Script for the
Virtual Stroke Lab
Tutorial

Professional
Development for
Teachers

http://www.mind.ilstu.edu

Introduction

Welcome to The Mind Project Website. This podcast provides professional development for teachers considering implementing "The Virtual Stroke Lab," a free virtual lab available from The Mind Project. Our goal in this online tutorial is to provide teachers around the world with the introductory training that we offer in our face-to-face workshops.

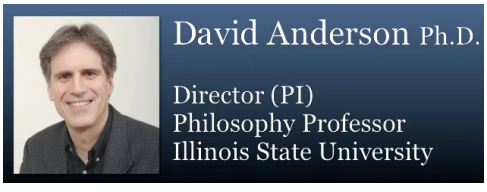
We are glad you are learning more about The Mind Project and we look forward to you joining the hundreds of other teachers who have implemented our labs with students.

This tutorial will cover the following topics:

- A brief background on The Mind Project
- An introduction to the lab
- Lab objectives aligned with standards
- Science and health content topics [covered in the Virtual Lab]
- Teacher implementation support for each of the three sections of the lab
- Addressing misconceptions that students may have after completing the lab
- Assessment suggestions
- Description of various teacher and student resources to accompany the lab.
- And the tutorial ends with, Tips for Getting Started

Background on The Mind Project

The Mind Project creates interactive, inquiry-based virtual laboratories that expose students to cutting edge science that apply to content they learn in the classroom. Our virtual labs are designed with several purposes in mind. One is to bridge the gap between health science and classroom science. We want to help teachers and their students, feel more connected with how science in the health field is conducted in the hospital setting. We also want to expose students to exciting career options in science, such as types of specialized medical doctors. The Mind Project provides a dynamic medical experience that generously welcomes students into the dramatic intersection of technology and its impact on medical science.



The Mind Project is made up of both university faculty and classroom teachers.Dr. David Anderson is the creator of The Mind Project and is a philosophy professor at Illinois State University. Dr. Ajeet Gordhan is the neuroradiologist, who was the medical doctor consultant for the Virtual Stroke Lab. Dr. Gordhan, performs the

surgery highlighted in this lab, and has published numerous articles the coiling procedure performed for subarachnoid hemorrhages.

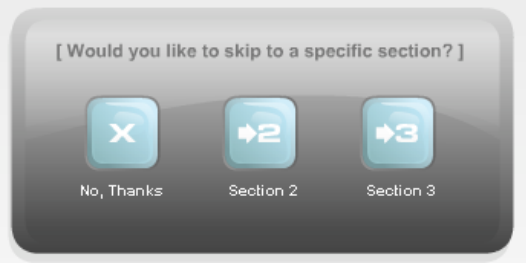
Dr. Darci Harland and Elisa Palmer are classroom biology teachers who paired up with Dr. Gordhan to storyboard a virtual lab that would correctly depict the diagnostic side of medicine. Darci and Elisa also developed curriculum, as well as professional development resources for classroom teachers, to use with their students. Kevin Stewart is the graphic artist and programmer who brought the virtual lab to life.

Stroke was chosen for this lab for a number of reasons. First, radiology is an increasingly important specialization and people know relatively little about it. It is a very interesting field and has the potential of attracting quality students to the medical profession who might not have otherwise considered medical school. It was also chosen because stroke is a serious health problem in this country and one where a timely diagnosis is vital. Brain damage occurs very quickly and the sooner the patient receives proper medical care, the more likely that permanent damage can be reduced or averted. This virtual lab introduces valuable lessons, which could one day help save a person's life.

Introduction to The Virtual Stroke Lab

The Virtual Stroke lab was designed to provide a fun and engaging way for students to learn about strokes by experiencing diagnostic medicine from the perspective of a radiologist. Because students read factual information only when they need to make a decision regarding their patient, they learn a lot of health and science facts in context with a problem they must solve. This learning is "just-in-time" instead of memorizing facts that may or may not be helpful later.

There are two versions of The Virtual Stroke Lab. The first is called the "Basic" version and should be used with students if they will be able to sit and complete all three sections within the lab in one sitting. They start at the beginning and work through the 3 sections.



However, if you would like to have students do the sections at different times, you should use the "Flexible" version. This allows students to jump to parts two or three, without having to complete previous sections. We have separate student entry pages for the Basic and Flexible versions. Be sure to provide your students with the URL for the version of the lab that you want them to use.

Objectives and Standards

Integrating our Virtual Labs is made flexible by focusing in on the content that you want students to learn. While there are a wide variety of content objectives, you can focus students on the topics that best supplement your curriculum.

Students who complete the Virtual Stroke Lab should be able to:

- Explain the importance of early treatment in stroke patients.

- Evaluate a patient's history and their stroke symptoms to determine whether it is an ischemic or hemorrhagic stroke.
- Explain the potential causes of aneurysms and associated risk factors.
- Locate the source of the stroke on a Head CT scan.
- Locate exact location of aneurysm on 3D Head CT angiogram.
- Analyze shape of aneurysm, and weigh risks and possible complications, to determine best surgery treatment.
- Perform a simulation of embolization (coiling) and also explain how it stabilizes the aneurysm.
- Analyze how technology has impacted the diagnosis and treatment of stroke patients.
- Describe the function of a radiologist in neurology.

Since this virtual lab was developed in Illinois, we have aligned the content addressed in this lab with the Illinois State Learning Standards. You can get a closer look at these standards by downloading the script of this tutorial or the professional development manual available on our website.

If you are not from Illinois you will easily be able to align these with any of the other state standards. If you do live in a state other than Illinois and if you identify the relevant standards for your state – please send us a list of those standards and we will post them on our website.

IL.12.A.5b
Analyze the transmission of genetic traits, diseases and defects.
IL.13.B.5d
Analyze the costs, benefits and effects of scientific and technological policies at the local, state, national and global levels (e.g., genetic research, Internet access).
IL.22.A.5a
Explain strategies for managing contagious, chronic and degenerative illnesses (e.g., various treatment and support systems).
IL.22.A.5c
Explain how health and safety problems have been altered by technology, media and medicine (e.g., product testing; control of polio; advanced surgical techniques; improved treatments for cancer, diabetes and heart disease; worksite safety management).
IL.23.B.2
Differentiate between positive and negative effects of health-related actions on body systems (e.g., drug use, exercise, diet).
IL.23.B.3
Explain the effects of health-related actions upon body systems (e.g., fad diets, orthodontics, avoiding smoking, alcohol use and other drug use).

Common Core Science Framework

This lab also aligns with all three dimensions of the Common Core Science Framework. In the first dimension, "Scientific and Engineering Practices," this lab provides the opportunity for students to analyze and interpret data that comes from diagnostic radiology images and then to construct explanations of what the images indicate and what course of treatment would most benefit the patient.

In the second dimension, "Crosscutting Concepts" students explore cause and effect of brain cell death with patient function, and students also determine the impact of the structure and function of blood vessels in the brain and its affect on circulatory function. And in the third dimension, "Disciplinary Core

Ideas" this virtual lab addresses the Life Science core concept, "from molecules to organisms: Structures and processes."

Content Addressed

The general stroke awareness that students will gain by participating in The Virtual Stroke Lab makes it appropriate for any health or science classroom. Students will learn how to recognize stroke symptoms and the importance of getting quick medical attention. By diagnosing their virtual patient, students will learn about the two basic types of strokes. One is an ischemic stroke where blockage called a thrombus causes the symptoms. And the second, is a hemorrhagic stroke where bleeding causes the symptoms. This virtual lab focuses on a hemorrhagic stroke caused by an aneurysm.

The role of imaging has become increasing important in the health and medical fields. Gone are the days of exploratory surgeries. ER and primary care doctors order CT, MRI, PET, and angiography exams so that radiologists, the doctors who are specially trained to read these images, can provide a thorough report of the anatomical trauma and/or disease. The diagnoses that come from these images allow doctors to develop individualized treatment plans for their patients.

While we don't expect students to become experts in reading CT scans, they can learn a few basic principles of interpreting diagnostic images. In this Virtual Stroke Lab, your students will use CT without contrast to confirm that their patient has had a hemorrhagic stroke. Make sure students read the "Emergency Medical Record" or the EMR, to determine how to interpret these images. As an additional diagnostic test, students will order and read a "3D CT Head Angiogram" image to locate the aneurysm.

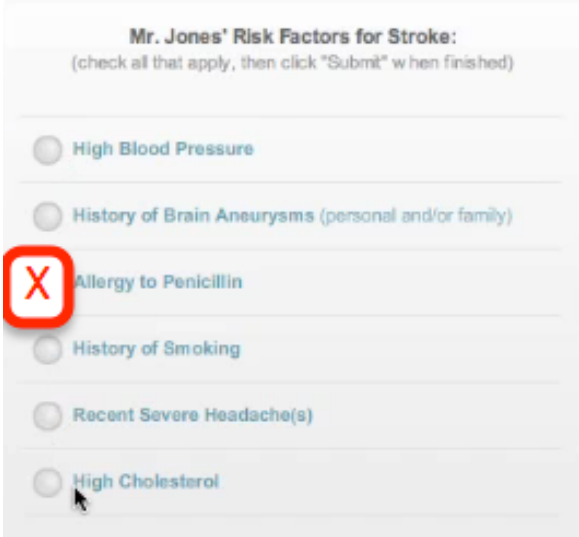
An important concept that students should glean, is that **stroke treatments depend on the type of stroke and where in the brain the stroke occurred.** Most strokes are ischemic. And if patients get treatment within three hours of the symptoms, clot-busting medications can minimize long-term damage. A smaller percent of strokes are hemorrhagic. In this Virtual Lab, the bleed comes from an aneurysm, and your students will decide what type of surgery, clipping or coiling the aneurysm will perform the best to strengthen the aneurysm.

Besides diagnosing and treating strokes, which you may or may not be one of your curricular goals, you can also use this virtual lab to introduce or reinforce more narrowly focused topics. For example, you could use The Virtual Stroke Lab as a way to connect the respiratory system and circulatory system. What better way to highlight the importance of delivering oxygenated blood to the brain, than diagnosing and treating a stroke? To help students see connections between structure and function, consider focusing on vessel anatomy. Have them brainstorm how damage to vessels affects the body. They may come up with several; heart attacks, organ failure, as well as strokes. You could focus on why not enough blood (ischemic) or too much blood (hemorrhagic) cause so many similar stroke symptoms. Or, maybe a study of how aneurysm structure impacts brain function might better interest your students. They could also connect brain damage of specific areas of the brain with how it impacts patient function.

In addition to all of the great science and health content students receive as part of the lab, The Virtual Stroke Lab also highlights careers in the health field. The neuroradiologist is the career that is featured in this lab, but there are other careers in radiology that do not require medical school. Students could become EMTs, nurses, or radiology technicians.

The Virtual Stroke Lab can also be used to highlight societal issues. You could address the importance of having an informed public regarding stroke treatments and how this affects permanent neurologic loss. Or you may choose to have students consider how life style choices such as diet and exercise, affect incidences of stroke and then factor in the cost to health care.

Teacher Support for Section 1



As students begin the lab, they are prompted to read EMR entries to help them make decisions regarding their patient, Mr. Jones. Students work between the EMR and Continue buttons, answering questions along the way. The answers to these are summarized in their doctor notes.

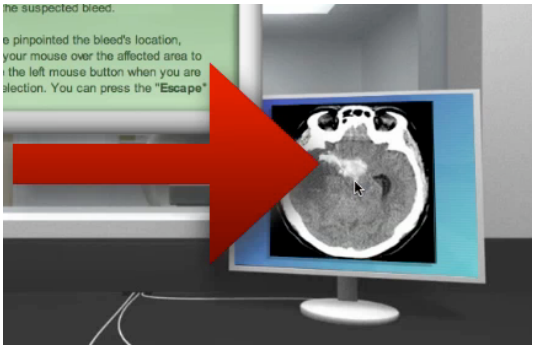
The first question students must answer is regarding the patient's history. Students are asked which are considered risk factors for stroke. **All** the answers should be selected EXCEPT allergy to penicillin. While the patient Mr. Jones does have this allergy, it is NOT a risk factor for stroke. The patient has a Hunt and Hess Score of 3, and has most likely had a hemorrhagic stroke. The appropriate diagnostic test is a CT Head Scan without contrast.

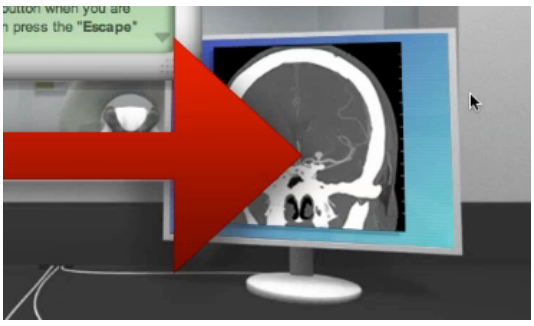
Ordering a CT Head Scan w/o contrast will determine whether the stroke was ischemic or hemorrhagic.

Teacher Support for Section 2

In this section, the patient is in the CT room and students must refer to the EMR to gain introductory skills in how to read CT scans. Make sure students understand that the images show cross sections of the head and that varying shades of gray and white indicate different diagnoses.

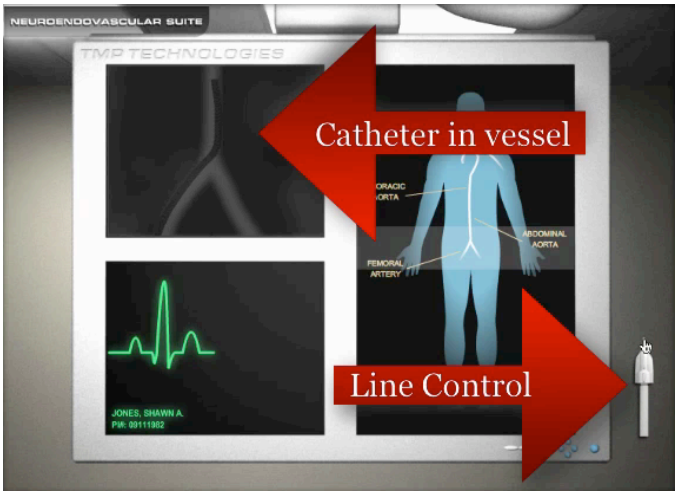
In this CT scan (in the image to the right), the bleed shows up as a white area. Students will click and drag to highlight the bleed.

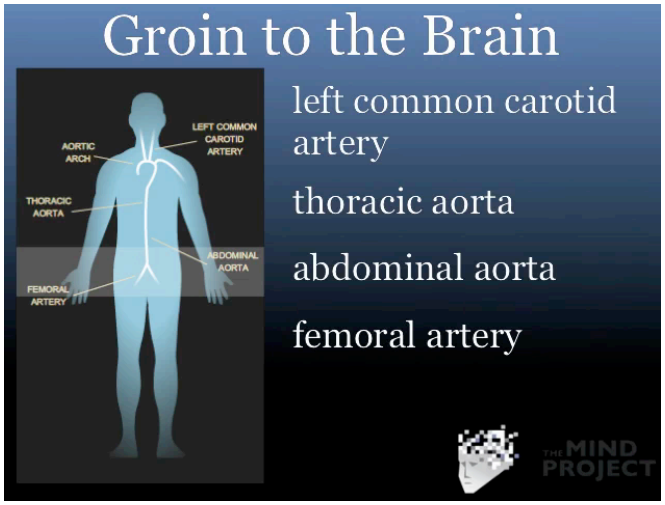




In the "3D CT Head Angiogram" image the aneurysm can be viewed as a gray bulb-shaped vessel (as shown in the image on the left).

Now the patient is in the neuroendovascular suite. It is important that students understand that they will be accessing the blood vessels in the brain, by entering the femoral artery in the groin. Students will simulate the embolization surgery by the insertion of needles, guidewires, and coils into the blood vessels of Mr. Jones. Students will use the line control to move the guidewire through the vessels. Once into the patient's neck area, move more slowly and twist the line control to move into the correct vessels. Even

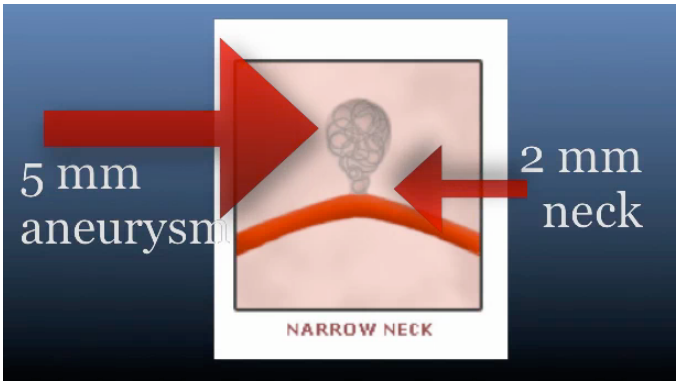




though the student tutorial reminds students that the human image on the right, is only for the benefit of this simulation, and does not represent the actual procedure, it may be helpful to remind students of this.

The roadmap from groin to brain includes the following blood vessels. Femoral artery to the abdominal aorta, to the thoracic aorta, to the left common carotid artery, where an aneurysm will be identified in the left internal carotid artery.

Its treatment decision time! The student now has a variety of data—images and information about the aneurysm and will be asked how to treat it. Students should refer to the EMR and read sectioned titled, "Aneurysm Treatment Options", "Importance of Aneurysm Neck Size", "What is a Working Projection?", and "Complications from Coiling."



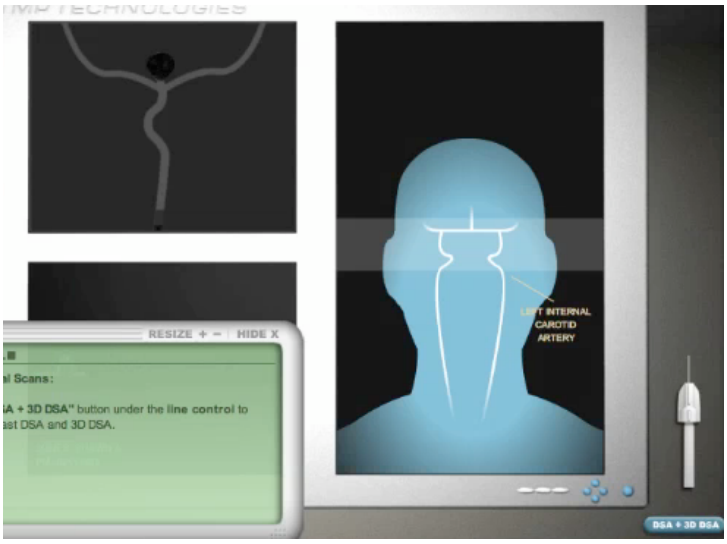
The DSA and 3D DSA revealed very important information regarding the structure of the aneurysm. It is a 5 mm aneurysm with a 2 mm neck. Students get this feedback after the tests, and it is permanently recorded in their doctor notes. The EMR entry, "Importance of Aneurysm neck Size" will help them determine whether they should clip or coil the aneurysm. Because the neck is smaller than the aneurysm itself, the coils will stay in place and make coiling the best option for this patient.

CT Head Scan determined it was a bleed, and therefore it was a hemorrhagic stroke. The location of the bleed classifies it as a Subarchnoid Hemorrhagic Stroke, which are caused by trauma or aneurysms. The 3D CT Head Angiogram confirmed the cause to be an aneurysm. The Digital Subtraction Angiogram or DSA provided important details of the aneurysm structure, which makes it a good candidate for the endovascular coiling procedure.

Teacher Support for Section 3

Students will simulate the coiling treatment procedure on Mr. Jones' aneurysm. Students will thread a microguidewire and microcatheter through the main catheter and up into the neck of the aneurysm. In order to embolize the aneurysm students thread coils of different sizes through the microcatheter and

into the aneurysm with the goal to insert just enough coils to block off the aneurysm, which will reduce blood flow, and thus eliminate the pressure and prevent further bleeding.



In reality, when coiling an aneurysm a neuroradiologist will study the 3D image of the aneurysm carefully to determine how many coils to use, and what size they should be. The structure of the aneurysm determines this. Usually, as in this lab, the larger coils are inserted first with the smaller coils used to fill in the gaps. These platinum coils have specially designed shapes but are stretched straight and spring loaded into the microcatheter during the delivery process. When pushed out of the sheath, the coils take on their preformed shape and gently push against the walls of the ballooned aneurysm providing strength and support to the weakened vessel.

After the final coil has been inserted into the aneurysm, taking final DSA and 3D DSA images help confirm whether or not blood continues to flow into the aneurysm. Therefore, just because the aneurysm is not visible does NOT mean the structure has been removed, only that blood is not flowing into it anymore! And that was the goal of the surgery.

After this has been confirmed, students are Congratulated for a job well done!

Possible Misconceptions

While this lab realistically simulates a neuroradiologist's treatment of a stroke patient; there are aspects of the lab where students might pick up misconceptions. Therefore, I want to highlight these so that you can clarify them with your students as you work with your students.

First of all, students may presume that because imaging and procedures go quickly in our simulation, that this is also true in real life. But realistically, it can take hours for the neuroradiologist to locate an aneurysm using CT angiography. The reason that so many different guidewires and catheters are needed is that the blood vessels narrow and become more fragile as one gets closer to the brain. Too narrow or flexible of a catheter in the larger blood vessels will not make sufficient progress towards the brain. Too large or rigid of a catheter can damage or rupture the smaller blood vessels.

Another possible misconception is, because students become a neuroradiologist they may assume that these doctors work in isolation and that they perform all of the tasks simulated in the virtual lab. However, in reality the neuroradiologist consults with other physicians before making these difficult decisions. And other health professionals such as EMT's, nurses, and radiology technicians are working with the neuroradiologist throughout the patient's time in the hospital. Therefore, students do not have to go to medical school to work in a radiology department; there are many other careers that support this work.

Students might also assume that surgery is always the best option. Just because this virtual patient had an aneurysm that could be treated with surgery, this is not always the case. Sometimes, the only mode of treatment is to monitor the bleed or aneurysm regularly and watch for any changes.

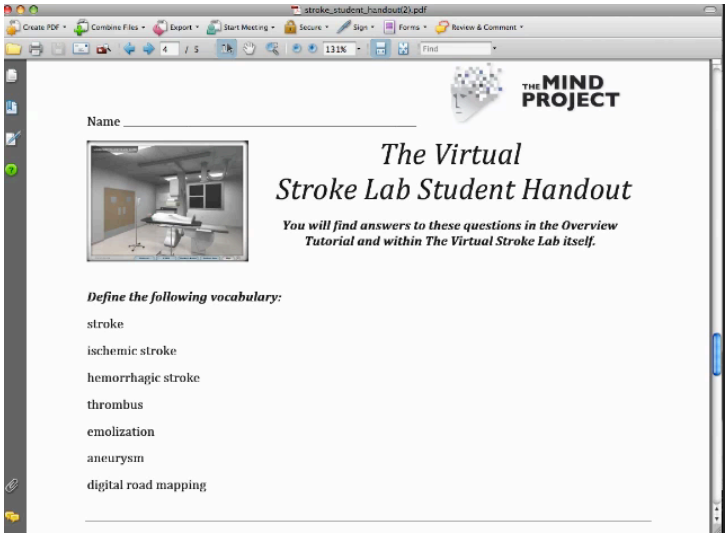
Lastly, because this lab focuses on hemorrhagic strokes, students may incorrectly assume that hemorrhagic strokes are the most common. But in reality, a majority of all strokes are ischemic strokes, caused by blocked arteries.

Assessment Suggestions

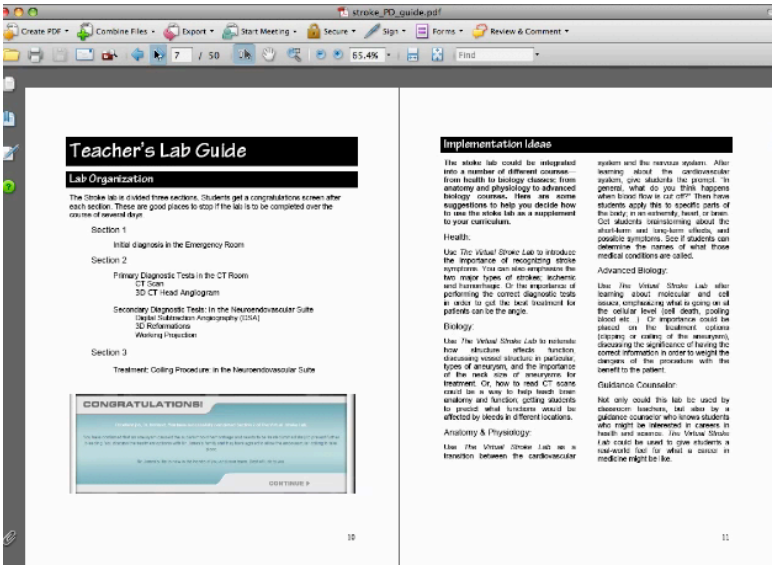
Your curricular goals will determine how you assess the student's experience during the Virtual Stroke Lab. If your goal was to include an enrichment activity that is connected to content you recently covered, then a completion grade may be all that you need.

However, if want a bit more accountability for students, you can have them show proof of each "Congratulations!" graphic they receive after completing each section.

Because the lab was designed not to focus on minute details, we prefer that students experience the virtual lab without having to complete additional assignments. However, we do have a handout that asks the big picture questions to be sure that students have focused on the main concepts of the lab. The handout could be used for students who complete the virtual lab on their own, as an enrichment activity, or as homework. And the handout may provide focus for students with special needs or others who are completing the lab with an adult who has not previously completed the lab.



Teacher and Student Resources



There are various resources that we have available for you, as you facilitate your students progress through The Virtual Stroke Lab.

The first is the Professional Development Manual. This was created for teachers who attend our face-to-face workshops. Its main purpose is to provide a step-by-step description of what students experience as they complete the lab. The manual has implementation suggestions, additional extension and supplemental activities. It also includes a printable version of the EMR. [This manual is available for download on our website.]

The Electronic Medical Record is also available in a separate download from our website. You could post this on your website or server

A document that lists the doctor's notes is also available for download from our website. All entries made into the "doctor's notes" area are listed in the order in which they appear in the virtual lab. Note, that while completing the lab, entries are listed only after students make decisions and perform scans. Therefore, there is no need to give this document to students. It is simply available for you as a resource. so that students could have access to it if they needed.

There is also a NBC Nightly News report that describes the coiling procedure. You might consider having students view this after they complete the lab. There are also quality animations, or actual surgery video of the coiling procedure are available elsewhere on the web.

The image on the left is a screen shot of the flexible student entry page. Both the Basic and Flexible student-entry pages includes the navigation and overview tutorials. The overview tutorial, in particular is suggested for viewing by anyone before beginning the Virtual Stroke Lab.

Piloting our Virtual Labs

We are always interested in knowing the teachers who decide to implement one of our labs. Please email us to let us know you are considering using it. We would be happy to support you in any way that we can. mindsup@ilstu.edu

You may also want to inquire if we are offering any pilot testing incentives. At times, we pay teachers to implement labs with students. This includes some pre/post testing surveys for both the teacher who implements the lab and for the students who complete it.

The Next Step?

Well, if you haven't already, on the homepage of the Mind Project website, create a user account to become a Mind Project member.

Familiarize yourself with the student tutorials associated with The Virtual Stroke lab and then decide how the lab best fits into your current curriculum and how you could implement it

Contact us and let us know who you are and how you are planning to use the lab – and we will let you know if we have any new support materials to make your job easier.

And lastly, implement The Virtual Stroke Lab with your students.

Thank you for watching this professional development tutorial for The Virtual Stoke Lab made available from The Mind Project. I hope that you found it helpful as you decide whether or not to use the lab with your students. Please feel free to contact us with any questions you may have. And don't forget to look at the other free virtual labs that we offer.

This Virtual Science Lab has been supported by NSF grant #0127561 and NIH/NCRR/SEPA grant #R25RR020425.

References:

National Research Council. (2011). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas.* Committee on a Conceptual Framework for New K-12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press. Available from: http://www.nap.edu/catalog.php?record_id=13165 (accessed Aug 2011).