OREGON HEALTH & SCIENCE UNIVERSITY

Collaborative Educational Platform in Anesthesiology – The Anesthesia Toolbox

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Faculty Disclosure

Company	Nature of Affiliation

Off-Label Product Usage
• None

Learning Objectives

- Be able to describe examples of current collaborative educational initiatives in GME
- Be able to identify the specific aims of the Anesthesia Toolbox Project
- Be able to identify the types of resources included in the Toolbox

Graduate Medical Education Change is in the Wind

- Changes in accreditation requirements for programs (ACGME)
- Changes in certification of physicians (ABA)
- Potential change in the future role of the anesthesiologist
- Culture, Technology, ….

Aggarwal R, Darzi A. Technical-skills training in the 21st century. N Engl J Med 2006; 355:2695-6.
Reznick R, MacRae H. Teaching surgical skills-changes in the wind. N Engl J Med. 2006; 355:2664-2669.

Challenges Facing GME

ACGME "Next Accreditation System"

- Delivery of a competency-based curriculum
- Assessment of multiple milestones
  - Development and Deployment of Assessment Tools
  - Faculty training
  - Tracking Learner Progress

Nasca T, etal. The next CME accreditation system – rational and benefits. NEJM 2012;366:1051-56.

Challenges Facing GME – desire to innovate

- Improving education
- New Technology
- Changes in education and learning theory

Challenges Facing GME

Balancing Teaching, Research, and Clinical Care

- **Patient care drives revenue** (teaching is a cost center)
- **Optimal patient care vs teaching**
  - Patient safety
  - Production
- **Financial constraints**
  - Harder to obtain grant funding
  - Reduced federal funding for GME
  - Reduced clinical revenue

Albanese M, Mejicano G, Gruppen L. Competency-based medical education: a defense against the four horsemen of the apocalypse. Acad Med. 2008;83:1132-1139.

Yarris, et al. Expertise, time, money, Mentoring, and reward: systemic barriers that limit education researcher productivity = proceedings from the AAMC GEA workshop. JGME in press.

Possible Solutions

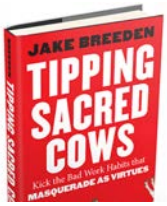
Adopt a standard curriculum?

Standardize competency assessment tools?

Share resources?

Technology?

National organization support?



MedEdportal

- Peer-reviewed publication
- Clearinghouse for educational resources
- Includes more UME and GME
- Funded by AAMC

www.mededportal.org

SCORE

- Standard 5 yr General Surgery Curriculum
- Educational resources
  - Online textbooks
  - Question bank
  - Operative videos
  - Image database
  - Weekly clinical cases
  - Online journal club
- Funded by
  - ABS, ACS, Assoc of PDs in surgery, Association for Surgical Education, Surgery RRC

www.surgicalcore.org

Stanford AIM: START and START Prep

- START
  - Online training program for PGY-1 residents to prepare them for anesthesia residency
- START Prep
  - Online 1-year curriculum to introduce anesthesia basic sciences

Aim.stanford.edu/project/startprep

Anesthesia Toolbox Business Drivers

- Limited faculty time
- Large cost to develop educational materials
- Problems with current Internet Resources
  - Multiple sites
  - Lack of peer review
  - Unable to integrate into a curriculum
- ACGME - Movement toward a competency-based educational model
- Facilitate education research

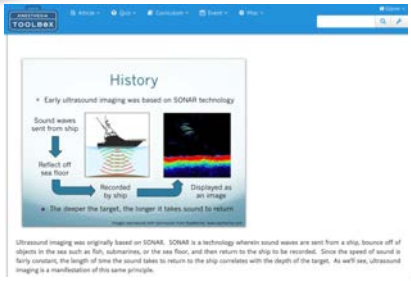
Project Goals

- Aggregate **Peer-reviewed** Educational Resources
- Share the resources
  - Target audience: academic anesthesiology departments, post graduates
  - Faculty and resident resources
- Technical Platform
  - Content submission
  - Peer Review
  - Curriculum building
  - Learning tracking
- Proof of Concept

Resource Types

- Lectures/Slide sets
- On-line Learning
- Hands-on Skills Training Guides OSCE/ Simulation Scripts
- PBLD/Learning Exercises
- Image/Clip Library
- Ask the Experts
- Skill and Knowledge Assessment Tools
  - OSCE/SIM
  - MCQ Assessments
  - Direct clinical observation

Lectures



PBLD/Learning Exercise

- Case/Oral board Style
- Can be used to support flipped classroom learning

Online Modules

- Self-paced learning
- Media rich, Support for Video
- Checks for Understanding

Hands-on Skills Training

- Faculty Guide for skills sessions
- Learner practice and review
- Guidelines for skills assessment

Image and Clip Library

- Normal anatomy
- Anatomical variants
- Examples of good and bad behaviors
- Simulations

Ask Experts

- Blog/Discussion of interesting cases
- Monitored by editorial staff
- Expert and Peer comments

Assessments

- Medical knowledge question bank
- Image/Video interpretation skills test
- Direct observation evaluations
- Procedural skills checklist
- OSCE/SIM evaluations
- The toolbox system is an education research platform

Curriculum

- Any item in the content can be assigned as part of a curriculum
- Subcommittees define curriculum elements
- Curricula assigned to learners for defined periods of time

	WEEK 1
Online Module	US Needle Guidance Femoral Sonoantomy
Lectures	Lect 01 Periph Nerv Anat
Video/Images	Examples of Femoral Nerve US clips
Hands-On Skills	HO 1 Needle Skills HO 2 Fem/Saph
Required Reading	Chin K, Perlas A, Chan V, et al. Needle visualization in ultrasound-guided regional anesthesia: Challenges and solutions. Reg. Anesth Pain Med 2008;33:532-544. ....
Suggested Reading	Brull R, Macfarlane A, Tse C. Practical knobology for ultrasound-guided regional anesthesia. Reg Anesth Pain Med 2010;35:568-573. ....
Additional Resources	OM 2 US Machine OM 3 US Probe

Curriculum Assignment

- Curricula can be assigned to learners within a block schedule
- Learners have a specified period of time to complete the curricula

Curriculum Tracking

- Track learner activity
- Review quiz results
- Extensive learner analytics

Project Status

- 29 Institutions Letter of Intent
  - Stanford, U Penn, Columbia, HSS, Cleveland Clinic, Virginia Mason, U Miami, U Colorado, U Virginia, OHSU, Columbia, Cornell, Stonybrook, U Wisconsin, Oklahoma University, U Toronto, U Michigan, U Maryland, Penn State, MGH, U Alabama, Brigham and Womens, U Maryland, U Ottawa, U Kentucky, U Iowa, Kansas U, St Vincents Melbourne, Dartmouth
- 12 institutions Live July 1, 2014

Conclusion

•Share Resources

•Support for Collaborative Initiatives
- ASA
- Specialty societies
- Program directors

Anesthesia Education Toolbox

A. Executive Summary

The majority of graduate medical education programs for procedural specialties, like anesthesiology, rely upon an apprenticeship model of education. Although most programs have high-level curriculum goals and objectives, they frequently do not have a clear description of how to achieve the goals set out in the curriculum. Furthermore, curriculum implementation and assessment of educational outcomes, vary widely between different anesthesia residency programs. Recent changes promulgated by the Accreditation Council for Graduate Medical Education and specialty boards including the American Board of Anesthesiology, are encouraging graduate medical education programs to evolve towards a competency-based educational model, where learners must demonstrate achievement of competency milestones. The program requirements developed by the residency review committees for this new educational model provide a higher level of specificity for what trainees must achieve during residency; however, the implementation of a curricula and assessment tools for measuring educational outcomes and milestone achievement are left to the individual residency programs. Changes made by anesthesia and other residency programs in response to accreditation requirements or innovations in medical education must be made in an environment where residency programs have limited financial and other resources to create educational materials due to clinical care and productivity pressures. In addition, each program developing educational material is frequently "reinventing the wheel", because they lack an infrastructure to support the co-development, peer review and sharing of high quality educational resources across academic institutions. What is also lacking is data that demonstrates the impact on educational outcomes from the implementation of competency-based curricula in residency programs or the natural history of milestone/competency achievement by residents.

Specific Aim: The aim of the Anesthesia Education Toolbox project is to create an infrastructure for an on-line peer reviewed set of educational resources that can be developed and shared by multiple anesthesia residency programs to implement a competency-based curriculum. The Toolbox will provide a mechanism for residency programs to submit, review and share educational materials that support both learners and educators with resources including: e-learning modules, lecture materials, problem-base learning exercises, simulation scripts, a video/image library, and competency assessment tools. The Toolbox will also provide a common technology platform for the deployment of curricula to learners, and the ability to administer competency assessments and tracking learner progress. Finally, the toolbox will provide a multi-institution research platform for studies on the achievement of competency milestones.

B. Introduction and Background

For the last 100 years graduate medical education in procedural specialties, including surgery and anesthesiology, has been based on the German-style of medical training introduced in the United States by Sir William Halstead in the early 1900's.[1-3] With this style of education, trainees progress through a prolonged period of apprenticeship with gradually increasing responsibility for the management of complex patients and performance of technical procedures. Over the years, the apprenticeship model has been supplemented by defined curricula and competencies secondary to the influence of the national organizations that are responsible for the accreditation of graduate medical training programs and for the certification of individual physicians by specialty boards.

The Accreditation Council for Graduate Medical Education (ACGME) is responsible for accrediting graduate medical training programs. Individual Residency Review Committees (RRCs) under the ACGME, create and maintain program requirements for the various medical specialties. For example, the anesthesiology RRC program requirements specify the length of training and individual clinical rotations anesthesia trainees must complete. [4] In addition to the ACGME, the American Board of Anesthesiology (ABA) plays a key role in defining anesthesiology curricula through its published content outline describing the topics that applicants are examined on during the certification process.[5]

The ACGME and specialty boards are the driving force in the recent evolution in medical education from a traditional experienced-based model to a competency-based model with defined educational goals and competency requirements.[6, 7] In 2013 the ACGME began requiring residency programs to initiate implementation of competency-based curricula that include methods for measuring attainment of competency milestones. [8] The milestones described by the ACGME and RRCs provide greater specificity as to what should be included in a residency curriculum. For example, the anesthesiology milestones for technical skills in airway management describe a level 3 milestone: "performs advanced airway management techniques, including awake intubations, fiberoptic intubations, and lung isolation techniques." [9] Although the ACGME and the RRCs have defined the competency milestones, *implementation of a curriculum and assessments for achievement of milestones* is left up to the individual residency programs around the country.

In addition to the significant changes in training imposed by certifying bodies, graduate medical education (GME) programs continuously seek to improve training based on changes in learning and education theory, and technological innovations that can improve medical education. Unfortunately, the goal of improving GME comes at a time when medical education is facing enormous obstacles. [10] Albanese et al. describe the "four horsemen of the medical education apocalypse": a decrease in access to teaching patients, a decrease in access to medical educators, the conflicting priority of patient care and clinical productivity versus clinical education, and a decline in funding for medical education. In this environment, clinical educators are facing increasing pressure to prioritize productivity, patient care and safety over education. Thus, academic departments are able to allocate less non-clinical time and financial resources towards education activities or to develop educational material.

The diminished ability to provide resources towards medical education is exacerbated by the cost of developing educational material. Although e-learning, video technology, simulation, etc. are attractive educational methodologies, the cost to produce and continuously improve educational material is very high. Innovations are unlikely to be commercialized in a manner that would recoup the investment of resources required to create these materials due to a limited market for final products (there are less than 150 accredited anesthesiology residency programs in the United States). A limited market and the limited financial resources of customers, make it unlikely that graduate medical education products will be turned into profit making ventures. These conditions can restrict the amount of resources an academic department is willing to invest in the creation of educational materials.

Even if a department or faculty member were to invest time and resources to develop innovative medical education material, they would still be challenged with a method to distribute or disseminate the materials. The traditional method of peer reviewed publications is time consuming, and usually results in a delay of several years before the material reaches other programs that might benefit from the material. Many authors have turned to the Internet to distribute educational material. Unfortunately, these materials are frequently not peer reviewed and would be difficult to incorporate in to a formal GME curriculum.

How then can GME programs allocate the resources required to develop and distribute innovative educational materials? One solution is for graduate medical education programs to pool resources to develop and share educational materials.[10] Traditionally, faculty have been wary of adopting standardized curricula or materials. A bias towards rejecting material “not invented here” is not uncommon. In addition, some departments may consider their educational programs or materials as a competitive advantage. This is in juxtaposition to a view of competency-based education, in which an anesthesiologist trained in any program should be learning and achieving competency in the same things. With the greater level of detail proscribed by accrediting bodies, we are closer to defining standardized curricula for GME, and departments may now be more accepting of sharing educational resources.

A few efforts have been made to create a national bank of curriculum materials. In undergraduate medical education, the Association of American Medical Colleges has created the MedEdPortal for the submission and publication of peer reviewed educational materials.[11] Although originally targeted at undergraduate medical education, this portal has become a source of high-quality peer reviewed educational resources that span the continuum of medical education. Because of the broad nature of the content in the MedEdPortal, it does not satisfy the focused needs of each particular GME specialty. In 2005 a Blue Ribbon Panel of the American Surgical Association recommended the creation of a national curriculum in surgery. Based on these recommendations, the Surgical Council on Resident Education (SCORE) was founded with representation from the American Board of Surgery, the American College of Surgeons, the American Surgical Association, the Association of Program Directors in Surgery, the Association for Surgical Education, and the RRC for surgery. One of the principal goals of SCORE was to develop a national web site to deliver educational content to general surgery residents.[12] The site, www.surgicalcore.org, currently has over 650 modules and 200 videos (http://www.surgicalcore.org/public/about accessed 5/30/14).

A similar site addressing the continuum of anesthesia training does not exist. Limited national efforts directed at certain aspects of anesthesia training have begun to arise. Stanford University has developed the START and STARTPrep e-learning programs.[13] The START online training program provides a standardized curriculum for post-graduate year 1 residents to prepare them for the transition to anesthesia residency. The STARTPrep is a one year curriculum designed for CA1 anesthesia residents to introduce them to the anesthesia basic sciences. Other limited efforts have been put together by anesthesia subspecialty organizations. For example the Society for Obstetric Anesthesiology and Perinatology has created a lecture series and published it online through the Open Anesthesia web site of the International Anesthesia Research Society (http://openanesthesia.org/w/index.php?title=Virtual_Grand_Rounds_in_Obstetric_Anesthesia#tab=Virtual_Grand_Rounds_in_Obstetric_Anesthesia Accessed 6/6/14). These lectures are largely directed at fellows in obstetric anesthesia, but could be adapted for residency subspecialty training in this area.

What is lacking is an integrated infrastructure to support the development, peer review and sharing of anesthesia educational resources, and a method to implement the resources into curricula for learners that will allow assessment of progress and educational outcomes. The specific aim of the Anesthesiology Education Toolbox project is to address the above challenges. In order to encourage the development and sharing of educational resources within anesthesiology, the Toolbox will provide an on-line mechanism for programs to submit, peer-review and share a variety of educational resources. The Toolbox will also provide a technical platform that will allow programs to organize and deliver Toolbox resources in a curriculum that can be assigned to learners. The Toolbox will include the ability to administer competency assessments and integrate their results with the tracking of learner progress through a curriculum. Finally, the toolbox platform will provide a multi-institution research platform for studies on the achievement of competency milestones.

C. Preliminary Data

A steering committee from 5 different institutions was formed and reviewed published curricula in regional anesthesia training for anesthesiology residents and fellows. [14-17] The steering committee organized the curriculum recommendations into curricula designed for 3 different levels of trainees: residents in their first training year being introduced to regional anesthesia and acute pain medicine, residents on a first subspecialty rotation dedicated to regional anesthesia and acute pain medicine, and residents on a second dedicated rotation. The steering committee further organized the curriculum elements into the type of resource that would *best support the teaching and learning of each particular curriculum item*. Resource types included:

- **e-learning Modules**: self-paced on-line modules that would require learner interactivity or rich multi-media to teach the material
- **Lecture**: traditional lecture with slides
- **Problem-Based Learning Discussion (PBLD):** A small audience format based on team problem solving of clinical cases to support “flipped” classroom learning.
- **Hands-on Training Session**: a small audience format that would require hands-on interaction for skills training
- **Simulation**: A small audience format requiring learner participation in low or high fidelity simulation of clinical scenarios.

- **Video Clip/Image Library**: independent learning through exploration of video clips or images demonstrating relevant examples.
- **Competency Assessment Tools**: a tool that would be required to assess competency of a particular portion of the curriculum.

Programs were asked to recommend faculty members for peer review of submitted educational resources. A subcommittee was formed to manage the peer review process, which would be modeled after the peer review processes in place at major journals. Programs were then asked to volunteer to submit educational resources to fulfill the defined curricula. Submissions were subjected to peer review. In a pilot project, an open access online content management system (Sakai) was used to organize the submitted peer reviewed educational resources for access by learners (**Figure 1**).

D. Project Description

This pilot project demonstrated the feasibility and value of a collaborative effort to develop and share educational resources. A second phase of the project is necessary to demonstrate that the same process can produce a comprehensive anesthesiology curriculum (not just regional anesthesia). In addition, the curriculum elements must be incorporated into an electronic learning management system that can provide access to curriculum materials to students, deliver competency assessments, and track learner progress. The project must also develop core business processes for the sharing of intellectual property, project governance, and peer review. Finally, the project must develop a sustainable business model. All of these things must be scalable to include a much larger number of universities.

In the Fall of 2013 we conducted an informal email solicitation to the regional anesthesia directors of ACGME accredited anesthesiology programs. Twenty five programs out of 75 responded that they would volunteer to explore the development of a repository of peer reviewed educational materials in anesthesia. Programs signing the letter of intent are presented in Table 2.

The second phase of the project will require limited modification of an existing web-based learning management system. The steering committee has selected a learning management system (COACH) developed by the Columbia University Department of Surgery, which meets the following project requirements:

- Content management system that supports e-learning courses, video, images, PDF files, word documents, excel spreadsheets, and PowerPoint slide sets
- Centralized content control to support content submission and a peer review process prior to publication
- Content that is searchable – the systems contains a search tool to locate content based on keyword tagging or text within the content
- Ability to share content with other medical organizations that are using the learning management system
- Assembly of selected content into curricula that can be assigned to learners
- Learning tracking and analytics, which allow analysis of content usage, learner progress through assigned curricula, and learner performance on assessments
- Multi-device access to content – support for multiple browsers including tablet and mobile devices

- 24/7 up time with reliable system backup
- Scalable to support 100 universities

The second phase of the Project requires modification of the COACH platform to include more robust support for assessment of learner achievement of competency milestones Furthermore, the software will require additional development to support a more robust and intuitive system for comprehensive tracking of learner progress through curricula and performance on assessments. The steering committee has developed a requirements document specifying the necessary software modifications. Upon completion of the software modifications, the second phase of the project will deploy in the COACH system the educational resources submitted by participating universities that have passed peer review.

To ensure successful deployment of a peer reviewed shared learning management system, the second phase of the Anesthesia Education Toolbox Project will also require development of the following organizational elements:

- **Governance**: the current project has been guided by a volunteer steering committee, with each institution appointing a member. This structure is unwieldy with more than 20 institutions participating. The steering committee will remain in place to provide advice to a smaller governing board.
- **Business Model**: the project is intended to be non-profit and self-sustaining. The second phase of the project will be funded with a mixture of grant funding and financial contribution by initial institutional participants. Funding from granting agencies will be sought to provide seed funding for software development and the roll out of the second phase pilot. Successful deployment will allow the system to demonstrate value and seek additional financial contributions from institutional participants.
- **Intellectual Property**: the second phase of the project will develop licensing agreements to protect the intellectual property of the content submitted by participating faculty. The agreements will specify the retained rights of the contributing authors and specify the rules governing the use of content contributed to the Toolbox.
- **Peer Review**: the second phase of the project will develop a formal process for peer review including tracking of submissions, peer review, author revisions, and publication of submitted content. A formalized peer review process will ensure high quality materials and assist contributors in receiving academic credit for accepted submissions.
- **Content Development**: the second phase of the project will organize section chiefs of the individual anesthesia topic areas who will be responsible for organizing steering committees from the faculty of participating institutions to develop the curricula for their subspecialty area of anesthesia. The process will be modeled after the process developed for regional anesthesia and acute pain medicine content in the pilot phase. The section chiefs will also be responsible for soliciting the faculty of participating institutions to submit content to fulfill the curriculum and enter the content into the peer process**.**

E. Project Significance

Success of this project has the potential to radically change anesthesiology training in the United States. The vast majority of current anesthesia training programs

do not have a high quality mechanism for implementing a learner centric educational curriculum with access to resources, which support both learners and faculty engaged in teaching the curricula. In addition, most programs are struggling with tracking learner progress through curricula or achievement of milestones. Every program, despite the resource constraints within academic departments, is essentially trying to recreate the same wheel. Successful demonstration of the ability of multiple well-known universities to share in the creation of peer reviewed educational resources to fulfill a standardized curriculum delivered via a web-based learning management system, should accelerate the adoption of this educational model. In addition, spreading of development costs and resources across multiple universities should increase the rapidity of development and quality of available educational resources, and thus, the quality of anesthesia training. Furthermore, the use of a common learning management system with assessment of competency milestones will create a research platform to study training and competency achievement in anesthesia residency programs. It is also hoped that engaging residents with this online program to support their residency training, will create a future audience of post-graduates that can stay connected with the toolbox to continue their training and education beyond residency.

F. Plans for Future Funding

Grant funding for educational research in graduate medical education is notoriously difficult to obtain.[18] Future funding will be necessary to 1) continue to develop the infrastructure to support the project, and for research into the effect of a peer reviewed shared anesthesia curriculum deployed through a common learning management system on educational outcomes as well as research on the achievement of competency milestones. Potential funding for the development of content, peer review, and learning management system will be sought from program participants, and anesthesia societies (American Society of Anesthesiology, Society for Neuroanesthesia and Critical Care, Society for Cardiovascular Anesthesiologists, Society for Obstetric Anesthesia and Perinatology, International Anesthesia Research Society, Society for Pediatric Anesthesia, American Society of Regional Anesthesia and Pain Medicine, etc.). The second phase of the project will also include the preparation of grant applications to support research into physician achievement of competency milestones during training. It is anticipated that grants will be submitted to the Foundation for Anesthesia Education and Research, the Robert Wood Johnson Foundation, the National Science Foundation, and the National Library of Medicine. In the third phase of the project, resources will be organized to deliver continuing medical education to post-graduates. Funding from post-graduate learners will help the project achieve self-sustainability.

G: References

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H. Personnel

Glenn Woodworth, MD, has 10 years experience in software and business development. He has provided consulting services and directly worked for several healthcare technology companies, including serving as the Senior Vice President of a billion dollar healthcare company. Dr. Woodworth gained his undergraduate degree at the University of California at San Diego with an emphasis on cognitive science, artificial intelligence and the design of human-machine interfaces. He continued this work while obtaining his MD degree from the same institution. Dr. Woodworth completed residency training in anesthesiology at the Mayo Clinic. He joined the faculty of Oregon Health and

Science University in 2010. His research interest has focused on the effectiveness of medical education and the assessment of physician competency. He was promoted in 2014 to Associate Professor and currently serves as the Director of Regional Anesthesia in the Department of Anesthesiology and Perioperative medicine.

Robert Maniker, MD, is an Assistant Professor of Anesthesiology at Columbia University Medical Center in NY, NY. Dr. Maniker earned his undergraduate degree at the University of Michigan in Ann Arbor, MI while completing honors thesis work in the field of human genetics. He then obtained his MD from the University of Michigan and went on to complete Anesthesiology residency at Northwestern University in Chicago, IL, followed by fellowship in Interventional Pain Medicine at Harvard University's Brigham and Women's Hospital in Boston, MA. He subsequently worked at the Mayo Clinic of Arizona before joining the faculty at Columbia University. He specializes in regional anesthesia and acute perioperative pain management, with a specific interest in resident and fellow education. His research interest focuses on new pharmacologic interventions to improve outcomes in regional anesthesia, as well as novel methods to improve resident and fellow education.

Figure 1 Web-portal page to access toolbox resources for the first week of the core regional rotation at Oregon Health and Science University

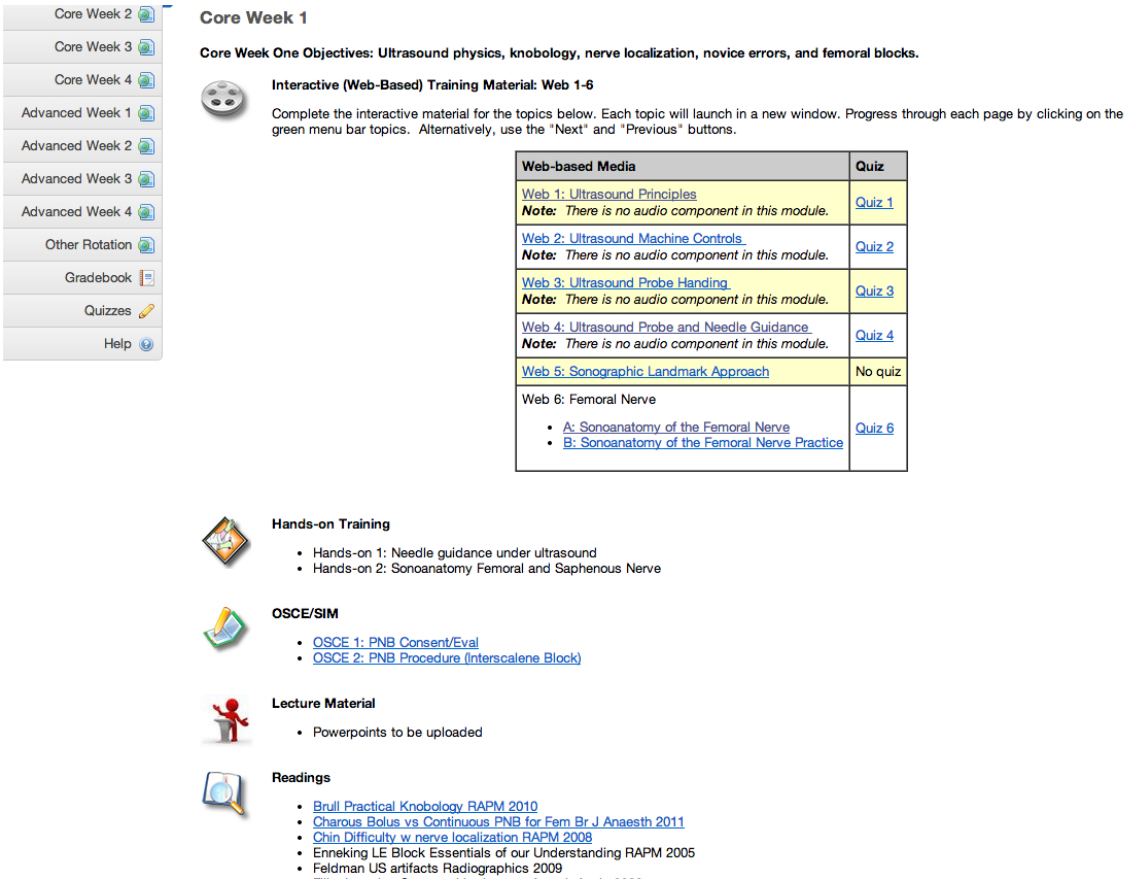

Table 1: Programs signing a letter of intent to participate in a collaborative project to develop, peer-review and share educational resources.

- Brigham and Women's Hospital
- Cleveland Clinic
- Columbia University
- Cornell
- Dartmouth
- Hospital for Special Surgery
- Massachusetts General Hospital
- Oklahoma University
- Oregon Health and Science University
- Penn State University
- Stanford University
- Stonybrook University
- University of Alabama
- University of Colorado
- University of Iowa
- University of Maryland
- University of Miami
- University of Michigan
- University of Pennsylvania
- University of Kentucky
- University of Toronto
- University of Virginia
- University of Wisconsin
- Virginia Mason