Open Course Ware, Distance Education, and 21st Century Geoscience Education

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Abstract

Open Course Ware (OCW) allows the highest quality educational materials (including videos of lectures from the best classroom lecturers) to find a wide audience. This audience may include many who wish to obtain credentials for formal study yet who are unable to be campus-based students. This opens a role for formal, credentialed and accredited distance education (DE) to efficiently integrate OCW into DE courses. OCW materials will in this manner be able to be used for education of credential-seeking students who would not otherwise benefit from them. Modern presentation methods using the Internet and video (including mobile device) technologies may offer pedagogical advantages over even traditional classroom learning. A detailed analysis of the development of Athabasca University's PHYS 302 Vibrations and Waves course (based mainly on MIT's OCW), and application of lessons learned to development of PHYS 305 Electromagnetism is presented. These courses are relevant to the study of geophysics, but examples of GEOL (Geology) courses will also be mentioned, along with an broad overview of OCW resources in Geoscience.

Open Course Ware (OCW)

In a very general sense, open course ware refers to freely shared educational materials. Following the opening of MIT OpenCourseWare, the term usually refers to online materials which are placed in the public domain on the internet, without credentials being offered based on them, and usually understood to facilitate self-study. In this sense a strong analogy may be made to books in a library. Now, many universities make OCW available. Often it derives from traditional classroom activities such as lectures and demonstrations. In some cases, extensive printed material such as textbooks (usually as PDF files) are available online. Other types of media such as web pages also figure extensively.

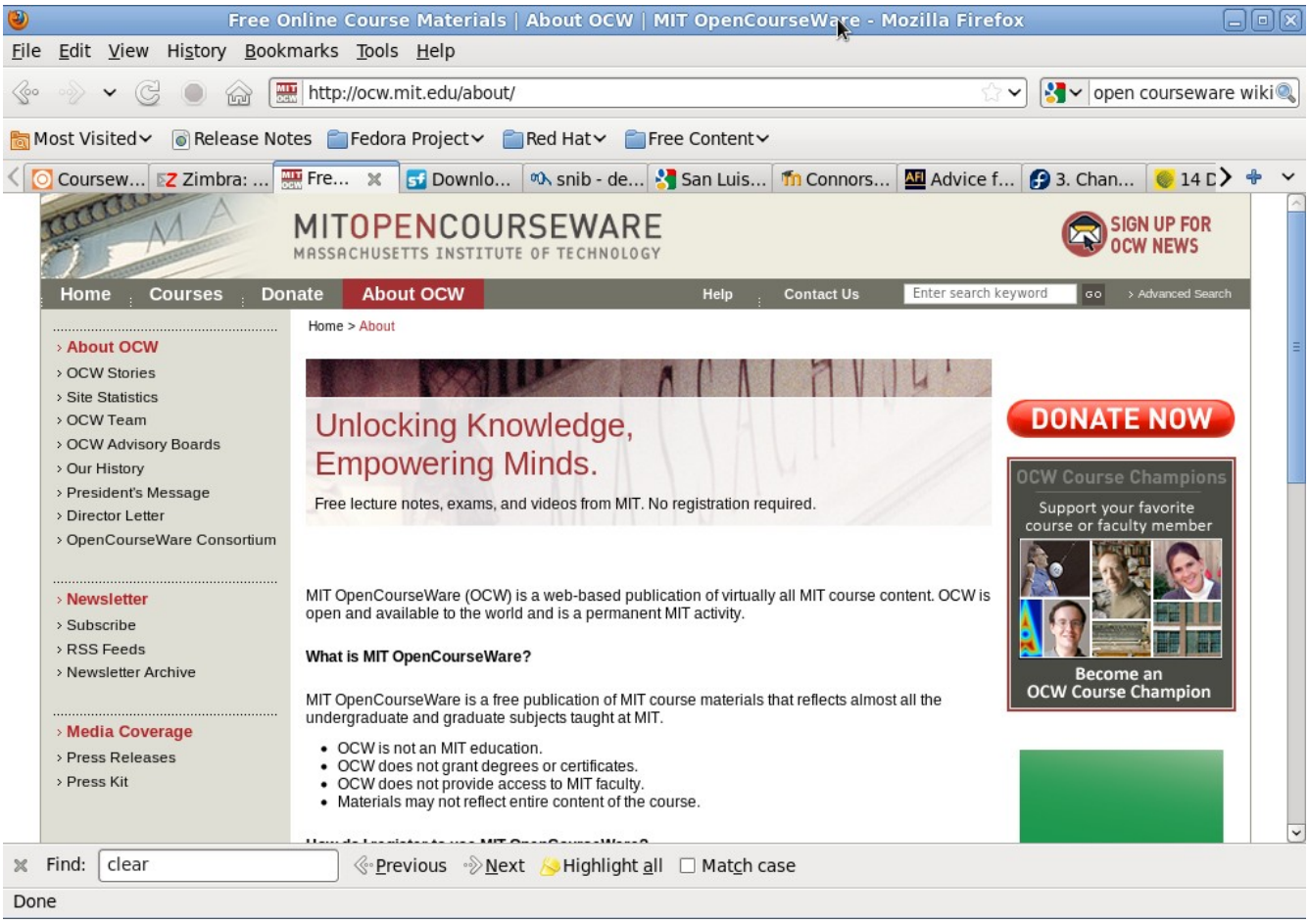


Figure 1. MIT Open Courseware “About” page at ocw.mit.edu.

Distance Education (DE)

Distance Education is presentation of an educational curriculum without requiring students to attend classes in person. In the past, much has been done with "correspondence courses" through sending printed materials to students. Other methods include broadcasting, in the past usually "synchronously" in that the programs were available at a fixed time, or possibly live. A now popular form of DE is practiced by Athabasca University, which offers "asynchronous" courses facilitated by web access, with mailed materials also used, and generally with tutoring support. This poster will explore the convergence of OCW with Distance Education. Distance Education can translate OCW into a credentialed setting, while retaining one of its main thrusts of facilitating home study.

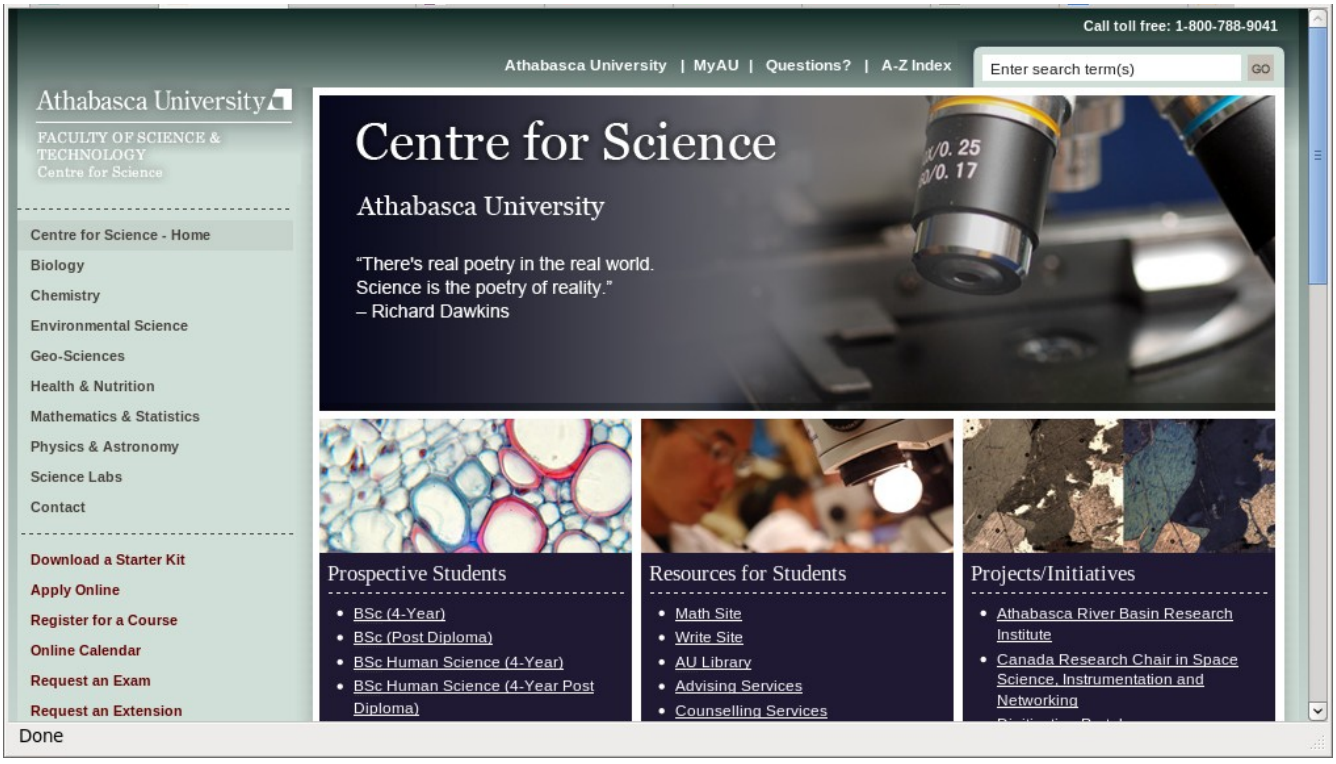


Figure 2. Athabasca University Science home page at science.athabascau.ca. Links at left lead to home study courses.

Presentation Methods

Most OCW resources are now found on the Internet, but they take diverse forms. Web pages usually provide access, and may also have active elements or text that form part of the educational experience.

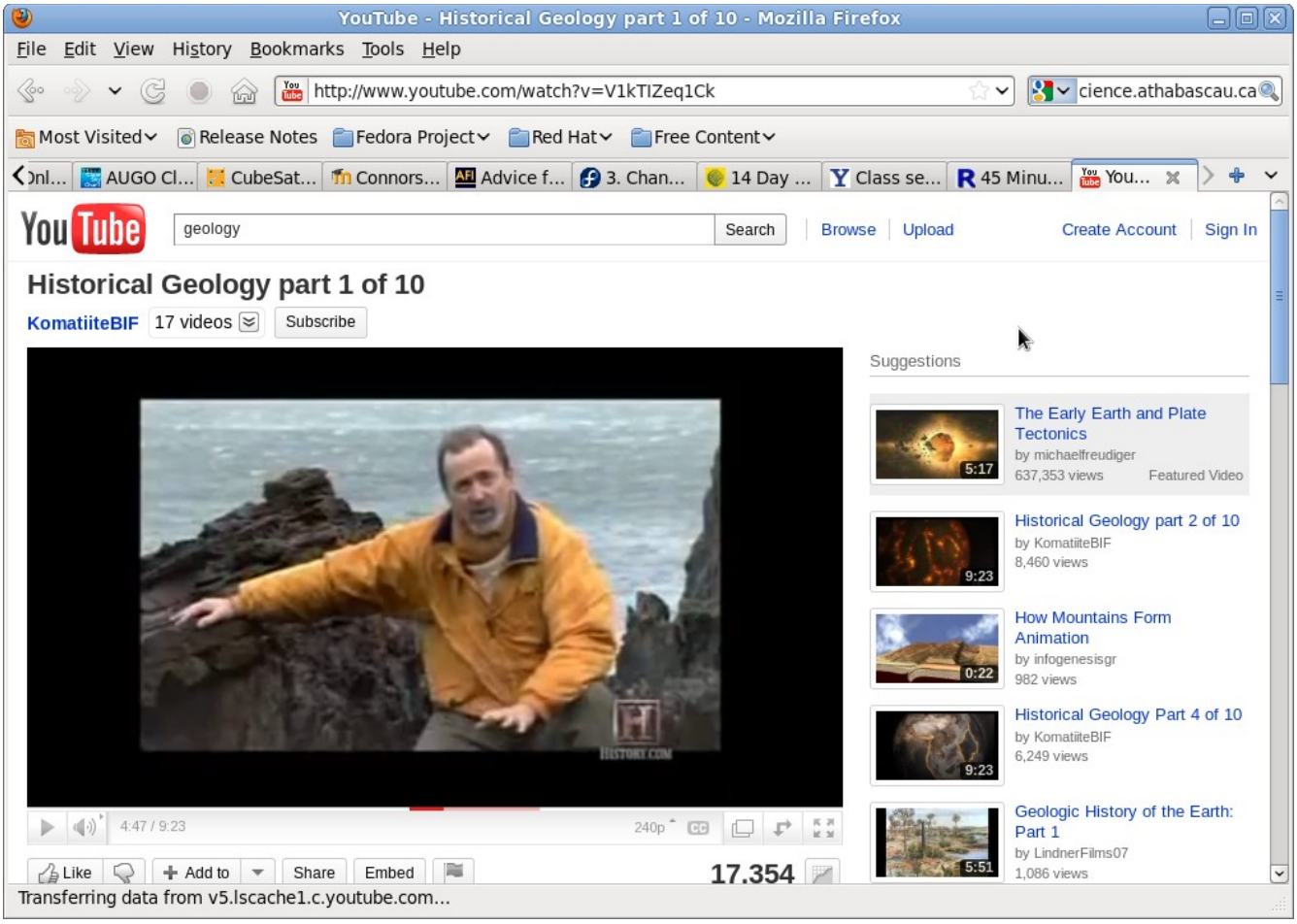


Figure 3. Sources not traditionally thought of for education may provide materials that appeal to students. Some sources may not obey copyright laws! history.com is itself not a place you might think to look, but does have several Earth Science programs with linkable clips.

Text and Video

While video alone might be superficial, thoughtfully combined text along with video can lay out learning objectives and allow them to be reached by a combination of methods.

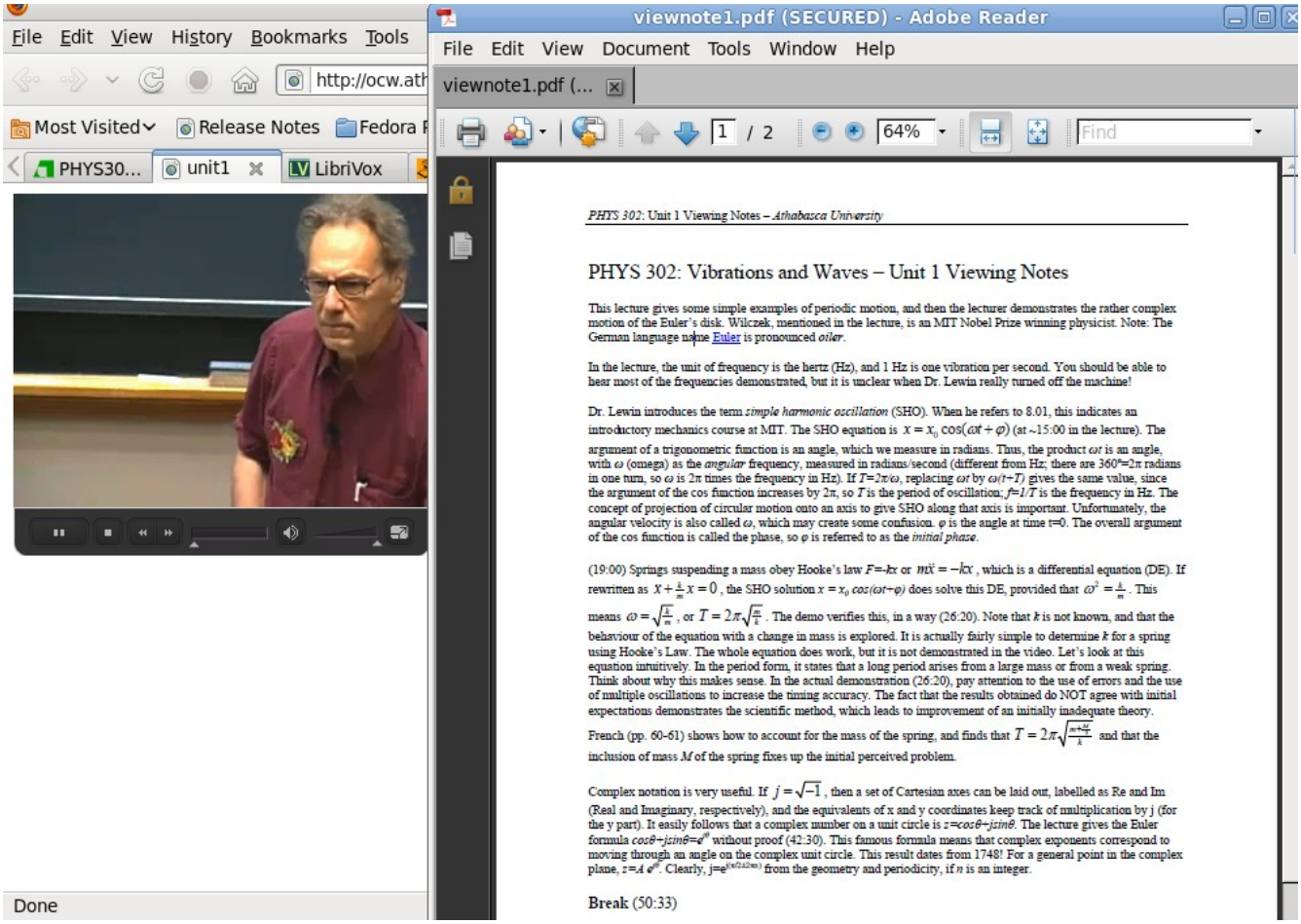


Figure 4. Watching video of MIT's Walter Lewin lecture on vibrations and waves while displaying AU viewing notes in PDF on a computer screen.

Mobile Devices

Many people watch video while commuting, traveling, or even relaxing. Inexpensive, small mobile devices have made this possible. A convergence of technologies makes viewing on cell phones popular, and many such devices are networked.

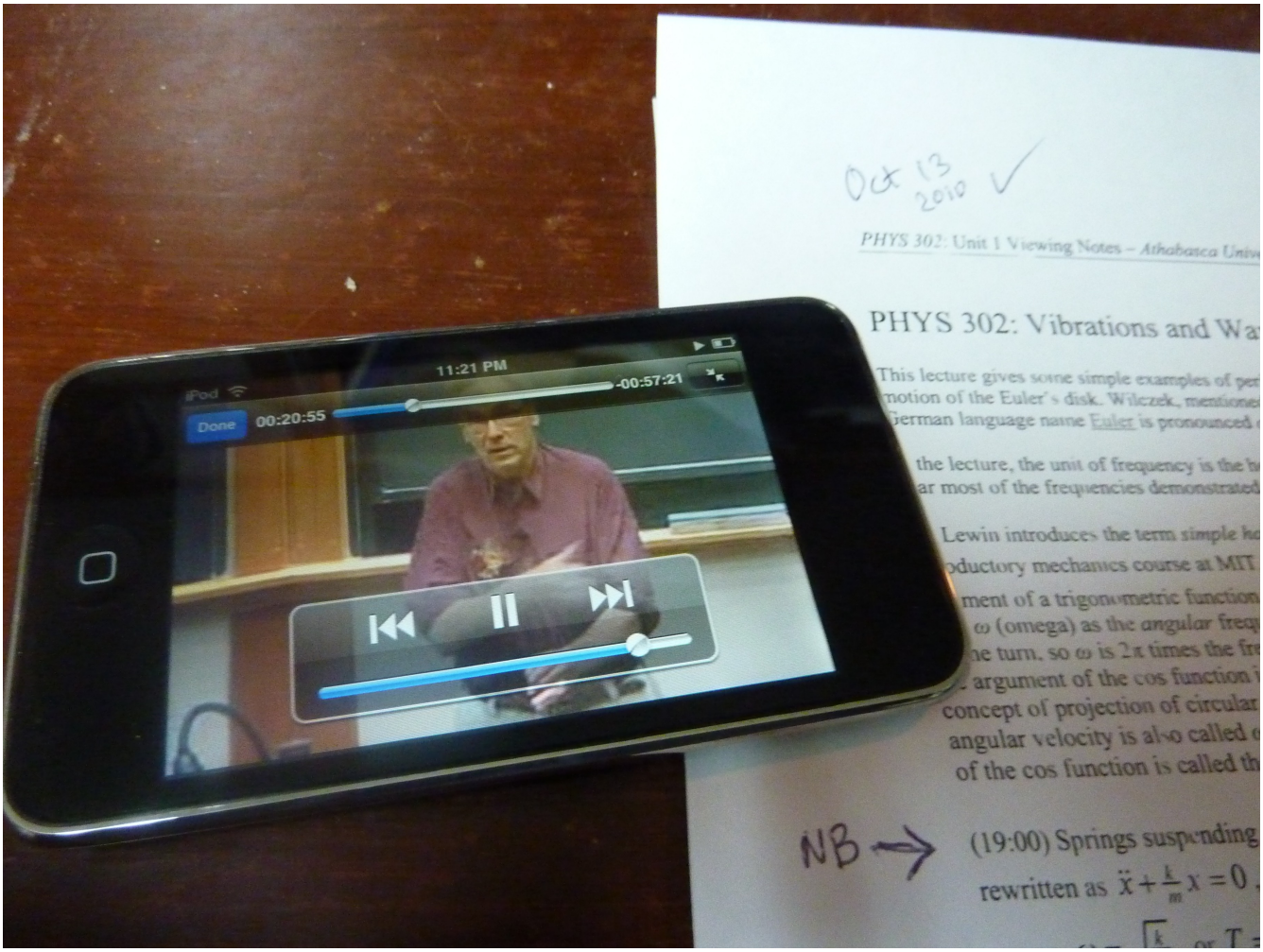
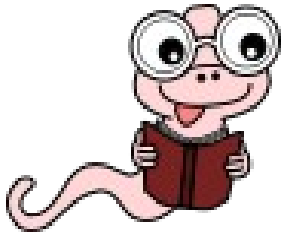


Figure 5. Viewing notes keyed to a lecture can be easily carried around if printed, and written upon. The equations at the marked time point (19:00 minutes) correspond to what was on the lecture hall blackboard. The lecture can be followed with minimal note-taking, emphasizing important points.

Books as Mobile Devices



In addition to viewing notes, reading notes are supplied to guide the students through the textbook.

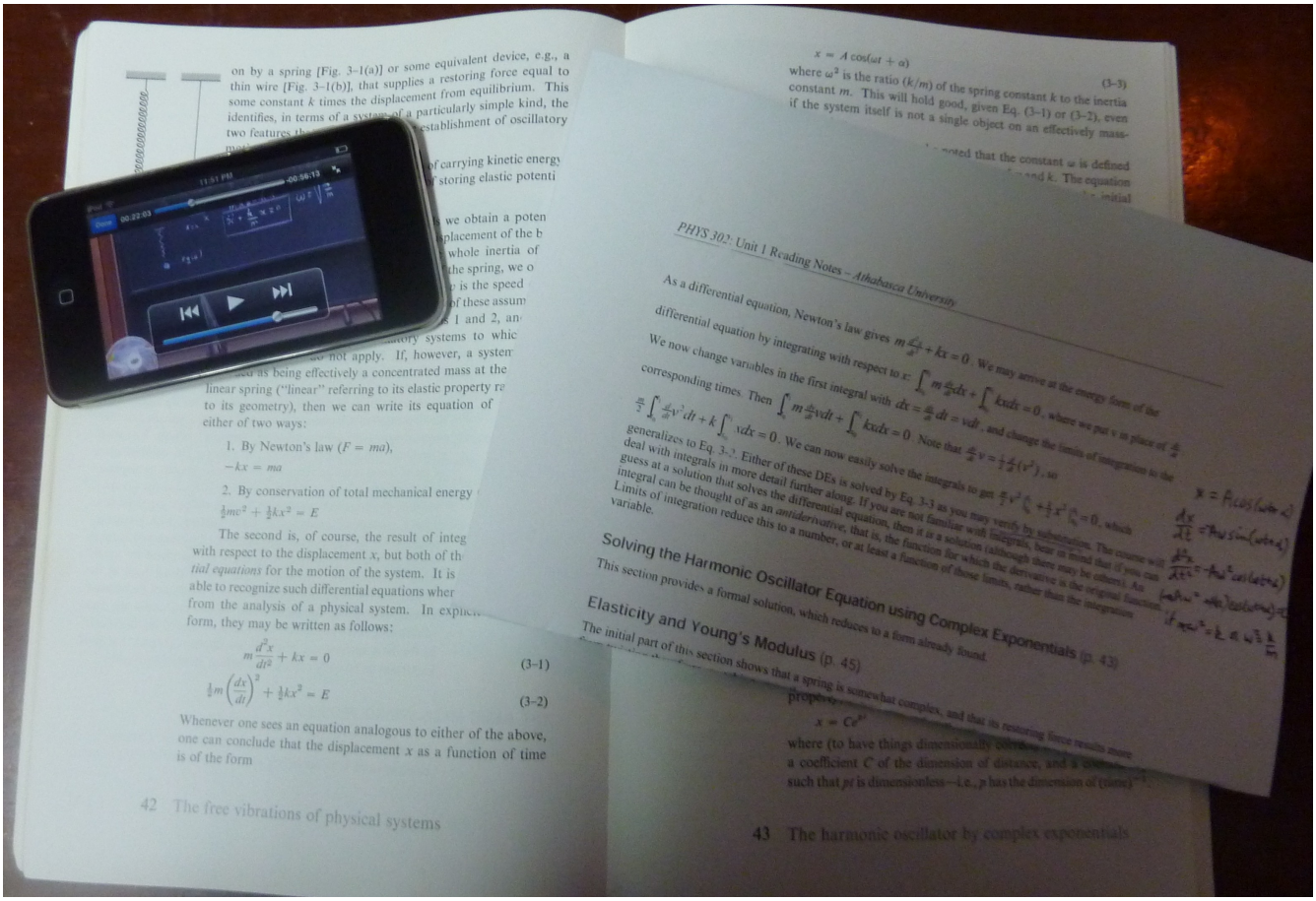
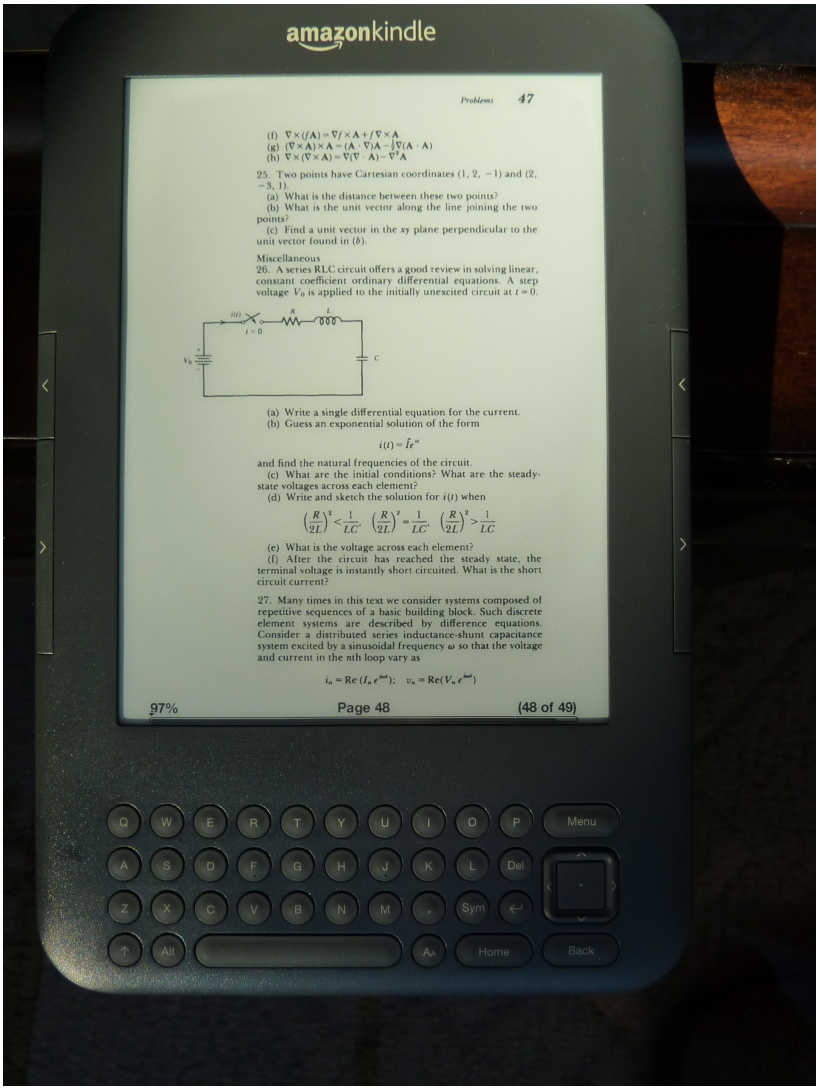


Figure 6. The course textbook of PHYS 302 (A. P. French, “Vibrations and Waves”, Norton & Co., 1971) along with reading notes. A suggested small exercise has been worked out on the notes. The lecture at the appropriate point is also being viewed.

A reasonably-sized book can also be carried around for study, and the notes are supplied by unit (of which there are 15) and are kept brief to be stuck into the book conveniently.

Mobile Devices as Books



e-book readers featuring “digital paper” are becoming a common and even preferred means of reading.

With the rising cost of textbooks, use of openly published textbooks, often available as PDF files, has the potential to reduce the cost of education.

Such books can be viewed on a computer screen, but the contrast and portability on e-book readers allow “real” reading.

Figure 7. Amazon Kindle at slightly smaller than life size. A page from the MIT OpenCourseWare PDF book “Electromagnetic Field Theory: A Problem Solving Approach” by Markus Zahn (ocw.mit.edu, accessed 10 October 2010) is shown. In practice the scale shown is too small for prolonged reading. It is easy to rotate the display and read sideways at a comfortable scale.

Many e-book readers can be used to browse the web, although not with all of the capability of a full-fledged web browser.

Moodle

Moodle is a Learning Management System which facilitates organization of courses on the web. It also provides a set of communication and other tools. It is a useful adjunct to classroom teaching.

Figure 8. Moodle home page moodle.org

Moodle is free and open source. It can be set up on a web or local host. Moodle is used in DE by Athabasca University. A compatible variant of Moodle called CCLE is used at UCLA.

Within a basic structure, course elements such as notes are easily added by the instructor.

Creative Commons License (CCL)

Much of the present openness of resources is enabled by the rules of the Creative Commons License, easy to follow and respect.

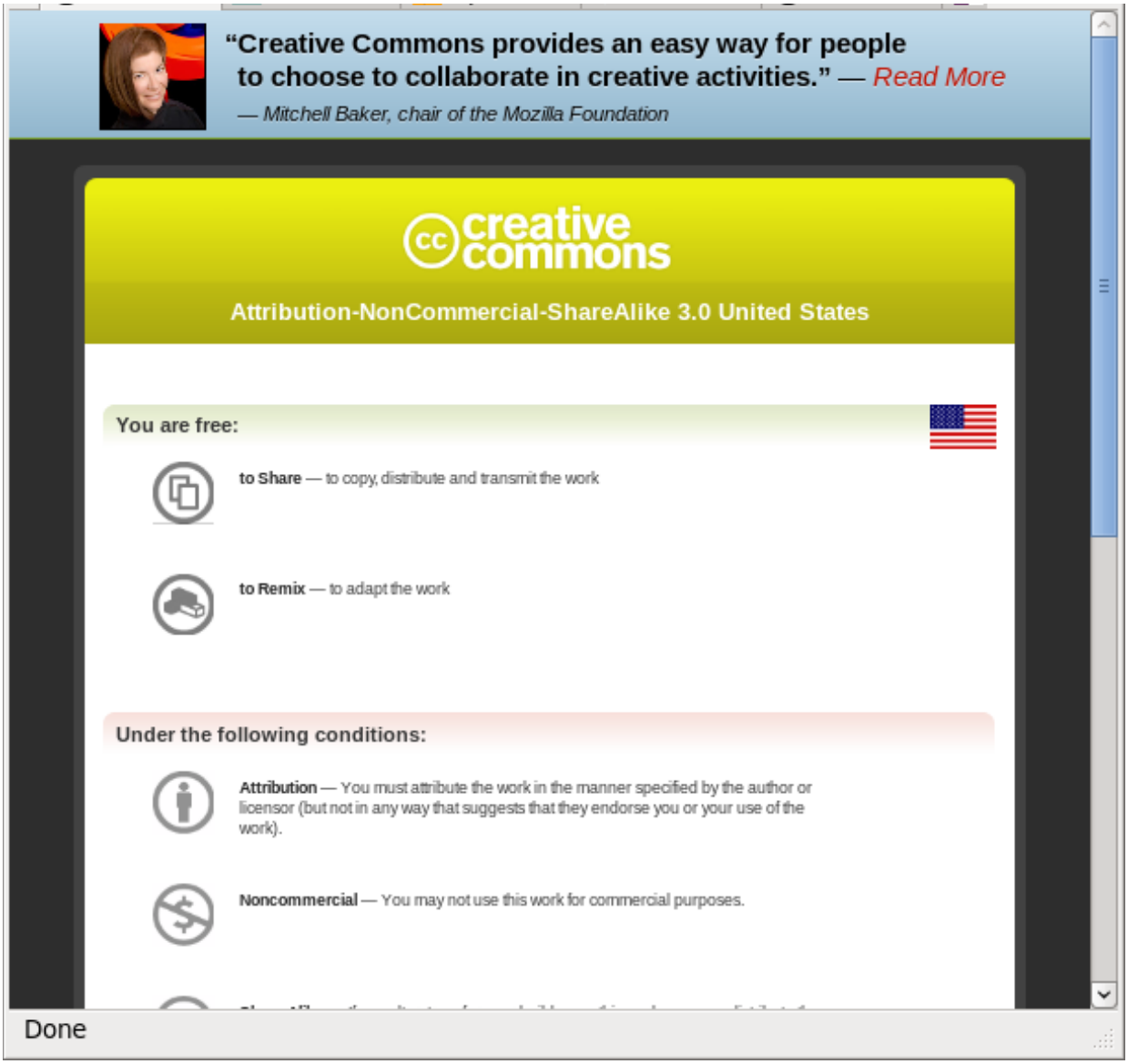


Figure 9. CCL link creativecommons.org/licenses/by-nc-sa/3.0/us/ allowing sharing and adaptation for noncommercial purposes. The most important part is off the bottom: **Share Alike** — If you alter, transform, or build upon this work, you may distribute the resulting work only under the same or similar license to this one.

PHYS 302 Vibrations and Waves

The Athabasca University course is in large part based on the MIT OCW 8.03 course by Walter Lewin, which includes excellent video lectures (see above). The entirety of the MIT course is not covered, but some related topics like quantum mechanical waves have been added. In keeping with the CCL, AU course materials are open and are found on ocw.athabascau.ca. Registered students do assignments, have support from a tutor, and must do invigilated exams. Evaluation materials are not open.

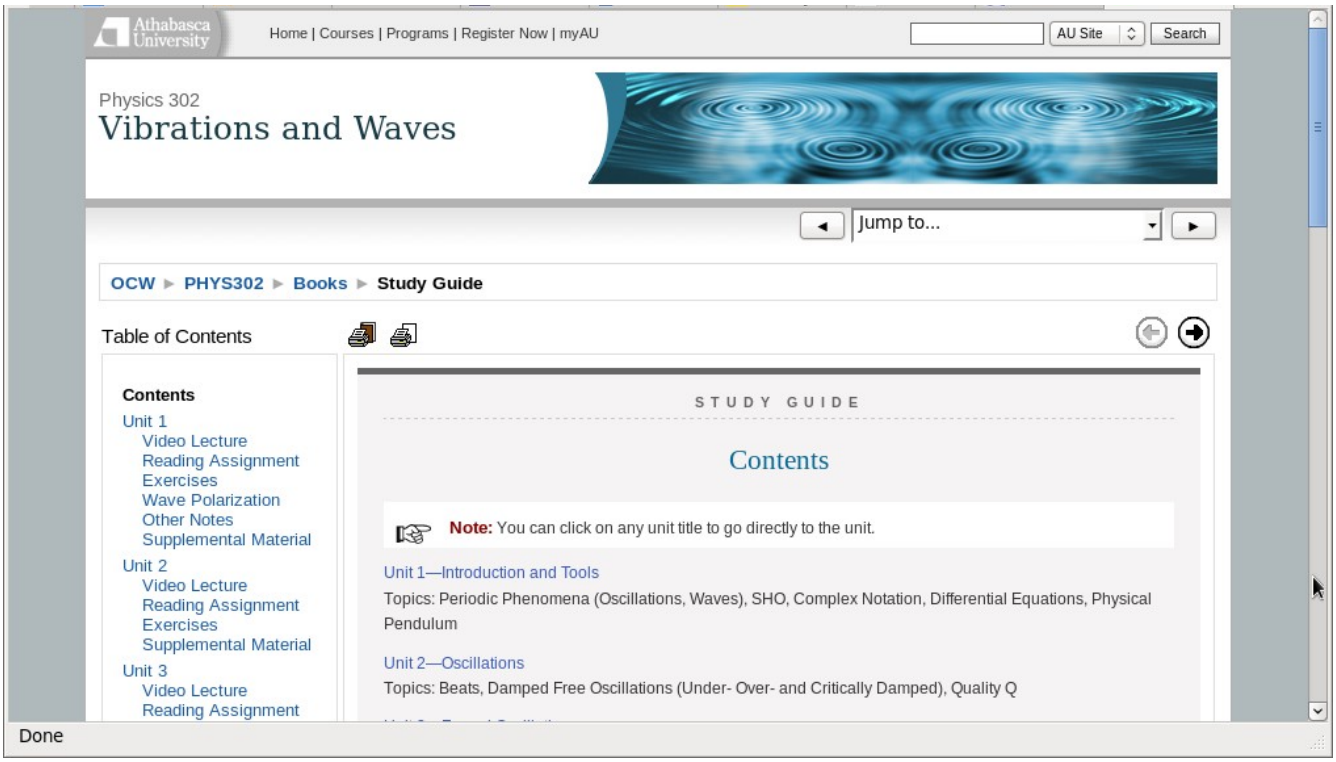


Fig. 10 The preparation of viewing and reading notes for PHYS 302 was an arduous task involving extensive mathematical typesetting. The lesson learned is that the closer OCW materials can be found to the final form needed for a distance education course, the easier it will be to create that course. The new course Electromagnetism (PHYS 305) is largely based on direct readings from the textbook.

AU GEOG/GEOL (Geography/Geology)

Athabasca University distance education courses in the Earth Sciences are beginning to use open courseware. We solicit contacts from anyone wishing to cooperate on educational or research projects.

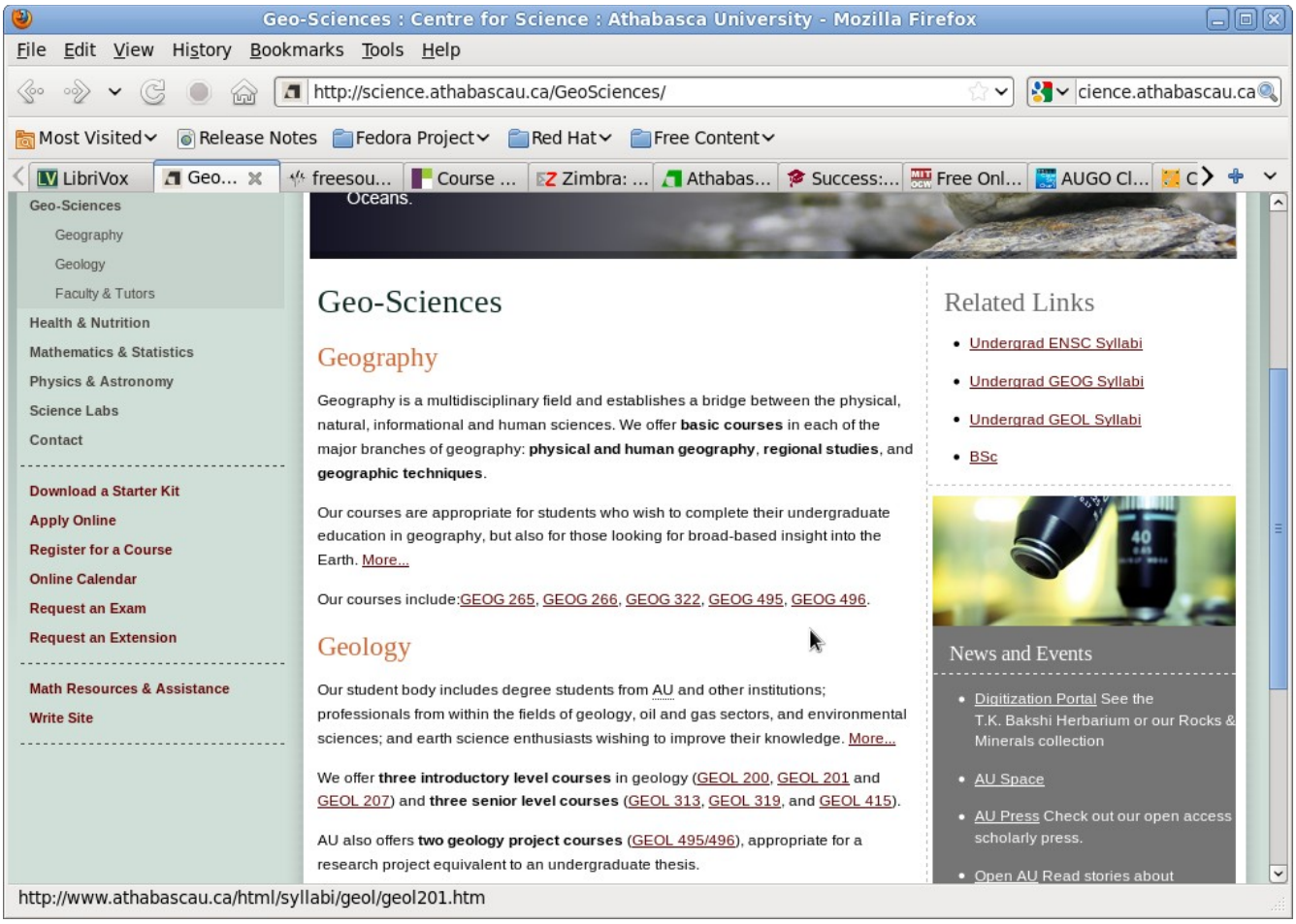


Fig. 11. Geography and Geology Distance Education courses available from Athabasca University include freshman (2xx) and higher level (3xx, 4xx) courses. Although mostly print-based, they are being migrated to Moodle as part of a university-wide project. Web page science.athabascau.ca/GeoSciences is shown.

OCW resources in Geoscience

It is a useful exercise to simply use a search engine to look for open resources. In some cases, compendium sites will be found and it may be difficult from them to determine the original source.

Research done for this presentation found less Geoscience OCW material than is available for Physics or Mathematics. There is room to make more! Penn State seemed to have the most complete site.

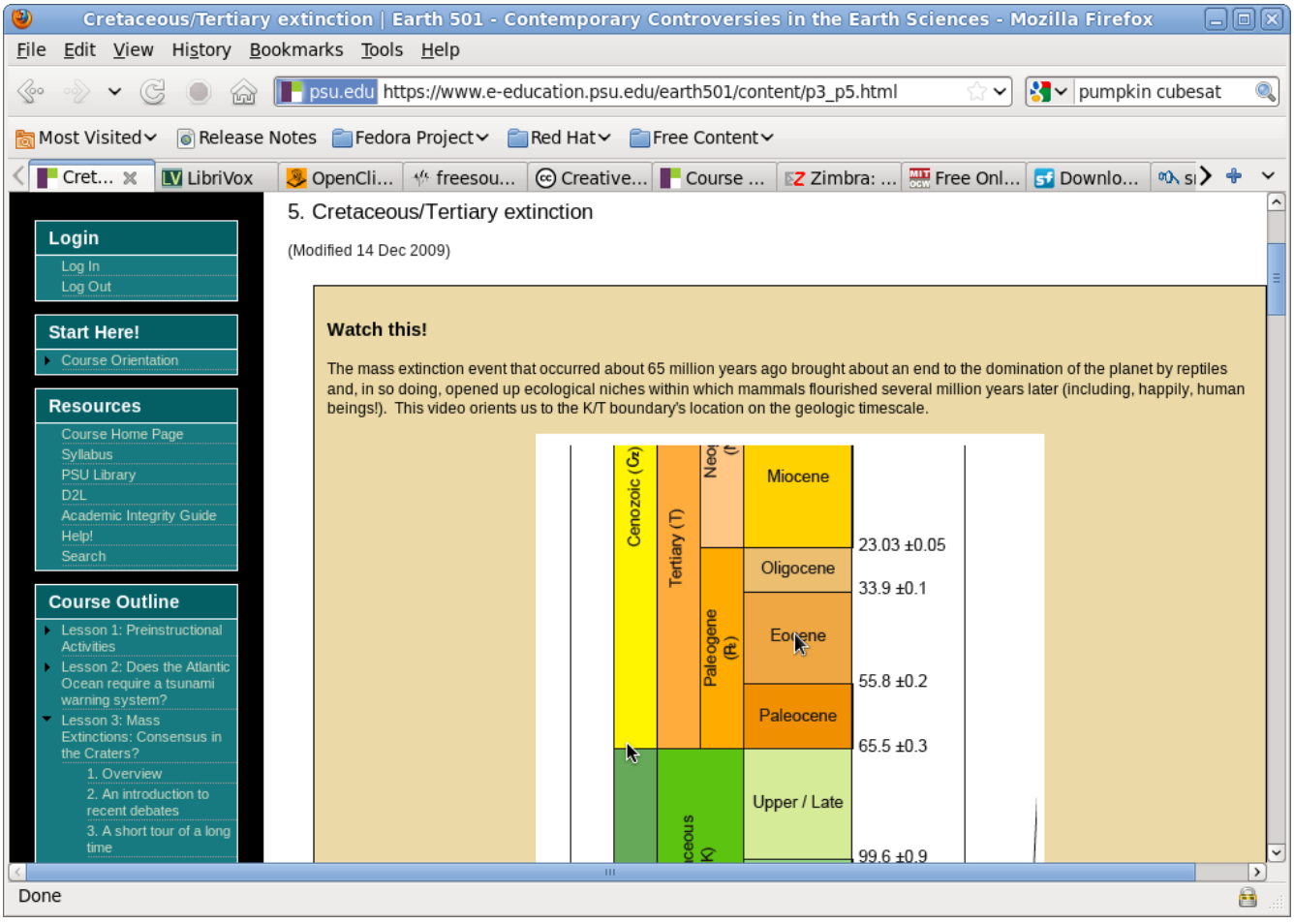


Fig. 12. Penn state OCW web page, shot from simple animated clip showing the KT boundary stratigraphy. The cursor shown moves to illustrate points made in the voice-over. www.e-education.psu.edu

AAPG Learn

The American Association of Petroleum Geologists (AAPG) has a blog on educational topics, including more emphasis on short courses and applied learning than discussed here (where the focus has been on courses comparable to university full-semester).

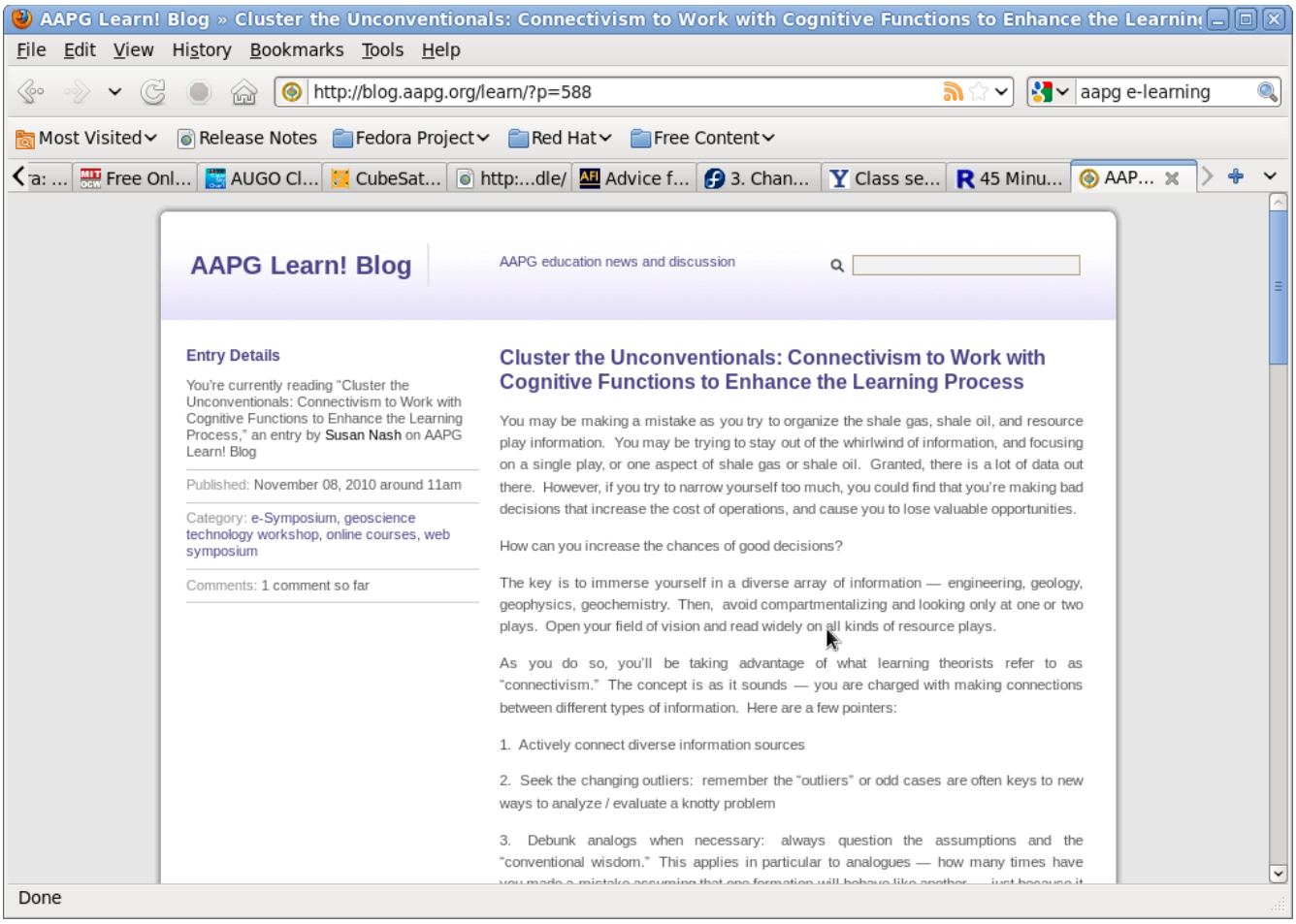


Fig. 13. Susan Nash's blog at blog.aapg.org/learn. Digging around this site you can find a presentation on e-learning that is worth a look. Content ranges from the theoretical (like this page) to the practical, and one can subscribe to the blog.

Conclusion - Pedagogical advantages?

There have in the past been many fads in education.

This time it has to be real. Education really must be improved (and here we focus on university level).

The crisis in trying to have a modern society in North America in the face of an under-educated population is one of the drivers of this and is explicitly recognized by the U.S. federal government.

So the big question is: can open resources and distance education transform education at the university level in North America?

Open resources can improve existing courses. They are there to be used. You should respect any licensing. Hopefully that license will be CCL Attribution-Noncommercial-Sharealike and you will enhance and then re-share.

Distance Education can potentially play a large role by reaching students who are not able to participate in a campus learning experience.

The education research question is: can Distance Education powered by Open Course Ware propel the education system forward to meet current needs?

One issue found in the current study is that geoscience open resources appear less common than in some other fields.

You are invited to get involved and answer these questions, or remedy the apparent gap.