Review article

Epileptic Disord 2020; 22 (3): 237-44

e-learning comes of age: Web-based education provided by the International League Against Epilepsy

Sándor Beniczky [1], Ingmar Blümcke [2], Stefan Rampp [3], Priscilla Shisler [4], Eva Biesel [5], Samuel Wiebe [6]

[1] Department of Clinical Neurophysiology, Danish Epilepsy Centre and Aarhus University Hospital; Affiliated partner of the ERN EpiCARE, Department of Clinical Medicine, Aarhus University, Denmark
[2] Department of Neuropathology, University Hospitals Erlangen, Collaborating Partner of the ERN EpiCARE, Erlangen, Germany
[3] Department of Neurosurgery, University Hospital Erlangen, Germany and Department of Neurosurgery, University Hospital Halle (Saale), Germany
[4] ILAE Headquarters Office, USA
[5] ILAE Academy, USA
[6] Department of Clinical Neurosciences and Clinical Research Unit, Cumming School of Medicine, University of Calgary, Canada

Received April 15, 2020; Accepted May 07, 2020

ABSTRACT – Education tools and programs using interactive digital content, distributed on the internet, are increasingly becoming an integral part of postgraduate medical education. The coronavirus pandemic and global lockdown hoisted a major challenge for traditional teaching courses. A timely solution is to focus attention and reinforce web-based teaching programs. For more than 15 years, the ILAE has been developing and managing a wide range of e-learning programs. This paper provides an overview on the e-learning portfolio of the ILAE, including tutored e-courses, self-paced interactive e-courses and online multimedia resources, all linked to the ILAE curriculum and learning objectives addressing specific levels of professional experience. All e-learning programs will become available through the new ILAE Academy platform (www.ilae-academy.org), in July 2020. e-learning is an important tool for reaching the global educational mission of the ILAE.

Key words: distance education, epilepsy, e-learning, ILAE, online education

Correspondence:
Sándor Beniczky
Visby Allé 5,
4293 Dianalund,
Denmark
<sbz@filadelfia.dk>

doi:10.1684/epd.2020.1157

e-learning denotes an educational approach that uses electronic media and devices in combination with information and communication technologies and is mainly delivered via internet. Synonyms are: distance education, computerized electronic learning, online learning, internet learning, web-based learning and many others (Sangrà *et al*., 2012). e-learning has been a game-changer in education, including postgraduate medical education (Zehry *et al*., 2011; De Leeuw *et al*., 2016; Huynh, 2017). The main advantages of e-learning are: flexibility,

broad resource-sharing capacity enabling global reach, and cost-effective scalability (Sandars and Schroter, 2007; Allen and Seaman, 2011). Participants can choose a comfortable and accessible place with time to study, which is important in postgraduate medical education (Curran and Fleet, 2005). The mobility restrictions during the 2019-2020 coronavirus pandemic highlighted further the importance of e-learning on a global level.

e-learning must be targeted to specific audiences, hence postgraduate e-learning programs require specific elements important for adult learning (Cook and Dupras, 2004; Childs *et al*., 2005). Applying learning-theories and quality models contributes to the success of e-learning programs (Sangrà *et al*., 2012). For example, active student engagement approaches and problem-based learning are essential, as demonstrated by their efficacy in medical education (Ruiz *et al*., 2006; Maggio *et al*., 2013).

The International League Against Epilepsy (ILAE) was among the first international medical organizations to recognize the huge potential of e-learning in postgraduate education, and, for more than 15 years, has been working on developing and implementing these educational resources to achieve its educational mission. Recently, the ILAE published its competency-based educational curriculum for epileptology (Blümcke *et al*., 2019). It is contemplated that e-learning will play a major role in addressing the learning objectives of the curriculum (ILAE, 2020a).

The goal of this paper is to provide an overview of the broad ranging e-learning activities and resources offered by the ILAE. These include tutored e-courses (Virtual Epilepsy Academy: VIREPA), self-paced interactive e-learning courses, and online multimedia resources (*table 1*). The ILAE Academy (ILAE, 2020b) has integrated its e-learning program into a virtual platform (www.ilae-academy.org) of educational activities, based on the learning management system, Totara Learn™. Along with face-to-face courses and educational activities at ILAE congresses, e-learning offerings on the ILAE Academy are an essential tool for the educational mission of the League. Combining a variety of approaches will allow for blended learning activities that address the needs and goals of learners, optimized for individuals' learning styles.

Table 1. ILAE e-learning.

Tutored e-learning courses	VIREPA courses: EEG in the Diagnosis & Management of Epilepsy – three courses: Basic, Advanced, Pediatric. Epilepsy & Sleep
	Online course on epilepsy for primary care physicians in Latin America
Interactive, self-paced e-learning courses	Learn From Cases
	ebrain sessions on epilepsy
	Epilepsy Imaging
Online multimedia resources	Diagnostic Manual
	Seminars in Epileptology: educational review papers in Epileptic Disorders
	Video-EEG educational database in Epileptic disorders
	Histopathology tutorials

Tutored e-learning courses

The VIREPA (Virtual Epilepsy Academy) courses, initially developed within the European Epilepsy Academy (Wehrs *et al*., 2007) in 2006, were transferred to the sub-commission on Distance Education of the ILAE in 2009. Currently, four VIREPA courses are available: three of them are on EEG, on the diagnosis and management of epilepsy (basic, advanced and pediatric), and one on sleep and epilepsy (advanced).

VIREPA courses are tutored e-learning courses, offered in English. Each course is held once a year, with the exception of the basic EEG, offered twice per year. The number of participants is limited to 30-35 per course, to facilitate intensive interaction with tutors and among the students. Courses have a duration of six months and consist of 7-9 thematic units, each with two tutors and lasting two to three weeks, plus a final assignment. Supplementary documents 1-4 show the thematic units and the tutors of the four VIREPA courses (*see accompanying supplementary material*).

Interaction with the tutors is based on asynchronous discussion fora within the e-learning platform, to enable communication among participants in different time zones around the globe (*figure 1*). Most units involve a teamwork of students within small workgroups, including individual and group assignments. Discussion fora allow for communication, collaboration and exchange of material among members of each workgroup.

Each thematic unit has an e-textbook, written by the tutors specifically for the topic of the unit. In addition, a virtual library is available with recommended literature (review papers, textbook chapters and guidelines).

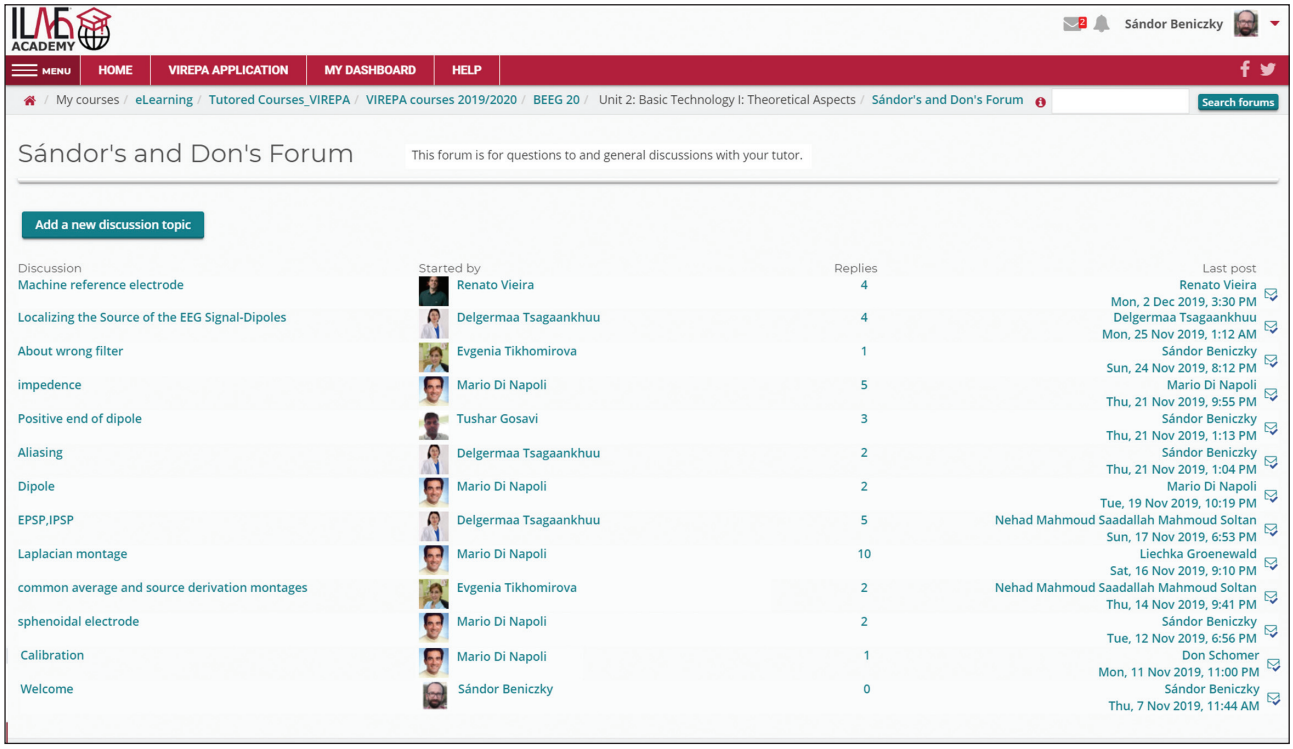

Figure 1. Example of a discussion forum in VIREPA (Unit 2; Basic EEG course).

While reading these e-resources, students can contact the tutors to clarify aspects that they do not fully understand. Each unit has student-engagement tasks and evaluations. The tasks vary from unit to unit: for example, students are required to evaluate EEG samples posted by the tutors, post their own de-identified samples or cases demonstrating a pattern or topic named in the task or answer multiple-choice questions related to the topic of the unit. Students are encouraged to interact during the course, for example by commenting on each other's postings. These virtual networks proved to be starting points of real-world friendships, and VIREPA alumni often interact with each other - also after the end of the VIREPA courses- on social media, ILAE courses and congresses. Depending on their postings and participation, students are granted credit points for each unit. Students receive a course certificate, provided they qualify.

The VIREPA courses are mainly intended for physicians dealing with patients with epilepsy. Course directors review student applications which are submitted online. As the number of qualified applicants regularly exceeds the number of available places, students are accepted on a first-come-first-served basis.

A typical thematic unit requires 6-8 hours per week of student time. Tutors, on the other hand, devote significant time and energy in preparation, supervision of the course interactions and evaluation. The dedication and generous contribution of the 57 tutors, who are experts from around the globe and do the tutoring *pro bono*, is essential for the success of the VIREPA courses.

Self-assessment quizzes are completed by the students before and after the courses. At the end of each unit, the students submit an online feedback questionnaire that is used to continuously improve the quality of the courses. Since 2006, 1,117 students from 114 countries representing all ILAE regions have graduated from the VIREPA courses. Approximately half of the students (*n*=569) came from low and middle-income countries and received financial support from the ILAE in the form of bursaries. The remaining students paid full participation fees. *Table 2* shows the number of students who completed the various VIREPA courses, and the main results of the post-course student feedback. Supplementary documents 5-9 show the detailed results of the pre- and post-course student surveys (*see accompanying supplementary material*). At the end of the courses, the vast majority of the students (89-98%) would recommend to others the course they have completed and were interested in taking other courses themselves.

In addition to the VIREPA courses, the ILAE more recently started offering online tutored educational courses in Spanish and Portuguese for primary care physicians in Latin America. The courses are based

Table 2. Alumni of the VIREPA courses and the main results of the post-course feedback.

VIREPA Course	Number of editions	Number of students	I would recommend the course to others.	I am interested in other VIREPA courses.
EEG - Basic	21	672	89%	93%
EEG - Advanced	6	159	98%	88%
EEG - Pediatric	9	249	97%	95%
Sleep & epilepsy	4	75	94%	98%

on an interactive, e-learning platform (MOODLE™). A detailed description of the Latin American course has been recently published in a report from the Education Commission of the ILAE (Carrizosa *et al.*, 2018). From 85 participants completing the course evaluation, 98% would recommend the course to other colleagues, and 99% showed interest in taking other similar e-learning courses.

Interactive self-paced e-learning courses

One of the new educational initiatives of the ILAE is the creation of self-paced, web-based e-learning courses which rely heavily on multimedia resources. In this educational offering, interaction with learners is not based on tutors, but on a variety of activity types and assignments (quizzes, exercises, reflection phases) which are built into the instructional design. Some of the many advantages of this educational offering is that the number of participants is not limited, the students can start the courses when they prefer, and they can proceed at their own pace. Here we highlight three of the self-paced e-learning offerings: "Learn From Cases", *ebrain*, and Epilepsy Imaging.

"Learn From Cases"

Learn From Cases is a course concept developed by the ILAE, consisting of a series of case-based e-learning modules aimed at the entry level (Level 1) of the ILAE educational curriculum (Blümcke *et al.*, 2019; ILAE, 2020a), and covering the most common epilepsies in children and adults. The modules are developed by a team of distinguished authors and ILAE experts and reviewed by neuropsychology experts to help build appropriate patient-clinician interaction and communication.

The aim of these courses is to guide the learner in a step-by-step manner through a specific clinical case (*figure 2*), encompassing the correct diagnosis, relevant clinical examination and treatment. Each case also contains specific scenarios for counselling and follow-up. Common errors in medical practice are foreseen and addressed in each scenario. The participant is fully engaged in the role of healthcare professional facing a specific patient with a specific problem. Clinical videos, EEGs and neuroimaging results are presented and accompanied by relevant explanations (*figure 3*). These diagnostic tests are explored to varying depths, depending on the learners' level. For example, Level 1 teaching courses do not require expertise in reading EEG or MRI, but more advanced courses will require learners to be able to interpret these tests. An important goal of these courses is to teach efficient clinical decision-making, taking into account the cost and time required by various diagnostic tests and their potential impact on unnecessary delays of initial therapy.

Interactive quizzes, exercises and reflection phases with subsequent feedback build realistic medical scenarios of high probability and low complexity, which are common in the clinical practice of learners in Level 1.

Additional course-specific resources and further readings from ILAE resources as well as e-learning, such as *ebrain* sessions (see below) are provided as supplementary materials.

After finishing the educational content, students complete a 10 to 15-question exam pertaining to the case. A score of 80% or higher is required to obtain an ILAE certificate for the corresponding course. Learners that successfully complete all 15 cases achieve the required learning objectives of the ILAE curriculum for level 1 and are eligible to receive a corresponding ILAE certificate.

Level 1 cases cover the most common childhood and juvenile epilepsies, focal and generalized epilepsies in children and adults, emergencies, infection and psychogenic non-epileptic seizures.

To assess our case-based e-learning approach, we tested three pilot cases involving almost 50 participants worldwide. The results demonstrated high relevance and usability:

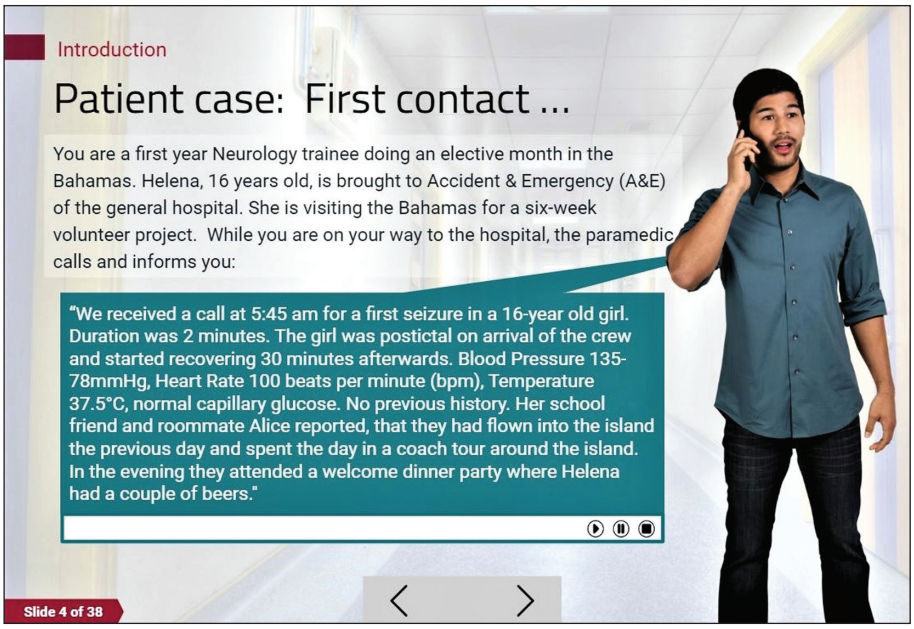

Figure 2. Screenshot of the introduction for the first contact scenario of a case.

Figure 3. Screenshot of another case, in which the learner is expected to review a seizure video and take notes, as the next task is to recall typical semiology signs.

– 80% assessed the cases as excellent, with 75% rating the content as very relevant (in total, 94% very relevant and relevant on a 5-point scale).
– About 75% rated the scenario-based, step-by-step, and interactive approach as very valuable (in total, 97% as valuable and very valuable on a 5-point scale).
– Finally, 97% stated that they would like to do another course and 98.3% would recommend the course to a colleague.

Deployment of the case-based learning offering will be done in stages. The initial cases are planned for mid-2020, and the entire set by the end of 2020. All cases are presented in English, however, translation into various other languages is planned, starting with Spanish in 2020.

ebrain e-learning sessions on epilepsy

ebrain is a comprehensive web-based training resource in clinical neuroscience (Dassan, 2012; Holmes, 2012; Thomson, 2013) developed under the auspices of the Joint Neurosciences Council (JNC). A total of 50 *ebrain* sessions related to epilepsy will be available on the ILAE Academy, covering aspects of

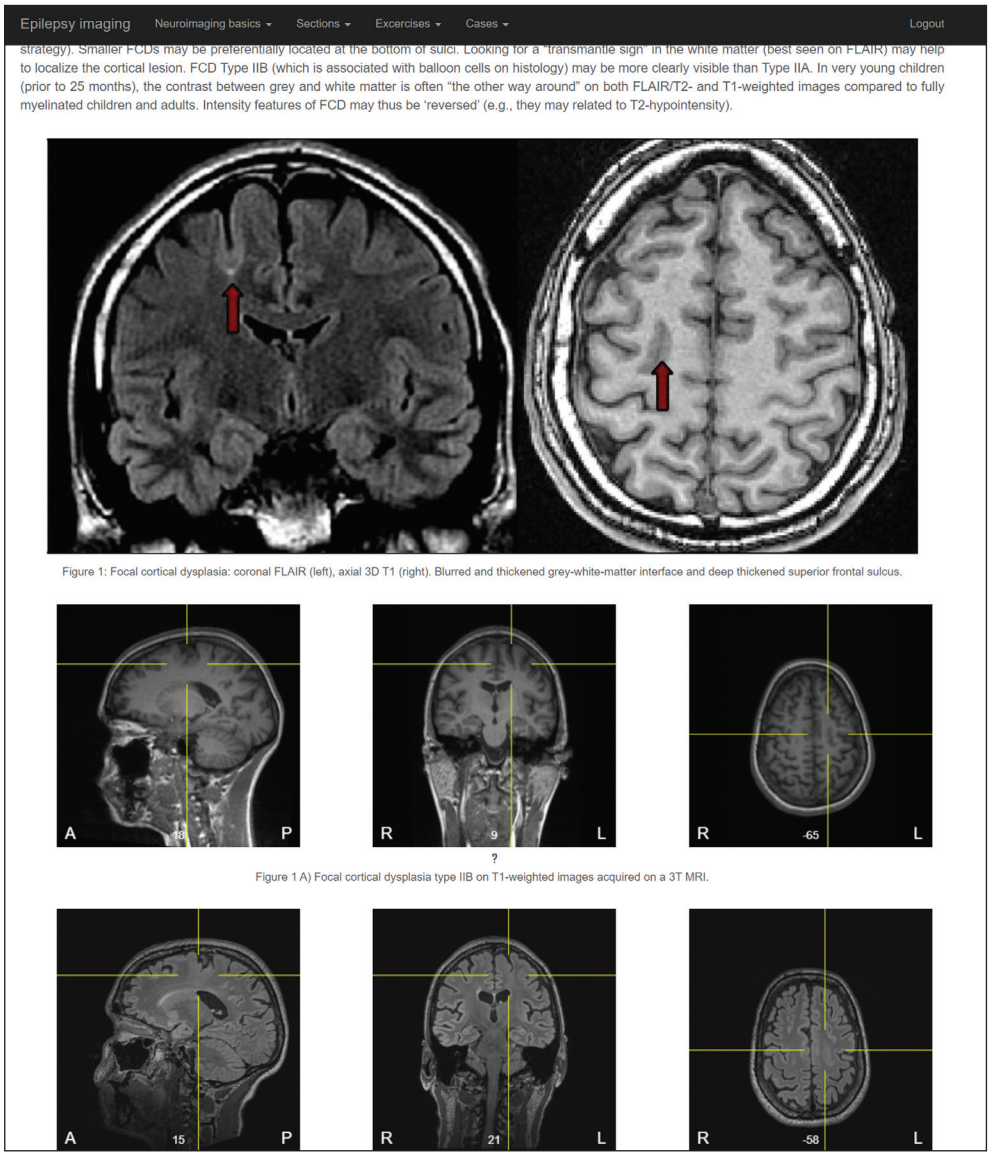

Figure 4. Screenshot of one of the text chapters showing illustrative figures (top) and embedded MRI viewers (middle and bottom row) with multi-planar reconstruction enabled.

diagnosis and treatment, using the well-known, interactive *ebrain* format. All sessions have been reviewed by ILAE experts and were recently adapted by JNC.

These interactive, multimedia-rich lessons address basic topics in epileptology such as clinical assessment, comorbidities, treatment, management of epilepsy in children, women, and the elderly, neuropsychological aspects, seizure classification, and transient loss of consciousness. Supplementary document 9 lists the *ebrain* modules that will be available on the ILAE Academy e-learning platform.

Each *ebrain* session is a self-contained 20-minute unit of knowledge that starts with learning objectives, presents the content, and ends with a summary of key learning points and final a quiz. Certificates of completion are provided if the assessment is passed with a score of at least 80%.

Epilepsy Imaging

Epilepsy Imaging consists of a self-paced e-learning course which covers the basics of brain neuroimaging in epileptology. The web-based training concept provides introductory text in seven chapters describing basic methodological aspects, important anatomical landmarks of the brain, as well as the imaging features of the most frequent epileptogenic lesions on structural brain MRI. Self-learning exercises and practice questions provide an opportunity to actively engage with the material. A number of cases from clinical

practice connect the imaging data to findings from other relevant diagnostic tests. The course provides an integrated online MRI-viewer (*figure 4*) supporting multi-planar reconstruction, flexible navigation, adjustment of brightness and contrast, and other features. Installation of additional software is not necessary.

Online multimedia educational resources

A number of educational resources developed under the auspices of the ILAE provide additional material for learners and are freely accessible on the internet. The following are some examples.

The Epilepsy Diagnostic Manual

EpilepsyDiagnosis.org is a web-based tool developed in partnership between the ILAE and *eResearch* at the University of Melbourne, Australia. The site provides easy-to-use, reliable information on seizure types, epilepsy types, syndromes and etiologies, including genetic correlates and differential diagnosis. The main target audience is clinicians in primary and secondary care settings, caring for people with epilepsy. The platform contains a multimedia database including video, EEG and neuroimaging examples of salient seizure and epilepsy types. It is available in English and Spanish, and it has over 35,000 viewers monthly.

Seminars in Epileptology

These are educational review papers published online in *Epileptic Disorders*, the official educational journal of the ILAE. A series of seminars is being created to specifically address the learning objectives of the ILAE curriculum in epileptology and constitute a core source of information for learners participating in other ILAE Academy educational activities. Supplementary document 10 (*see accompanying supplementary material*) lists the first seminar series addressing level-1 learning objectives. The educational value of these seminars is enriched by the case presentations and the self-assessment multiple-choice questions included in each review.

Video-EEG educational database in Epileptic Disorders

A large collection of video and video-EEGs with illustrative, educational cases is available on the homepage of *Epileptic Disorders* (www.epilepticdisorders.com). On the journal website, these can be accessed either from a list of all videos or by searching for specific key words within the search fields (*i.e.* etiology, phenomenology, localization, syndrome). This is one of the largest collections of epilepsy videos and video-EEGs published by a journal.

Histopathology tutorials

Nine web-based tutorials, lasting 5-10 minutes each, address the Level-1 learning objectives pertaining to common brain lesions in epilepsy. In each tutorial, the histopathology slide of a given case is introduced using digital microscopy, accompanied by recordings highlighting the specific cellular components of the lesion, anatomical landmarks, stainings used and perisurgical or other laboratory artefacts. The same series focusing on differential diagnosis will be offered for Level-2 learners.

Conclusion

The ILAE offers a wide variety of e-learning courses, educational tools and resources. The continuous increase of participants and large number of students applying for these courses and the overwhelmingly positive feedback reinforce the high educational value of the ILAE e-learning programs. Further development of e-learning will play an increasingly important role in achieving the ILAE educational mission. □

Useful links

https://www.ilae.org/education
https://www.ilae-academy.org
https://www.epilepticdisorders.com
http://www.epilepsy-imaging.org

Supplementary data.
Supplementary documents are available on the www.epilepticdisorders.com website.

Acknowledgements and disclosures.
We would like to express our gratitude to Walter van Emde Boas, who contributed significantly to developing and coordinating the VIREPA courses; Kate Riney, who created and maintains epilepsydiagnosis.org; Finola Quinn, who serves as course coordinator; Deborah Flower who contributed to the development and maintenance of the ILAE homepage; the course directors and tutors of the VIREPA courses (supplementary documents 1-4); and members of the ILAE Young Epilepsy Section for assisting with translation of educational materials. Thanks are due also to the numerous members of the ILAE community who have contributed to the creation, testing and implementation of ILAE educational material, and not least, to ILAE members who over the years have devoted themselves to the education of epilepsy professionals around the world.

SB serves as editor-in-chief of Epileptic Disorders. SW received educational grants from UCB Pharma, Eisai and Sunovion. The remaining authors do not have disclosures related to the work presented in this paper.

References

Allen IE, Seaman J. *Going the distance: online education in the United States, 2011*. The Sloan Consortium: Organizations Committed to Quality Online Education, 2011.

Blümcke I, Arzimanoglou A, Beniczky S, Wiebe S. Roadmap for a competency-based educational curriculum in epileptology: report of the Epilepsy Education Task Force of the International League Against Epilepsy. *Epileptic Disord* 2019; 21: 129-40.

Carrizosa J, Braga P, Albuquerque M, *et al*. Epilepsy for primary health care: a cost-effective Latin American e-learning initiative. *Epileptic Disord* 2018; 20: 386-95.

Childs S, Blenkinsopp E, Hall A, Walton G. Effective e-learning for health professionals and students-barriers and their solutions. A systematic review of the literature-findings from the HeXL project. *Health Info Libr J* 2005; 22(2): 20-32.

Cook DA, Dupras DM. A practical guide to developing effective web-based learning. *J Gen Intern Med* 2004; 19: 698-707.

Curran VR, Fleet L. A review of evaluation outcomes of web-based continuing medical education. *Med Educ* 2005; 39: 561-7.

Dassan P. Changing the face of learning: ebrain and UCL distance learning diploma in clinical neurology. *Neurology* 2012; 79: 2359-60.

De Leeuw RA, Westerman M, Nelson E, Ket JC, Scheele F. Quality specifications in postgraduate medical e-learning: an integrative literature review leading to a postgraduate medical e-learning model. *BMC Med Educ* 2016; 16: 168.

Holmes D. ebrain brings the e-learning revolution to the neurosciences. *Lancet Neurol* 2012; 11: 126-7.

Huynh R. The Role of e-learning in Medical Education. *Acad Med* 2017; 4: 430.

ILAE. *Explore the ILAE Curriculum for Epileptology*. 2020. Available at: https://www.ilae.org/education/ilae-curriculum

ILAE. *Academy*. 2020. Available at: https://ilae-academy.remote-learner.net/

Maggio LA, Tannery NH, Chen HC, Cate O, O'Brien B. Evidence-based medicine training in undergraduate medical education. *Acad Med* 2013; 88: 1022-8.

Ruiz JG, Mintzer MJ, Leipzig RM. The impact of e-learning in medical education. *Acad Med* 2006; 81: 207-12.

Sandars J, Schroter S. Web 2.0 technologies for undergraduate and postgraduate medical education: an online survey. *Postgrad Med J* 2007; 83: 759-62.

Sangrà A, Vlachopoulos D, Cabrera N. Building an inclusive definition of e-learning: an approach to the conceptual framework. *International Review of Research in Open and Distance Learning* 2012; 13: 145-59.

Thomson S. ebrain: the electronic learning platform for clinical neuroscience. *Br J Neurosurg* 2013; 27: 577-9.

Wehrs VH, Pfäfflin M, May TW. e-learning courses in epilepsy-concept, evaluation, and experience with the e-learning course "genetics of epilepsies". *Epilepsia* 2007; 48: 872-9.

Zehry K, Halder N, Theodosiou L. e-learning in medical education in the United Kingdom. *Procedia Social and Behavioral Sciences* 2011; 15: 3163-7.