



MIT Workshops on technology-enhanced & open education
Port-au-Prince, Haiti, January 16–19, 2012
Organizers: Michel DeGraff & Vijay Kumar

This is the second of a 5-year series of workshops whose main goal is to implement and evaluate faculty- and curriculum-development activities based on Kreyòl-based Open Education Resources for science and math courses in Haitian schools and universities. How can these resources be most constructively used to improve science and math courses in Haiti? How can similar resources be designed *in situ* by educators in Haiti and become fully functional and sustainable?

These workshops are based on specific samples of courses and resources from MIT. This time around, the sample will consist of workshops in math (differential equations), physics (electro-magnetism, electric circuits and Newtonian mechanics) and biology (biochemistry and genetics). To help achieve full mastery of the materials, we will organize hands-on exercises based on them. We will also use this opportunity to develop a long-term evaluation plan in collaboration with our colleagues in Haiti.

Registration requirement: As we register participants to the workshops, we will give priority to applicants who teach in Haiti and who already have a Master's Degree and those who are currently enrolled in a Master's Program in engineering, science or mathematics. Applicants to the workshops should provide copies of their Curriculum Vitae alongside their highest diploma and, if relevant, attestation of registration in a Master's program. PDF or JPEG copies of these documents should be sent via email to mit-haiti@mit.edu. **The deadline for registration is Friday, January 4, 2013, or when all slots are filled.**

Applicants also need to fill out a registration survey at https://www.surveymonkey.com/s/SondajPouEnskripsyon_MIT-Haiti_Jan2013.¹

Please note that the workshops are designed for the introduction and exploration of *tools*, and not content. It's important that participants be already fluent with the corresponding disciplines. For example, the biology workshops will assume that the participants are already thoroughly familiar with fundamental concepts in genetics and biochemistry, and are ready to experiment with software tools for active learning in these areas.

¹ There's a computer laboratory available at the Faculté des Sciences (UEH) for applicants who need help submitting their credentials on line. Professor Jean Milou Pierre has kindly offered to help applicants who visit the FdS computer lab.

Workshop Abstracts:

Lourdes Alemán, Alison Brauneis, Ruthly François (Biology / STAR)

The STAR (Software Tools for Academics and Researchers) program seeks to bridge the divide between scientific research and the classroom. Our multidisciplinary team, consisting of research-trained scientists and software engineers, collaborates with MIT faculty to design innovative and intuitive software tools for classroom use. The STAR educational tools are FREELY available. In addition to the software, the STAR web site (<http://web.mit.edu/star/>) contains educational materials that help incorporate these tools into various educational settings. The workshop will highlight two biology STAR tools: StarBiochem (<http://web.mit.edu/star/biochem>) and StarGenetics (<http://web.mit.edu/star/genetics>). **StarBiochem** is a molecular 3D viewer that allows students to learn key concepts about the biology of molecules and proteins in an interactive manner. **StarGenetics** is virtual genetics laboratories where students can simulate mating experiments and actively explore a wide array of genetics concepts.

We will cover the following items for each tool:

- the rationale for designing the tool
- the design process
- how to access the tool and supporting educational materials
- tour of the tool
- hands-on activity with an example exercise
- examples of how the tool is currently being used
- how to build custom exercises

Instructors' biographies:

Lourdes Alemán is a Research Scientist within the MIT HHMI Education Group and the Program Coordinator for Curriculum Innovation at MIT's Office of Educational Innovation & Technology. Lourdes obtained her PhD at MIT's Biology Department with Professor Philip A. Sharp, studying the specificity of RNA interference. Lourdes has helped develop innovative software tools and curricula for biology classrooms.

Alison Brauneis is a Postdoctoral Associate in Professor Graham Walker's HHMI Education Group at MIT. At MIT's Office of Educational Innovation & Technology, she designs, develops and assesses innovative biology educational software and curricula. Alison completed her Ph.D. research in the laboratory of Professor Tyler Jacks in MIT's Department of Biology and the Koch Institute for Integrative Cancer Research.

Ruthly François graduated in 2012 from Suffolk University where she earned a Bachelor of Science in Biology. She is currently completing her post baccalaureate at MIT, taking classes and doing research at Novartis Institutes for Biomedical Research, investigating tumorigenesis of breast cancer.

Peter Dourmashkin (Physics / TEAL)

For the past ten years the Physics Department at MIT has developed a program called *Technology Enabled Active Learning* (TEAL) which has fundamentally changed the way the introductory Newtonian Mechanics and Electricity and Magnetism physics courses are taught at MIT. TEAL represents an attempt to incorporate a variety of new teaching ideas and technologies into first-year physics subjects. The course is a non-lecture based course with an emphasis on active engaged learning. Students work together in groups of three, using tabletop experiments and computer-based visualizations to develop their conceptual and analytic understanding of mechanics and electricity and magnetism. The syllabus is designed to integrate concepts, experiments, and problem solving skills in an interactive learning environment in which students regularly discuss concepts and problems in class with their teachers. All of the course materials are now available in OCW Scholar. This workshop will focus on describing TEAL and in particular how the TEAL materials on OCW Scholar can be adapted for use in teaching physics in many institutional settings.

Instructor's biography: *Peter Dourmashkin* is currently Senior Lecturer in the Department of Physics at MIT, specializing in the teaching of first-year students at MIT. His research interests are in Mathematical Physics, Lie Group and Algebra Representation Theory. Starting in 2001, he has been part of the development, implementation, and teaching team for Technology Enabled Active Learning (TEAL), a project that has successfully reformed first-year physics education at MIT.

Haynes Miller (Math / Mathlets)

Understanding differential equations—their significance, methods of solution, and interpretation of the behavior of solutions—is a critically important element of the skill set of scientists and engineers. People who use differential equations on a daily basis have a firm visual grasp of many aspects of them and of their solutions, and most people respond well to graphical representations; the visual memory and imagination are well-suited to organizing relationships, and it's a loss not to make use of this innate human skill. An animation—or, even better, a computer “manipulative”—can powerfully convey relationships between different representations of the same information.

Over the past ten years we have developed a suite of Java applets—called “Mathlets” (<http://mathlets.org>)—designed to help students visualize a variety of mathematical concepts. Most of the applets were developed for use in a course on ordinary differential equations taught to about 85% of MIT students, usually in their second or third semester. Use of the Mathlets is actually part of a more general “active learning” strategy, which I will try to model for you this week.

This workshop will introduce these teaching aids. We will model their use in lecture and show some examples of their use in homework or for discussion by small groups of students. Then, on Friday, we will conduct a hands-on session in which participants will experiment with generating their own scripts.

Instructor's biography: *Haynes Miller* has been Professor of Mathematics at MIT since 1986, after stints at Harvard, Northwestern, and the Universities of Washington, Notre Dame, and Paris. He has led the basic differential equations course at MIT nine times, and in 2005 was awarded a MacVicar Fellowship for his teaching efforts. His research interests lie in the intersection of algebra and topology.

Glenda Stump (Pedagogy, assessments and evaluation—these workshops are for ALL the participants so we can together design an optimal plan to evaluate the use of these new tools and methods in Haitian schools and universities)

Instructors' beliefs about how learning occurs and their resultant choice of pedagogy have a strong influence on student learning. The opening session of this workshop will focus on current views of learning and in particular, pedagogies related to active learning. Teaching that actively engages students with the material has been shown to increase students' motivation to learn and improve their learning outcomes. MIT faculty have used instructional strategies that promote active learning in numerous classes over the past decade. Examples of these pedagogies will be presented as models for workshop participants to consider implementing into their own courses.

In addition, assessment of student learning from various pedagogies is a critical component of instruction. Assessment both during and after instruction can provide information that helps to improve student learning outcomes as well as provide evidence that students have met course learning objectives. The opening session of this workshop will focus on the assessment process and how it can be used in multiple contexts. A later session will focus more in-depth on this process and discuss multiple tools for assessment. Faculty will also be given opportunity to practice development of meaningful assessments for their students.

Instructor's biography: Glenda Stump is the Associate Director of Assessment & Evaluation in the Teaching & Learning Laboratory at MIT. At MIT, she conducts assessment and evaluation of individual classroom innovations as well as larger programs, and is active in larger scale educational research. Glenda is also an experienced educator in post-secondary settings.)

Schedule:

Tuesday, January 15:

~6PM-??? (pending arrival time): Organizational Meeting:
Informal planning and check-up session among organizers

Wednesday, January 16:

8:30–10:45AM, Intro to active learning and evaluation:

This session is for ALL the participants. There we'll start the discussion on the methods and goals that will guide our initiative which will last at least 5 years

8:30–9AM: General introduction, background on MIT-Haiti Initiative, including last workshops (March 2012)
9–9:45AM: Pedagogy and assessment (Stump)
9:45–10:45AM: Active learning—architecture, models, culture (Dourmashkin)
10:45–11AM: Logistics, Break

11AM-1PM, Biology / STAR workshop:

StarBiochem I (Instructors: Lourdes Alemán, Alison Brauneis, Ruthly François)

11AM-1PM, Physics / TEAL workshop:

TEAL I (Instructor: Peter Dourmashkin)

11AM-1PM, Math / Mathlets workshop:

Mathlets I (Instructors: Haynes Miller)

1–2PM: Lunch

2–6PM, Biology / STAR workshop:

StarBiochem II (Instructors: Lourdes Alemán, Alison Brauneis, Ruthly François)

2–6PM, Physics / TEAL workshop:

TEAL II (Instructor: Peter Dourmashkin)

2–6PM PM, Math / Mathlets workshop:

Mathlets II (Instructors: Haynes Miller)

Thursday, January 17:

9AM-9:30AM, Educational Technology:

Checking-in about previous day's highlights and lessons learned
Survey and Q&A about educational technology for active learning

9:30AM-1PM, Biology / STAR workshop:

StarGenetics I (Instructors: Lourdes Alemán, Alison Brauneis, Ruthly François)

9:30AM–1PM, Physics / TEAL workshop:

TEAL III (Instructor: Peter Dourmashkin)

1–2PM: Lunch

2–6PM, Biology / STAR workshop:

StarGenetics II (Instructors: Lourdes Alemán, Alison Brauneis, Ruthly François)

2–6PM PM, Math / Mathlets workshop:

Mathlets III (Instructors: Haynes Miller)

The workshops on Friday and Saturday (January 18-19, 2013) include ALL the participants. There we will continue the discussion on the methods and goals that will guide the implementation of our long-term initiative. And we will get deeper into the details of how best we can all collaborate (in “konbit” fashion) to adequately evaluate the use of our new tools.

Friday, January 18:

9AM-9:30AM, Educational Technology:

Checking-in about previous day's highlights and lessons learned

Survey and Q&A about educational technology for active learning

9:30AM-1PM, Assessment-&-evaluation workshop:

Assessment and evaluation (Instructor: Glenda Stump)

1-2PM: Lunch

2-6PM, Studios for STAR, TEAL and Mathlets:

Hands-on interactive studio sessions for generative lesson plans, scripts, exercises, etc.

Saturday, January 19:

9AM-1PM, Closing presentations:

STAR, TEAL and Mathlets presentations by selected participants to entire group

1-2PM: Lunch

2-4PM, Closing:

Post-mortem, next steps, etc.