

# OpenSpectrum: A Wiki-based learning tool for Spectroscopy that anyone can edit

Principal Investigator:

Stewart Mader, The Science of Spectroscopy ([www.scienceofspectroscopy.info](http://www.scienceofspectroscopy.info))

Emerson College

Boston, MA 02116

slmader@gmail.com

## 1. Introduction

This project aims to transform The Science of Spectroscopy, a successful five year old web-based education tool, into an open resource based on the idea that building a network of people is critical for the long-term and sustainable success of technology in teaching and learning. Wiki technology will be used to make the entire library of content on the site editable by any user, and all material will be made available in French, as well as English. Through collaboration with NASA Ames Research Center, new material will be developed for the site which makes use of NASA astronomical and terrestrial data and imagery to explain cutting edge astrobology, space science and medicine (see attached Memorandum of Understanding).

## 2. Rationale

The combination of an ever-increasing presence of technology in education, and faculty who possess varying degrees of technology proficiency has created a situation of “haves and have-nots”. The “haves” – educators with advanced technology experience – are developing new and more sophisticated learning resources, but finding they have less and less time to maintain what they develop. The “have-nots”, by contrast, can either choose to learn more advanced technology skills, which takes a significant investment of time and motivation, or use the already-developed learning resources on an “as-is” basis. In order for technology to become truly useful in education, and move beyond a novelty, the “middle ground” between these extremes must be fully developed. In the same way that programs like Macromedia Dreamweaver replaced hand-coding of web pages with visual design and allowed many more people with varying skill levels to create web sites, tools are needed which allow technologically savvy educators to create learning resources, and enable a community of peers with varying skill levels to contribute to the growth of the resource.

The “wiki”, named for the Hawaiian word “quick” is a new technology that allows a web site to be edited by anyone who visits. For example, an educator can create a wiki-based site devoted to chemistry, post some material on the site and make it available on the Internet. When other users visit, they can add their own information to any page, thus enriching the digital learning resource. Each member of this community can feel a sense of “buy-in” to a tool that contains their knowledge, and concentrate on building knowledge instead of building technology.

We propose to do this with The Science of Spectroscopy. Since its launch in 1999 as a web-based learning resource for spectroscopy, The Science of Spectroscopy has achieved considerable success including mention in the journals *Science*, *Chemistry International*, *NSTA Reports*, *Science Books & Films* and *Biochemistry and Molecular Biology Education*, and membership in several prominent digital libraries such as the

National Grid for Learning (UK), MERLOT (US), PSigate(UK) and Science.gov (US). Our mission with this project is to make the resource even more relevant and content-rich, attract an increasing base of author-users, and better support our international users by taking advantage of the wiki technology to provide content in multiple languages.

### 3. Goals

- Create a clear, logical platform for any user to contribute content to The Science of Spectroscopy
- Ensure the long-term usefulness of The Science of Spectroscopy by creating a cycle of sustainability in which the content submitted keeps the resource relevant, and the resource's ease of use encourages any educator to submit content
- Introduce new content topics, such as cutting-edge applications of spectroscopy in astrobiology, space science and medicine, through collaboration with NASA Ames Research Center
- Increase the worldwide usability of The Science of Spectroscopy by translating all content into French to serve the significant Canadian and French user base of the web site. (This last goal will serve as the starting point for conversion of content to other languages which reflect the site's user base, such as Italian, German and Spanish.)

### 4. Research Plan

The centerpiece of this project is a dynamic content management tool called OpenSpectrum, which is based on the open-source MediaWiki software. The software was chosen based on three criteria:

- Cost – How much to set up? Maintain?
- Improvement – Are user suggestions implemented? How often? Can it be customized?
- Reliability – is it being used successfully elsewhere?

MediaWiki has been chosen for this project because it is freely available, supported by a large open source developer community and used successfully in a demanding application. The software itself is based on two proven open source technologies; it is written in the web programming language PHP and uses a mySQL database to store content. A large developer community, organized by the non-profit Wikimedia Foundation (<http://www.wikimedia.org>), maintains and improves the software frequently, and it is used by the highly successful Wikipedia online encyclopedia (<http://www.wikipedia.org>), which has over 600,000 articles in 50 languages.

**4.1 Implementation.** The implementation of OpenSpectrum will be guided by the unique structure of The Science of Spectroscopy and the specific needs of this project. Structurally, The Science of Spectroscopy web site has a main level, category level and content level. Main level consists of a single page which directs users to information organized by category, such as Applications, Techniques, Theory and Virtual Instruments. Category level contains a page for each category which links to content pages for a range of topics. Content level pages are built as static HTML files with text,

images and multimedia that can only be edited by someone with a password to access the computer server where those files are stored.

This project will impact the content level of the web site, replacing all static pages with wiki-based dynamic pages that can be edited directly within a web browser by any user. The content of each static page will have to be manually transferred to a new dynamic page. Once this process is complete, links on the Category level pages will be redirected to the new dynamic pages, and the static HTML pages will be moved to an archive. The static page archive will be made continuously available to satisfy users who prefer information in this format; however, the archive will no longer be updated with new information once the dynamic pages are made publicly available.

Once this stage of the project is complete, new dynamic pages will be added on an ongoing basis. Jointly developed with NASA Ames Research Center, these pages will make use of NASA astronomical and terrestrial data and imagery to showcase topics in spectroscopy. A Memorandum of Understanding (MOU) has been agreed to by both parties and is attached to this proposal.

Throughout the entire project, a core group of five faculty members at institutions around the country will be assembled to test the new platform, contribute some of their own material, and publicize the project to their colleagues and professional networks.

#### **4.2 Research Approach**

Research will examine the usefulness of OpenSpectrum by answering questions in the following areas:

##### *Engagement*

- How do teachers initially react to OpenSpectrum?
- Is it intuitive and visually obvious?
- Does it feel undemanding, simple enough to use day after day?
- How often have they contributed to OpenSpectrum?

##### *Pedagogy*

- What are your expectations for OpenSpectrum?
- In what settings has OpenSpectrum been used – lecture, laboratory, online?
- Is it being used as a supplement or a principal source of information?
- Do graded assignments call for use of OpenSpectrum?
- What innovative uses have they found for OpenSpectrum in their own teaching?

##### *Community*

- What supports are needed to keep educators involved and feeling that OpenSpectrum fully meets their needs?
- Are they comfortable sharing learning material in a forum as open as this?
- What changes would they make to the way information is handled by OpenSpectrum?

Formative evaluation will be conducted before participants use OpenSpectrum in classes. In survey form, it will gather data about length of experience teaching, comfort level with and attitude toward technology, and expectations for OpenSpectrum. The *Engagement* questions above will be presented to educators in survey form shortly after their initial exposure to OpenSpectrum. The fourth question will be answered using data collected automatically by the MediaWiki software and will be collected on a monthly basis, in order to examine trends in contribution frequency throughout a typical

semester. Questions addressing *Pedagogy* and *Community* will be presented as a portion of summative evaluation. Participants will also be asked how well OpenSpectrum met their expectations set out in formative evaluation, whether expectations changed as they used OpenSpectrum, and if so, how they changed. Participants will be asked for specific changes they would like to see in OpenSpectrum, and these will be made in a timely fashion so further evaluation can take place during the following semester.

### 4.3 Timeline

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|---------------------|--|
| November 2004       | <ul style="list-style-type: none"><li>✓ Install MediaWiki platform, transfer content from selected static pages to wiki-based pages, perform testing to ensure stability and ease of use</li><li>✓ Generate quick tutorials which show how to add content or edit a page</li><li>✓ Prepare and post a web page informing users of changes taking place on the site:<ul style="list-style-type: none"><li>○ <a href="http://www.scienceofspectroscopy.info/openspectrum">http://www.scienceofspectroscopy.info/openspectrum</a></li><li>○ Overview and explanation of wiki technology</li><li>○ Explain why changes are being made</li><li>○ Indicate the location of tutorials</li><li>○ Explain that static pages will continue to be available for users who prefer them</li></ul></li></ul> |
| December 2004       | <ul style="list-style-type: none"><li>✓ Invite potential collaborators to beta test the site</li><li>✓ Continue moving content from static to wiki pages</li><li>✓ Develop evaluation instruments</li></ul>  |
| January 2005        | <ul style="list-style-type: none"><li>✓ Finish moving content from static to dynamic pages</li><li>✓ Finalize core group of educators who will use and help publicize the web site</li><li>✓ Post an announcement giving users advance notice of the date that dynamic pages will replace static pages on the web site, and announce that this will require a brief service outage (1-2 hours)</li><li>✓ <b>Live BETA Release of OpenSpectrum February 1, 2005</b></li><li>✓ Begin development of new content pages in collaboration with NASA Ames Research Center</li></ul>  |
| February-March 2005 | <ul style="list-style-type: none"><li>✓ Continue development of content pages and announce release of each new page so users know that new topics are available to use and edit</li><li>✓ Conduct preliminary spot evaluation to find and fix user interface issues, and make improvements</li><li>✓ Begin French language translation of pages</li><li>✓ Conduct mid-semester evaluation of student experience</li></ul>  |
| April 2005          | <ul style="list-style-type: none"><li>✓ Prepare report to project funders</li><li>✓ Continue ongoing development of new content pages</li></ul>  |

### 5. About the Author

Stewart Mader, Educational Technologist at Emerson College, specializes in developing technology-based educational materials that make the learning process more representative of everyday practices in science. He is co-author, with Michael Rooke of Long Island University, of *The Science of Spectroscopy* (<http://www.scienceofspectroscopy.info>). Launched in 1999, the site is recognized and used internationally, has been featured in the journals *Science*, *Chemistry International*

and *Science Books & Films* and was named an NQ, or National Qualification, by Learning and Teaching Scotland. In 2002 he collaborated with NASA to produce "Seeing the Scientific Light", a documentary which aired on PBS Arizona and is currently in retail distribution. He has served as Instructional Designer and Interim Director of the Faculty Center for Learning Development at University of Hartford, and recently collaborated with faculty at Long Island University on a series of teaching and learning projects. At Hartford, he led the Teaching with Technology Colloquium, a series of intensive weeklong summer conferences in which faculty developed ideas for technology-based curriculum tools into finished products for use and assessment during the academic year. This project was funded by the Connecticut Distance Learning Consortium for two years. He led a pilot of the Teaching with Technology Grant Program, which provided equipment funding, student assistance, course releases and formal recognition for technology-based curriculum development projects. Mader was awarded an American Chemical Society Award for Outstanding Achievement in the Chemical Sciences, and holds associate membership in Sigma Xi, The Scientific Research Society.

#### **6. Advisory Board**

**Michael A. Rooke, PhD**

Associate Director of Information Technology and Director of the Faculty Technology Resource Center, Long Island University

**Todd S. Gernes, PhD**

Director, New Pathways Program, Emerson College