

CURRICULUM
DEVELOPMENT AND ASSESSMENT

Physiology education in the medical program at Mandume Ya Ndemufayo University: content description and critical overview

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Abstract

The Faculty of Medicine at Mandume Ya Ndemufayo University began teaching in 2009, taking on the challenge of outcomes-based education and aiming to train qualified professionals according to the needs of the community. This article aims to describe and analyze how the teaching of physiology is organized in the medical program at this university. This is a descriptive study of the course pedagogical plan from 2009 to 2020. The results revealed that there is a correspondence between learning outcomes of the Physiology course, the competencies set out in the Profile of the Angolan Doctor, and internationally established sets of competencies. Some weaknesses were identified in relation to the development of skills, pedagogical methodology, and the evaluation process. The recent educational context of this medical school poses great challenges, which require the contextualization and periodic adjustment of its pedagogical plans.

NEW & NOTEWORTHY An Angolan faculty of medicine has taken on the challenge of outcomes-based education, aiming to train qualified professionals according to the needs of the community. This article aims to describe and analyze how the teaching of physiology is organized. The results revealed a correspondence between learning outcomes, the competencies set out in the Profile of the Angolan Doctor, and internationally established sets of competencies. The educational context requires contextualization and periodic adjustment of pedagogical plans.

medical education; pedagogical plan; physiology; teaching

INTRODUCTION

Angola recognizes the role of institutions of higher education in guaranteeing sound scientific, technical, cultural, and human preparation, promoting scientific research and the provision of services to society. They are therefore required to observe high quality standards, striving for excellence, merit, and innovation, in the fields of teaching, scientific research, and participation in the development of the country (1).

Competency-based medical education is an educational model that has become a trend worldwide, aiming to equip students with demonstrable competencies or learning outcomes translated into relevant knowledge, skills, and attitudes necessary for medical practice and adequate to meet the needs of community health care (2, 3).

There are several competency frameworks, the result of collaborative processes, which form the basis of competency-based medical education for medical schools; these emphasize the importance of biomedical sciences as a scientific foundation for medical practice (4–7).

The Profile of the Doctor in Angola, drawn up by Agostinho Neto University's Faculty of Medicine, in collaboration with

the Faculty of Medicine of Porto and with the participation of the Ministry of Health and the College of Physicians of Angola, lists the skills considered essential to a doctor's clinical performance in Angola, according to the criteria defined by the World Federation of Medical Education (8–10). In addition to the competencies that must be acquired by the end of the course, it also presents a set of skills aimed at the basic sciences and their contribution to the training of the desired professional (8).

Learning outcomes are verifiable statements about what a student should know, understand, and be able to do, providing guidance for their studies (11, 12).

Regarding physiology, several medical schools define as learning outcomes the domain of the normal functioning of organs and systems and their interactions, the demonstration of laboratory skills in the analysis and interpretation of data obtained, as well as their clinical application (13–16). General skills such as capacity for autonomous learning, responsibility, teamwork, critical and reflective thinking, oral and written communication, and public presentation of scientific articles or reports are also among the expected results (16, 17).

The traditional curriculum of basic sciences in medical schools has demonstrated deficiencies, including curricular



fragmentation, lack of clinical applicability, and deficient student involvement in the learning process (18). Schools that follow the traditional curriculum teach physiology in the basic or preclinical cycle, over two or three semesters (13, 14, 16, 17, 19, 20), and teaching is fundamentally based on lectures and laboratory practices (18, 21).

Currently, there are many medical schools that have adopted a new curricular organization in their courses, opting for different levels of curricular integration, which have the advantages of reorganizing the curriculum, combining units and reducing their number, as well as introducing active learning methodologies (2, 18, 22, 23).

The Faculty of Medicine of Mandume Ya Ndemufayo University (FMMNU) emerged from a collaboration between the governments of the Republics of Angola and Cuba for the development of higher education and the training of health professionals in Angola (24). The medical course at FMMNU started its teaching activity in 2009 and, as described in pedagogical plan of the Physiology course, it is believed it has a structure capable of providing the necessary requirements for the training of a competent professional to develop actions for the promotion, prevention, restoration, and rehabilitation of health (24).

The curriculum design contributes to the training of the physician with the profile expected (5), and the Physiology course is considered a central component of the undergraduate medical curriculum (6, 7). At FMMNU, the Physiology course is taught in the preclinical cycle and it is divided into Physiology I and II (taught in 2nd and 3rd semesters). This article aims to describe the way in which physiology teaching is organized in the medical program at Mandume Ya Ndemufayo University and to analyze the contents and curricular organization and their relationship with the competencies that future doctors should have at the end of their pregraduate training.

MATERIALS AND METHODS

This is a descriptive study on the pedagogical plan of the Physiology course in use at FMMNU, from the beginning of its teaching activities in 2009 until the year 2020.

A review of the Study Plan for the Medical Course and an analysis of the pedagogical program for the disciplines of Physiology I and II were made, based on the internal documents provided by FMMNU. The objectives and learning outcomes defined for those subjects were analyzed according to the curriculum contents. This study plan did not change during the study period.

RESULTS

Pedagogical Objectives and Learning Outcomes

The objectives stated in the pedagogical plan of the discipline are divided into educational and instructive objectives; the former are the same for both curricular units, Physiology I and Physiology II, whereas the latter are very similar but differ regarding the specific content covered, as mentioned below (Table 1).

Educational objectives:

- 1) Attaining materialistic and dialectical thinking to “defend scientific positions and repel diversionary

Table 1. Content taught in Physiology I and II

Physiology I	Physiology II
Theme 1. General physiology of excitable and contractile tissues; organization of reflex nervous activity	Theme 1. Physiology of the blood
Theme 2. Physiology of sensory systems	Theme 2. Physiology of the circulatory system
Theme 3. Nervous control of balance and body movements	Theme 3. Physiology of the respiratory system
Theme 4. Nervous control of visceral functions; hypothalamus; limbic system	Theme 4. Physiology of the urinary system
Theme 5. Dream and wakefulness; higher functions of the nervous system	Theme 5. Physiology of the digestive system
Theme 6. Physiology of the endocrine system	Theme 6. Energy exchange with the environment
Theme 7. Physiology of the reproductive system	

- currents in the field of discipline” and take “fair positions” before the community, society, and the world;
- 2) A scientific approach to actions and procedures as a professional, allowing him to abstain from the subjective and teleological character of nature, society, and physiological phenomena.
- 3) The development of cognitive skills, focusing on continuous learning and autonomy; the knowledge of the characteristics of man in his relations with the environment, so that it serves as a basis for the knowledge of the symptoms and mechanisms of various diseases;
- 4) The development of a humanistic character, elevating values such as solidarity, modesty, honor, honesty, and generosity in their relations with others;
- 5) The development of a critical and self-critical character, recognizing the fairness of the priority of the interests of the majority to the detriment of their own, as well as the strict disciplinary subordination of “the last before the first.”

Instructional objectives defined for the Physiology I and Physiology II courses:

- 1) “Interpret functional expressions of tissues and systems perceived or detected in different ways (observation, exploration, graphically, etc.) that occur in physiological and/or pathophysiological (rest, exercise, organic insufficiencies, etc.) situations of these systems with a degree of depth that will be able to reach the mechanisms at the cellular and, often, molecular level that will be foreseen in the specific objectives of the class as sufficient and not more than necessary for the application of knowledge by the Basic General Physician.”
- 2) “Predict the functional expressions of the tissues and systems indicated in *objective 1*, which should be expected in young adults in physiological and/or pathophysiological situations (rest, exercise, organic deficiencies, etc.) referred to (these functional expressions) in different ways, with a degree of depth that will be able to reach the mechanisms at the cellular and, with some frequency, molecular level that will be described in specific lesson objectives according to what is sufficient and no more than necessary for the application of the knowledge by the Basic General Physician.”

The instructional objectives were constructed taking into account the content defined to be covered by the two disciplines as shown in Table 1.

The pedagogical plan values the link between physiology (as part of the basic sciences) and the clinic, highlighting the essential aspects in order to prevent encyclopedism. There is a delimitation of the approach, clarifying what should and should not be taught, as well as its depth and limitation. The required depth is that which is necessary to satisfy the resolution of a clinical problem presented, being sufficient and no more than necessary for the application of knowledge by the basic general practitioner.

According to the pedagogical plan, the instructional objectives are outlined at a level of productive or reproductive assimilation, corresponding to the level of application complexity. The plan adds a clarifying note that the productive level encompasses the reproductive, which are exploited by the application of knowledge, that the skills of identifying, describing, and explaining are contained in those of interpreting and predicting, and that when interpreting and predicting the student must identify the fact to interpret, describe, and explain it before concluding his answer with the importance, meaning, and prediction of consequences, thus completing the exploration of these two skills.

The specific objectives are essentially directed to the interpretation and prediction of physiological and pathophysiological situations related to each of the themes.

Prerequisites

For the Physiology I course, in addition to knowledge of cellular and molecular biology, functional morphology of basic tissues, embryonic development, organogenesis, and anatomy of the ostemioarticular system, obtained in the previous semester, students should have fundamental ideas about their future functions as basic general practitioners, studied in Society and Health.

For Physiology II, knowledge of cell biology, biochemistry, histology, and anatomy is required, as well as society and health and physiology.

Teaching Strategies and Methodology

The pedagogical model is declared to be outcomes based. According to the pedagogical plan, the discipline is taught in close coordination with other disciplines so that the student receives the content related to the same topic at the same time, facilitating integration, allowing the appropriate distribution of weekly work time, and avoiding unnecessary repetition, making use of common terms and approaches. The program states that this form of curricular organization requires interdepartmental work by the Interdisciplinary Coordination Committee or Horizontal Committee.

Although the declared adopted pedagogical model is outcomes based, the selected methodology is the traditional one, mainly based on didactic lectures, essentially favoring problem-solving (normal or pathological) in all teaching activities.

New content is taught in the lectures, always starting with a problem situation (working on interpretation and prediction skills), as described at the pedagogical plan: “the solution of which, by the teacher and in cooperative dialogue with students, requires information, which will be the

content of the lesson.” The essential aspects, which the student must study independently to do their assignments, are indicated in the conclusions. In independent study, the student deepens and consolidates knowledge and exercises its application, following study guides.

Laboratory practices, practical classes, and seminars are the other forms of teaching indicated, which call for a reduction in the number of students. In the laboratory, the student must be able to interpret the experimental results, and in the seminars he must independently resolve, interpreting or predicting according to the case, the different situations presented verbally.

For Physiology I and II, there is a bibliographic research assignment on a physiological or pathophysiological problem related to primary care. It presents the physiological basis for such situations and the most significant functional tests for their study. The assignment is presented by the student before a jury.

Study Materials

The main base bibliography is the Guyton and Hall *Textbook of Medical Physiology* (25), which is complemented by a brochure published by ISCM-Habana (Higher Institute of Medical Sciences of Havana), and the *Review of Medical Physiology* by Ganong (26).

Evaluation System

The evaluation system consists of frequent evaluations, partial evaluations, and final evaluations. As described, frequent evaluations correspond to students' activities in laboratory practices, practical classes, and seminars; partial evaluations consist of two partial knowledge assessment tests and a bibliographic research paper. The final evaluation is done with a final exam (oral or written). The final classification calculation includes all evaluations performed, with a weight proportional to the volume and the importance of each. Physiology has been seen as challenging, and throughout the study period the performance of students remained mostly at the lowest levels, “Fail” (<10 points) and “Sufficient” (from 10 to 13 points), on a scale of 0 to 20 points.

DISCUSSION

The pedagogical plan of the medical course of the FMMNU was established in 2009, and since then it has not been subject to any review. It was inspired by the Cuban medical curriculum, and it was believed that the adopted structure was capable of providing the necessary requirements for the training of a competent professional to develop actions for the promotion, prevention, restoration, and rehabilitation of health (24). Since 2009 medical education has evolved, and with this work we intend to look at the Physiology program with a critical view of the defined objectives, the methodologies used, the assessment methods, and the way it is organized, and thus contribute to its improvement and training of better doctors.

Pedagogical Objectives and Learning Outcomes

Different terms such as “educational objectives,” “learning objectives,” “pedagogical objectives,” or “learning outcomes”

are used to define the knowledge, attitudes, or skills that students must have acquired by the end of a teaching/learning period, and there is no universal agreement upon their definitions (5, 15, 27, 28).

González and Leonardo (28) state that educational objectives reflect what is intended to be formed in terms of convictions and feelings, directed at aspects of the personality, from a philosophical, political, professional, ethical, and aesthetic point of view. Instructional objectives are limited to the skills to be learned, which are associated with a set of knowledge linked to the mastery of the discipline's content (28).

The educational objectives for the Physiology course at FMMNU point to scientific, critical reasoning and the development of character, which when confronted with the Profile of the Angolan Doctor agree with the competencies set out within the scope of professionalism and personal development. However, considering the way those educational objectives are stated, it is not explicit how students can evidence they are able to demonstrate their achievement at the end of the learning process.

Instructional objectives are described with the verbs "to interpret" and "to predict" and are placed at the application level.

Formulating instructional objectives requires setting out the necessary skills and corresponding knowledge, identifying the methods, means, and other resources that the student will use to acquire the knowledge and achieve the skill, and determining the level of mastery the student should have of the content and the depth with which the necessary content is learned to master each skill. The starting point for all of this should be the problems that the future professional must know how to solve (27).

The integration of knowledge can be done through the analysis and interpretation of the problems presented. However, and according to the study plan, these problems are presented and solved by the teachers, which calls into question the way in which the students make this integration, as presented above in *Teaching Strategies and Methodology*.

Learning outcomes are a guiding element in curriculum planning and teaching-learning organization. They promote student-centered learning and provide coherence between training, evaluation, and the overall outcomes that students must achieve (11, 12).

When constructing learning outcomes, underlying principles must be taken into account. For example, they must be clear, observable and measurable, feasible, and relevant, with clear criteria for their evaluation, and they must have a direct relationship with the skills to be learned in the course (11, 27, 28).

Considering the instructional objectives as the outcomes students are able to demonstrate they have achieved at the end of the Physiology course, they contribute to the learning in clinical courses. For example, the basic theoretical-practical knowledge of physiology facilitates the understanding and rational deduction of pathophysiology, diagnosis, treatment, and prevention of diseases in the systems studied, carrying out functional explorations and laboratory techniques, as well as interpreting results (17).

When analyzing the objectives proposed in the course plan for physiology at FMMNU, it appears that in terms of

knowledge (according to Bloom's taxonomy) they cover the first five levels of complexity, the last being achieved by the verb "to predict" (29).

The attitudes to be developed by the students are transversal across the entire medical program and are mentioned in the educational objectives; however, the plan does not clarify how they will be developed or evaluated within the course. It seems there is a lack between what is stated in the objectives and what pedagogical methodology is used to facilitate their achievement. One way of encouraging them seems to be associated with how the teaching is organized, such as the standard to which these conferences/lectures set out in Cuban programs are carried out (30). This model could be used in this course, with the necessary adaptations.

Throughout the course plan, mention is made of laboratory practices, student and experimental research work. However, clear objectives related to the development of these skills are not stated.

The objectives (educational and instructional) presented in the Physiology course plan reflect the intention of creating a closer link between clinical practice and the basic sciences, as set out in the Study Plan for the Medical Program at FMMNU (24). This connection must pass from intention to a clearly described strategy in the course plan, based on the on-the-job training model promoted in the Program Study Plan and in other disciplines such as comprehensive general medicine.

Within the real context of clinical practice, students will be able to gain experience that helps consolidate content studied as well as develop and apply skills and attitudes. This can be an illuminating and complementary factor that helps students to be able, in an objective way, to know where and how to allocate the different competencies (knowledge, skills, and attitudes) that are being acquired in the course.

There is a correspondence between the competencies listed in the Profile of the Angolan Doctor, in the FMMNU Medical program plan, and in the Physiology course plan, and in general it agrees with international experience within the different competency frameworks (2, 7–10, 13, 15–17, 22, 29, 45). However, it is not explicit how students can acquire some of these during the course.

In setting up specific objectives, they must contemplate the task to be carried out (the act, the content, and the condition of accomplishment) and the evaluation criteria (acceptable level of action that the student must reach) and must be relevant, logical, concrete, feasible, observable, and measurable (31).

The specific objectives included in the course plan are related only to the domain of knowledge. And, although the classification of the different components of the objectives is subject to interpretation, which leads to some variation (32), it appears that in general they only present the action and the content.

Adequate exposure to physiological concepts provides the necessary basis for studies in clinical courses (30).

The course plan states that there must be a basic-clinical connection and delimits the approach to the content so that students have the necessary depth to satisfy the resolution of a presented clinical problem. It is emphasized that this should be "sufficient and no more than necessary for the application of knowledge by the basic general practitioner."

It is important to reflect on what is considered sufficient or indispensable content for the physician, since different clinical problems require different depth. This can be combined with the question raised by Hansen (33) about the outcomes in learning physiology (recognizing that these condition the content) on which they should focus, in the case of basic level subjects, for better understanding or in direct application in clinical practice.

Content overload is a persistent problem and has a negative impact on understanding, so it is essential to clearly define what a student should know after taking the Physiology course, what the intended learning outcomes are, and what it is desired he should retain after completing the program (although this has been discussed, there is still no universal agreement on this point) (20, 31, 34).

The categorization and prioritization of content favor the delimitation of the extension and depth that students must master, as well as preventing curriculum hypertrophy or content overload. International experience, for example at the Faculty of Medicine at the University of Ibadan (Nigeria) and the Faculty of Medicine at the University of Barcelona, and the learning objectives drawn up by the American Physiological Society (APS) and the Association of Chairs of Departments of Physiology (ACDP) show the same thing (2, 7, 35).

Prerequisites

There is some discrepancy between the course curricular program and the medical curricular plan at FMMNU, since the Functional Morphology of Basic Tissues course and the Society and Health course are not taught and embryonic development is addressed in the Embryology course, which is taught only in the second semester, at the same time as Physiology I.

In the program, Biochemistry corresponds to the curricular units Molecular Cell Biology and Intermediate Metabolism and its Regulation, taught in the 1st and 2nd semesters, respectively, thus corresponding to the requirements for Physiology II.

Teaching Strategies and Methodology

In the curricular organization at FMMNU, it appears there is horizontal integration, with temporal coordination, although the course is taught in an isolated way.

The course program calls for interdepartmental work by the Interdisciplinary Coordination Committee or Horizontal Committee, so that curricular integration is achieved within a competency-based approach teaching model.

For Silva (32), the difficulties of integrating basic knowledge with clinical practice are not a matter of curricular content but rather a defect in strategy, emphasizing that the basic sciences make the difference between progress and stagnation, since these are indispensable for research (without which there is no medical progress).

The traditional methodology adopted by FMMNU, characterized mainly by the interrogative method and/or the presentation of "problems," tries to stimulate reasoning and logical thinking. However, the teaching and learning process is not centered on the student since the course plan states that in the classroom it is the teacher who solves the problem, with the student's participation, and we may question the feasibility of the competence-based model adopted.

There is growing concern and a call for the transition from traditional lectures to interactive teaching and learning (32, 46).

Student-centered and active learning methodologies are international trends, and their adoption may be of added value given their verified effectiveness in different contexts (18, 21, 36–41). Therefore the use of these methodologies is highly recommended in the Physiology course.

The course plan does not clarify whether practical classes, laboratory practices, and seminars are other forms of teaching or evaluation or whether they work for both but at different times.

Sometimes, the idea communicated is that there is a simultaneous combination of learning and evaluation, and the purpose of each of these forms of teaching/evaluation is not identified, nor what they consist of. For example, will they serve to improve understanding of some topic? To learn something new? Or to develop some skill?

Several medical schools around the world make use of practical and laboratory activities for the development of skills in physiology, which contribute to the development of skills for clinical practice (2, 14–17, 35, 40, 42). An example is the measurement of blood pressure, where students have to train in the technique and interpret the results.

As the medical program of the FMMNU is in close relation with the same program in Cuba, some reforms could be adopted for the Physiology course like the integration of all basic sciences. The new course, Morphophysiology, uses workshops, integrating seminars, and practical classes (30) and may be an opportunity to introduce new pedagogical approaches like active learning that facilitates students' development of communication skills, attitudes, and values related to the medical profession and consolidation of knowledge and scientific research.

The FMMNU program plan includes student monitors, which could be an opportunity for the implementation of the peer teaching strategy (43), to improve teaching and learning in physiology.

The course plan includes 128 teaching hours for lectures (68 hours for Physiology I and 60 hours for Physiology II) and 36 hours for practical classes, laboratory, and seminars (34 hours for Physiology I and 30 hours for Physiology II).

It appears that the time specifically allocated to activities in which students can have a more active role is limited. On the other hand, the plan allots a total of 224 h for students' self-preparation distributed among the different learning activities.

Active methodologies have the advantage of reducing class time and placing the student at the center of the teaching-learning process. An example is the Nelson R. Mandela School of Medicine (South Africa), which adopted a problem-based curriculum. Time in class with a teacher in larger groups was reduced (from 144 h in the traditional model to 48 h), as was the duration of each practical session (from 36 to 14 h) (21). The adoption of those methodologies may represent a gain in the effectiveness of the teaching and learning process, allowing the teachers to dedicate more time to student guidance.

Study Materials

The use of the Guyton and Hall *Textbook of Medical Physiology* is transversal to many physiology courses around

the world; examples are the All India Institute of Medical Sciences (13), the Faculty of Medicine of the Autonomous University of the State of Morelos (Mexico) (14) and the Faculty of Medicine of the Complutense University (Spain) (23). However, nowadays there are other resources with interactive tools that can be also effective for student learning and complement this classic manual.

Evaluation System

The FMMNU medical course plan calls for a qualitative and integrative system of evaluating students' performance, based on the principles of objectivity, systematization, and continuity, with a feedback system that can adequately monitor the teaching-learning process (24).

The Physiology course plan does not clarify the characteristics of each of its forms of evaluation, and the instruments to be used are not clearly defined. For example, for the final evaluation it is not clear what it consists of or what its limitations are. It also appears that evaluations are fundamentally geared to knowledge, whereas skills and attitudes are not observed, according to the objectives defined.

The plan does not state the formative evaluation, and feedback opportunities are not identified.

Evaluation of the Curriculum

The Physiology curriculum was designed by a group of professors of the Physiology Department of the Institute of Basic and Pre-Clinical Sciences "Victoria de Girón." There were six full professors and one assistant professor for the design of the Physiology I plan and five full professors for Physiology II.

It is necessary to regularly review medical curricula (every 5 yr) to ensure that they reflect changes in society (2). The review of teaching programs is an essential component of curriculum development and implementation. It is important to take into account students' ideas and suggestions, as they are useful for improving the quality of the existing curriculum (19, 44).

The lack of an evaluation plan for FMMNU's pedagogical activities is a weakness that may reduce the quality of training of future doctors. Therefore, a periodic review is required as well as adapting the plan according to the school's context and societal needs.

Lessons Learned and Points for Improvement

Based on this reflection, we summarize here some proposals aiming to contribute to the improvement of the medical curriculum at the FMMNU:

- It seems there is a mismatch between what is planned and what is communicated.
- Although we found that course competencies are aligned with the competencies defined for the Profile of the Angolan Doctor, it will be useful to better clarify how the learning outcomes defined for physiology can contribute to their development.
- To better develop the learning process, horizontal integration of different disciplines must be promoted, not only the coordination between them.

- The defined learning outcomes will be better reached if active learning methodologies are adopted, like the introduction of tutorial classes in a flipped approach.
- The evaluation process must be more clear and must consider the separation between the learning moments and the assessment moments and go beyond the assessment of knowledge.

Conclusions

The Faculty of Medicine of Mandume Ya Ndemufayo University bases the training of future doctors on competency-based medical education.

FMMNU's curriculum for its Physiology course defines learning objectives and outcomes that correspond to the competencies set out by the school's medical program, the Profile of the Angolan Doctor, and in general the competencies established internationally. In our analysis we found that some of the objectives, namely those related to soft skills, lack clarity and it is difficult to demonstrate their achievement.

The effective achievement of these outcomes constitutes a major challenge for FMMNU, because of issues related to the design of the curriculum and the elements that should be included in this program.

Some weaknesses in the design of the course's teaching plan are related to insufficient methodological guidelines, the lack of guidance on how and where students will develop some skills and attitudes, and an unclear evaluation system. There is a statement of the intention to develop skills, but it is not confirmed in the teaching and evaluation process.

This plan requires well-defined methodological guidelines, adapted to the context in which it is used, taking advantage of existing resources and opportunities.

Limitations and Future Perspectives

This study basically had a documentary basis, so there may not be a neat correlation with this faculty's real performance in activities. Therefore, in future research it would be enriching to make a comparison of the situation on paper and in practice.

A look at the opinions of the different actors in the teaching-learning process (teachers and students), or the college itself, would offer a broader view on the teaching of physiology at FMMNU.

DISCLOSURES

No conflicts of interest, financial or otherwise, are declared by the authors.

AUTHOR CONTRIBUTIONS

K.S.M.C. conceived and designed research; K.S.M.C. analyzed data; K.S.M.C. drafted manuscript; K.S.M.C. and I.N. edited and revised manuscript; K.S.M.C. and I.N. approved final version of manuscript.

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