Information Literacy Integration & Assessment in Undergraduate STEM Programs

Summary of Original Proposal

Brian Winterman (IUB Libraries Department of Teaching and Learning) and Richard Hardy (Department of Biology)

In this project the investigators will analyze student-learning data that was gathered as part of a larger project intended to develop a program-level assessment of undergraduates’ information literacy skills. The analysis of these data will inform adjustments to course-based exercises and assessments to improve student learning in targeted Science, Technology, Engineering and Math courses (STEM). This collaboration between a librarian and a biology instructor will build upon previous success in engaging science graduate students in course-based learning assessments to explore models for program-level assessment. The graduate students in this project will develop an assessment model with a strong focus on authentic learning to measure STEM learning outcomes at the individual, course, and program levels in Biology. Authentic assessments typically ask students to do the type of thinking and tasks that an expert would do when practicing their discipline.

Participating graduate students will facilitate the integration of concepts, exercises, and assessments throughout the undergraduate curriculum, from introductory through advanced biology courses. This model of curriculum development and assessment will be adaptable to a variety of learning outcomes and disciplines, and participating graduate students will regularly communicate results and best practices to students and instructors in other STEM programs at IU and beyond.
Information Literacy Integration & Assessment in Undergraduate STEM Programs

Brian Winterman  
Information Fluency and Assessment Librarian  
IUB Libraries Department of Teaching and Learning

Richard Hardy  
Associate Chair of Teaching  
Department of Biology

Funding level requested: Phase II  
Duration of funding period: 2 years  
Contact: Brian Winterman (bwinterm@indiana.edu)
**Purpose**

In this project, we propose to analyze student-learning data gathered as part of a larger project to develop a program-level assessment of undergraduates’ information literacy skills. The analysis of these data will inform adjustments to course-based exercises and assessments to improve student learning in target STEM courses. Furthermore, this SOTL proposal requests funds to allow the investigators to attend national conferences to disseminate the results of our work.

This SOTL grant will supplement a grant to the investigators in November 2012 from the Alfred P. Sloan Foundation and the Teagle Foundation via the Council of Graduate Schools (CGS) and the University Graduate School at IU to develop new approaches for enhancing graduate student skills and understanding in the assessment of undergraduate learning.

The collaboration among the investigators will build upon previous successes in engaging science graduate students in course-based learning assessment to explore models for program-level assessment. The graduate students in this project will develop an assessment model with a strong focus on authentic learning to measure STEM learning outcomes at the individual, course, and program levels in Biology. Participating graduate students will facilitate the integration of concepts, exercises, and assessments throughout the undergraduate curriculum, from introductory through advanced biology courses. This model of curriculum development and assessment will be adaptable to a variety of learning outcomes and disciplines, and participating graduate students will regularly communicate results and best practices to students and instructors in other STEM programs at IU and beyond.

To this end, the investigators, along with Katie Kearns (CITL), have founded a program called Science Education Assessment (SEA) Scholars which will serve as the core team for program level integration and assessment of information literacy-based exercises. The SEA Scholars, all Biology graduate students, have been recruited and work is under way. Implementation of the model is scheduled for Fall 2013, and the SEA Scholars are preparing by meeting weekly with the investigators to learn about science pedagogy, information literacy, assessment principles and methods, and best practices for course and assignment design.

While the CGS grant allows us to focus on preparing future faculty, the broader goals of our work are focused more on improving teaching and learning of undergraduate students. The investigators will be applying for a National Science Foundation grant in May to extend and expand our work into a full-scale longitudinal, trans-disciplinary study of integration and assessment. Additional support from SOTL at this time would bridge our current work with our broader goals by allowing SEA Scholars to focus specifically on using student assessment data in order to revise and improve student learning in targeted STEM courses. Also, CGS funding does not provide support for dissemination-related travel, an essential project component for the investigators and the participants.

**Previous Research Results and SOTL-Related Publications/Presentations**
Much of the local research on information literacy integration and assessment has been funded or supported by the Scholarship of Teaching and Learning in some way. The results of the various studies have all been considered and drawn from to develop this current project in a way that will make it as effective as possible. Some of the most relevant and important results are summarized here:

- Integrating information literacy principles into the research and writing process empowers students by teaching them expert-level skills in their information use. It also by nature makes writing a deliberate and process-based endeavor. Rubric assessment of writing samples has shown that this approach results in better organization of thoughts and information, and better writing overall. Student subjects often report that information literacy-based exercises make them feel confident, creative, and professional.
- Information literacy is often seen as the domain of librarians, but research shows that collaboration is crucial in successfully producing information literate students. Information literacy principles become most meaningful in the context of a discipline, so librarians and instructors in disciplines must work together for best results.
- Assessment of student learning is most meaningful when it is authentic. Rubric assessment has shown to be a viable and effective option for authentically assessing information literacy-based student work. (Co-investigator Winterman was involved in a federally-funded study called Rubric Assessment of Information Literacy Skills (RAILS) and co-presented with Dr. Megan Oakleaf in 2012 for the SOTL community.)

The following recent publications resulted from work supported by SOTL:


Donovan, C., Slough, R., & Winterman, B. (2011). Information Literacy for Multiple Disciplines: Toward a Campus-Wide Integration Model at Indiana University, Bloomington. *Communications in Information Literacy*, 5, 1: 38-54.


**Significance and Impact**

It is expected that results of this project will have significant impact locally and beyond in several regards:
Once fully implemented, our model of information literacy integration in the Biology department will ensure that all majors learn key skills at the right time along their path through their program. Students graduating with an undergraduate degree in biology should be prepared to engage, communicate, and think like a biologist.

The SEA Scholars program and the implementation of the information literacy integration model will directly impact most instructors and required courses in the major in the Biology department (and hopefully others). The SEA Scholars will act as consultants to instructors and these relationships will presumably result in more effective and thoughtful teaching throughout the program.

This project promotes an assessment model that is flexible and manageable, and should be effective at the course and program levels. Assessment plans with these characteristics are highly desirable to other programs on campus and beyond.

This model is based on information literacy standards, which are designed to address any disciplinary environment, so the model should be easily adoptable by most other programs on campus. Widespread adoption would result in university-wide engagement with meaningful teaching and learning assessment.

Participating graduate students will gain valuable experience far beyond their traditional roles as assistant instructors. They will, in effect, become scholars of the teaching and learning assessment endeavor. As most will teach professionally in some capacity in the future, their experience in this program will benefit students in future classes at IU and at other institutions.

**Research Methodology**

We will evaluate the SOTL-funded portion of the project in a number of ways focusing primarily on course and program level rubric assessment data, the implementation of the program-wide plan, and the collaboration and communication between participants and instructor. This analysis will include the following assessments:

- Course-level rubrics used in targeted courses will provide data on student performance in information literacy exercises. These data will be compiled to identify strengths and weaknesses in attaining overall program goals.
- A program-level report summarizing student learning outcomes will serve as windows into opportunities for revising and improving exercises and assessment tools at the course level.
- Ongoing electronic course portfolios will provide valuable evidence of SEA Scholars’ progress related to exercise design and assessment and their grounding in sound pedagogical principles and content knowledge.
  - Course-level exercises, assessments, and rubrics
  - Reflection on the integration of these course-level exercises and assessments within the larger undergraduate science curriculum

**Dissemination**

The investigators will report progress and results as appropriate via publishing and presenting in both local and national publications/conferences. Also, the graduate student participants will be
expected to publish and present the results of their student learning assessment locally and nationally. Following is a list of potential audiences for dissemination:

- Biology faculty and instructors
- SOTL community
- Library faculty and staff
- College of Arts & Sciences
- State and national conferences in science education and library science

**Reflective Teaching**

This project by nature encourages and offers a viable structure for reflective teaching for SEA Scholars and instructors. By having them examine courses in the context of the entire program, and assessing student learning at both the class and program level, they will see how learning in one class affects another, and they will likely never view a single class or the teaching practices employed therein as a standalone experience for the student or instructor again.

**Budget Narrative**

Additional project funding is needed to extend participant stipends for up to a semester after CGS funding expires in order to focus on analysis of student learning assessment data and to pay for presentation-related travel for the investigators and participants.

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stipends</td>
<td>$2,400.00 (3 grad students at $800 each)</td>
</tr>
<tr>
<td>Travel</td>
<td>$2,600.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$5,000.00</strong></td>
</tr>
</tbody>
</table>

**Research Plan and Timeline**

The overall plan is to initiate implementation in the Biology program by targeting 3-5 classes that are required or likely to be taken by Biology majors. Once the model is tested in Biology, it can be shared and adapted to other disciplines, and implemented in their programs. It is expected that results and best practices will be ready for reporting and sharing in the spring of 2014. Current funding only allows for this initial stage of implementation with a focus on graduate student participants. Funding support from SOTL would allow us to expand our focus.

**SPRING 2013:** SEA Scholars recruitment and training; mapping information literacy standards to course and program goals; identifying target course and planning with instructors

**SUMMER 2013:** Assignment and assessment design; continued communication with instructors

**FALL 2013:** Implementation of exercises and assessments in target courses in biology, SEA Scholars monitor progress and consult; collection of assessment data
SPRING 2014: Data analysis and interpretation; compilation of results for local dissemination and reporting; revise and improve exercises and assessments; identify new target courses for the fall
SUMMER 2014: SEA Scholars train instructors and graduate students in other STEM-related programs on adoption and implementation of model; additional courses in Biology targeted
FALL 2014: Expanded implementation in Biology program; SEA Scholars monitor and consult on implementation in other STEM-related programs
CURRICULUM VITAE

BRIAN WINTERMAN
Information Fluency and Assessment Librarian, Teaching and Learning Department
Indiana University • Wells Library W121 • Bloomington, IN 47405
bwinterm@indiana.edu

Education

Master of Library Science, Indiana University, Bloomington, IN (2003)
BA in Anthropology and Classical Studies, Indiana University, Bloomington, IN (1998)

Professional Experience

2009-present: Information Fluency and Assessment Librarian, Teaching and Learning, IUB
2008-2009: Head, Geography and Map Library and Assistant Librarian, Life Sciences Library and Chemistry Library, IUB
2004-2009: Assistant Librarian, Life Sciences Library and Chemistry Library, IUB

Professional Memberships

Special Libraries Association (SLA), Biomedical, Chemistry, and Sci-Tech Divisions, 2004-2010
Association of College and Research Libraries, Instruction Section, 2007-2008
Chemical Information Division of the American Chemical Society (ACS), 2007-2008
Indiana Health Sciences Librarians Association, 2004-2006
Indiana University Librarians Association, 2004-present

Professional Development, Research, and Creativity

Awards, Grants, and Research

- 2005: White Collaborative Award. Designed and assessed a pilot for a biology information literacy course with George Hegeman, Prof. Emeritus of Microbiology.
- 2007: Scholarship of Teaching and Learning Research Award. Explored and assessed integration of information literacy principals with courses and curricula in different disciplines.
- 2008: Science Seeker. Designed and assessed a module to teach information literacy skills in a large entry-level biology lecture.
- 2010: Science Seeker II. Designed and assessed a more condensed and sustainable module (see Science Seeker above).
- 2010: New Pedagogies/New Technologies Grant. Partnered with Medical Sciences faculty to improve teaching and learning in large physiology lecture with new teaching approaches and new technology.
- 2011-12: RAILS (Rubric Assessment of Information Literacy Skills). National study funded my IMLS, et al., headed by Dr. Megan Oakleaf.
- 2012: SEA Scholars. $50k from Alfred P. Sloan and Teagle to train and employ STEM graduate students as scholars of information literacy integration and assessment at the program level.
Presentations

- 2008: Scholarship of Teaching and Learning Poster Session. Overview of SOTL grant research.
- 2009: Georgia Conference on Information Literacy, Speaker. Overview of information literacy research.
- 2009: International Society for the Scholarship of Teaching and Learning Poster Session. Results of SOTL grant research.
- 2009: Purdue Information Literacy Forum, Featured Speaker. Information literacy initiatives, assessment, and policy at IUB.
- 2010: SLA Annual Conference Poster Presentation. IUB Library re-organization and implications for information literacy initiatives.
- 2010: Association of Research Libraries (ARL) Assessment Conference. Integrated Information Literacy Education and Assessment at Indiana University, Bloomington: Progress and Possibilities.”
- 2012: Scholarship of Teaching and Learning. Co-presented with Dr. Megan Oakleaf on rubric assessment of information literacy skills.
- 2012: Society for Neuroscience. Poster presentation on Information Fluency grant results.
- 2012: LOEX. Presentation on library teaching and learning initiatives in greater organizational context.

Publications


Donovan, C., Slough, R., & Winterman, B. 2011. Information Literacy for Multiple Disciplines: Toward a Campus-Wide Integration Model at Indiana University, Bloomington. *Communications in Information Literacy, 5, 1: 38-54*.


Malacinski, G. M., & Winterman, B. (2012). Engaging and motivating undergraduate science students in a writing workshop designed to achieve information literacy and professional level competence. *International Journal of Arts & Sciences, 5(6), 397-414*. 
Continuing Education

- 2005: Chemistry CE courses at SLA
- 2006: PubMed Training
- 2006: ACRL workshop on Information Literacy Assessment
- 2006: Association of Research Libraries Leadership Workshop
- 2006: PubChem Training
- 2008: National Center for Biotechnology Information 3-day workshop on Molecular Databases
- 2011: ACRL Information Literacy Immersion Assessment Track
- 2012: RAILS – Rubric Assessment of Information Literacy Skills

Courses and Committees

Courses

- 2005-present: SLIS L624/S523 Information in Science and Technology
- 2006-2008: Biology L301 Information Literacy in Biology (see above under Performance)
- 2008-present: Biology L322 Writing Workshop in Molecular Biology

Relevant Committees

- 2006-present: Bloomington Faculty Council Educational Policies Committee
- 2010-present: IUB Campus Assessment Task Force
RICHARD W. HARDY, PH.D.

PROFESSIONAL PREPARATION
University of Newcastle-upon-Tyne (U.K.) Genetics B.Sc. (Hons.) 1990
University of Alabama at Birmingham Microbiology Ph.D. 1998
Washington University, St. Louis, MO Virology Post-doc. 1998/2002

APPOINTMENTS
07/02-06/08 Assistant Professor, Department of Biology, Indiana University
07/08-current Associate Professor, Department of Biology, Indiana University
07/09-05/11 Director of Microbiology Graduate Program, Indiana University
07/09-current Director of Microbiology Undergraduate Program, Indiana University

RECENT PUBLICATIONS (8 of 28)
A. J. Burnham, L. Gong, and R. W. Hardy. 2007. Heterogeneous nuclear ribonuclear protein K interacts with Sindbis virus nonstructural proteins and viral subgenomic mRNA. Virology. 367: 212-221
J. D. Kissel, D. M. Held, R. W. Hardy, and D. H. Burke. 2007. Active site binding and sequence requirements for inhibition of HIV-1 reverse transcriptase by the RT1 family of single-stranded DNA aptamers. Nucleic Acids Research. 35 (15): 5039-5050

SYNERGISTIC ACTIVITIES
2009-current Director of Undergraduate Studies in Biology and Associate Chair for Teaching
2009-current Member of College of Arts and Sciences Committee for Undergraduate Education
2009-2011 Co-Director of Research Experience for Undergraduate Summer Program (NSF)
2006-current Faculty Advisor for the Student Global AIDS Campaign, and the
CURRENT RESEARCH FUNDING
Agency: NIH/NIAID
Amount: Total Award $1,842,671
Project Dates: 05/01/2010-05/31/2015
Title: Host determinants of alphavirus infection

PRIOR RESEARCH FUNDING
Agency: National Science Foundation (MCB Division)
Amount: Total Award $450,000
Project Dates: 03/01/2008-02/28/2011
Title: Mechanistic studies on Sindbis virus replication.
Agency: NIH/NIAID
Amount: Total Award $408,734
Project Dates: 02/01/2008-01/31/2010
Title: An organismal approach to viral host factor discovery.
Agency: National Science Foundation
Amount: Total Award $336,417
Project dates: 2006-2010
Title: Research Experience for Undergraduates (REU)
Agency: National Science Foundation
Amount: Total Award $510,000
Project dates: 09/01/04-08/31/08
Title: Research Experience for Undergraduates (REU)

COLLABORATORS AND OTHER AFFILIATIONS
Collaborators:
Justin Kumar, Indiana University, Bloomington, IN
Richard Kuhn, Purdue University, West Lafayette IN
Janet Smith, University of Michigan, Ann Arbor MI

Previous Advisors:
Graduate advisor - Gail W. Wertz, University of Alabama at Birmingham.
Post-doctoral advisor - Charles M. Rice, The Rockefeller University, New York NY.

Post-doctoral Scholars: David Nickens, Ph.D. (06/24/05 – 02/28/09), Vasanthi Avadhanula, Ph.D. (04/03/06 – 08/01/09)

Graduate Students: Sheya Martin (11/14/05-12/01/08), Andrew Burnham (05/01/05-), Brian Wasik (current), Jonathan Rupp (current), Ying Cao (current), Rohini Kohli (current), Zhijing Huang (current), Megan Kingsolver (current).

Undergraduates (20) April Abbott (Post-doc, U. Washington), Kristin Gillett, Linnea Horton, Sheya Martin (Director of Biosafety, U. Michigan), Valerie Ray (graduate student, Loyola University), Meredith Canada (graduate student, Columbia University), Amanda Luschinski (U.S. Army), Christopher Simmons (MD-Ph.D. student, University of Kentucky), Christopher Walcott, Michael Hahn (REU supplement recipient), Samuel Scarpino (graduate student, University of Texas), Michelle Grimard (graduate student, Mt. Sinai), Joel Dankwa (graduate student, Boston University), Hilary Renshaw (graduate student Washington U., REU supplement recipient), Shannon Kearns (05/01/09-03/01/2010), Kassie Heinzman (current), Natalia Lui (current).
February 12, 2013

Members of the Selection Committee:

I am submitting this letter of reference for Brian Winterman, who is applying for the Scholarship of Teaching & Learning grant in support of his work toward developing a model for curriculum integration of information literacy education at Indiana University. As the Head of Teaching & Learning for the Indiana University Libraries, I have the privilege to supervise Brian in his capacity as Information Fluency and Assessment Librarian (October 2009-present) and to have known him and worked with him as a colleague for the past five years.

Building on a legacy of collaboration and success, Brian has worked with faculty in the many disciplines and departments in order to build information-seeking concepts and research-based assignments into individual courses. While the success of these types of collaborative projects often hinges on the commitment and work of the faculty teaching the course, Brian exercises excellent leadership in designing learning experiences and building assessment measures.

Brian is seeking this award in order to continue established partnerships and key opportunities toward the development of information literacy teaching, learning, and assessment in the curriculum of the Biology Department and beyond. Among librarians at IUB, Brian is uniquely situated to undertake this project, as he has developed the working relationships necessary to collaborate closely with teaching faculty in the department and the primary focus of his job is instruction which affords him the knowledge and experience required to lead such an initiative. I believe the timing is right for Brian to undertake this project for his own professional development and for the improvement of the libraries instructional programs, overall.

While the IU libraries and librarians provide excellent learning experiences for student researchers through library instruction sessions, these means do not lead to the type of large-scale, sustainable educational initiative that will ensure all students have the research skills to succeed at IU and beyond. In fact, even proposing to teach such sessions more frequently or through enhanced pedagogical methods would not improve students’ learning of the research process. The librarians’ instructional influence, as it is manifest through this model, is limited to the role of guest lecturer and does not satisfy
the needs of learners nor the demands of the discipline. Brian’s plan to develop a curriculum-based model for information literacy and assessment would lead the libraries beyond this limited approach into the next instructional frontier; allowing librarians to follow his blueprint for information literacy integration by exercising their leadership as disciplinary and pedagogical experts in their own right.

This has long been a priority for the IU libraries and, with the recent adoption of a general education curriculum including information literacy, the time could not be better for Brian to engage in this project. As the head of a library department focused on teaching, it is my role to offer guidance and advice to Brian throughout the development and implementation of his plan; but unfortunately, my support ends there. This particular project requires funding that I do not have and, because I believe Brian’s plan will result in long-lasting results for our department, our libraries, and the campus, I hope you will join me in encouraging Brian in this endeavor by selecting him as the recipient of these funds.

Sincerely,

Carrie Donovan
Head, Teaching & Learning
Indiana University Libraries
cdonovan@indiana.edu
February 11, 2013

Dear SOTL Grant Review Committee,

I am pleased to provide my strong support for the proposal of Dr. Richard Hardy and librarian Brian Winterman to the Scholarship of Teaching and Learning Program for funding of the Science Education Assessment (SEA) Scholars Program.

The SEA Scholars Program engages graduate students in course-based learning assessment. Individuals involved in this program develop assessment models to measure STEM learning outcomes from the individual to the program level by facilitating assessable exercises throughout the undergraduate Biology curriculum. This model of curriculum development will be disseminated to other STEM disciplines at IU and elsewhere by the participating graduate students. These exercises will focus on integration of the information literacy practices into the Biology curriculum, which is an important program-level learning goal for the Biology undergraduate major. Funding the SEA Scholars program will thus benefit our undergraduates, our graduate students, and the Biology major overall.

Sincerely,

Roger Innes
Professor and Chair
Scholarship of Teaching and Learning
Grant Completion Report

Title of Study: Information Literacy Integration & Assessment in Undergraduate STEM Programs

Principal Investigator Name and Department:
Brian Winterman
Information Literacy and Assessment Librarian
IUB Libraries Department of Teaching and Learning

Richard Hardy
Associate Chair of Teaching
Department of Biology

Co-investigators Names and Departments:

Year/Semester Awarded: Spring 2013

Phase (1, 2, or 3): Phase 2

How many undergraduate students were subjects in your study: ~300

How many graduate students were subjects in your study: 3

Executive Summary: Please briefly describe the key findings of your study in one paragraph or less, similar to an abstract for a research article.

This SOTL grant supplemented a grant to the investigators in November 2012 from the Alfred P. Sloan Foundation and the Teagle Foundation via the Council of Graduate Schools (CGS) and the University Graduate School at IU to develop a program (Science Education Assessment Scholars) for enhancing graduate student skills and understanding in the assessment of undergraduate learning. The SEA Scholars were a group of three biology graduate students with a strong interest in teaching. The additional support from SOTL allowed SEA Scholars to focus specifically on using undergraduate student assessment in order to improve student learning in STEM programs. They explored how course-based assessment of student learning can facilitate the program-level assessment. The SEA Scholars focused on information literacy skills – the ability to access, read, synthesize, and publicly present results from the primary scientific literature – as the framework for content acquisition, assignment design, and program assessment in the Department of Biology. They collaborated with biology instructors who were interested in implementing information literacy exercises in their courses and, through these efforts, were able to create a system for program-wide assessment of student learning. During this project, the SEA Scholars developed information literacy learning outcomes that aligned to faculty-written program goals, model exercises and rubrics for courses at each level of the required curriculum, course-level assessment templates, and assignment design guides.

Budget Narrative Report: Please describe how the funding was allocated.
Scholarship of Teaching and Learning
Grant Completion Report

This additional project funding was needed to extend participant stipends for up to a semester after CGS funding expired in order to focus on analysis of student learning assessment data and to pay for presentation-related travel for the investigators and participants.

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stipends</td>
<td>$2,400.00 (3 grad students at $800 each)</td>
</tr>
<tr>
<td>Travel</td>
<td>$2,600.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$5,000.00</strong></td>
</tr>
</tbody>
</table>

**Narrative:** Please discuss the outcomes of your SOTL Project and the plans you may have for continuing this work.

**Course development and curriculum design products:**
In the process of facilitating the enhancement of information literacy assignments and assessments, the SEA Scholars produced a variety of materials for use by the department:

- Information literacy learning outcomes – the knowledge, skills, and values we want students to have acquired – aligned to faculty-written program goals
- Model exercises and rubrics for courses at each level of the required curriculum
- Course-level assessment template
- Assignment design guide

Many of these documents can be found in **ILIAD**, the central repository of information literacy assignments: [http://iub.libguides.com/iliad](http://iub.libguides.com/iliad)

**Tiered information literacy**
The SEA Scholars created three tiers – beginner, intermediate, advanced – each with specific learning outcomes aligned to the Department of Biology program goals. Each tier of outcomes also had recommended model exercises and associated performance rubrics. The major learning outcome of each tier represents an important step in the development of information literacy skills, but also in attaining the learning goals of the program as a whole. It is important to note that few of the tier-level outcomes are unique; rather, they are most often accompanied by related outcomes in the neighboring tier. Therefore, the tier system represents a learning progression for achieving top-level outcomes, i.e., those associated with “Innovations,” by the end of the program:

![Tier system diagram](image)

By using three biology graduate student consultants, the SEA Scholars approach represents a sustainable model for enhancing undergraduate instruction and assessing both learning outcomes and program goals with minimal extra investment on the part of the instructors.
Scholarship of Teaching and Learning
Grant Completion Report

The system of tiers simplifies the collection of uniform assessment data across the curriculum by using standardized rubrics. The SEA Scholars approach helped meet the needs of undergraduate student learning, of graduate students interested in teaching and assessment, and of instructors who wish to design more interesting assignments and receive more granular data about student performance. The following recommendations for instructors illustrate this approach.

SEA Scholars’ recommendations for Biology faculty & course development

Recommendation #1: Distribute and read the information literacy learning outcomes and departmental learning goals. The Department of Biology program goals define the skills students should obtain by graduation in order for them to become lifelong scientific learners and effective employees and innovators. The SEA Scholars’ information literacy learning outcomes directly address two-thirds of these departmental goals. To make it easier for instructors to see student progression—from freshman to graduate—the information literacy learning outcomes were divided into three learning stages, which we call Tier I, Tier II and Tier III. Instructors should examine the Tier Learning Outcomes for all tiers, not just their own. By doing so, they will identify the skills they can reasonably expect students to have at the beginning of a course and what skills to emphasize in preparation for future courses or graduation.

Recommendation #2: Design or revise assignments to align with one or more learning outcomes. SEA Scholars found that many courses already have assignments in place that could address the tier learning outcomes with minimal additional effort on the part of the instructor. Instructors should NOT overhaul their classes to fit our recommendations, learning outcomes, or the departmental goals. SEA Scholars recommend that instructors in all three tiers design or revise one assignment to address one or more information literacy learning outcomes. This approach will produce data on student learning for use by individual instructors as well as the department.

Recommendation #3: Assess student performance on learning outcomes and reflect on strengths and weaknesses. SEA Scholars found that many instructors have rubrics or similar grading methods already in place to assess student performance. SEA Scholars recommend that instructors modify or design rubrics to assess each of the information literacy learning outcomes emphasized in a particular assignment. Examples of rubrics with performance levels can be found on the iRubric website (available to all instructors) or on our ILIAD database of assignments at [http://iub.libguides.com/iliad](http://iub.libguides.com/iliad). If necessary, the assessment rubric can double as a grading rubric. Regardless, each learning outcome should be covered by one rubric criterion that is divided into well-defined performance levels.

Recommendation #4: Open a consistent dialogue among instructors. Through workshops with instructors, SEA Scholars observed the value of constructive discussions
about teaching among instructors. The discussions were particularly beneficial when focused on specific assignments and learning outcomes, as opposed to more generalized conversations about teaching. Instructors should be encouraged to share assignments that they are designing and revising. Sharing rubric data can help instructors across tiers identify areas where students need more help or practice. The department may consider assigning an individual or committee to oversee this discussion or conduct future workshops. In response to requests from many faculty members, we have also set up an online database for instructors to share assignments and rubrics (ILIAD).

Program-level view of biology undergraduate student performance
Drawing from this cross-tier implementation of information literacy activities and assessments, the SEA Scholars designed assessment rubrics and analyzed data from three assignments – one from each tier – to identify themes in student performance:

Students had success in the following areas:
1. Most students wrote clearly and effectively. It is important to note that all of the assignments assessed provided ample time for feedback and revision.
2. Using effective search techniques, students could find a peer-reviewed scientific article relevant to a broad topic.
3. In all tiers, students were able to glean the main points of a primary or secondary article that was provided to them.
4. Students in Tier III were able to design an experiment to address a scientific question.

Students had difficulties in the following areas:
1. While students in Tier I were able to summarize the main points of an article, they were unable to identify the specific hypothesis that drove the research.
2. In Tier II and Tier III, students had a difficult time placing a primary article in the context of a scientific field or question. This is consistent with the observation in Tier I that students are unable to identify a hypothesis. Students need practice recognizing the justification for an experiment: how does this experiment or paper fit into what came before it and what might come after it?
3. Students in Tier III were able to design an experiment but had trouble recognizing flaws or alternative approaches.

Extensions and Dissemination of the SEA Scholars project
The information literacy exercises as well as the course and program assessment tools developed by the SEA Scholars have been adapted and adopted by instructors in a variety of disciplines already ranging from Painting to Apparel Merchandising to Human Resources
Scholarship of Teaching and Learning Grant Completion Report

Management. In addition, a second SOTL grant was awarded in 2015 to replicate aspects of the SEA Scholars approach in the Geography undergraduate curriculum.

Dissemination has occurred in a number of formal and informal ways. The investigators and the SEA Scholars are preparing to submit a co-authored report for publication in Fall 2016. Also, the SEA Scholars and/or the investigators have presented aspects of their work at campus workshops for instructors as well as the following venues/audiences:

- 2015: Investigator consulted on program-level learning outcomes development for Pomona College Chemistry Department (Claremont Colleges Consortium).
- 2015: Claremont Colleges Library Teaching Retreat. Investigator led workshop on communicating with instructors to integrate and assess information literacy (part 2 of 2).
- 2014: Claremont Colleges Library Teaching Retreat. Investigator led workshop on communicating with instructors to integrate and assess information literacy (part 1 of 2).
- 2014: CUNY Assessment Conference, NYC. Investigator invited to speak on curriculum integration and assessment of information literacy in undergraduate science programs.
- 2013: Scholarship of Teaching and Learning Fall Celebration, IUB. Co-presented a poster on SEA Scholars project.
- 2013: IU Libraries Information Literacy Colloquium, IU Southeast. SEA Scholars and investigator co-presented on project design and expected results of the SEA Scholars effort to integrate and assess information literacy in undergraduate programs.