

## Software Support for Evaluator-Integrated Books Final Report

Category: Strategic Initiative Grant

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### **Background**

Evaluator-integrated books (EIB) represent a new direction in online education. As prototyped here at UMass, EIBs are web-based books that are built around a back-and-forth interaction style between the book and the reader, and rely on a software marriage between the UMass OWL automated homework system, and a traditional book narrative. A first volume in this style, a computer science text called *iJava*, has shown tremendous potential as a new kind of vehicle for science education. However, the marriage of OWL to an instructional narrative has been imperfect. The work of this grant has been aimed at providing a more satisfactory framework for EIB development.

We report here on three aspects of our work: our efforts to develop a uniform cross-disciplinary software framework; our work on an expanded framework design; and our efforts to build a dissemination model for an EIB bookshelf with a variety of units on and off campus.

### **A Preliminary Cross-Discipline Software Framework for EIBs**

By the spring of 2007, our EIB work had developed a single web artifact, the elementary Java programming textbook *iJava*. This book had been developed with significant attention given only to one specific application, the indicated programming instruction text. The principal contribution of the work of this grant has been the development of a provisional framework that allows us to develop applications in other disciplines. We “front-loaded” the support provided by the grant so that we could develop several additional EIB applications quickly. To this end we built such a framework, which allowed Professor David Gross (Biochemistry – Amherst) to develop a physical chemistry text entitled *Physical Chemistry – Applications in the Life Sciences*; and which allowed Professor Roberta Day (Chemistry, Emerita – Amherst) to frame her chemistry

preparatory short course as an EIB. Thus we succeeded in developing a common framework that allowed us to produce three successful but admittedly experimental volumes for the purpose of more effective science education. These artifacts can be viewed as follows:

*iJava* – view a public html version, at

<http://owl.cs.umass.edu/extapps/ccbit/CompSci/JavaCS1/ebook1-13/ch0/Sect-1-TitlePage.htm>

Physical Chemistry –

Go to the OWL link: [owl.cs.umass.edu](http://owl.cs.umass.edu)

Go to chemistry upper level; UN = guest1; PW = pchem

Chemistry Prep Course –

Go to the OWL link: [owl.cs.umass.edu](http://owl.cs.umass.edu)

Go to chemistry general (UMass Amherst); UN = guest1; PW = chemprep

We are delighted with these developments. A year ago, the grand vision idea of a bookshelf of EIBs in the sciences was just that – an idea. With ITC help, we now have three developed books, and in addition a number of other interested potential authors in statistics, accounting, IT, and chemistry. Our efforts toward developing a common framework for EIBs have and continue to serve other ITC purposes as well: Dave Gross's physical chemistry text had its own ITC grant, and Professor Beatrice Botch of the Chemistry department at UMass-Amherst has just begun another ITC-sponsored project to write a full, one-semester EIB for preparatory chemistry.

Several other developments are worthy of note. First, we have developed a follow-on provisional EIB framework, which will allow us to experiment more fully with general evaluation and look-and-feel elements of the EIB paradigm. At this writing we are testing that framework, and we expect to make it the standard support software for the *iJava* text sometime in July (*iJava* is being used in a distance learning programming class, CS 121, at Amherst this summer). Second, we used our fall EIB work as the basis for an interdisciplinary NSF grant proposal (\$500K) to complete the framework and build substantial parts of our planned EIB electronic bookshelf. NSF liked the proposal, but not enough to fund it, alas. However we were encouraged enough by NSF's response that we plan to pursue a larger NSF grant for EIB development across disciplines later this year.

### **Expanded Design Efforts for EIBs**

While our work on a common framework was successful, we quickly recognized that significant aspects of this work were awkward, and somewhat at odds with the principal aims of the general EIB endeavor. One shortcoming is the lack of an effective authoring tool for textbook writers. A second problem is that the basis of the system is still OWL, which is primarily an automated homework system rather than an interactive teaching and learning system – which is how we view EIBs. A third, strategic problem has also affected our comprehensive EIB framework. It turns out that our evolving view of dissemination has had a significant impact on the nature of the design we are developing. Much of this came out at a design summit meeting with scientists, potential authors, EIB developers, and Cengage representatives in January.

We turn next to a discussion of these complexities.

### **Complexities of Dissemination**

As we pointed out in our proposal, the OWL effort has had its most spectacular success as a homework and learning support system under license to Cengage Learning – a Thompson spin-off – for their chemistry textbooks. Annual student subscriptions for this homework service have now reached 100,000. Because of this relationship, Cengage is an obvious choice for a commercial EIB publishing partnership. However this has led to some unexpected problems. First of all Cengage has design ideas for a commercial EIB framework which are not entirely clear or coherent. Second, some of their ideas make the most sense in the context of chemistry textbook products, but are less relevant for other areas such as computer science, developmental math, IT, and so forth. And finally, our interests are more clearly in the direction of building effective teaching and learning tools, and less obviously in the direction of commercial success. These three factors have influenced our design ideas in somewhat contradictory ways, and have made it difficult for us to settle on a final umbrella framework for the full spectrum of EIBs we would like to build.

### **Disposition of Funds**

Funds for this award were used as follows: \$1000 was paid to Robert Moll, project PI, to direct the work and frame the overall project conception. The remaining \$24,000 was used to pay Gordon Anderson, Computer Science Department Graduate Student and staff member to the UMass-Amherst Center for Educational Software Development, who provided design and programming support.

### **Discussion / Prospects**

We continue to view the Evaluator-Integrated Book paradigm, with its emphasis on the integration of a narrative with a range of evaluated, interactive activities, as a landscape-changing improvement in the way we do science education. Our larger goal is the construction of an extensive, robust bookshelf of EIBs in the sciences and mathematics that are superior for teaching and learning, and which are available to students at a greatly reduced cost. The work of this grant has allowed us to build and evaluate a small set of

EIBs – a down payment on our extended vision -- under a common framework. We have used these exemplars to pursue additional funding for our extended vision, both with NSF, and with potential commercial partner Cengage Learning. We are also considering other channels for dissemination, such as direct University sales through UMassOnline.

We nevertheless emphasize that the task of developing effective and useful EIBs remains complex. Authors need to feel that their scholarly work is protected and rewarded; the University's interests (as OWL owner) need to be honored; a commercial partner wants revenue, as well as an ownership stake if they put up development money; and even a well-engineered online system is far from free, requiring considerable maintenance costs. Balancing these complex components has become a major consideration in our work.

Finally, I wish to thank the Information Technology Council for their generous support at a critical time in the development of a project we continue to believe will pay off handsomely as a new educational paradigm.