The ChemCollective: Monitoring the Path from Seeing to Using to Contributing

David Yaron
Carnegie Mellon University
4400 Fifth Avenue
Pittsburgh, PA 15213
412-268-1351
yaron@cmu.edu

Jordi Cuadros
Carnegie Mellon University
4400 Fifth Avenue
Pittsburgh, PA 15213
412-268-7914
jcuadros@andrew.cmu.edu

Gaea Leinhardt
University of Pittsburgh
Learning Research & Development Ctr
Pittsburgh, PA 15260
412-624-7465
gaea@pitt.edu

ABSTRACT
The ChemCollective's digital library (www.chemcollective.org) hosts activities for introductory chemistry courses at the high-school and first-year post-secondary level. It aims to not only make materials available to instructors, but also to empower them to adapt existing materials to their local needs or to create their own materials. In this report, we present a strategy and initial data for monitoring community growth. We consider three main stages for community participation: initial exposure to the collection (*see*), use of existing materials in the classroom (*use*), and contribution of either educational materials or feedback/assessment information to the collection (*contribute*). Estimates for the number of members of the target audience at each of these stages are gleaned from conferences and workshops, emails from users, and web server logs. Conservative estimates are that 7000 instructors have seen the collection, 200 use activities in their classroom, 11 have contributed activities, and 40 have contributed feedback. These results give insight into the number of users that go from seeing to using a collection (3%), from using to contributing activities (5%), and from using to contributing feedback (20%).

Categories and Subject Descriptors
K.3.1 [**Computers and Education**]: Computer Uses in Education – *collaborative learning*, *computer-assisted instruction (CAI), distance learning.*

J.2 [**Physical Science and Engineering**]: *chemistry*.

General Terms
Measurement, Performance, Design, Experimentation, Human Factors, Theory.

Keywords
Chemistry education reform, digital library, online education, virtual laboratory, scenario based education.

1. INTRODUCTION
The ChemCollective's digital library hosts activities for introductory chemistry courses at the high-school and first-year post-secondary level. Its research goal is to explore the degree to which digital library structures can attract and support a community of educators working toward a common vision of educational reform: promoting conceptual learning through virtual labs and scenario-based learning activities.[1,2] The ChemCollective aims not only to make materials available to instructors, but also to empower them to adapt existing materials to their local needs or to create their own materials.

In this report, we present a strategy and initial data regarding community growth. We consider three main stages for community participation. The first is initial exposure to the collection, which we will label *see*. We next consider the *use* of existing materials from the collection. Finally, users may *contribute* either educational materials or feedback/assessment information to the collection.

2. TARGET AUDIENCE
We consider the primary target audience of ChemCollective materials to be the teachers of introductory chemistry. From the U.S. Department of Labor's most recent information (November 2003), there are currently 1,033,020 secondary teachers (not including vocational and special education). We estimate that about 1/3 are science teachers and 1/3 of these teach one or more chemistry courses, leading to approximately 100,000 teachers. Of the current 17,880 post-secondary chemistry teachers, we estimate that roughly half of those teach introductory chemistry (9000).

3. SOURCES OF DATA
One source of data is from web server logs. The ChemCollective grew out of a previous educational development effort called the IrYdium Project. The ChemCollective web site was launched in March of 2004, but web sites for both projects remain active. Web metrics reported here include both of these sites. The ChemCollective also attends national and regional conferences to present talks and workshops, and typically rents a booth in the exhibit hall. We can estimate exposure from attendance at these events, and the number of CD-ROMs distributed. We received 346 emails in the past 15 months and these have been categorized by type of request. Finally, we have the number and type of contributions made to the collection.

4. SEE

The following estimates for chemical educators exposed to the collection are listed from most reliable to most speculative.

We exhibited at 3 chemical education conferences in the last 20 months, with a total attendance of about 2600. 1000 visitors came to our booth and picked up a CD-ROM. Although attendance at more general conferences, in chemistry (ACS National Meeting) and in science education (NSTA, NCSTA), totaled 26,000, we distributed only 1500 CD-ROMs.

In the last two years, several articles have been published about our collection. *Science* has a total readership of 740,000, and our listing in the Netwatch section (11/03, 4/04) led to more than 200 visits to our site via links on the Science website, and an undetermined number who entered the URL directly. (85% of our web hits are from typed URLs or bookmarks.) We were awarded Editor's Choice for MERLOT (8/03, about 2000 hits from direct link), and were featured in ChemMatters (9/04), ChemistryCoach (3000 hits from direct link, presumably mostly students) and the Eisenhower National Clearinghouse (1/05, 250 hits from direct link in one month). We have no information on the identity of these users but estimate that a few thousand chemistry instructors have seen us through such sources.

We have had about 25,000 hits from search engines. Of these, the only search terms that we would identify as likely coming from teachers are "chemistry virtual lab" and variants (ranked on first page of Google with about 1500 hits last year).

Finally, we can use web server logs to get an overall sense of visibility. We get about 8000 unique visitors each month. 16% of users stay more than 5 minutes, and 1.7% stay more than an hour.

The most conservative estimate for chemistry educators that have seen the collection is the 2500 that directly received a CD-ROM or attended a workshop. We estimate the number that have seen an article discussing the collection or found us in a web search to be an additional 5000. So about 7000 chemistry educators have been made aware of the collection. The above venues are geared toward post-secondary educators, which we estimate to make up about half of these 7000.

5. USE

Since the collection does not require users to register or log in, and the software can either be run from the web site or downloaded from CD-ROM, we do not have complete usage statistics. We can however, make a reasonable estimate of the number of educators who are using the learning activities in their classroom.

42 instructors contacted us for help with technical issues, 33 contacted us for solutions to activities, and 42 with comments and feedback. This corresponds to about 100 instructors that we have direct information are using activities in their classroom.

188 web sites at educational institutions currently link to our collection. Since many of these are password protected sites, our information is limited. We estimate that about 100 of these are links for students to access the material as part of class activities from instructors who have not directly contacted us.

Our virtual lab software can be used either as a general simulation environment or as a platform for activities. When an activity is loaded on a computer with a live internet connection, it connects to our web site to check for new activities, which occurred 15,000 times last year. If we assume an average class size of 100 and that each class uses 1.5 activities, this gives an estimate of 100 classrooms. This number does not include instructors using the virtual lab offline or as a demonstration tool in class. This also does not include use of other Java applets in the collection (loaded 30,000 times in the past year), nor does it include classrooms using the "Mixed Reception" murder mystery or other scenario-based learning activities.

Taken together, this leads to a conservative estimate of 200 instructors using the activities in their classroom.

6. CONTRIBUTE

Users can contribute to the collection by suggesting or submitting activities, or by providing feedback/assessment data on the activities.

9 instructors have contributed a total of 35 different activities to the collection. (These contributors work closely with our development team.) In the past 15 months, we also received 23 emails with suggestions for activities or collaborations, about 10 of which we believe will reach fruition. Finally, 8 users have offered to translate items in the collection into foreign languages, of which 2 have made contributions and we believe 2 more will be completed. We therefore have 11 current contributors and 12 additional expected contributors of activities to the collection.

The web page invites instructors to contribute feedback on the use of the materials in their classroom and to participate in assessment studies. In the past year, 42 instructors have provided feedback (although much of it is general and does not address specific educational issues or goals) and about 60 expressed interest in participating in studies. It is interesting that we have received more requests to participate in studies than to give simple feedback on classroom use.

7. SUMMARY

The above conservative estimates for our target audience are that 7000 instructors have seen the collection, 200 use activities in their classroom, 11 have contributed activities, and 40 have contributed feedback. These results give insight into the number of users that go from seeing to using a collection (3%), from using to contributing activities (5%), and from using to contributing feedback (20%).

8. ADDITIONAL AUTHORS

Emma Rehm, Michael Karabinos, and Tim Palucka, Carnegie Mellon University, Pittsburgh, PA 15213.

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10. REFERENCES

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