

PERSPECTIVE | SJIP 2026

Building a Modern Physiology Program in a Newly Established Medical Faculty: Five Years of Progress, Innovation and Reflection

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Abstract

The establishment of a new medical faculty provides an opportunity to design physiology education around modern graduate outcomes, but implementation is challenging when institutional systems, infrastructure and academic culture are still developing. The Faculty of Medicine, University of Moratuwa, Sri Lanka, commenced academic activities during the COVID-19 pandemic and subsequently functioned within a period of national socioeconomic downfall. Early teaching relied heavily on Moodle-supported online delivery, synchronous sessions, recorded practical demonstrations, formative assessments and moderated question-and-answer forums. With the return to onsite teaching, effective digital practices were retained within a blended-learning model, while face-to-face sessions increasingly emphasized interpretation, problem-solving and practical application. Curriculum mapping helped define core medical physiology and strengthen horizontal and vertical integration with other basic sciences, medical technology and clinical-science modules. Teaching-learning activities were diversified beyond lectures through case-based learning, problem-based learning, small-group discussions and selective or elective learning opportunities. Assessment was aligned with the integrated curriculum through a basic sciences stream paper using multiple formats and clinically relevant contexts, supported by Moodle-based online assessments and automated or semi-automated marking. In parallel, the department developed a scholarly portfolio in medical education and applied physiological research, while identifying autonomic and pulmonary function services as future priorities. Key lessons were that innovation should be outcome-driven, integration requires sustained collaboration, assessment strongly shapes learning behavior, and educational change should be systematically evaluated. This reflection will benefit other new medical faculties developing physiology programs particularly under resource constraints.

Keywords: Blended learning, early clinical exposure, educational development, integrated assessment, integrated curriculum, medical education, outcome-based education, physiology education

1. Introduction

Physiology provides the conceptual framework through which medical students explain normal function, understand mechanisms of disease and interpret clinical findings. In a modern medical curriculum, physiology must compete for curricular time while

supporting early clinical exposure, technology-enabled learning and integrated assessment. The challenge is therefore not simply to teach less physiology, but to identify the physiological concepts that every medical graduate should be able to apply.

The Faculty of Medicine, University of Moratuwa was established in 2020 and commenced its academic program in May 2021. Its curriculum was

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How to cite this article: Wariyapperuma UN, Dinupa KDT, Samarasinghe SM, et al. Building a modern physiology program in a newly established medical faculty: five years of progress, innovation and reflection. SAAP J Integr Physiol. 2026;1(3):33-36.

designed as an integrated, iterative, and outcome-driven program¹. The Department of Physiology was therefore developed within a new institutional environment, during the COVID-19 pandemic and subsequent national socioeconomic challenges. An early institutional account described the establishment of physiology teaching within this new faculty, including the integrated curriculum, student-centered learning activities and emerging laboratory infrastructure².

This perspective reflects on the first five years of development of its Department of Physiology, focusing on undergraduate teaching, curricular integration, assessment, scholarship and future directions. Modern standards in medical education support outcome-based curriculum design, horizontal and vertical integration, systematic assessment and continuous quality improvement³. Integration is best understood as a purposeful coordination of content, learning experiences and assessment across disciplinary boundaries⁴. These principles were useful in guiding local development, but implementation required adaptation to the realities of a newly established faculty operating under constrained circumstances.

2. Defining Core Physiology and Strengthening Integration

A major early priority was defining the core medical physiology curriculum. Content was mapped against program outcomes, subsequent clinical learning and assessment requirements. Material that was highly detailed, duplicated or weakly linked to graduate competencies was reduced or repositioned, while concepts required for explaining disease, interpreting investigations and making safe clinical decisions were prioritized. This process distinguished unnecessary repetition from deliberate reinforcement within a spiral curriculum.

Horizontal integration was strengthened with anatomy and other basic sciences through combined sessions in areas where structure and function were inseparable. Collaboration with the medical technology stream linked cardiovascular physiology to electrocardiographic signal acquisition, electrode placement, artefact recognition and interpretation. Vertical integration developed through contributions of physiology to clinical-science modules and practical activities, including neurology-related learning, such as gait assessment and interpretation of gait disorders.

The wider faculty program of early clinical exposure further supported the connection between basic-science learning and clinical reasoning. Simulation-based history taking and examination provided opportunities for students to apply basic science knowledge within structured clinical contexts. Student perceptions of simulation-based history taking were reported in a peer-reviewed research letter⁵, while the design of the spirally integrated early-clinical-exposure program was subsequently published as an institutional case study⁶.

Teaching and learning activities were progressively diversified beyond lectures, with greater emphasis on student-centered approaches such as case-based learning, problem-based learning and small-group discussions. Selective and elective learning opportunities were also introduced, allowing interested students to explore physiological concepts in greater depth. These activities were important not only as teaching strategies, but also as mechanisms for developing a departmental culture of inquiry, reflection and application.

3. Blending Technology into Teaching and Learning

During the first two academic years, restrictions on face-to-face teaching required most instructions to be delivered online. The Moodle-based learning management system became the organizing

platform for learning objectives, lecture resources, recorded practical demonstrations, formative questions and academic communication. Synchronous sessions were supplemented by moderated question-and-answer forums, allowing students to request clarification asynchronously. The technological strengths and cross-faculty expertise within the University of Moratuwa substantially supported the transition to online and blended delivery.

This experience reinforced an important educational principle i.e., effective digital learning requires deliberate instructional design, learner support and opportunities for interaction, rather than the simple electronic dissemination of lecture material⁷. The department evaluated its own early experience through a peer-reviewed study of the first student cohort. This study found frequent physical and psychological concerns related to prolonged online learning, while screen time was not significantly associated with academic performance⁸. These findings encouraged shorter and more purposeful online activities, greater interactivity and closer attention to student well-being.

When onsite teaching resumed, the department did not simply return to its pre-pandemic approach. Preparatory online material, formative work and reusable question-and-answer discussions were retained, while face-to-face time was increasingly used for interpretation, problem-solving and practical application. A subsequent peer-reviewed evaluation of blended-learning activities in cardiovascular, respiratory and gastrointestinal physiology documented student perceptions, engagement and performance outcomes, providing evidence to support further refinement⁹. The durable lesson was that technology should serve a defined educational purpose and complement, rather than replace, direct interaction and practical experience.

4. Aligning Assessment with Integrated Learning

Assessment was redesigned to reinforce curricular integration. Physiology was assessed not as a separate discipline-based paper, but within a single integrated basic science stream assessment that examined physiological concepts in relation to other basic sciences and clinically relevant contexts. Multiple assessment formats were used, including true/false items, single-best-answer questions, extended-matching questions, objective structured practical examinations (OSPE) and structured essays. This enabled broader curriculum sampling and evaluation of competencies ranging from factual recall to integrated and applied physiological reasoning.

As assessment crossed disciplinary boundaries, blueprinting, departmental and interdepartmental scrutiny, agreed marking schemes and post-examination analysis became increasingly important quality-assurance processes. This approach is consistent with contemporary assessment principles, which recognize that no single method can assess all outcomes and that assessment should be judged by its combined validity, reliability, educational impact, acceptability and feasibility¹⁰. A notable innovation was the use of Moodle-supported online assessments, including automated and semi-automated marking, with the university's computer laboratories providing the infrastructure for standardized large-group examination delivery. A central lesson was that assessment shapes students' perception of curricular priorities; integrated teaching is weakened when examinations emphasize fragmented recall rather than synthesis, interpretation and application.

5. Research, Scholarship, and Service Development

Alongside teaching and assessment, the department developed a scholarly portfolio in medical education and applied physiological research. Full publications have documented early departmental development, online learning and student well-being, blended learning,

simulation-based history taking and early clinical exposure^{2,5,6,8,9}. Further, additional conference abstracts have documented departmental work across medical education, autonomic physiology, pulmonary-function testing and small-airway assessment. These outputs are important because they move the department's work beyond description and provide evidence of educational implementation, learner experience and institutional development.

The department also continues to build research activity in cardiovascular, autonomic, and respiratory physiology, including work related to autonomic function, heart-rate variability, pulmonary-function testing and small-airway assessment. These were presented at various national and international research forums as conference papers and should be developed as research themes that should be prioritized for full-paper publication, postgraduate supervision and future service development.

The proposed development of autonomic and pulmonary function services offers an opportunity to connect education, research, and community service. Such services would allow students to observe real physiological measurement, support locally relevant research and improve access to specialized testing. However, service development must be clinically governed, with trained personnel, standard operating procedures, quality assurance, appropriate referral pathways and structured reporting.

6. Lessons, Limitations, and Future Directions

The experience generated several educational insights. Curricular innovation was most effective when guided by clearly defined learning outcomes, not merely by technological availability or novelty. Effective curricular integration depended on sustained interdepartmental collaboration, shared educational responsibility and deliberate coordination of content across disciplines. Assessment functioned as a major determinant of student learning behavior. Therefore, examination design needed to reflect the intended integrated curriculum. Educational change also required evaluation, so that innovations could be refined in response to evidence, feasibility, learner experience and institutional context.

This perspective has several limitations. It is an institutional reflection rather than a controlled program evaluation and therefore does not provide longitudinal graduate outcomes or direct comparison with established faculties. Future work should prioritize full-paper publication, prospective evaluation and mixed-method studies to examine educational outcomes, learner experience, faculty workload and institutional impact more rigorously.

Future priorities include maintaining a clearly defined core physiology curriculum, strengthening formative feedback and item analysis, expanding interpretation of authentic physiological datasets, and consolidating research themes in medical education, autonomic physiology and pulmonary physiology. For a newly established department, the most sustainable model is one in which teaching, assessment, research, and service reinforce one another while remaining anchored in the physiological reasoning required of every medical graduate.

7. Conclusion

During its first five years, the Department of Physiology progressed from emergency online delivery to a blended, integrated and clinically contextualized program. Its development was supported by curriculum mapping, interdepartmental collaboration, assessment alignment and a growing scholarly portfolio. The next challenge is to move from innovation by necessity to evidence-informed consolidation. The experience suggests that a modern physiology department should not function only as a teaching unit, but as an

academic platform linking undergraduate learning, applied physiological research and service to the wider community.

Acknowledgments

The authors acknowledge the academic, technical and administrative staff, collaborating departments and students who contributed to the development of physiology education at the Faculty of Medicine, University of Moratuwa, Sri Lanka.

Funding

No specific funding was received for the preparation of the manuscript.

Conflict of Interest

The authors declare no conflict of interest.

Disclosure of AI Use

OpenAI ChatGPT (GPT-5.6 Sol) was used to assist with language refinement. The authors reviewed the final content and take full responsibility for the accuracy and integrity of the manuscript.

Authors' Contributions

UMW conceptualized the article and led manuscript synthesis, revision and final approval. MK contributed to early curriculum and assessment framework development. SPW contributed to curriculum development, laboratory development and departmental administrative work. KDTD and SMS contributed to departmental academic assessment and laboratory development activities. MK, SPW, SMS and KDTD provided intellectual input and critically reviewed the manuscript. All authors read and approved the final version.

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