

Educational Strategies in a Neuro Facility: Virtual Course in Encephalic Vascularization

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ABSTRACT¹

Knowledge of encephalic vascularization is essential to all in a tertiary, Neurology-Neurosurgery facility. **Objective:** To describe the creation of an online course on encephalic vascularization that is relevant for clinical practice and elevates overall educational levels in a specialized institution. **Methods:** “Pelopidas Digital” Virtual-Teaching-Platform (PD-VTP) is a customized educational

platform, designed to provide short, point-of-care video-tutorials and tests on subjects of interest to Unit's personnel. The virtual course “Basis of Encephalic Vascularization” is presented to professionals through a short vignette and is composed of six modules: Overview of the Arterial Supply, Venous Sinuses, Cerebral Veins, Middle Cerebral Artery, Posterior Cerebral Artery, and Anterior Cerebral Artery. **Discussion:** Making neuroanatomy meaningful to clinical practice is one challenge that has been greatly helped by technology. A broader one is to convey the importance of vascular neuroanatomy in understanding clinical symptoms, helping to assess risk, and conveying the urgency of an

¹The Authors acknowledge Dr. Antonio Cavalcanti de Albuquerque Martins MD, PhD (Peer editor) and Ms. Camila Pimentel Lopes BA (Non-peer print-editor)

investigation or therapeutic measure to staff personnel in a specialized facility. **Conclusion:** An educational electronic platform can engage participants at very different levels and disseminate knowledge. Creation of a virtual course on cerebral vascularization can be an attractive tool for Continuing Education in a Neuro facility

Keywords: Vascular Neuroanatomy, Virtual Continuing Education, Health Professionals, Interdisciplinary Education, Educational Technology.

INTRODUCTION

To make neuroanatomy meaningful to clinical and surgical practice is a challenge embraced at several levels, and the application of technology has greatly been incorporated into this endeavour [1, 2]. Furthermore, to convey the importance of vascular neuroanatomy in understanding clinical symptoms, helping to assess risk, or conveying the urgency of an investigation or therapeutic measure to the staff personnel in a specialized facility is a much broader challenge, infrequently undertaken, but which the successes or drawbacks of an Institution can be traced back to.

In the virtual environment, health education is reaching

new formats. Meaningful education is key for producing content for Continuing Education that successfully bridges the gap, reaches broader and varied audiences, and makes a difference in elevating the educational level in a Health Institution.

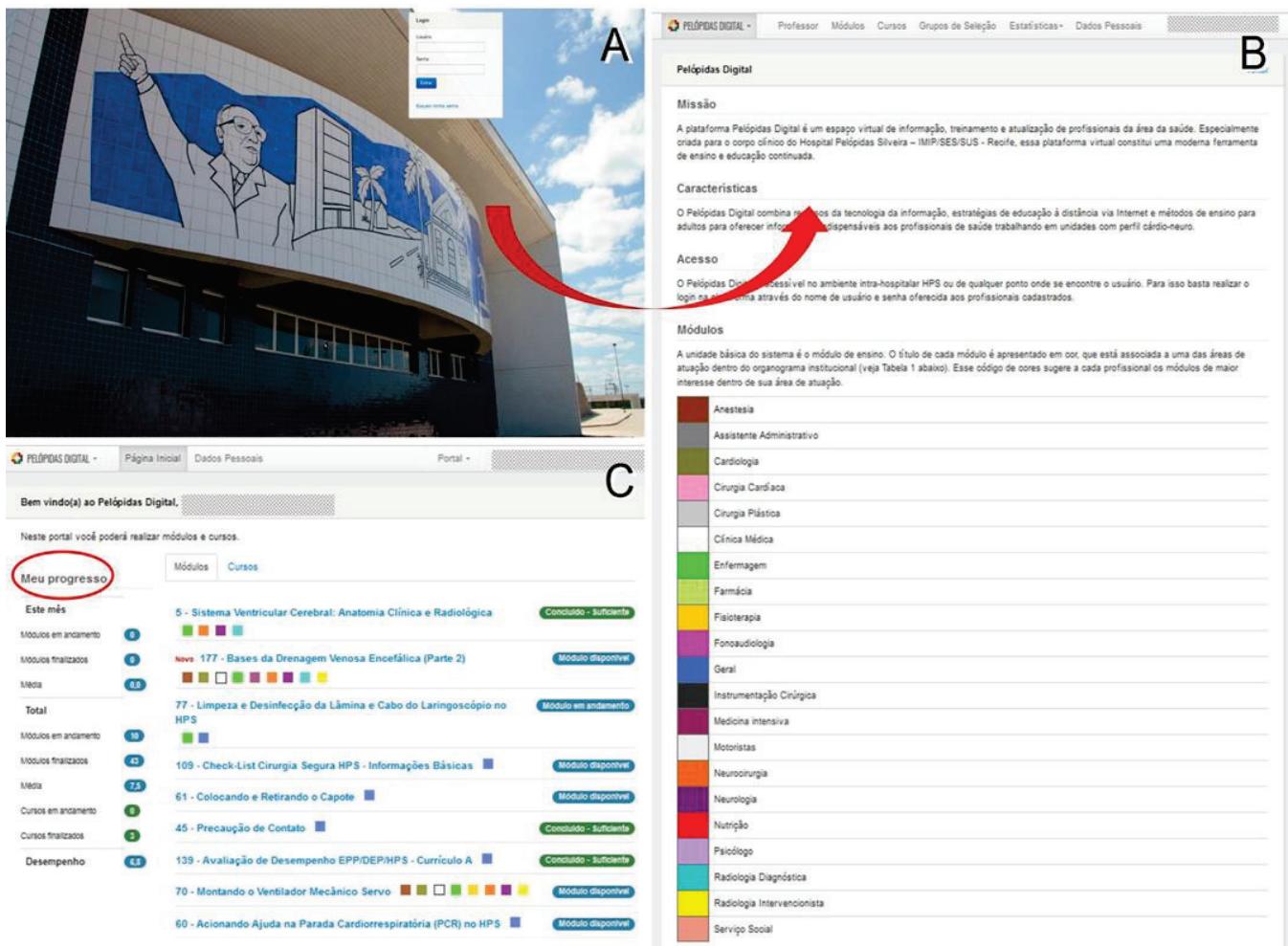
This paper describes the creation of an online course on encephalic vascularization that aims at achieving such goals.

METHODS

“Pelopidas Digital” Virtual-Teaching-Platform (PD-VTP) Pelopidas Silveira Hospital has a customized educational platform called “Pelopidas Digital” Virtual-Teaching-Platform (PD-VTP) designed to provide short, point-of-care video-tutorials and tests on subjects of interest to Unit’s personnel [3, 4] (Fig. 1).

The basic unit of the PD-VTP is a module formed by introduction, learning objectives, a 05-minute tutorial video, a test, recommended reading, and associated modules. Tests can be followed by a review of answers and accessing Tutor’s comments for extended learning (Fig. 2). A new attempt on each test can be undertaken if the participant fails the first attempt.

Modules can be grouped into Courses. As of Jan/22, PD-



VTP houses 200 modules, and more than 15 courses are available to be undertaken at the participant's own pace of study.

Fig. 1. "Pelopidas Digital" – Virtual Teaching Platform. A & B. Web gateway and basic platform structure. This e-learning tool was developed in 2013, by the senior author. In January/2018, 100% of the clinical and non-clinical personnel had become users. PD-VTP has been developed to mirror HPS-Continuing Education basic tenets and provide point-of-care, online tutorials on topics of cardio-neuro care, for the entire HPS community. Access is granted by individual username and password. Web gateway provides public information on the platform, including its mission and characteristics (red arrow). C. Modules are color-coded to guide users in accessing content related to his/her professional role in the Institution. The area "My Progress" in the dashboard (red circle) provides information on individual progress. The basic unit of the PD-VTP is a module, formed by a) introduction, b) learning objectives, c) 05-minute tutorial video or videotext, d) test and e) recommended reading and associated modules. Tests can be followed by review of answers and accessing Tutor's comments to enhance learning.

RESULTS

Virtual Course "Basis of Encephalic Vascularization"

The virtual course "Basis of Encephalic Vascularization" has been launched during semester 2/2021 (Fig. 2).

The course is presented to professionals by a short vignette and is composed of six modules: 1) Overview of the Arterial Supply (Module 166), 2) Venous Sinuses (Module 176), 3) Cerebral Veins (Module 177), 4) Middle Cerebral Artery (Module 178), 5) Posterior Cerebral Artery (Module 179), and 6) Anterior Cerebral Artery (Module 188) (Figs. 3 & 4).

Successful completion of a Virtual Course enables the professional for Certification.

Since its release, four months ago, 436 out of 1037 (42%) health professionals have accessed the Courses content, including Clerks, Stretcher Bearers, Scrub Nurses, Nursing Assistants, Clinical Nurses, Administrative Nurses, Pharmacists and Pharmacy Assistants, Lab Technicians, Imaging Technicians, Nutritionists, Psychologists, Trainees, Residents, Doctors.

All modules in this course have been accessed, ranging from 127 for the last one released up to 436 accesses on the initial module (Fig. 5).

Fig. 2. Didactic structure of PD-VTP. A. Modules can be grouped into Courses. There are 200 modules available. The Course Basis of Encephalic Vascularization is presented to professionals by a short vignette and composed of six modules. C. Module 166: Overview of the Arterial Supply was the first module released on the subject, and exemplifies the typical format, being formed by a) introduction, b) 03 learning objectives, c) a 4:52 min videotext and d) recommended reading & associated modules. D. Module 179: Posterior Cerebral Artery exemplifies the test that follows each content. A new attempt can be undertaken if the participant fails the first attempt. Upon completion, tests can be followed by review of answers and accessing Tutor's comments to enhance learning. As video texts and test execution for each module may vary from 5 to 10min, a core content as displayed in a Course such as Basis of Encephalic Vascularization requires 55 to 110min to complete, making it suitable also as online preparation for in-person interactions, scenario-training, and case-discussions as in a flipped-methodology session. Successfully completion of a Virtual Course enables the professional for Certification.

Ninety-three health professionals (8,9%) have completed the entire course and eighty health professionals have successfully finished it, including Clerks (11), Stretcher Bearer (1), Nursing Assistants (37), Nurses (14), Pharmacy Assistants (4), Lab Technicians (10), Imaging Technicians (7), Trainees (5), Residents (2), Doctor (1), Social Assistant (1).

DISCUSSION

Anatomy is a compulsory subject for health professionals. Its training offers an opportunity to understand the three-dimensional body; to appreciate the importance of the patient; to learn the basic language of health professions, of diagnostic imaging, and for everyday health activities [5].

In recent years, active learning - comprising presential and virtual experiences - has gained ground in health education in all areas, including anatomy.

Virtual education may increase students' motivation, class attendance, and satisfaction; improving higher order thinking outcomes [6] and preparing for applying contents in clinical scenarios; but it relies strongly on content and how it is presented.

The Virtual Course in Encephalic Vascularization is a new format developed to present the neurovascular anatomy, correlating neuroimaging and clinical implications.

The didactical basis for the creation of this course involves correlating new and established neurovascular knowledge by displaying combinations of arteriograms and silicone-injected microsurgical anatomical dissections. Also, the use of well-known encephalic anatomical features combined with less familiar vascular

views have been carefully chosen to enhance understanding about vessel segmentation and its clinical implications (Fig. 3A & C).

The application of such a method in the medical profession and training is readily seen. It has been shown [7] that while 79% of neurologists reported making clinical decisions on stroke care based solely on their own interpretation of neuroimaging studies, fewer than 8% of neurologists rely entirely on someone else's interpretation of an imaging study to make clinical decisions.

This data emphasizes that doctors, particularly specialized ones, often mobilize important clinical knowledge influenced by the interpretation of the imaging studies. It is critical, therefore, that the practicing neurologist/neurosurgeon is familiar with the interpretation of neuroimaging studies, and understands the associated pitfalls, best practices, and risks associated with them.

Even so, additional electronic or web-based resources could supplement trainees', interns', and resident's education in areas of perceived weakness [8, 9].

On the other hand, it is often not so clear that degrees of vascular neuroanatomical and neuroimaging understanding are required across the board from the entire range of associated professionals for clinical and institutional goals to be eventually met.

The use of an electronic platform, devised to present short video-tutorials can help overcome concerns and prejudices and help participants at very different levels and experiences to face contents in a positive, open-minded way; and producing and selecting images of high aesthetic qualities can also work towards this end.

The PD-VTP and the Course Basis of Encephalic Vascularization have features that allow for its classification into several categories [9] (Fig. 6).

They can be classified as e-learning because they reach a broad audience, in which each subject works at his/her workstation and is mainly a passive learning experience - when considered in isolation. They can be classified as a Massive Open Online Course (MOOC) because of their short format, that divide courses into mini-events, present high quality learning at scale, have the ability to collect and provide large amounts of data, offer open and multiple content to all employees, that can advance at their own pace, in areas and subjects of their choice, putting learners at the forefront; but they are also Corporate Open Online Courses (COOC) because they are created, offered, produced, and distributed by the Institution, are used as a communication tool and provide certification, which is attractive to potential employees.

By showing digital training as a core institutional value, it speaks directly to a young generation of health professionals and are Institutional tools for finding talented and motivated people within ranks.

Systems and interfaces like these are increasingly needed for triggering analogical thinking in other disciplines, fomenting logical thinking, technological innovations and entrepreneurship in professional areas and the Health Industry.

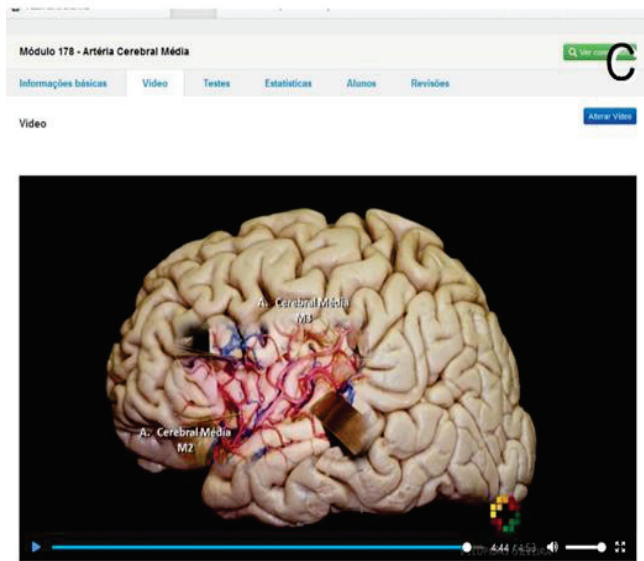
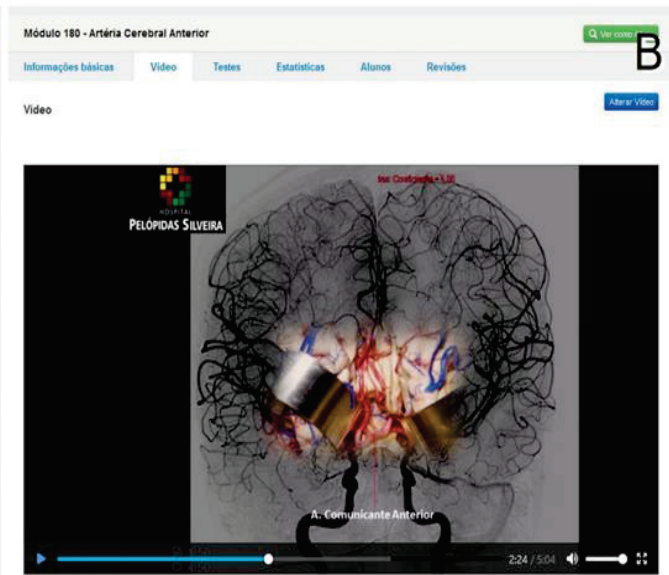
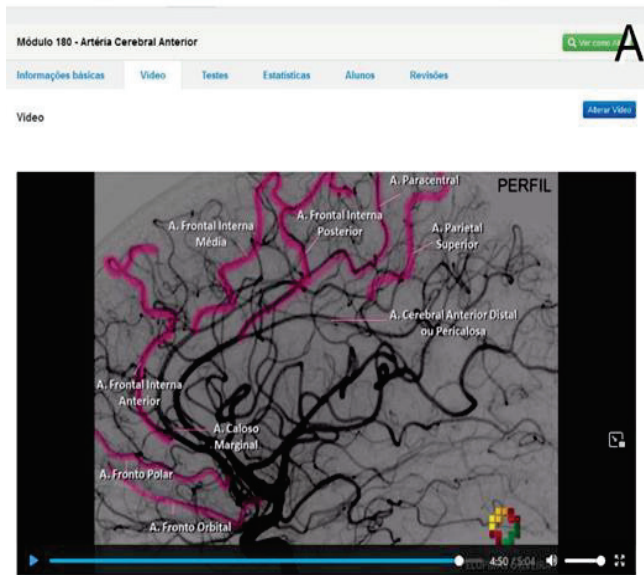


Fig. 3. The Course Basis of Encephalic Vascolarization has been created to highlight the anatomo–radiologic correlation of vessels and its clinical implications on a day-to-day basis in a tertiary, cerebrovascular unit. A. Facilitated arteriograms and (B) combination of arteriograms and Rhotonian microsurgical dissections, as depicted on Module 180: Anterior Cerebral Artery (a 04:53 min module), have been extensively used during this course. C & D. The use of well-known macroanatomical encephalic features combined with less frequent vascular microsurgical views have been carefully chosen to enhance understanding about vessel segmentation and its clinical implications. These points are exemplified by the introduction of the segments of the middle cerebral artery and the clinical and radiological results of its occlusion, as depicted on Module 178: Middle Cerebral Artery (a 5:04 min module).

Therefore, the creation of a virtual course on cerebral vascularization can be an attractive tool for dissemination

of knowledge in a Neuro facility.

It may involve trainees as tutors, once familiar with the technological tools and supported by institutional educational teams. In fact, increasing residents' time as teachers in presential and virtual modalities has been proven to positively impact on their annual scores in cognitive domains (8), opening another avenue for learning by actively involving trainees in delivering education.

CONCLUSIONS

Health education in digital environments such as PD-VTP accelerates training of members of therapeutic teams; allows for periodic audits and certification; is unlimited in number of times professionals can consult its contents and may engage trainees, residents, and staff members as tutors, involved in creating virtual tools for Neuroeducation.

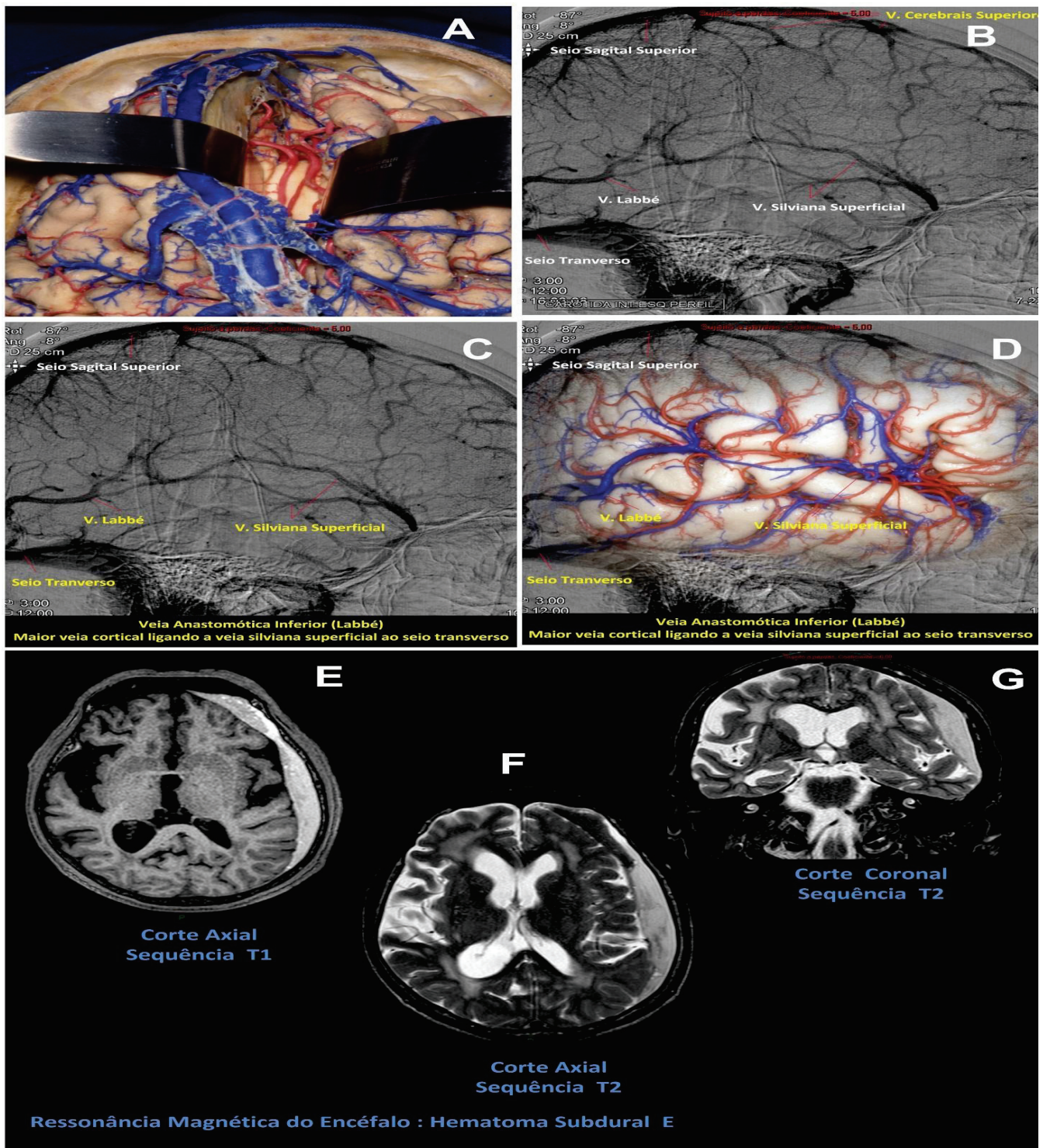


Fig. 4. The anatomical content of the Course can be appraised by using as examples Modules 176: Venous Sinuses, and Module 177: Cerebral Veins. A-G. The components of the superficial venous cerebral system are introduced, and the example of the superior superficial cerebral veins are mentioned (A-B). On the sequence, their main anastomotic channels, including the vein of Labbé are presented (C-D). This introduction is made by using anatomical images of the surface of the brain in silicone-injected cadaveric specimens (A) and with the help of

angiograms (B & C). This strategy allows for reaching the combined understanding of this anatomy (D). Further on, the clinical importance of these structures is emphasized by presenting a sequence of axial resonance imaging of the brain (E-G) in a situation when these structures have been ruptured. The resulting blood collection, called subdural hematoma, is a common disease faced and daily treated at the Institution.

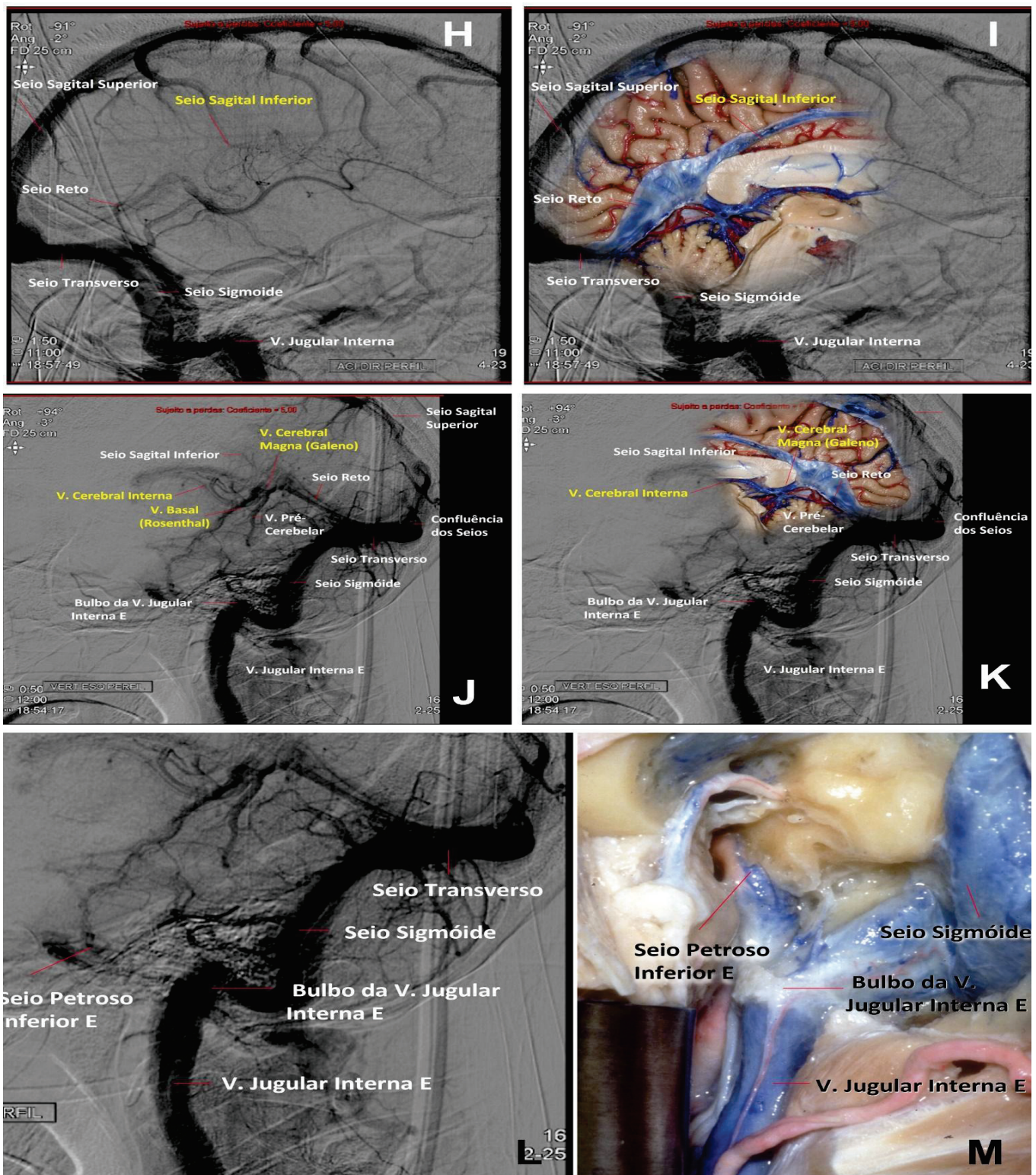


Fig. 4. Continuation. Likewise, by building on combined views, previously introduced on Module 176 (H & I), the components of the deep cerebral venous system are introduced during Module 177 (J & K). This sequential, progressively complex reasoning, which is constructed using less than 5-min videos and incorporating nuances of spaced-education, fosters the momentum for the

presentation of more complex anatomical and angiographical concepts. In this case, the understanding of the intracranial formation of the internal jugular vein (L & M), which leaves the skull to pass along the neck. By culminating at this point, these Modules and – in fact – the whole Course – can be linked to a whole new series of Modules pertaining to different anatomical subjects.

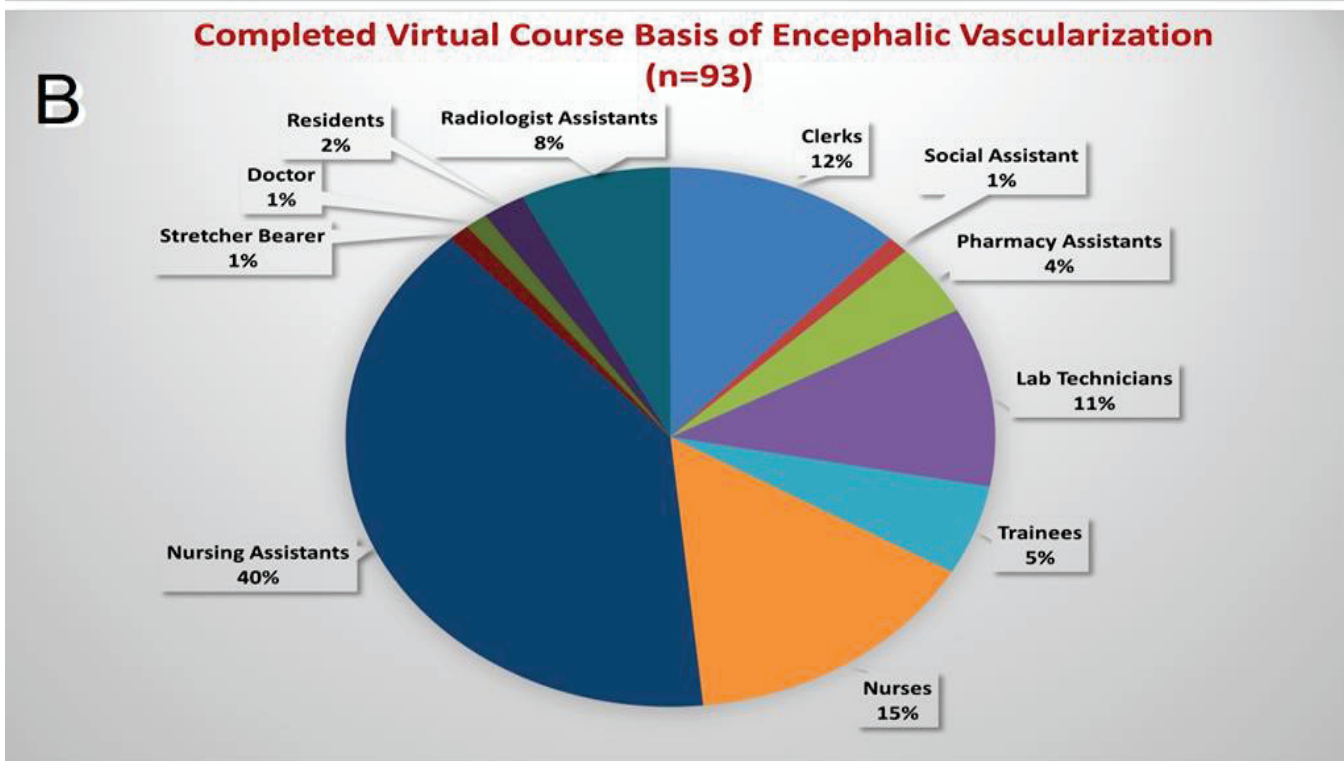
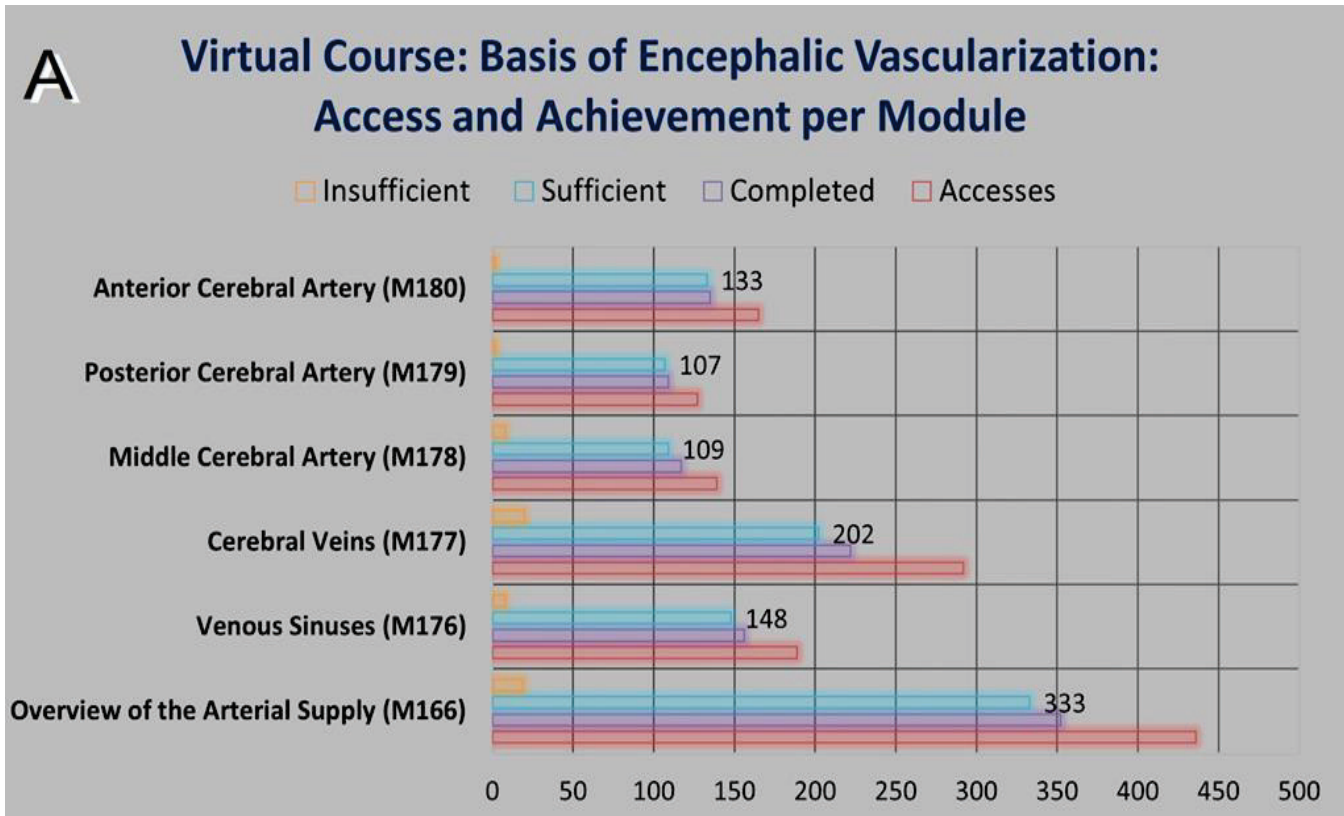


Fig. 5. Virtual Course: Basis of Encephalic Vascularization. Enrollment and Achievements. A. Since its release, four months ago, 436 out of 1037 (42%) health professionals have accessed the Courses content. All modules have been accessed, ranging from 127 accesses, for the last one released, up to 436 accesses on the initial module. B. Ninety-three health professionals (9% of HPS

community) have completed the entire course and eighty health professionals (86%) have successfully finished it, including Clerks (11), Stretcher Bearer (1), Nursing Assistants (37), Nurses (14), Pharmacy Assistants (4), Lab Technicians (10), Imaging Technicians (7), Trainees (5), Residents (2), Doctor (1), Social Assistant (1).

Pelópidas Digital Virtual Teaching Platform		
E-Learning	MOOC	COOC
<ul style="list-style-type: none"> ✓ Broad audience ✓ Passive Learning (when considered in isolation) ✓ Each participant works at own workstation 	<ul style="list-style-type: none"> ✓ Short format, divides courses into mini-events ✓ High quality learning at scale ✓ Collects and provides data ✓ Open and multiple content to all employees ✓ Participants advance at their own pace, in areas and subjects of their choice ✓ Learners at the forefront 	<ul style="list-style-type: none"> ✓ Created, offered, produced and distributed by the Institution ✓ Contents produced in a short range of time ✓ Used as communication tool ✓ Provides for Certification ✓ Attractiveness for potential employees and young generation of health professionals ✓ Digital training as core institutional value ✓ Tool for finding talented and motivated people within ranks

Fig. 6. Virtual Educational Characteristics. PD- VTP and its Virtual Course in Encephalic Vascularization can be classified as e-learning, massive open online courses (MOOC) and as corporate open online courses (COOC) for different reasons. Although not further detailed in the table, the Virtual Course in Encephalic Vascularization also shares features with nano open online courses (NOOC), as the entire content can be taken in a little over one hour and are suitable for being adapted into small private online courses (SPOC) [10] particularly supporting sessions intended to application of knowledge.

It is crucial for Institutions to reflect on the type of Continuing Education they are offering, its potentials and limitations; and the degree to which it speaks to clinical practice, human resources, professional development,

technological innovation, and market opportunities as both educational and corporate tools.

ACKNOWLEDGEMENTS

The authors acknowledge the role of Prof. Dr. Antonio Cavalcanti de A Martins MD, PhD – Professor of Anatomy and Surgery – College of Medicine - Faculdade Pernambucana de Saúde, Recife – Brazil – antoniocavalcantideamartins@gmail.com (Peer editor) and Ms. Camila Pimentel Lopes BA - Cambridge Certified Teacher for English, Cultura Inglesa - Recife - Brazil - camila.lopes@teamculturane.com.br (Non-peer print-editor) is this paper.

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