

CHEMWIKI BIOWIKI MATHWIKI SOLARWIKI GEOWIKI PHYSWIKI STATWIKI

The UC Davis Dynamic Textbook Project consists of seven pseudo-independently operating and interconnected "STEMWikis" that focus on augmenting education in separate STEM (Science, Technology, Engineering and Mathematics) fields. The key benefit of the Dynamic Textbook Project approach is that work by current students can be harnessed in combination with faculty effort to generate freely-available textbook substitutes taking full advantage of online utility to address student learning needs via an extensive question database system that is linked to content.

PROJECT MIGRATION: NEW HOST & NEW SOFTWARE

The seven STEMWikis of the Dynamic Textbook Project are in the process of being transferred to MindTouch Inc. (San Diego). This will provide a scalable, cost effective, and efficient management methodology for the foreseeable future of the project. This migration will provide a significant upgrade to the current capabilities of the project including considerably improvements in access speed and a new more modernized skin.

The STEMWikis will be hosted in the newly released MindTouch 4 cloud-based platform that was designed to have superior speed (100x) and utility over the existing Core v10 platform currently used by the Dynamic Textbook Project. Shifting to Mindtouch will enable to the ChemWiki to sustain its current high traffic (2.4 million pageviews a month) and provides the opportunity for its continual growth (with approximately 3-fold scaling per year). This enhanced utility is especially important as the other STEMWikis grow and attract new visitor traffic.



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STEMWikis Under Construction

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THE NATIONAL SCIENCE FOUNDATION FUNDS CHEMWIKI CONSTRUCTION



The ChemWiki construction team received a two-year grant from the National Science Foundation (NSF) to assist in the creation of a single, flexible resource for chemistry education. The ChemWiki will provide students not only with a supplement or alternative to their traditional textbook, but also the opportunity to develop content for an integrated online resource. This support was provided by the Division of Undergraduate Education (DUE) under the Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics (TUES) program.

The ChemWiki is organized around a collaborative approach to chemistry education where an Open Access textbook is constantly being written and re-written, partly by students and partly by faculty, resulting in a no-fee, high-quality textbook, accessible anytime, anywhere, by anyone with internet access. The ChemWiki is enabling Wikitexts to be created by individual faculty by ordering modular content in a way that is meeting localized needs, and is allowing other Core Modules to be modified via an embedded graphical editor, and then incorporated into the Wikitexts. The ever growing

list of Wikitexts is available for anyone to peruse, adapt and adopt as needs dictate. The ChemWiki is designed with the flexibility to address chemistry education in students at a broad range of academic levels including two-year, four-year and University students and its open-access nature will reduce financial barriers that hinder wide-spread adoption of commercial alternatives to benefit financially disadvantaged students.

The project enables student participatory learning by engaging them in the content construction. The nature of The ChemWiki modular concept is permitting content to be used and re-used in multiple courses at multiple levels. The open and dynamic nature of The ChemWiki is allowing both straightforward error correction and timely content with near instantaneous modification possible for state-of-the-art material. The multiple author construction approach is enhancing usage flexibility by the very nature of the breadth of strategies employed.





Larsen (UCD)



Soderberg (UM-Morris)



Farmer (Sonoma SU)



Smith (CCCC)



Kruger (Hope)



Rusay (DVC)

CHEMWIKI PILOT PLANNED SPRING 2014

The first ChemWiki pilot for a Third quarter General Chemistry course is set for Spring 2014 at UC Davis (Chem 2C) with 400 student enrollment. The UC Davis Center for Education and Evaluation Services (CEES) will provide independent evaluation services for formative and summative evaluation of the ChemWiki's educational quality. Formative evaluation will include surveys of participating students and faculty. To objectively examine the quality of ChemWiki vs. conventional paperbased textbooks, CEES will develop a paired comparison analysis, matching course content and instructor and varying only the textbook material source (e.g., one course will use ChemWiki exclusively and a second matched course that will use the traditional text), as a summative evaluation measure.

Students and faculty working together to build the ChemWiki

Constructing the ChemWiki is a large endeavor requiring the effort of many contributors and follows a "bottom-up" modular development scheme that is implemented in parallel at six campuses across multiple states at the community college, four-year college, and university levels. The ChemWiki project team is led by Prof. Larsen at the University of California at Davis with participation by Prof. Farmer at Sonoma State University, Prof. Rusay at Diablo Valley College, Prof. Smith at Contra Costa Community College, Prof. Kruger at Hope College, and Prof. Soderberg at the University of Minnesota at Morris. This multi-campus partnership of both faculty and students is developing, delivering and expanding transformative content for chemistry education within the integrated ChemWiki resource.

This multiple pronged construction effort is also supported by the efforts of talented students at multiple campuses. This combined faculty/student construction approach enhances flexibility by incorporating a wide breadth of pedagogies to contribute to a broad use, and maximizes the impact to a broad spectrum of students.

Profs. Rusay, Smith, and Larsen handle developing general chemistry content. Profs. Soderberg and Farmer handle the organic chemistry content, by integrating existing online content from William Reusch's Online Organic Chemistry Textbook, and Soderberg's Organic Chemistry With a Biological Emphasis. Prof. Farmer directs students focusing on high school teaching at toward ChemWiki development as their undergraduate research requirement. Prof. Larsen also

THE CHEMWIKI IS NOT A TEXTBOOK; IT IS A 'TEXTBOOK ENVIRONMENT' CAPABLE OF SUPPORTING MULTIPLE CHEMISTRY TEXTBOOKS WITHIN A CENTRALIZED SYSTEM.

The ChemWiki received permission to integrate over 35 sites of online content including Stephen Lower's Chem1 Virtual Textbook, Charles Ophardt's Virtual Chembook, William Reusch's Online Organic Chemistry Textbook, and Tim Soderberg's Organic Chemistry With a Biological Emphasis. Students take the role of integrating the pages of these sites into the ChemWiki.

focused on developing content for physical chemistry for non-majors and in cooperation with Prof. Krueger also handles developing physical chemistry for majors.

The faculty and students of the project team are enthusiastic about the ChemWiki's potential, which will be even stronger as the greater STEMWiki network grows.



Goonatilleke (UCD)



Karim (UCD)



Muller (UCD)



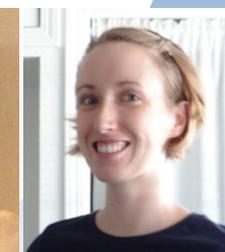
Tran (UCLA)



Reeves (UC Berkeley)



Maniya (UC Berkeley)



Havens (UC Berkeley)

The ChemWiki currently has a visitor traffic of 18 M visits with 26 M pageviews per year and an estimated 1634 hours of reading/writing occurring daily

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Building an integrated STEM E-Text HyperNetwork

The Dynamic Textbook Project is much more than the ChemWiki and involves the simultaneous construction of multiple STEMWikis with a primary goal of re-conceptualizing the way STEM courses are taught by offering students easy access to vetted course textbook materials, while providing an integrated infrastructure for faculty to adapt and adopt existing pedagogies and materials to suit their specific needs. A multi-disciplinary team was formed of faculty and students representing Chemistry, Physics, Mathematics, Geology, Statistics, Engineering, Molecular and Cell Biology, and Evolution and Ecology to develop and connect the STEMWikis as principal components of an integrated “E-text Hypernetwork” that enables the seamless transition of topics and dependencies across differing STEM fields.

PHYSWIKI

PhysWiki Development was directed by Prof. Eric Christiansen (South Florida Community College) with his student Eric Harrigan who have seeded the PhysWiki with an open-source, calculus-based textbook. Working with Prof. Paul D’Asandris (Monroe Community College), they have expanded the PhysWiki with the “*Spiral Physics*” textbook. The UCD Physics Club complemented this effort by focusing on the construction and integrating of advanced course materials including advanced *Quantum Mechanics* material contributed by Prof. Michael Fowler (University of Virginia).

MATHWIKI

Prof. Joseph Biello (UCD) ran a special topics class of motivated students to kickstart the development of the MathWiki. These enterprising students created 20 Modules for his *Vector Calculus* class, which have been integrated with Modules donated by Prof. Larry Green (Lake

Tahoe Community College). Prof. Jiří Lebl (Oklahoma State U) contributed Modules addressing *Ordinary Differential Equations* and *Real Analysis*, which complement the *Linear Algebra* modules contributed by Profs. Schilling, Lankham, and Nachtergale (UCD).

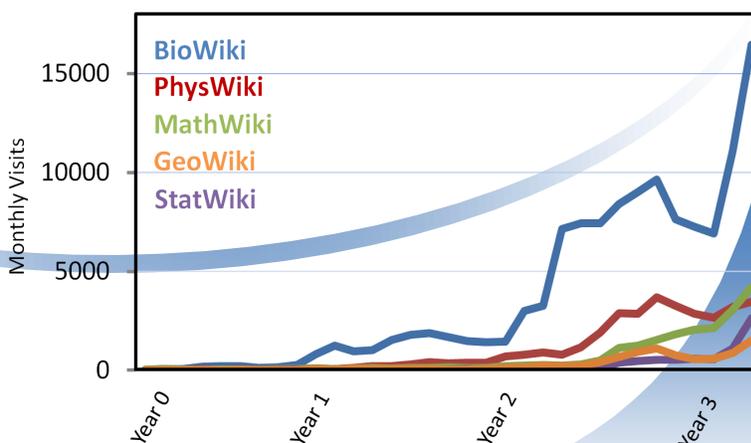
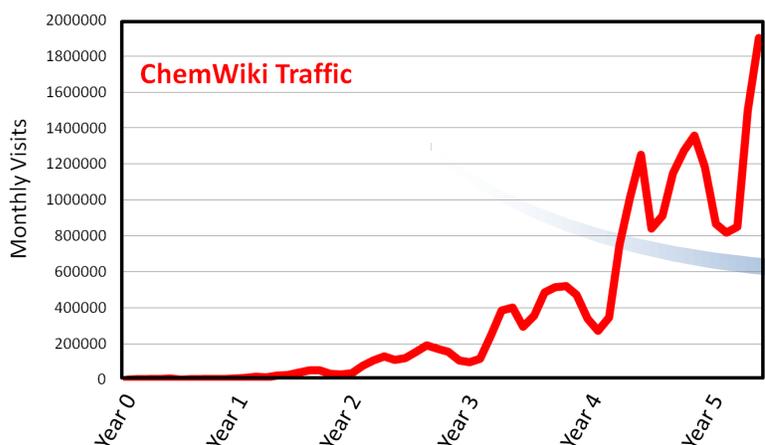
STATWIKI

Prof. Debashis Paul (UCD) has been constructing of the StatWiki with a team of motivated students lead in part by undergraduate student Scott Brunstein. Their efforts has expanded the StatWiki’s visitor traffic 10-fold and provided a solid platform for coupling the StatWiki to other STEM-Wikis. Preliminary evaluation of a server-side software for use as an “Computational & Visualization Application” to foster enhanced analysis skills in students via R or Octave and will eventually extend to the other STEMWikis. Other faculty members have contributed to the StatWiki including Prof. Wolfgang Polonik (UCD).

BIOWIKI

The BioWiki is the second most visited STEMWiki with ~10,000 visitors/month and is growing rapidly. The *Biochemistry* section contributed by Prof. Henry Jakubowski (College of St. Benedict/ St. John’s University) was expanded with equations converted to the MathJax LaTeX infrastructure used in MathWiki and StatWikis. The *Genetics* section of the BioWiki was recently initiated with the contribution of Prof. Ross Hardin’s (Penn. State U) e-textbook “*Working with Molecular Genetics*.” The Project team will reach out to faculty of the College of Biological Sciences this upcoming year to encourage motivated faculty and student to continue construction efforts.

THE CHEMWIKI CONSTITUTES THE MOST VISITED SUB-DOMAIN OF UC DAVIS WITH 9.2% OF INCOMING CAMPUS TRAFFIC —ALEXA.COM



Monthly visitor traffic development profiles for the ChemWiki (left) and five other STEMWikis (right); the SolarWiki is not shown.

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We are growing, but we still require your help

The STEMWikis are practitioner-developed, practitioner-adopted, and practitioner-evaluated. They are infused with an end-user mentality at every stage of construction, which entails developing, collecting, integrating, and vetting open-access content within a central unified and hyperlinked infrastructure. Our approach follows a “bottom-up” modular development scheme involving faculty and students with faculty contributing content and organization and students contributing through supporting tasks. Please consider contributing to the construction of a STEMWiki as there are multiple avenues to contribute to the project:

FACULTY OPPORTUNITIES

CONTENT DONATION

Faculty with existing materials that were personally created for use in one or multiple classes can contribute that content to the STEMWikis. This includes homework questions, answers, solution manuals, supplements, and any other textbook materials that are intrinsically copyrighted by the faculty member that developed the material. This would then be transcript from whatever format the material was in (e.g., PDF, word, Latex) into the STEMWiki server via student effort. No additional effort is necessary on behalf of the “Contributing Faculty” member. All content will have the contributors bylines on each Module.

STUDENT SUPPORT

Faculty wishing to participate, but have little time and no existing materials to contribute can provide students (both undergraduate and graduate) extra credit (e.g., 5%) in classes to construct STEMWiki Modules for the classes they are enrolled. The existing DTP team will facilitate all necessary efforts to ensure this is as painless as possible for faculty including preparing the STEMWiki Modules, instructing the students on their effort and handling all Q & A. Faculty only effort will be to evaluate the extra credit, which can be performed by the faculty member or by Teaching Assistants.

ACTIVE CONSTRUCTION

Faculty desiring a more active involvement in the project can contribute in by: (1) Mentor students in their efforts to build the STEMWikis, (2) Directly edit/create STEMWiki modules, (3) Provide feedback and consultation on fine-tuning Wikitexts and Modules for existing classes, or (4) Test out new e-texts ideas with the STEMWikis

Active faculty contributors may also participate as co-PIs on grants and their STEMWiki development efforts can be used to address education components (e.g., “Broader Impacts”) in research grants



Please link, like, or tweet the STEMWikis for increased visibility

STUDENT OPPORTUNITIES

INTEGRATION

Students can help upload and integrate existing materials for use by faculty and students. This includes homework questions, answers, solution manuals, supplements, and any other textbook materials that are intrinsically copyrighted by the faculty member that developed the material.

This is a critical job that requires accurate transcribing and integration of material into the format of the STEMWiki with specific dedicated toward building the E-text hypernetwork.

CONSTRUCTION

Students wishing to be more engaged in content development can transcript their notes in a class into the STEMWiki or aid faculty in building materials, including Modules and Wikitexts, from scratch. This entails combing skills such as writing, composition, chemistry and computers (html coding). Students can have their names added under the contributor section of Modules, which will be preserved. These “byline” have been used as referenced works in résumés and CVs.

CONTRIBUTION

Students desiring a more unique mode of participation can contribute in different ways as agreed upon per student. Students can garner important secondary benefits: receive academic research credit, prepare for GRE or MCAT exams, become an active participant in changing the future of education, and help reduce education costs for students

Students can also participate in outreach, publicity efforts, and implementation of new online technologies into the project



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