who were assigned to the e-learning group or the lecture-based group. The e-learning and lecture-based groups were compared on a score of effectiveness. As compared with the lecture-based course, e-learning was noninferior with regard to the post course test score (15.1; 95% UCI 14.2; $+\infty$), which can be compared with 12.5 [the mean effectiveness in the lecture-based group (15.0) minus the noninferiority margin (2.5)] concluding that the e-learning course is an effective tool for the acquisition of ECG interpretation skills by medical students [9].

CONFLICT OF INTEREST

There are no conflicts of interest.

REFERENCES

1. Taglieri, Catherine, *et al*. "Comparison of long-term knowledge retention in lecture-based versus flipped team-based learning course delivery." *Currents in Pharmacy Teaching and Learning* 9.3 (2017): 391-397.
2. Knowles, Malcolm S. "Andragogy: Adult learning theory in perspective." *Community College Review* 5.3 (1978): 9-20.
3. Cabi, Emine. "The impact of the flipped classroom model on students' academic achievement." *International Review of Research in Open and Distributed Learning* 19.3 (2018).
4. Hungerford, Harold R., and Robert Ben Peyton. "Procedures for Developing an Environmental Education Curriculum. A Discussion Guide for UNESCO Training Seminars on Environmental Education. Environmental Educational Series 22." (1986).
5. Krupat, Edward, *et al*. "Assessing the effectiveness of case-based collaborative learning via randomized controlled trial." *Academic Medicine* 91.5 (2016): 723-729.
6. Harden R. M., Gleeson F. A. Assessment of clinical competence using an objective structured clinical examination (OSCE). *ASME Medical Education Booklet No, 8. Medical Education* 1979; 13: 41-54.
7. Sawatsky AP, Berlacher K, Granieri R. Using an ACTIVE teaching format versus a standard lecture format for increasing resident interaction and knowledge achievement during noon conference: a prospective, controlled study. *BMC Med Educ.* 2014 Jul 1;14:129.
8. Wong, Terri H., *et al*. "Pharmacy students' performance and perceptions in a flipped teaching pilot on cardiac arrhythmias." *American journal of pharmaceutical education* 78.10 (2014).
9. Montassier *et al*, e-Learning versus lecture-based courses in ECG interpretation for undergraduate medical students, *European Journal of Emergency Medicine*: April 2016, Volume 23, Issue 2, p108-113.