

# **Designing a PBL and TBL Curriculum that Enhances Education Opportunities for General Medical Practitioners in Mozambique**

## **Theme: Skills Development**

### **Subtheme: Skills Development for National Development**

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## **BACKGROUND**

West Virginia University and the Catholic University of Mozambique have established a partnership for improving medical education in Mozambique. The Catholic University of Mozambique Faculty of Medicine was established relatively recently in Beira, Sofala Province in 2000. The first class of physicians graduated in 2007.

The initial curriculum was established in cooperation with the University of Maastricht in the Netherlands as a problem-based learning (PBL) curriculum. In this curriculum, students learn the basic science subjects by working through cases based on local epidemiological profiles. While this type of PBL curriculum has been successful in the Netherlands, as well as elsewhere in the world, it has not been as effective at Catholic University of Mozambique based on student performance on standardized tests provided in both the Netherlands and Mozambique. These standardized test results particularly identified weaknesses in anatomical knowledge of the Catholic University of Mozambique students when compared with performance of the students at University of Maastricht.

To identify the source of these weaknesses, members of the anatomy faculty at West Virginia University traveled to Mozambique to evaluate the current curriculum at the Catholic University of Mozambique Faculty of Medicine. For comparison, and to better understand the student population and resources available elsewhere in the country, we also met with and interviewed faculty at the government-run Universidad Eduardo Mondlane, which uses a more traditional lecture-based curriculum of basic sciences education. Faculty at the Universidad Eduardo Mondlane have begun to implement some PBL classes as well, but not as the primary teaching method.

## **NEEDS ASSESSMENT**

Our goal was to identify why a curriculum successful elsewhere was not as successful at the Catholic University of Mozambique, especially for anatomical education. To do this, we interviewed faculty at both the Catholic University of Mozambique and the Universidad Eduardo Mondlane to learn more about their background and preparation to teach anatomy, as well as the background of the students enrolling in the medical schools in Mozambique, examined the facilities and other resources (i.e., textbooks, libraries, computers with internet access) available, and copies of the available PBL cases used for teaching in the first two years of the medical curriculum at Catholic University of Mozambique.

In addition to interviews conducted at the medical schools, we extended our inquiries to officials within the Minister of Health's office and the recently established National Doctor's Council, as well as current physicians graduated from each of the two medical schools to gather more information about the resources available to newly graduated physicians, preparedness for practice, access to post-graduate continuing education, and the environment in which new graduates practice medicine in the Mozambican context.

## **CHALLENGES**

Both the Catholic University of Mozambique and the Universidad Eduardo Mondlane have small faculties for teaching at the medical schools. While the Catholic University of Mozambique has faculty with strengths in such areas as epidemiology and microbiology, only one full-time faculty member is sufficiently trained to teach anatomy. Both universities rely upon physicians from nearby central hospitals to supplement their medical teaching. A key difference between the two universities is that the Universidad Eduardo Mondlane has a dedicated laboratory space for cadaver dissection, which is the classical method employed for anatomical education. The Catholic University of Mozambique lacks such facilities. Instead, the Catholic University of Mozambique relies on anatomical models and student observation of autopsies at the Central Hospital in Beira for anatomical training.

When faculty at the Catholic University of Mozambique were interviewed, we determined that there was great variability in the information presented to students by the faculty facilitators of their PBL group. This variability existed in the amount of information offered, the amount of effort students needed to demonstrate to obtain that information, and which subject areas were emphasized by individual facilitators. Often, facilitators emphasized the subjects with which they were most comfortable, i.e., those reflecting their own specialization areas.

On the other hand, because of the extreme physician shortage in Mozambique, newly graduated physicians are required to spend 2 years in clinical service in locations assigned by the Minister of Health's office. These locations include rural health centers and clinics where there may be only one or two physicians assigned to serve a large patient population. Therefore, the problem solving, clinical reasoning and independent learning skills that a PBL medical curriculum develops are essential for the new graduates expected to practice immediately upon graduation. Without the mentoring of more senior physicians, recent graduates are expected to be fully independent practitioners.

## **TEAM-BASED LEARNING AS SOLUTION**

Based on the needs of the Mozambican medical students, and the prompt immersion into practice post-graduation, we determined that the most suitable curriculum for basic sciences education, especially in anatomy, would be introduction of a team-based learning (TBL) curriculum in the first years of the medical curriculum, years 0 and 1. The TBL method was first developed and presented by Michaelson (1992), and has been gaining acceptance for teaching of medical students (Thompson et al., 2007). Team-based learning has been demonstrated to

promote critical thinking skills and long-term retention of basic sciences required in the medical curriculum (McInerney, 2003). A recent study in the U.A.E. assessed the effectiveness of team-based learning as preparation for later problem-based learning courses (Abdelkhalek et al., 2010). Similar to the Mozambican context, students were not yet prepared for the level of independent learning required in a fully problem-based learning curriculum upon entry to university. After initial coursework employing team-based learning, students were more successful in their later problem-based learning courses. We propose a similar approach for the Mozambican students.

Similar to a problem-based learning curriculum, team-based learning requires students to work in small groups to independently solve problems (Michaelson, 1992). However, team-based learning also meets several needs of the Mozambican students that problem-based learning does not address. Most importantly, one faculty member can facilitate multiple teams in a single classroom, managing as many as 200 students (Fink, 2002). This is in contrast to problem-based learning, where one faculty facilitator is required per group of 8 to 10 students. Secondly, team-based learning is more structured around specific, pre-determined learning objectives, whereas in problem-based learning, students are expected to formulate their own learning objectives. The structure of team-based learning is more suited to provide uniform learning among students of diverse educational backgrounds who still need to develop independent learning skills.

There are several components to team-based learning (Michaelson, 1992):

First, students are assigned preparative work. This preparative work can be of many types, selected to suit the course objectives. For example, in the case of anatomy, they may be asked to complete a dissection of a particular anatomical region, read an assigned textbook chapter pertaining to that region, attend a brief lecture on the subject, or read case studies discussing the consequences of abnormal development, disease or injury of structures within that region.

Second, effectiveness of student preparation is assessed. Students are given a brief multiple-choice style quiz at the beginning of the class session based on the preparatory assignment. This determines their individual readiness. After this brief quiz, the class divides into assigned teams, and the students work together to answer the same set of quiz questions. When students in the group differed in their responses on the individual quiz, they are encouraged to discuss their reasoning and arrive at a consensus on the correct answer. This allows students who had gaps in their preparation to benefit from the explanations of their peers. Importantly, the quizzes are immediately graded to provide feedback to the students on their level of preparation prior to continuing the remainder of the TBL exercise for the day.

After the students are quizzed individually and in groups about the preparatory material, they are presented with a series of application type questions, which require problem-solving skills and synthesis of information from the preparatory materials to answer. In order to direct the focus of the discussion, again, multiple choice answers are provided. These multiple choice answers have multiple part answers and can have more than one "correct" option offered with the most correct choice requiring prioritizing of importance, as is often encountered in a clinical situation.

When students have completed their group application questions, the answers each team chooses are presented to the class. Inter-group discussion is then facilitated by the instructor who asks students to defend their own answers, or explain why they do not think another group's response is correct.

The session concludes with an opportunity for each group to identify a new set of questions that the discussion raised for them and would help complete their understanding of the

subject if they were answered. These questions can either be answered in impromptu format by the instructor at the end of the session, or more formally in a subsequent summary lecture.

While team-based learning is quite structured, there is also flexibility to adapt each component to the needs of the specific course, the experience level of the instructor, and the resources available to the students.

Specifically, for the purpose of teaching anatomy to the Mozambican medical students, formal preparatory lectures are recommended. At the Universidad Eduardo Mondlane medical school, there are several qualified faculty already able to provide these lectures. At the Catholic University of Mozambique medical school, there is only one full-time faculty member qualified to teach anatomy, but with minimal experience in providing formal lectures on the subject. However, at the Catholic University of Mozambique, a computer facility with internet access is available to the students. Pre-recorded lectures prepared by faculty at the partner institution, West Virginia University could be provided for those students. Currently, the Catholic University of Mozambique does not have a cadaver dissection facility. Photographs and videos, although less than ideal, can supplement their learning until resources are obtained for building such a facility.

The most challenging aspect of developing a team-based learning curriculum is writing the questions students will answer. These are typically written by teams of faculty with content-expertise. Again, this is a component of the curriculum that can be provided by the partner institution in collaboration with the Mozambican faculty.

As with any new curriculum, the team-based learning exercises will evolve over time as well. For example, when first introduced, the anatomy faculty may not be comfortable with answering impromptu questions at the end of the session, and may instead choose to answer the questions in a more formal lecture after allowing time to prepare responses. As they become more comfortable and experienced in facilitating these exercises, they will be better able to answer questions in an impromptu format. Additionally, a benefit of recording the student questions to prepare formal lectures is to revise the application questions or preparatory material to answer these questions, if appropriate. Because of our determination that the PBL curriculum was not uniformly applied by all faculty facilitators, support in training the faculty in the TBL method is also essential for success.

The method of assignment of students to teams is an important consideration. Typically, students are assigned to teams in a pseudo-random fashion, with factors such as previous coursework in the subject and gender balanced across groups. In Mozambican universities, students in year 0 typically have had no previous exposure to the anatomical sciences, so we do not consider this an important consideration in balancing the team assignments. Instead, we consider students' fluency in English as an important factor in balancing assignments. Many of the textbooks available to the students are written in English, whereas the national language of Mozambique is Portuguese. In addition, many of the lectures offered to the students are given in English, particularly at the Catholic University of Mozambique where visiting faculty who are not fluent in Portuguese often give the lectures. Faculty at the Catholic University of Mozambique anecdotally reported that students arriving at the medical school with stronger English language skills perform better in the courses offered. Therefore, we will consider English language skills in assigning students to teams. We anticipate that this will allow the students with weaker English skills an opportunity to learn from their peers during the team discussions, which can be held in Portuguese. We hypothesize that this team-based learning model with team assignments balanced for foreign language proficiency will be useful in any educational environment where students are taught in a language other than their native spoken language.

In summary, we expect that using a team-based learning curriculum supplemented with traditional lectures to teach basic science courses in years 0 and 1 of the medical curriculum will prepare Mozambican students to be more successful in using a PBL curriculum in later years of

more advanced clinical training. This approach will initially be tested in the anatomical sciences, as students at the Catholic University of Mozambique currently exhibit the greatest weakness in that subject.

## REFERENCES

Abdelkhalek, N, Hussein, A, Gibbs, T, Hamdy, H 2010, 'Using team-based learning to prepare medical students for future problem-based learning', *Medical Teacher*, vol. 32, no. 2, pp. 123-129.

Fink, LD 2002, 'Beyond small groups: Harnessing the extraordinary power of learning teams', In LK Michaelsen, AB Knight and LD Fink (eds.), *Team-based learning: A transformative use of small groups*, Praeger, Sterling, VA pp. 3-27.

McInerney, MJ 2003, 'Team-based learning enhances long term retention and critical thinking in an undergraduate microbial physiology course', *Microbiol Ed J* vol. 4, no. 1, pp. 3-12.

Michaelsen, LK 1992, 'Team learning: A comprehensive approach for harnessing the power of small groups in higher education.' In DH Wulff and JD Nyquist (eds.), *To improve the academy: Resources for faculty, instructional, and organizational development*, New Forums Press, Stillwater, OK pp. 107-122.

Thompson, BM, Schneider, VF, Haidet, P, Levine, RE, McMahon, KK, Perkowski, LC and Richards, BF 2007 'Team-based learning at ten medical schools: two years later', *Medical Education*, vol. 41, pp. 250-257.