Assessment of Student Learning
School of Science
IUPUI
2011-2012 Report

Overview: The School of Science provides outstanding science education for all IUPUI students, education in depth for Science students, and engages in research in the physical, biological, mathematical, and psychological sciences in order to increase scientific knowledge and advance the development of the life sciences at IUPUI and in Indiana. Within the seven academic departments (Biology, Chemistry & Chemical Biology, Computer & Information Science, Earth Sciences, Mathematical Sciences, Physics, and Psychology) and the Forensic and Investigative Sciences Program, there are over 160 full-time faculty members. The School is the academic home of ~2,000 undergraduate majors and ~450 graduate students.

Part 1: Student Learning Outcomes for Each Academic Program

Faculty comprehensively reviewed and revised all Program Outcomes and Student Learning Outcomes based on the work of the Assessment Committee in 2010-2011. A comprehensive list of SLOs for both undergraduate and graduate education and degree programs can be found in the IUPUI Bulletin, 2012-2014 (by clicking the links below), or at http://www.iupui.edu/~bulletin/iupui/2010-2012/schools/purdue-science/undergraduate/student_learning_outcomes/index.shtml.

Undergraduate (B.A. and B.S.)	**Graduate (M.S. and Ph.D.)**
• Biology • Chemistry • Computer and Information Science • Environmental Science • Forensic and Investigative Sciences • Geology • Interdisciplinary Studies • Mathematics • Physics • Psychology	• Biology • Chemistry • Clinical Psychology • Computer and Information Science • Geology • Industrial Organizational Psychology • Mathematics • Physics • Psychobiology of Addictions

How is the School of Science assessing Student Learning Outcomes and Student Learning?

The main focus of this 2011-2012 School of Science's annual report is on the efforts undertaken in the last year to refine, measure, and improve the attainment of the student learning outcomes for our programs. The following data and information provides evidence that we are assessing our programs, that we are addressing the IUPUI Principles of Undergraduate Learning and Principles of Graduate Learning, that we have deliberate and ongoing processes in place for performing these assessments of student learning, and that we are using the results to guide improvements in our programs.

We will also report on assessment and improvement of processes that support student learning and student retention and success, as well as research on formative and summative assessment of student learning. Several new grants from the National Science Foundation (NSF) that focus on undergraduate education or undergraduate student success have allowed us to commit significant resources to expanding best practices related to the academic experience in the School of Science.

Part II: Outline of Assessment Activities and Accomplishments, 2011-2012

This year's report will next highlight a number of ongoing and new initiatives in the School of Science that assess student learning outcomes and student success. While this is not a comprehensive list, it details many of our major initiatives in the School of Science. This report builds on our previous assessment work; previous School of Science Assessment reports can be viewed at http://planning.iupui.edu/43.html (scroll down to "School Assessment Reports"). Appendix A shows an example of the previous mapping of the SLOs to specific departmental courses.

Overview of the 2011-2012 PRAC Report

1. External Funding received to develop new courses or curricula
    A. NSF STEP: A $2 million effort for student success (Watt et. al)
    B. NSF TUES: Contextualized Chemistry and Biology (O'Donnell et. al)
    C. NSF TUES: Cyber PLTL (Varma-Nelson et. al)

2. Course Redesign Based On Assessment Of Student Learning Outcomes
    A. Genetics K322 Peer Recitation (Biology)
    B. Chemistry C341: First Semester Organic Chemistry Workshop Series (Chemistry)
    C. Calculus Course Redesign with Recitations (Mathematics)
    D. Psychology Introductory Sequence (Psychology)
    E. Forensics Course Revision (Forensic & Investigative Science)
    F. Experiential Learning in Earth Science (Earth Science and Geology)

3. Formative and Summative Assessment of SLOs via Improved Pedagogy
    A. Mastering Biology / Mastering Chemistry/ SmartPhysics
    B. Human Physiology N217: Developing Patterns for Organization of Information to Advance Student Learning (Biology)
    C. Assessment of Technology Use in Science Classrooms, and Subsequent Improvement of Learning (Biology, Chemistry, Psychology)

4. Summative Assessment of Student Learning:
    A. PUL data for School of Science Courses (Appndix B)
    B. ETS Major Field Test (Computer Science)
    C. ETS Major Field Test (Biology)

5. Student Success Initiatives
    A. STEM Summer Residential Bridge (School of Science)
    B. Mathematics Success Initiatives (Mathematics)
    C. Thematic Learning Communities (Psychology)
    D. Career Development Services (School of Science)
    E. Physics Learning Space – PhyLS (Physics)
    F. Graduation statistics (School of Science)

6. Assessment of student learning in Graduate Programs
    A. Program overview
    B. Degree Production

Part III: Evidence of using assessment to guide continuous improvement in instruction, curriculum, and/or student support services

1. External Funding received to adopt, expand, or develop new courses or curricula

A. New Grant: Central Indiana STEM Talent Expansion Program at IUPUI (2010-2014) Principal Investigator: Jeff Watt, Co-PI; Kathleen Marrs, Charlie Feldhaus, Andy Gavrin, Stephen Hundley (NSF DUE) $1,995,765.00.

The *Central Indiana STEM Talent Expansion Program* at IUPUI is creating a central Indiana pipeline to increase the number of students from the greater Indianapolis region (central Indiana) obtaining STEM degrees. The goals of this project are to increase the numbers of students of all demographic groups who:

- Pursue STEM academic and career pathways;
- Participate in STEM research, industry internships, and honors activities;
- Graduate with an undergraduate degree in STEM fields; and
- Transition into industry, graduate and professional programs.

To this end, the School of Science has spent the last 18 months initiating a series of new programs and funded a series of STEP mini-grants to expand, extend, or develop new programs at IUPUI based on successful existing high-impact practices. These initiatives and activities fall under one of four broad categories: (1) Articulation with 2-year Colleges, (2) Student Success, (3) Student Centered Pedagogies, and (4) Career Services. Our proposal aims to 'set the stage' for student success, removing barriers to learning and promoting a vision of a career in STEM. As a result, *we are targeting for each year of the funding*, a:

10% increase in the number of new and transfer students admitted to STEM majors,
10% increase in the number of minority students admitted to STEM majors
10% increase in the DFW rates for MATH, CS, PHYS, TECH and other courses
15 additional students participating in internship and research experiences
50 graduating seniors participating in honors seminars

The primary goal of these activities it to reach the set a target of increasing the number of STEM graduates at IUPUI by 10% per year (an increase of an additional 782 STEM graduates by 2015).

B. New Grant: Cyber PLTL (cPLTL): Development, Implementation, and Evaluation, 2010-2012 National Science Foundation Transforming Undergraduate Education in Science (NSF–TUES) , Pratibha Varma-Nelson (PI), Lin Zhu, J. Randy Newbrough, Tom Janke, Lorie Shuck

Peer-Led Team Learning (PLTL) is a model of teaching where six to eight students work as a team to solve carefully constructed problems under the guidance of a peer leader. The impact of the PLTL workshop on students, leaders, faculty and institutions has been assessed and evaluated in a variety of settings for more than ten years (Review and references). On average, 4,800 PLTL students earned 14% more ABC grades (76%) than their non-PLTL counterparts (62%), with students making positive gains in critical thinking and more "autonomous motivation" when compared to their non-PLTL counterparts. At IUPUI, PLTL was first implemented in general chemistry C105 in 1998. Since then more than 7,000 students have completed the course using PLTL. The PLTL program has achieved sustained success, with the DFW rates for fall semesters decreasing from above 45% before PLTL was implemented to below 20% in 2010.

With the advancements in technology and the proliferation of online courses, experimenting with cPLTL was a natural next step. Several of IUPUI's Chemistry faculty, Instructional Technology specialists, and peer leaders worked collaboratively to develop Cyber PLTL (cPLTL)—synchronous, interactive online workshop environments where students work through problem solving while using technology as a conduit for collaboration. This new NSF grant introduces cPLTL, using Web conferencing software to adapt this face-to-face pedagogy to a synchronous online environment. Preliminary data gathered at IUPUI indicates that under the guidance of a peer leader in a synchronous online environment, achievement levels of students enrolled in cPLTL are commensurate with those enrolled in PLTL, which was implemented with great success in a general Chemistry course (CHEM C105). In a quasi-experimental study conducted in the Fall 2010 semester, cPLTL students at IUPUI (M = 72.3) significantly outperformed control group students enrolled in PLTL (M = 66.5), and the national average (M = 61.3) on the American Chemical Society (ACS) Exam taken as a final.

C. New Grant: Advancing Undergraduate Chemical Education Through Contextualized Organic Laboratories (2011-2014) Martin O'Donnell, Ryan Denton, William Scott, Kathleen Marrs. NSF TUES

This NSF grant will allow the Departments of Biology and Chemistry & Chemical Biology, as well as students in the Honors College, to work collaboratively to develop a fully integrated Distributed Drug Discovery (D3) program of combinatorial synthesis, computation and evaluation of small molecules with potential biological activity. Undergraduates in Chemistry and Biology at IUPUI and around the world are involved in an interdisciplinary research project directed at discovering drug leads for various rare and neglected diseases. The broader impact of this project consists of students applying scientific literacy to solving important humanitarian problems and learning about the drug discovery process while being actively involved in an authentic research project.

The project is entitled: "Discovering Biofilms: An Inquiry-Based Distributed Drug Discovery (D3) Project to search for Drug Leads for Neglected Disease" and begins in fall of 2012 in the Biology Honors K102 recitation and lab. Students will study the rare disease Cystic Fibrosis (CF) and a search for molecules that may disrupt the biofilms that form in the lungs of people with CF.

2. Course Redesign Based On Assessment Of Student Learning Outcomes, 2011-2012

A. Genetics K322: Introduction of Peer Recitation to enhance Student Learning

The Department of Biology has long realized the benefit of undergraduate peer mentoring on success of students in Gateway Courses (typically large enrollment introductory courses for majors or non-majors). Gateway courses often have unacceptably low student success rates (A, B, and C grades), indicating that students are not attaining the learning goals and outcomes of the course.

In 2005, the gateway courses in Biology, K101 and K103, plus non-majors courses in Anatomy (N261), Physiology (N217) and Human Biology I and II (N212 and 214) implemented mandatory or supplemental recitations sections with their traditional lecture courses to increase student achievement and retention. Peer mentoring is currently supported in these 5 courses each semester, reaching over 2,500 students each fall, spring, and summer semester. DFW (drop, fail, withdraw) data analyzed from 2000--2011 supports the trend of positive improvement student learning and success during recitation implementation. The average DFW rates for K101 without a recitation (pre 2005) was 38%. During implementation of the recitation, the average DFW rates for K101 has dropped considerably and today is stable at about 24-26%. Similar statistics have been seen throughout other peer mentored Biology courses throughout the department.

No corresponding peer mentoring exists for Biology K322: Genetics and Molecular Biology, the next required course for the 600+ biology majors in the School of Science. Enrollment in this course has steadily increased over the last 5 years, with enrollments exceeding 150 students in a single lecture section now common for the fall semester and just over 100 in the spring. The success rate in K322 is high (80% or above), but the lead instructors have been dissatisfied with student attainment of three of the SLOs and associated PULs for K322 students:

- Critical Thinking
- Core Communication and Quantitative Skills
- Intellectual Depth, Breadth, and Adaptiveness

In both Fall Semester, 2011 and Spring Semester, 2012, a peer leader was hired to provide problem solving assistance to all genetics students. Up to 10 hours of time per week was available for drop-in-mentoring with a focus on helping students address and attain the SLOs for Genetics. The peer mentor was supported by a NSF-STEP mini-grant (Reese and Judd, 2011)

Major findings include: During the fall semester, at least 48 students (36%) attended one or more mentoring sessions, similar to the attendance in the spring. There was a modest decrease in the DFW rate in Genetics in both the fall and spring (from an average rate of 16% in the previous 5 years before the introduction of mentoring to about 14% in the past two semesters with mentoring). It is difficult to say whether this modest benefit was a result of the peer mentoring, but due to the difficulty of the genetics course, student evaluations and focus group comments were overwhelmingly positive of the benefits of the extra support. The two faculty members teaching the course were also highly positive and have requested that the mentoring continue, both stating that they will promote the benefits of attending the peer mentored sessions to the Genetics students this coming fall and spring.

B. Chemistry C341: First Semester Organic Chemistry introduces PLTL Workshop Series

The Department of Chemistry and Chemical Biology continued their development and implementation of the nationally recognized Peer Led Team Learning (PLTL) workshop series at IUPUI from Freshman Chemistry C105 into the first semester organic chemistry course, Chem C341. Organic Chemistry is a challenging course that bring together many of the student learning outcomes for Chemistry as well as places a Major Emphasis on PUL 2: Critical Thinking. Given the traditionally high the DFW rate, the primary goal of implementing the Organic Chemistry Workshop Series is to facilitate students' collaborative development of Organic Chemistry problem-solving skills, as measured by performance on an ACS Organic Chemistry Exam and survey data, as well as develop student's critical thinking skills. In order to achieve these goals, a modified Peer-Led Team Learning (PLTL) workshop series was instituted as a component of the first semester Organic Chemistry course, funded by the NSF-STEP grant (Watt, Marrs, Gavrin, Feldhaus, and Hundley). The peer leaders elicit the participation of all group members, challenge students to expand their conceptual understanding through Socratic dialogue, share insights from being reflective on their problem-solving processes, and encourage students to explain their new understanding of concepts to one another in their small group during these 75-minutes workshops. Answer keys are not provided to students since it would short-circuit the process of discussing the fundamental principles and nuances of each workshop problem.

Training of Leaders: Peer leaders are trained weekly in preparation for the workshops. These weekly training meetings consist of a discussion of helpful techniques to uncover and remediate common misconceptions pertaining to the weekly problem set concepts, ways to use graphic organizers or model kits to facilitate conceptual understanding, and methods to enhance student collaboration. Eight to ten students of mixed ability are assigned a peer leader for the duration of the semester. Each peer leader, who divides their students into smaller groups of four to five students, facilitates each small group's discussion of the weekly problem sets.

Assessment of Success in Chem 341 before and after peer mentoring:

Semester	DFW Rate	N	Comments
Spring 2008	24.6%	224	
Fall 2008	29.7%	216	
Spring 2009	25.4%	135	
Fall 2009	23.1%	238	
Spring 2010	23.7%	142	
Fall 2010	15.3%	215	Workshops implemented with a 15:1 student to peer leader ratio
Spring 2011	16.3%	85	Workshops implemented with a 15:1 student to peer leader ratio
Fall 2011	15.5%	208	Workshops implemented with a 8-10:1 student to peer leader ratio
Spring 2012	18.64%	134	Workshops implemented with a 8-10:1 student to peer leader ratio

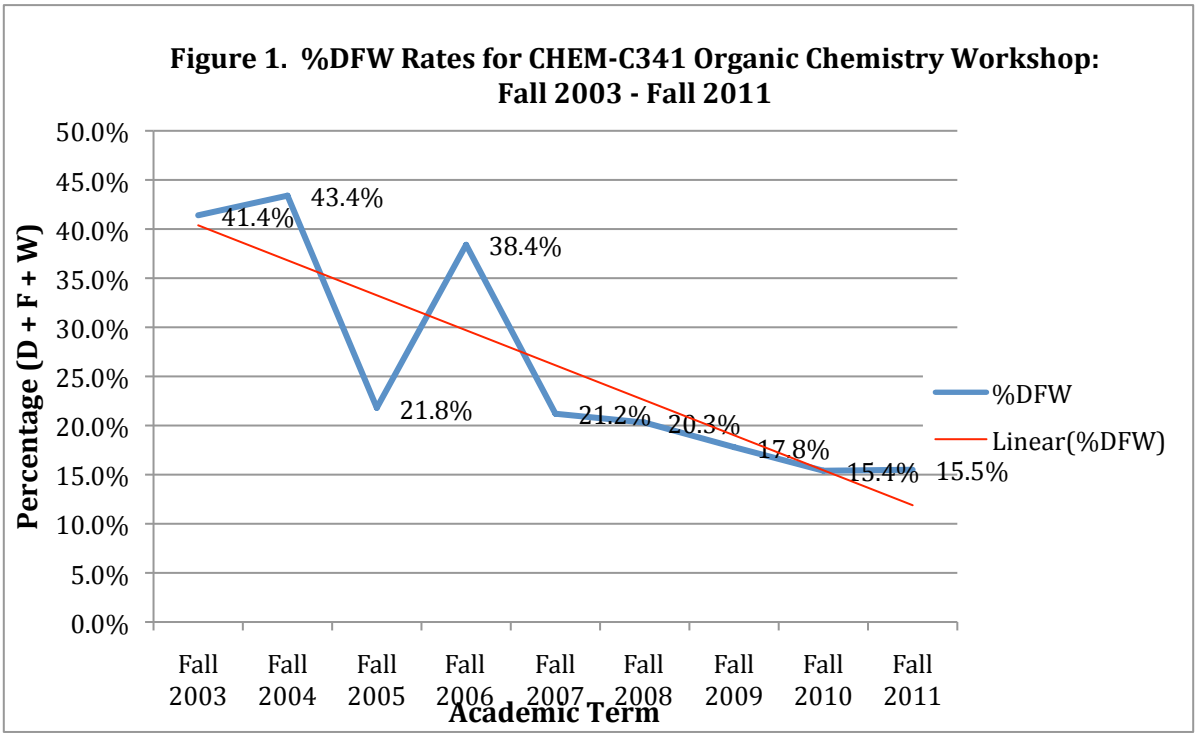
Three hundred undergraduate first semester Organic Chemistry students were impacted during the 2011-2012 academic year from the previous CI-STEP funding, with DFW rates of 15.5% (Fall) and 18.6% (Spring), as compared to DFW rates ranging from 23-30% prior to the workshops being

implemented. Moreover, 50% (Fall) to 66% (Spring) of students state that the workshop discussions aided understanding, while 40% (Fall) to 60% (Spring) of students perceived an increase in their problem-solving ability from involvement in the workshops. This CI-STEP grant enabled smaller group sizes, thus better matching the PLTL model, increasing the student perceptions of the impact of the workshops on their learning, and bolstering performance on the ACS Organic Chemistry final exam. In addition to the benefits of workshop involvement for the students, each of the sixteen peer leaders cited an increase in their understanding of Organic Chemistry concepts and more than 25% of the peer leaders expressed an interest in teaching as a career or as part of their career as a result of their participation in the workshop series.

During the current year (2012–13), the NSF funding will provide a means for the revision of workshop materials to align with the new textbook as well as consider feedback from students. Secondly, there will be further development of the peer leader training curriculum. Lastly, the pattern of lower attendance at the Friday 9am workshop sessions is motivating an exploration of new workshop times to better suit student needs.

Major findings include: (1) the DFW rates have decreased about 10% after workshops were implemented, (2) 6 to 10% increase in positive student perception of problem-solving ability, (3) 25% of the peer mentors expressed an interest in teaching after this experience, and (4) study findings to date suggest that faculty have been successful in using the PLTL approach to lower the failure rates in the workshops (see Figure 1 that provides a historical summary of DFW rates for fall semesters using workshops). Reduction of DFW rates for the chemistry course and training of additional discussion leaders (using the PLTL model) to decrease the number of students in each workshop are positive interventions for increasing the success and number of STEM graduates.

Figure 1. %DFW Rates for CHEM-C341 Organic Chemistry Workshop: Fall 2003 - Fall 2011



C. Calculus Course Redesign - Introduction of Recitations to Increase Student Learning

Calculus is another course that has an unacceptably high DFW rate, indicating that a large number of students are not successful in meeting the course SLOs or attaining proficiency with PUL 1b: Quantitative Skills. Calculus recitations were developed and implemented for the large lecture section of MATH 16500 (fall semesters) and 16600 (spring semesters). Using funds provided by the NSF-STEP grant (Watt, Marrs, Gavrin, Feldhaus, Hundley), recitations have now become a required component of the course. Graduate student recitation leaders were trained on how to facilitate discussions using peer-mentoring techniques used in the Mathematics Assistance Center. Students in all sections of the course (with or without required recitations) are required to take a departmental final exam with fixed grading curve, providing a control group to compare with the sections using the supplemental assistance of the graduate student mentor. The following data compares the DFW rate of students in sections of the course that have recitations to those that do not.

		2009-10	2010–11	2011-12
MATH 16500 (fall semester only)				
No Rec	# Students (Sections)	281 (6)	289 (5)	283(5)
No Rec	DFW Rate	33%	32%	39%
Rec	# Students (Sections)	101 (1)	98 (1)	100 (1)
Rec	DFW Rate	25%	26%	21%
MATH 16600 (spring semester only)				
No Rec	# Students (Sections)	175 (4)	185 (3)	172 (4)
No Rec	DFW Rate	40%	41%	33%
Rec	# Students (Sections)	95 (1)	106 (1)	97 (1)
Rec	DFW Rate	23%	20%	20%

The following data compares the performance of students in sections of calculus with and without recitations in MATH 16500 on the departmental final exam during the fall 2011 semester. The departmental final exam is commonly administered and commonly graded.

Fall 2011 MATH 16500	With Recitations	No Recitations	Combined
Number of Sections	1	5	6
Number Enrolled	100	283	383
Number Taking Final	82	183	265
Mean Score	72.2	61.7	65.6
Median Score	78	65	67
% of Students No Show	18%	35%	31%

Major findings include: (1) despite the larger class size, sections of calculus with recitation sections have a significantly lower DFW rate, ~20%, than other sections of the course.

(2) Students in sections of calculus with recitations perform 10 percentage points better on the departmental final exam.

D. Psychology Course Redesign - Consolidation of B104 and B105 => B110 based on assessment data

Extensive use of assessment data has contributed to the relatively recent revision of the Department's undergraduate SLOs (and adoption of graduate SLOs). However, over the last several years, data collected for the assessment of the Department's initial set of SLOs have served as the foundation for a number of curricular changes at the undergraduate level. In particular, drastic positive changes have been made to the structure and content of the Department's primary introductory course (B104). Recently, based on a variety of factors that included student exam data, the Department further decided to consolidate its two introductory courses (B104 and B105) and to commission faculty members within the Department to write a textbook for the course to ensure that students were systematically and comprehensively exposed to the information and pedagogical approaches consistent with the course SLOs. Assessment data indicating excessive variability in students' experiences related to the Department's introductory statistics course (B305) have also served as the basis for the adoption of a course coordinator with the goal of standardizing some elements of the course. Feedback obtained from psychology majors also served as a trigger for an audit of the frequency and timing of Department course offerings, which led to concerted efforts to make sure Department courses were offered regularly and at least occasionally in the evening.

The new Psy B-110, Introduction to Psychology, is a 3-credit hour foundational course that integrates biological and social aspects of behavior. In addition to serving students who will go on to major in Psychology, it serves students who are interested in pursuing careers in Nursing, Education, Business, Medicine, Allied Health Professions, Dentistry, Law, and Social Work. The goal of this course is to familiarize students with the logic of the discipline of psychology as a systematic, scientific way to think about behavior and mental processes. Topics include Research Methods, Behavioral Neuroscience, Sensation and Perception, Learning, Memory, Cognition and Language, Motivation and Emotion, Personality, Social, Stress and Health, Psychological Disorders and Treatment, and Life-span Development. The course philosophy and materials are based on principles of cognitive science and critical inquiry, including distributed practice, active learning, chunking, self-assessment, essential questions, immediate feedback, and other methods to enhance long-term retention and in-depth understanding of concepts. The new introductory course sequence begins in Fall 2012.

E. Forensics Course Revision: Courtroom Experience Puts Forensics Students to the Test A courtroom trial exercise is now a part of coursework to provide forensic and investigative science (FIS) students experience in being challenged as expert witnesses in court by a prosecuting attorney. Developed by FIS faculty member Scott Newman, a former Marion County Prosecutor, this mock trial targets student learning outcomes for the FIS program needed to develop highly trained and capable forensic scientists. (SLOs: Apply the evidentiary rules and law of evidence in the collection of evidence, examination of the evidence, and preparation of scientific reports and testimony. Describe the kinds of evidence that require a scientific foundation for its admission.)

F. Experiential Learning in Earth Science: To address the Student Learning Outcome of "Demonstrating competence in communicating environmental science problems to a broad audience through written, oral, and visual means", students in the Department of Earth Sciences were involved in over 40 Earth Month events either sponsored by IUPUI or by others in the community, including an IUPUI ToxAway Day and a panel discussion of IUPUI experts on current and future sustainability initiatives at the university.

3. Formative and Summative Assessment of SLOs via Improved Pedagogy

A. Mastering Biology /Mastering Chemistry / Smart Physics: A Research Study

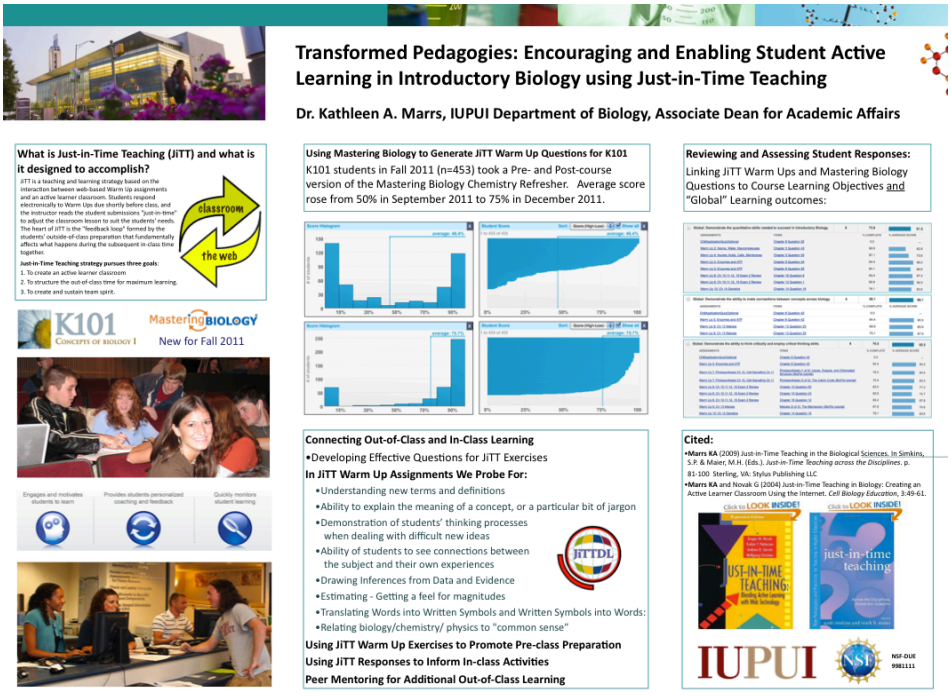
A number of Gateway and other large enrolling courses have been using active learning and classroom technology such as Just in Time Teaching (JiTT), clickers and other classroom technologies, and electronic homework to assess student understanding and learning in real time or in a greatly reduced time frame that permits rapid formative feedback.

The newest generation of active learning technologies is grounded in science education research, and these technologies are now being used in several large introductory science courses. Mastering Biology, Mastering Chemistry, and smartPhysics are integrated systems in which the textbook, homework problems, testing, classroom response and assessment metrics are all linked through a single course site for students and faculty. By setting up continuous feedback loops between the instructor and the students, inside and outside of class, students are better prepared and instructors can access powerful data to understand their students' strengths and weaknesses.

With these systems, assessment occurs at every phase of learning, including:

- Embedded questions within each Warm Up / PreLecture assignment
- Interactive clicker questions for use during lecture
- Quizzes that follow each Lecture
- Student homework that includes concept-driven feedback
- High level exam questions that connect formative and summative assessments
- Easily displayed data to demonstrate assessment outcomes.

All three of these systems are backed by research showing that the work in and out of class, and the feedback loop created by the faculty, the students, and the web improve student learning. A wide variety of published papers based on NSF-sponsored research illustrate the benefits of the Mastering programs and the Smart Physics. At right is a snapshot of a March 2012 poster session related to the use of Mastering Biology to assess Student Learning Outcomes in Biology K101.



B. Human Physiology N217: Developing Patterns for Organization of Information to Advance Student Learning: A Research Study

Non-science students have routinely identified Human Physiology, a large enrollment course (350 students per section) as a challenging and often overwhelming course, and have difficulty determining how and where to start studying. In response to this information, instructor Dr. Pat Clark has made changes within the course as well as a major addition to the supplemental (voluntary) instruction for N217. Problem sets provide students with outside of class activities that allow them to assess their level of study, and by providing these questions, students have the opportunity to assess their level of study compared to questions comparable to those they might experience on an exam. As the Problem Sets are open book, untimed, and collaborative, students have the ability to fine tune their knowledge by referring back to notes, to the text, or by discussing the questions with their peers. By making the total point value low relative to the number of points available, the pressure for perfect performance on individual Problem Sets is reduced and students can concentrate on mastery of the material. After the due date, Problem Sets are reviewed in class, and students provide explanations for how they arrived at the correct answer. Additionally, students are given graded Immediate Response Questions that require submission of answers via laptops or cell phones.

In working with the IUPUI Bepko Learning Center and their Peer Mentoring Program, a new information organizational tool is now a part of the Peer Mentoring Sessions. In response to the students' stated difficulty in organizing material, they now learn a series of tools to assist them in developing patterns of information organization that can be applied to class information. The variety of organizational patterns allows students to identify different levels of relationship among concepts that may not be immediately identifiable to them from their in-class notes. It also allows them to make connections between what may have initially been seen as unrelated components of a lecture or the relationship between a lecture and a laboratory activity.

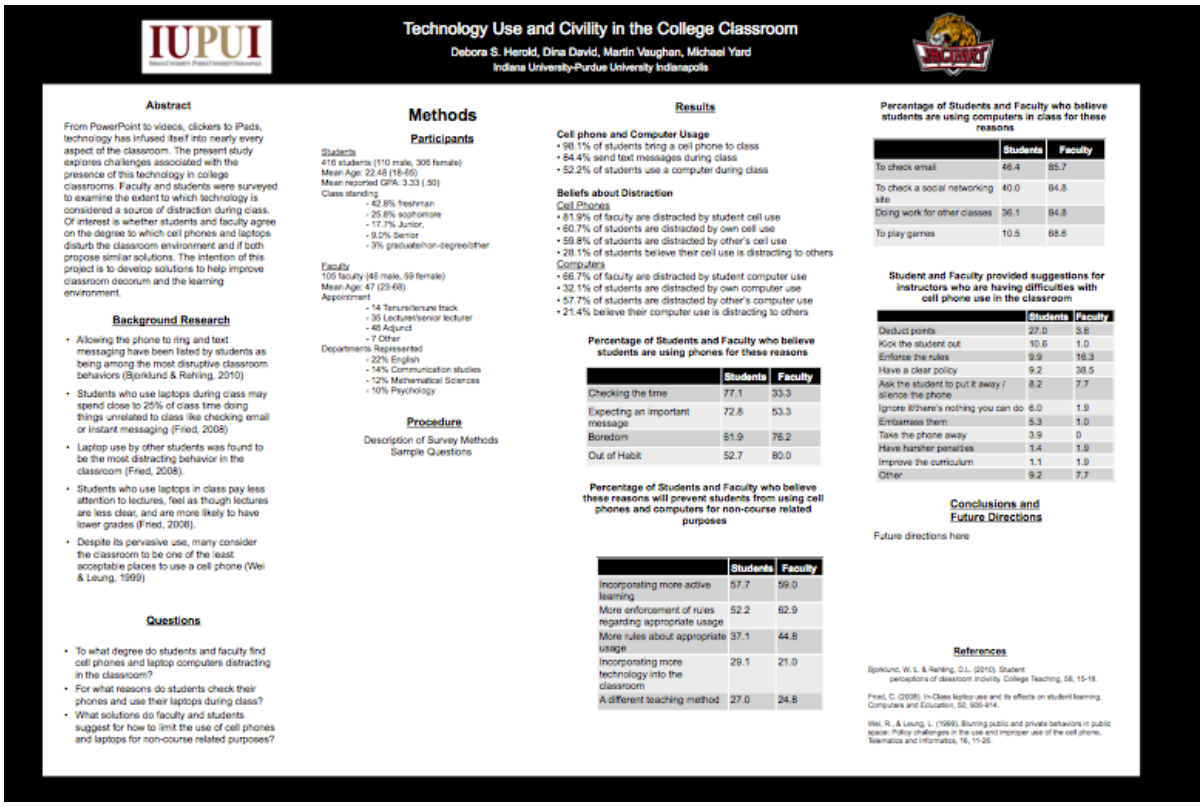
C. Assessment of Technology Use in Science Classrooms, and Subsequent Improvement of Learning: A Research Study

From PowerPoint to videos, clickers to iPads, technology has infused itself into nearly every aspect of the classroom, regardless of the discipline. Allowing the phone to ring and text messaging have been listed by students as being among the most disruptive classroom behaviors (Bjorklund & Rehling, 2010), and students who use laptops during class may spend close to 25% of class time doing things unrelated to class like checking email or instant messaging (Fried, 2008). Prior studies have shown that laptop use by other students was found to be the most distracting behavior in the classroom (Fried, 2008), and that students who use laptops in class pay less attention to lectures, feel as though lectures are less clear, and are more likely to have lower grades (Fried, 2008). Interestingly, despite its pervasive use, many consider the classroom to be one of the least acceptable places to use a cell phone (Wei & Leung, 1999).

In Human Anatomy N261 and other classes we assessed the many challenges associated with the presence of technology in college classrooms and attempted to use the results of this assessment to improve learning. Faculty and students were first surveyed to examine the extent to which technology is considered a source of distraction during class. Of interest was whether students and faculty agreed on the degree to which cell phones and laptops disturb the classroom environment, and if both proposed similar solutions. The intention of this initial project was to develop solutions to help

improve both classroom decorum and the learning environment. The results of this initial phase were presented at the Scholarship of Teaching and Learning Conference in October 2011.

For the second part of this project, in an effort to assess the benefits and drawbacks of using cell phones as a personal response system in the classroom, the entire Human Anatomy class of 600 students was selected in order to allow us to explore the benefits and/or drawbacks due to the use of cell phones in Gateway classes at IUPUI, such as Anatomy and Introductory Biology. The professors had students use their cell phones to respond to questions posed during class as a regular part of the lecture activities. Subsequently, students were surveyed as to their perception of the inclusion of this technology, and its effect on learning the subject matter. The results of this phase of the project are being tabulated, and will be presented in November 2012 at the Lilly International Conference on College Teaching.



Technology Use and Civility in the College Classroom

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Abstract

From PowerPoint to videos, clickers to iPads, technology has infused itself into nearly every aspect of the classroom. The present study explores challenges associated with the presence of this technology in college classrooms. Faculty and students were surveyed to examine the extent to which technology is considered a source of distraction during class. Of interest is whether students and faculty agree on the degree to which cell phones and laptops disturb the classroom environment and if both propose similar solutions. The intention of this project is to develop solutions to help improve classroom decorum and the learning environment.

Background Research

- Allowing the phone to ring and text messaging have been listed by students as being among the most disruptive classroom behaviors (Bjorklund & Rehling, 2010)
- Students who use laptops during class may spend close to 25% of class time doing things unrelated to class like checking email or instant messaging (Fried, 2008)
- Laptop use by other students was found to be the most distracting behavior in the classroom (Fried, 2008).
- Students who use laptops in class pay less attention to lectures, feel as though lectures are less clear, and are more likely to have lower grades (Fried, 2008).
- Despite its pervasive use, many consider the classroom to be one of the least acceptable places to use a cell phone (Wei & Leung, 1999)

Questions

- To what degree do students and faculty find cell phones and laptop computers distracting in the classroom?
- For what reasons do students check their phones and use their laptops during class?
- What solutions do faculty and students suggest for how to limit the use of cell phones and laptops for non-course related purposes?

Methods

Participants

Students
416 students (110 male, 306 female)
Mean Age: 22.48 (18-66)
Mean reported GPA: 3.33 (.50)
Class standing:
- 42.8% freshman
- 25.8% sophomore
- 17.7% Junior,
- 9.0% Senior
- 3% graduate/non-degree/other

Faculty
105 faculty (46 male, 59 female)
Mean Age: 47 (23-68)
Appointment
- 14 Tenure/tenure track
- 35 Lecturer/senior lecturer
- 48 Adjunct
- 7 Other

Departments Represented
- 22% English
- 14% Communication studies
- 12% Mathematical Sciences
- 10% Psychology

Procedure

Description of Survey Methods
Sample Questions

Results

Cell phone and Computer Usage
- 98.1% of students bring a cell phone to class
- 84.4% send text messages during class
- 52.2% of students use a computer during class

Beliefs about Distraction

Cell Phones
- 81.9% of faculty are distracted by student cell use
- 60.7% of students are distracted by own cell use
- 59.8% of students are distracted by other's cell use
- 28.1% of students believe their cell use is distracting to others

Computers
- 66.7% of faculty are distracted by student computer use
- 32.1% of students are distracted by own computer use
- 57.7% of students are distracted by other's computer use
- 21.4% believe their computer use is distracting to others

Percentage of Students and Faculty who believe students are using phones for these reasons

	Students	Faculty
Checking the time	77.1	33.3
Expecting an important message	72.8	53.3
Boredom	61.9	76.2
Out of Habit	52.7	80.0

Percentage of Students and Faculty who believe these reasons will prevent students from using cell phones and computers for non-course related purposes

	Students	Faculty
Incorporating more active learning	57.7	59.0
More enforcement of rules regarding appropriate usage	52.2	62.9
More rules about appropriate usage	37.1	44.8
Incorporating more technology into the classroom	29.1	21.0
A different teaching method	27.0	24.8

Percentage of Students and Faculty who believe students are using computers in class for these reasons

	Students	Faculty
To check email	46.4	85.7
To check a social networking site	40.0	84.8
Doing work for other classes	36.1	84.8
To play games	10.5	68.6

Student and Faculty provided suggestions for instructors who are having difficulties with cell phone use in the classroom

	Students	Faculty
Deduct points	27.0	3.8
Kick the student out	10.6	1.0
Enforce the rules	9.9	16.3
Have a clear policy	9.2	38.5
Ask the student to put it away / silence the phone	8.2	7.7
Ignore it/there's nothing you can do	6.0	1.9
Embarrass them	5.3	1.0
Take the phone away	3.9	0
Have harsher penalties	1.4	1.9
Improve the curriculum	1.1	1.9
Other	9.2	7.7

Conclusions and Future Directions

Future directions here

References

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Both phases of the study were conducted by Debora Herold, Ph.D. (Psychology), Martin Vaughan, Ph.D. (Biology), Prof. Michael Yard (Biology), and Dina David, M.A. (Communications). The studies were funded by the Gateway to Graduation Program at IUPUI.

4. Summative Assessment of Student Learning:

A. PUL Data: Principles Of Undergraduate Learning:

During the Spring 2012 semester faculty members teaching a variety of undergraduate courses evaluated the performance of their students on the Principles of Undergraduate Learning (PULs) identified as receiving a Major and a Moderate emphasis in their courses, from 100-level to 400-level senior / capstone courses. These data were pooled together with data from each semester back to Spring 2010. Only one example is shown below, with the remainder found in Appendix B.

Faculty Ratings of School of Science Student Performance on PULs with Major Emphasis (400-Level)

PUL – Major Emphasis	Mean [2]	Not Effective	Somewhat Effective	Effective	Very Effective	Total
1A. Written, Oral, & Visual Communication Skills	4 3.00	0 0.0%	1 25.0%	2 50.0%	1 25.0%	4 100.0%
1B. Quantitative Skills	24 2.33	4 16.7%	9 37.5%	10 41.7%	1 4.2%	24 100.0%
2. Critical Thinking	310 2.96	32 10.3%	44 14.2%	138 44.5%	96 31.0%	310 100.0%
3. Integration and Application of Knowledge	154 3.58	9 5.8%	6 3.9%	25 16.2%	114 74.0%	154 100.0%
4. Intellectual Depth, Breadth, and Adaptiveness	113 2.81	14 12.4%	19 16.8%	54 47.8%	26 23.0%	113 100.0%
Total [1]	605 3.07	59 9.8%	79 13.1%	229 37.9%	238 39.3%	605 100.0%

[1] Combined number of student ratings in all 400-level courses sampled in Spring 2010, Fall 2010, Spring 2011, Fall 2011, and Spring 2012. A student may be evaluated more than once if he or she is taking more than one 400-level course.

[2] Scale: 1 = "Not Effective", 2 = "Somewhat Effective", 3 = "Effective", 4 = "Very Effective"

Overall, these data indicate that while the majority of our students are rated as "Effective" or "Very Effective", there are still significant numbers of students who are ranked by faculty as being only 'Somewhat Effective' or "Not Effective' in 1B: Quantitative reasoning. Some of this effect may be due to the small sample size, and that there is only one instructor who selected this value as a Major Emphasis". Nonetheless, during the coming year, these results indicate the need for a more careful study, comparing the 400-level courses to the ratings for the 100, 220 and 300 level courses.

A second report asked <u>students</u> to rate their effectiveness on each of the PULs. Here we compare the results of IUPUI Science students with students from two other schools on campus:

IUPUI Undergraduate Student Self Ratings of Effectiveness on the Principles of Undergraduate Learning Scales

School	Written, Oral & Visual Skills	Quantitative Skills	Information Resources and Technology Skills	Critical Thinking	Integration and Application of Knowledge	Intellectual Depth, Breadth, and Adapativeness	Understanding Society and Culture	Values and Ethics
IUPUI	3.41	2.98	3.40	3.34	3.25	3.26	3.43	3.42
School of Science	3.34	3.08	3.41	3.27	3.20	3.27	3.42	3.33
School of Engineering and Technology	3.36	3.18 *	3.33	3.31	3.15	3.16	3.28 *	3.29 *
School of Liberal Arts	3.49	2.79 *	3.47	3.38	3.26	3.28	3.47	3.53

[1] Mean combined student self ratings of effectiveness from Spring 2010 and Spring 2011 *IUPUI Continuing Student Satisfaction and Priorities Survey*.

[2] Students were asked, "indicate how effectively you can perform each of these skills" using the scale 1 = Not at all effective, 2=Somewhat effective, 3=Effective, 4=Very effective.

* Effect Size between mean for this school and IUPUI mean is equal to or greater than 0.2.

In general, these data indicate that Science undergraduate students are confident in their attainment of our the campus PULs. At the same time, it is important to recognize that student ratings are likely to be somewhat lenient as they represent self-reported data. It will be necessary to compare these subjective, self-reported data with more objective data to draw further conclusions.

B. Computer and Information Science Major Field Tests (MFT): As in prior years, the Department has engaged undergraduate seniors in the Bachelor of Science program in a senior capstone course that requires, as part of the curriculum, the completion of the Major Field Test (MFT) in Computer Science. The MFT is a standardized exam that covers topics in programming concepts, discrete structures and algorithms, and computer systems, norm-referenced to a large set of college seniors. After implementing the test in the capstone course for two consecutive years, the Department started data analysis and discussion of future improvement of the undergraduate curriculum. The Department determined that we should add an additional course to the core requirements, CSCI 48400, Computational Theory. It includes topics in computational theory, complexity, and algorithms; areas that the MFT results have shown to be lacking in our senior-level students. The course was taught in Spring 2012 by Dr. Snehasis Mukhopadhyay. Adding this course to the core curriculum has led to a marked improvement in the Discrete Structures and Algorithms scores on the MFT, up to the 89th percentile in 2012 from the 70th percentile in 2011.

Major Field Test: The ETS Major Field Tests are comprehensive undergraduate assessments designed to measure the basic, critical knowledge obtained and understanding achieved by students in a major field of study. The Major Field Tests go beyond the measurement of factual knowledge by helping you evaluate your students' ability to analyze and solve problems, understand relationships and interpret material from their major field of study.

ETS offers comprehensive national comparative data gathered from all Major Field Tests taken, enabling the Department to evaluate students' performance and compare the program's effectiveness to those at similar institutions nationwide.

- prepare students to succeed by using test results to improve curricula
- demonstrate the strengths of the program to prospective students and faculty
- compete for performance funding
- help ensure students have mastered their field of study
- use Department faculty time to focus on other aspects of accreditation

The Major Field Test for Computer Science consists of 66 multiple-choice questions, some of which are grouped in sets and based on materials such as diagrams, graphs and program fragments.

Performance in Major Field Test: In April 2012, twelve seniors completed the Major Field Test in Computer Science as part of CSCI 495, the senior capstone course. These students did very well, scoring an average of 157 on a scale of 120-200. This placed the Department's average in the 67th percentile of all institutions, five points higher than the 2011 results. The exam measures performance in three core areas of computer science: Programming, Discrete Structures and Algorithms, and Systems (Architecture, Operating Systems, Networking, Databases). Percentile scores for IUPUI when compared to the full MFT group and comparing with a group of 10 peers are listed below:

Part of Exam	IUPUI %ile Compared to Group (All)	IUPUI %ile Compared to Peer Group
Programming	52	67
Discrete Structures and Algorithms	89	60
Systems	75	70
Total Score	67	70

These results indicate that IUPUI Computer Science majors score better relative to the overall group and a group of peer institutions. Peers included: Clemson University, Louisiana Tech University, Old Dominion University, University of Alabama-Birmingham, University of Arkansas-Little Rock, University of Illinois-Chicago, University of Memphis, University of Missouri-Kansas City, University of Missouri-St. Louis, and University of Nebraska-Omaha. Unfortunately, many other Urban 13-type institutions do not participate in the MFT, and thus cannot be included for comparison. The Department recognizes that this group of peers is not a perfect match.

Planning Next Stage for Improvement: The next step for the Department is to continue to conduct MFT exams each spring for the CSCI 49500 class and determine the effectiveness of CSCI 48400. We will also begin to assess other core courses to determine if more curricular changes may need to be made.

C. Department of Biology Major Field Tests (MFT): The Department of Biology is conducting an assessment of domain knowledge based student learning outcomes (SLOs) in Biology for curriculum enhancement. The overall domain knowledge of graduate candidates is being evaluated with the Major Field Test (MFT) in Biology by ETS. The test consists of four sections (Cell Biology, Molecular and Genetics, Organismal Biology, and Population Biology, Evolution, and Ecology). These four areas are main sectors of the vast subject of Biology and are represented in the SLOs and Biology curriculum. The current biology core consists of Concepts of Biology I and II, Genetics and Molecular Biology, and Principles of Ecology and Evolution. No defined sequence is required for the core, except Concepts of Biology I and II being prerequisites. Students are then required to take 3 additional lecture courses (Immunology, Biological Chemistry, Cellular Biochemistry). They are also required to take 4 labs for a BS and 3 for a BA.

Each section of the MFT test reflects one or more SLOs. These SLOs and testing sections can further be categorized by one or more courses in the Biology curriculum. Scores will be analyzed to determine where there are weaknesses in the domain knowledge of our graduates. Scores in each area can also be compared for validity with student's grades in the correlating courses. By identifying what specific courses correlate with each test section, course content weaknesses can be identified. Course material can then be tailored to build on current weaknesses in the overall curriculum. Furthermore, these findings, along with comparison to the core curriculum of peer institutes, will lead to the refinement of the Biology B.S. and B.A. degrees. With fine grain assessment and qualitative improvement, IUPUI will lead the way with a top-notch Biology program.

Further data collection and analysis is needed. Thus far, Population Biology, Evolution, and Ecology have been identified as a weakness in the curriculum. A larger population pool, grade analysis, and course content analysis will clarify the state of this domain of knowledge in the Biology curriculum.

An example modification in this area would be splitting Ecology and Evolution into two separate semester courses. Currently, they are offered in conjunction as a one-semester course. At many peer institutions, these subject areas are taught separately.

The preliminary analysis has also reinforced the observed trend that some students are grasping the material well, while others are lagging behind. Over the past academic year, multiple programs have been developed to reinforce material for students such as, a genetics recitation funded by STEP, [Other examples. I thought this was a good tie in to other programs]

Teaching Examples (Britt Reese)
Laboratory courses are a perfect setting for students to practice scientific reading and writing. These skills are hard to develop in the undergraduate lecture course environment. Therefore, requiring students to practice these skills in conjunction with correlated laboratory material is highly beneficial to their overall learning. For each course taught, students are required to read several papers throughout the semester. They then have various assignments to assess their understanding of scientific literature. These exercises include, quizzes, discussions, class presentations over assigned readings, and literature review writing. A literature review assignment, for example, will require students to analyze at least three scientific journal articles. They are to synthesize a review that integrates the material from each article, including comparing and contrasting results and procedures, overall research purpose, and how they enhance the scientific understanding of the general topic.

The laboratory is also ideal for perfecting cognitive and psychomotor learning levels. Through Honor's courses and projects, students are challenged to build on application, analysis, and evaluation to master the level of creating. Students are presented with an open-ended project, with minimal direction. Through completion of the projection, students practice planning, designing, and executing their project, along with acquiring valuable laboratory skills. Through all laboratory work, naturalization of psychomotor skills is a prominent goal that cannot be accomplished in any other classroom setting. Students work to move beyond imitation of techniques to precision and articulation, with little cognitive exertion (normalization).

5. Student Success Initiatives

A. STEM Summer Bridge and Resident Programs

Student Retention is often dependent on both academic as well as social support factors. The School of Science has long participated in a Science, Psychology, or general Summer Bridge program as a joint effort with University College. It is known that Summer Bridge participation influences students' academic performance levels and attainment of student learning outcomes, as evidenced by increased success, grades, and persistence as freshman. Based on recent data, Summer Bridge participants had higher levels of academic performance (Fall 2010 GPA 2.98) compared to non-participants (Fall 2010 GPA 2.77). Students participating in Summer Bridge also had lower DWF rates (13%) compared to non-participants (18%). Summer Bridge participants were significantly more likely to be retained the following year compared to non-participants, even when entering High School GPA, SAT Scores, and Low Income (received a Pell Grant) were taken into account (UCOL data). In addition, African American students who participated in Summer Bridge had notably higher GPAs, lower DFW rates, and higher fall-to-fall retention rates compared to non-participating African American Students.

Female Science majors are considered an underrepresented population in many areas of science. The School of Science has a Women in Science House (WISH) specifically to provide a residential learning community to retain young women in science. Using funds from the NSF-STEP grant (Watt, Marrs, Gavrin, Feldhaus, Hundley), the School of Engineering and Technology and the School of Science developed and implemented a summer residential STEM bridge program to be held during the two-week period before fall semester begins. The residential bridge program was designed for first-year students that would be housed in Purdue House 1 and 2, and the Women in Science House.

During summer 2011, 26 first-year students participated in the first STEM bridge program. The selected students had two things in common: 1) they would be living on campus during their first year, and 2) they were majoring in science, engineering, or technology programs. The bridge program model used by other programs on campus was utilized with two minor changes: 1) the introduction of two sessions focused on housing and roommate issues, and 2) extending the course into the semester for 12 weeks (typically the classes would only meet for up to five weeks into the fall semester). There were several positives to the residential, multi-disciplinary STEM bridge program. Students living in the same buildings had an opportunity to get to know one another before the semester began and there was more interaction as the semester continued. Students in different schools had full opportunity to interact, which is typically difficult to do during the first year.

One of the class participants from the 2011 residential STEM bridge program was be a student mentor for the 2012 STEM bridge class. A problem that faces bridge programs is finding faculty willing to teach the experience during the summer. Thus, the other STEM bridge programs (non-residential) will experiment with increasing the number of STEM majors served by increasing the students to faculty ratio, but lowering the students to student-mentor ratio in the third year (2012–13).

During the third year (summer 2012), it is expected that the number of student participating in STEM bridge programs will increase by 20% per year.

	Number of Students		
STEM Bridge Program	2010	2011	2112 (enrolled to date)
Residential STEM Bridge	0	26	23
Biology Bridge	19	24	29
Science Bridge	24	13	30
Engineering/Tech Bridge	22	23	23
Total	65	86	105

Major findings include: (1) there was a 32% growth in the number of STEM students taking a STEM bridge course after the first year of the grant, followed by a 22% in the second year.

(2) Although too early to report first year retention and graduation rates, it is expected that students taking bridge will have significantly higher rates than those who did not.

(3) Regarding study findings, the table below shows an extract of preliminary survey results based on the 26 students who participated in the residential STEM Bridge program in 2011. Overall, the favorable ratings (5 = strongly agree) reported in the table are quite promising and encouraging to faculty and students.

2011 IUPUI Bridge Program: Summary of the "Residential STEM Bridge" Results

Survey Item	Total		
	N	Mean	Std. Dev.
Participating in the STEM Living Learning Summer Bridge increased the degree to which *I understand the importance of pursuing a major in the STEM area*.	26	4.54	0.95
Participating in the STEM Living Learning Summer Bridge increased the degree to which *I will communicate with my roommates*.	26	4.23	0.95
Participating in the STEM Living Learning Summer Bridge increased the degree to which *I understand the benefit of living on campus*.	26	4.62	0.85
Participating in the STEM Living Learning Summer Bridge *included beneficial interaction with other housing residents*.	26	4.62	0.90

(4) Recent study findings at IUPUI indicate that overall, the STEM bridge participants have higher levels of academic performance compared to non-participants, students participating in Summer Bridge also have lower DFW rates compared to non-participants, and minority students (especially African Americans) who participate in Summer Bridge obtained higher GPAs, lower DFW rates and higher Fall-to-Fall retention rates compared to non-participating African American students. (Detailed results are presented elsewhere in the UCOL 2011 Summer Bridge Program Report.)

B. Mathematics Success Initiative

1. Promoting the MATH Minor

As part of the activities of the NSF STEP grant, the department of mathematical sciences (Jeffrey Watt) began actively promoting the math minor to students and advisors across campus as a way of setting a short-term goal on the path to completing a BS degree. The department will complete the paperwork and have the registrar post the minor on the transcript at the time of completion (usually at the end of the sophomore year). This documentation on the transcript provides motivation to the student that they have completed a component of their degree. Many STEM majors will automatically have a minor in their plan of study, or will earn the minor by selecting one more MATH or STAT course as an elective. The number of minors awarded each year provides an indicator of the number of STEM majors passing through the midpoint of the pipeline for a STEM degree.

MATH Minors by S-T-E-M	2008	2009	2010	2011
Science	10	16	7	22
Technology	0	3	3	4
Engineering	27	31	47	81
Computer Science	5	5	8	15
Other	2	3	1	6
Total	44	58	66	128

Major findings include: The number of minors awarded each year has doubled over the last few years. This rapid growth is partly due to students becoming more aware of their eligibility to obtain the minor, but it is also due to 53 students (of the 128 awarded last year), who took one additional course above their requirement (as a free elective) to qualify for the minor - hence, an indicator of motivation.

2. Post Enrollment Requirement Checking (PERC) in MATH Courses

One situation that causes some STEM students to drop out of their intended major is the result of not being successful in the first math course, and then moving onto the next math course, and failing it. These students believe they can pass the next math courses without being successful in the prerequisite, but after a year of college, these students find that they are more than a year behind in math. This is a situation that the advisor and course instructor find difficult to catch before it is too late - and contributes to lowering the first year retention rate.

During the second year (2012–13), the math department has worked with the registrar's office to develop an automatic withdrawal program that will remove enrolled students in math courses one week before the semester starts if they do not have the proper prerequisites (a prerequisite check). The proper prerequisite is a grade of C or better in the prerequisite math course or an appropriate placement exam score for the course. When the Post Enrollment Check (PREC) is run two weeks before classes start, the identified students are withdrawn from the math course, and the student and their advisor will be automatically notified by email of the situation and what actions need to be taken to register for the prerequisite course.

Major findings include: 47 students have been identified as enrolling for a fall 2012 math course without passing the prerequisite course in the spring or summer 2012 semester.

C. First-Year Seminars and Learning Communities

First-year seminars facilitate student transition to college and student success in the first year by introducing key information and skills needed to succeed and by offering opportunities to connect with faculty, staff, and other students. First-year seminars are taught by an instructional team (faculty member, student mentor, academic advisor, and librarian) and are often linked with other entry-level courses (such as writing, speech, or math) to form learning communities where faculty may collaborate in creating class assignments. All University College first-year seminars incorporate the Personal Development Plan as a required curricular element that aims to keep students on track to timely graduation. In fall 2011, the School of Science offered one section of CSCI 12000, three sections of PSY-B 103, and 10 sections of SCI-I 120. University College offered an additional seven sections of UCOL-U 110 linked to School of Science courses.

Themed Learning Communities

Themed learning communities (TLCs) are integrated learning communities that offer a structured first-semester learning environment where students can easily develop a strong sense of community. TLCs engage a cohort of 25 students in three to five shared courses organized around an interdisciplinary theme. In 2011, 812 students participated in TLCs. Themed learning communities being offered by the School of Science for fall 2012 include:

- Meaning Making: Psychology and Religion
- Freaks, Geeks, Cliques, and Clans: Cultural and Psychological Perspectives on Learning and Belonging
- Baby I Was Born This Way

Themed learning communities offered by University College for fall 2012 that involve School of Science courses and faculty include:

- Career Perspectives: Psyched for Success
- Communicating Today's Health Science Culture: Science Education through New Civic Engagement and Responsibilities
- Making Your Dreams Come True: Pathways to Health Professions
- Science Matters
- Powerful Learning
- Are You Connected? (two sections)

Recent study findings at IUPUI indicate that overall, students successfully completed the First Year Seminars and TLCs participants have higher levels of academic performance compared to non-participants, lower DFW rates compared to non-participants, and minority students (especially African Americans) who participate in Summer Bridge obtained higher GPAs, lower DFW rates and higher Fall-to-Fall retention rates compared to non-participating African American students. (Detailed results are presented elsewhere in the UCOL 2011 Summer Bridge Program Report.)

D. School of Science Career Development Services (CDS) Center

During the first year of the NSF STEP grant (2010–11), the School of Science Career Development Services (CDS) Center was planned, space on campus was secured (located adjacent to the Math Assistance Center), and the first Director was hired (Willow King Locke) to begin implementing the center. One of the primary goals for 2011–12 for the CDS was to increase the awareness of the center, its location, and services provided. The new director promoted the center through various programs and methods. Though only two employees staff the center, outreach to hundreds of undergraduate, graduate, and pre-professional students, including some enrolled in gateway and learning community courses, has been successful. School administrators have also allowed for increase contact with departmental faculty. What follows are the results of increased promotion and awareness of the center, as well as other notable initiatives and outcomes.

Career Counseling and Advising: The number of students utilizing career services increased from 95 students in the first year to 327 students in 2011–12. This dramatic increase is most likely due to several factors including a growing awareness of the office by students, faculty and staff. This notable increase is made even more remarkable due to the physical location of the CDS [located in Taylor Hall (University College) versus the LD/SL building].

One-on-one advising (including appointments and walk-ins)
- 95 students in 2010–11
- 327 students in 2011–12 (includes 59 who attended a resume critique clinic)

Email advising
- 202 students in 2011–12

Educational Programs: These programs facilitate student learning regarding specific topics of career development and include presentations made to classes and presentation workshops. Educational program topics range from resume development to social media and networking. The increase from Fall to Spring can be attributed to the spring series being sponsored by the School of Science Undergraduate Student Council for advertising and lunch.

Classroom presentations
- Windows on Science – 11 presentations to 210 first year students
- Other classroom presentations – 4 presentations to ~189 students
- Women in Science House pre-professional panel – ~15 students

Fall Programs 2011 – 3 programs to ~14 students
Spring Programs 2012 – 4 programs to 64 students

Faculty and Advisor Relationships: Strategic and intentional efforts were undertaken in order to acquaint faculty with CDS staff and services. These included individual meetings with department and program chairs. These meetings resulted in several invitations to present in classrooms and other future ideas to be explored. CDS staff also attended bi-weekly advising meetings in order to stay informed and aware of current policies and issues students face and to stay connected to departmental advisors. In the coming year, CDS will explore ways to formalize communication with faculty members and advisors.

Outreach Efforts: Outreach is defined as the marketing and publicizing of CDS to students, faculty and staff. This includes services, resources, and events. A major goal for this year was to increase awareness of CDS for students, faculty and staff. Major initiatives include: Fall outreach at the School of Science picnic, Presentations to Student Council clubs, Announcements made during BIOL K101 classes, Resume clinic held prior to the Just-in-Time Job Fair, Table staffed at Science Scholars celebration, Attended 7 Jag Days and Spring Previews, and Presentations during Summer Orientation for first year and transfer students.

Graduation Survey and Employment Data: 86 students filled out the Graduating Student survey administered in late Spring 2012. This survey will be repeated every spring, and compared to this baseline data:

Students' plans following graduation:
- Accepted a position – 17%
- Currently searching for a job – 27%
- Attending graduate school – 24%
- Attending professional school – 19%
- Other – 13%

Completed an internship during school:
- Yes – 43%
- No – 52%

ScienceCareers (powered by CSO): This is a comprehensive site that provides web access for employers to post positions including part-time, full-time, volunteer, internship, and other opportunities for science majors. Students can view these postings, upload their resume, and apply within the system.

First year postings (2010–11)
- 722 new job postings

Second year postings (2011–12)
- 850 new job postings
- 605 employers in system

Notable Employer Relationships and Community Partnerships: Employer relationship building and development is an on-going process. Building quality relationships and partnerships will enhance the opportunities for STEM students for both internships and full-time work. The following are companies and organizations that have built relationships with the CDS: Roche, Theoris Scientific, Indy Partnership, Develop Indy, Appriss, ChaCha Inc, WorkOne Indianapolis, and Biostorage.

Major findings include: Career Development Services in the School of Science has initiated and expanded its reach over the past year and is expected to continue its growth each semester for the near future. As this year's priority was focused on outreach and internal relationship development, the upcoming year will focus on expanding employer development with especial regard to internship growth while maintaining and expanding internal visibility among students, faculty, and staff.

E. PhyLS - the Physics Learning Space

The Department of Physics is committed to advancing student success in all of our introductory courses. To this end, we will implement a new effort to provide mentoring services to all students taking these courses. These courses are required by many majors, and are considered to be difficult by many students. As a result, these courses often create barriers to retention and graduation. There are six relevant courses organized into three two-semester sequences (PHYS 218/219, P201/P202, and 152/251). Combined, these courses serve almost 1500 students during each academic year. The enrollments for 2010–11 are shown in Table I as an illustration.

Table I: Representative enrollment and student success in introductory physics classes

2010-11 Enrollment								
Course	**Fall day**	**Fall night**	**Spring day**	**Spring night**	**Summer day**	**Course totals**	**Credit Hours**	**DFW Rate***
218	N	95	N	72	47	214	856	21%
219	N	33	N	36	25	94	376	22%
P201	139	N	N	105	99	343	1715	30%
P202	N	71	81	N	68	220	1100	11%
152	117	N	140	35	53	345	1380	35%
251	108	34	70	N	55	267	1335	22%
Semester totals	364	254	309	276	347	**1483**	**6762**	**25.1%**

*DFW rates represent the averages for the period Fall 2004 through Fall 2008. The final entry in this column is the average of the figures above, weighted by total enrollment.

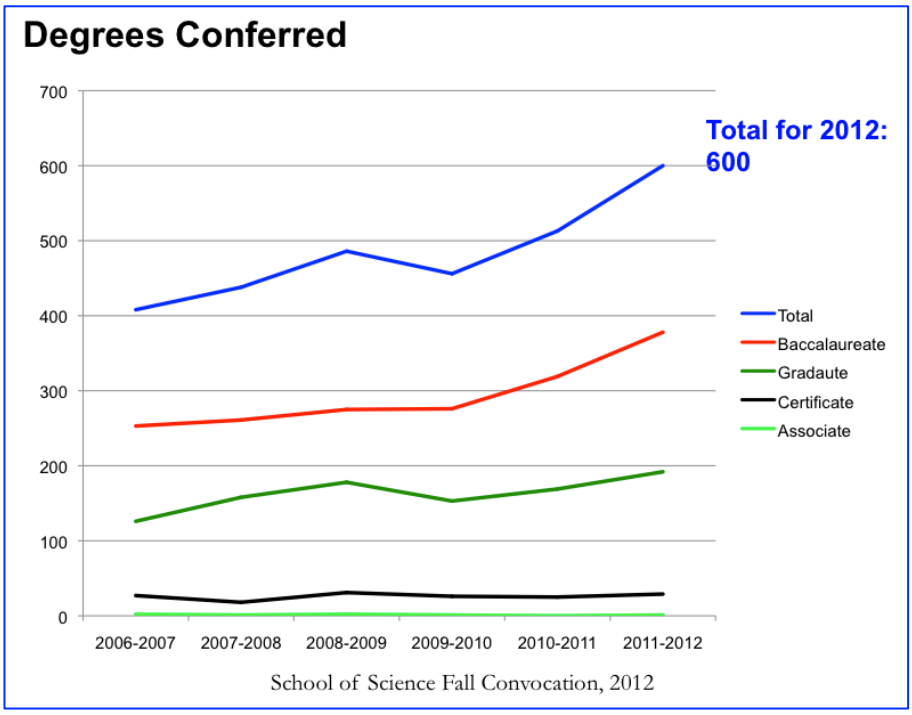
In order to reduce our DFW rates, the Physics Department will adopt the "assistance center" model that has proven successful in Mathematics, Psychology, Chemistry and Biology, using funding partially provided by the NSF-STEP grant. In this center, students will be able to interact with mentors and faculty in small groups or one-on-one, focusing specifically on the areas that cause them the most trouble, and receive individual support. They will also have guided access to computer simulations, video analysis software, and other online tools that support learning in physics.

Completed Work: Mentoring will occur in the newly established Physics Learning Space, "PhyLS" for short. During spring 2012, the physics department (Andy Gavrin and other physics faculty) renovated a small space (~225 square feet) for this purpose, and the PhyLS will open with the beginning of the fall semester, 2012. We have also established an assessment plan, in collaboration with Dr. Howard Mzumara of the IUPUI Testing Center. Under this plan we will track usage of the PhyLS by students in each of the affected courses using a sign-in sheet. We will also use the sign in data to identify random samples of students who will be asked to participate in a survey, and a smaller sample of students who will be asked to participate in a focus group. Both of these methods will be used to provide formative assessment of the PhyLS and its services during the first year of operation. A summative review will be undertaken after two years.

Major findings include: None to report at this time. The learning center will open fall of 2012, and will report first year findings the following year.

F. Progress to Date: Number of STEM BS/BA Graduates at IUPUI

The program has set a target of increasing the number of STEM graduates at IUPUI by 10% per year (an increase of an additional 782 STEM graduates by 2015). Each year represents students graduating in May, August or December of that year. Our preliminary data indicate:



Evidence of Undergraduate Success and Accomplishment: This year, 34 of the Top 100 Students at IUPUI were from the School of Science. This short section highlights some of the many outstanding accomplishments of our students, the result of student and faculty commitments in undergraduate research, desire to participate in study abroad, support for the Women in Science House, and efforts leading to graduate schools, medical schools, and other professional schools.

- Outstanding Student Research leads to Future Careers (May 2012): Among the many outstanding 2012 graduates, a number of science students developed a passion for undergraduate research while at IUPUI. Two featured here are heading to prestigious graduate programs. Biology major Jacob Layer will enter Harvard University's top-ranked Biological and Biomedical Science PhD Program, and Chemistry & Chemical Biology major Josh Horton will be entering the MD/PhD program at NYU, funded by the National Institutes of Health. Horton was also selected as the 2012 Chancellor's Scholar for School of Science.

- IUPUI Senior Morgan Rhodes Awarded First Sukhatme RISE Scholarship (May 2012) Established by Executive Vice Chancellor and Dean of the Faculties Uday Sukhatme, the inaugural RISE Scholarships emphasize the growing importance of a curriculum that involved Research, International, Service learning and Experiential learning (RISE) experiences for IUPUI students. Ms. Rhodes, a pre-med psychology major, participated in the Health Studies Summer Program in Santiago, Chile.

- Science Students Honored With Plater Medallion (April 2012) Six students in the School of Science at IUPUI have been named recipients of the 2012 William M. Plater Civic Engagement Medallion. Biology majors Kathryn DelaCruz, Jessica Jackson, Daniel Popoola, Pich Seekaew and Ashley Winfield were recognized, along with Colleen Games, a student in Forensics and Investigative Sciences. All six students have had a major impact both on the IUPUI campus and within the Indianapolis community.

- Undergraduate Chemistry Major Cornelius Audu Selected to Participate in 12th Annual Berkeley Edge Conference (March 2012) The conference is a highly competitive program designed to increase the number of doctorates awarded to underrepresented minorities and to diversify the nation's faculty in STEM disciplines. Cornelius is a McNair Scholar sponsored by the IUPUI Center for Research and Learning.

- Biology Senior Daniel Popoola Presents Research Before Congress (April 2012) Daniel presented his research on alcohol dependence at the National Conference for Undergraduate Research (NCUR) in March 2012 and at IUPUI Research Day in April 2012, and was selected as one of only 74 students nationally to present at the highly competitive *Posters on the Hill* event in Washington DC in April 2012.

- Three Science Students Honored as Outstanding Women Student Leaders (April 2012) Science majors Jessica Jackson, a senior in biology; Ashley Winfield, a senior in biology; and Fatoumata Bah, a junior in chemistry were among five students named as Outstanding Woman Student Leaders by the IUPUI Office of Student Involvement as part of the Women's History Month celebration.

- Undergraduate Tomas Meijome Recognized For His Extensive Research (April 2012) Tomas earned the Bowling-Jones Russo Memorial Undergraduate Research Award for his research in regenerative medicine. Meijome has been part of several IUPUI research programs, including the Diversity Research Scholars Program, the Louis Stokes Alliances for Minority Participation (LSAMP) Program and the IU School of Medicine Prospective Physician-Scientist Summer Research Program.

- Women in Science House Fosters Success & Impact (May 2012) Five seniors women who graduated among the top 100 students on campus are all residents of the Women in Science House (WISH): Kylie Bontrager, Jessica Hashu, Jessica Jackson, Jessica Rodenbeck and Ashley Winfield. These women are among the 30 who live in the WISH environment that fosters academic development through the study of science.

6. Graduate Program Assessment

A. Program Overview: Graduate programs at the Ph.D. and M.S. level are advanced fields of study that provide new knowledge in areas unique to the specialization of particular faculty members within research disciplines. At the graduate level overall, however, there are generally similar educational outcomes that are usually independent of the specific field of scientific study. IUPUI has a series of Principles of Graduate Learning (PGLs) that form a conceptual framework that describes expectations of all graduate/professional students at IUPUI. Virtually all graduate students in almost all disciplines are assessed on:

(a) Ability to undertake appropriate research, scholarly or creative endeavors, and contribute to their discipline;
(b) Demonstrating mastery of the knowledge and skills in an advanced area expected for the degree and for professionalism and success in the field
(c) Thinking critically, applying good judgment in professional and personal situations
(d) Behaving in an ethical way both professionally and personally"
(e) Ability to teach, often at the undergraduate level; and
(f) Communicating effectively to others in the field and to the general public
(g) Success in finding employment in a field related to their graduate work.

Together, these PGLs are expectations that identify knowledge, skills, and abilities graduates will have demonstrated upon completing their specific degrees. In general graduate programs in the School of Science assess M.S. and Ph.D. students through comprehensive written and/or oral examinations by a committee related to their field of study, and regular committee meetings to discuss research progress and mastery of skills and knowledge. Graduate students often teach in the department, and they are evaluated for their ability to teach by the campus Student Satisfaction of Teaching survey that all faculty receive. Depending on the department, the Teaching Assistants may receive peer evaluation, if teaching. Their record of presentations at meetings, invited talks, publication and submission for grants or fellowships is also a means of assessment, and contributions to the scholarly literature both during and several years immediately after graduation similarly have are used as a form of program assessment. Evaluation of these undertakings by committees of graduate faculty remains the ultimate assessment standard of student success at the graduate level. These metrics are generally found to be an academically acceptable method of capturing most of the information necessary for graduate student assessment. To this end, the table below represents our current graduate profile by department.

MS and PhD Spring 2012 Enrollments

	MS	PhD	Total
Biology	108	15	123
Biostatistics	---	21	21
Chemistry & Chemical Biology	22	17	39
Computer & Information Sci.	73	25	98
Earth Sciences	19	2	21
Forensic & Investigative Sciences	10	---	10
Mathematical Sciences	36	23	59
Physics	3	17	20
Psychology	24	39	63
School Total	295	159	454

School of Science Fall Convocation, 2012

103 M.S. and Ph.D. degrees were awarded in May 2012,
65 Biology MS
2 Chemistry MS
1 PhD Computer Science
8 Computer Science MS
2 Geology MS, 2 Forensic & Investigative Science MS
8 Mathematics MS, 6 in Applied Math Statistics,
2 PhD Mathematics
1 Physics MS
4 Psychology MS / 2 in Psychobiology (Ph.D.)

Appendix A
IUPUI Department of Biology
Student Learning Outcomes (SLOs)

Biology Student Learning Outcomes and IUPUI Principles of Undergraduate Learning

1. Demonstrate knowledge of how biological molecules such as DNA, RNA, protein, lipids, and carbohydrates contribute to the structure and function of prokaryotic and eukaryotic cells. PUL 1a, 1b, 1c, 2, 3, and 4
2. Integrate the cellular, molecular and physiological basis of how organisms develop structure, carry out functions, sense and control their environment, and respond to external change. PUL 1a, 1b, 1c, 2, 3, and 4
3. Describe how genetic principles associated with natural selection contribute to the functioning of an organism and the evolutionary diversity of life on earth. PUL 1a, 1b, 1c, 2, 3, and 4
4. Access, evaluate, and communicate information relevant to the study of biological sciences. PUL 1a, 1b, 1c, 2, 3, and 4
5. Work safely and effectively with basic laboratory techniques and instrumentation. PUL 1a, 1b, 1c, 2, 3, and 4
6. Exhibit problem solving and critical thinking skills needed to design and implement laboratory projects, and gather, analyze, and draw conclusions from data. PUL 1a, 1b, 1c, 2, 3, and 4
7. Apply basic principles of chemistry, math and other disciplines to the functioning of living systems. PUL 1a, 1b, 1c, 2, 3, and 4
8. Successfully complete a laboratory or literature-based research project with supervision from a faculty sponsor. PUL 1a, 1b, 1c, 2, 3, 4, 5, and 6

Course	Title	Cr	1	2	3	4	5	6	7	8
K101	Concepts of Bio. I Major PUL: 2	5	B E		B E	B E	B L	B L	B E	
K103	Concepts of Bio. II Major PUL: 2	5	B D, E	B D, E	B D, E	B L	B L	B L	B E, L	
K322	Genetics Major PUL: 3	3	I E		I E				B E	
K323	Genetics Lab Major PUL: 2	2	I E	B E			I E, L	I E, L	I E, L	
K324	Cell Biology Major PUL: 4	3	I E	I E		B E			I E	
K325	Cell Biology Lab Major PUL: 3	2	B E	I E			I E	I E	I E	
K331	Embryology Major PUL: 3	3	I E	A E	B E	I E			I E	I E
K333	Embryology Lab Major PUL: 3	2	I E	A E			I E	I E	B E	
K338	Intro. Immunology Major PUL: 3	3	I E	I E						
K339	Intro. Immunology Lab varies by section	2	I E	I E			I E	I E	B E	
K341	Principles of Ecol. & Evol. Major PUL: 3	3		I E	I E			I E		
K342	Prin. of Ecol. & Evol. Lab Major PUL: 2	2		I E,L,O	I E,L,O	I E,L,O	I E,L	B E,L	B E,L	
K350	Comp. Animal Physiology Major PUL: 2	3	I D,E	I D,E	I D,E	I E			I E	I P
K356	Microbiology Major PUL: 4	3	I E	I E	I E	I E			B E	
K357	Microbiology Lab PUL 1b	2	I E	I E	I E		I E	I E	I E	
K411	Global Change Biology	3		I O,P	I O,P			I O,P		
K483	Biological Chemistry Major PUL: 4	3	A E,D						A E,D	
K484	Cellular Biochemistry Major PUL: 4	3	A E	A E		A E	A E	A E	A E	
K295	Special Assignments Major PUL: 3	Arr				B V	B V	B V	B V	B V
K490	Capstone Major PUL: 3	1								A V
K493	Independent Research Major PUL: 3	1 to 3				A V	A V	A V	A V	A V
K494	Senior Thesis Major PUL: 3	1				A V		A V		A V

SLO Levels:
B - Beginning
I - Intermediate
A - Advanced

SLO Assessment Tools:
D - Discussion
E - Exam
L - Lab Report
O - Oral Report
P - Paper
V - Varies by Section Instructor

IUPUI Faculty Ratings of Student Performance on Principles of Undergraduate Learning

~Report for School of Science~

Combining

Spring 2010, Fall 2010,

Spring 2011, Fall 2011, and Spring 2012 Evaluations

Office of Information Management and Institutional Research

June 2012

Faculty Ratings of School of Science Student Performance on PULs with Major Emphasis (100-Level & Lower)

PUL – Major Emphasis	Mean [2]	Not Effective	Somewhat Effective	Effective	Very Effective	Total
1A. Written, Oral, & Visual Communication Skills	334 3.68	14 4.2%	9 2.7%	48 14.4%	263 78.7%	334 100.0%
1B. Quantitative Skills	2,197 2.69	443 20.2%	441 20.1%	661 30.1%	652 29.7%	2,197 100.0%
1C. Information Resource Skills	346 3.22	30 8.7%	41 11.8%	99 28.6%	176 50.9%	346 100.0%
2. Critical Thinking	1,625 2.50	347 21.4%	464 28.6%	467 28.7%	347 21.4%	1,625 100.0%
3. Integration and Application of Knowledge	766 2.57	162 21.1%	191 24.9%	230 30.0%	183 23.9%	766 100.0%
4. Intellectual Depth, Breadth, and Adaptiveness	185 2.32	40 21.6%	73 39.5%	44 23.8%	28 15.1%	185 100.0%
6. Values and Ethics	4 4.00	0 0.0%	0 0.0%	0 0.0%	4 100.0%	4 100.0%
Total [1]	5,457 2.70	1,036 19.0%	1,219 22.3%	1,549 28.4%	1,653 30.3%	5,457 100.0%

[1] Combined number of student ratings in all 100-level courses sampled in Spring 2010, Fall 2010, Spring 2011, Fall 2011, and Spring 2012. A student may be evaluated more than once if he or she is taking more than one 100-level course.

[2] Scale: 1 = “Not Effective”, 2 = “Somewhat Effective”, 3 = “Effective”, 4 = “Very Effective”

Faculty Ratings of School of Science Student Performance on PULs with Moderate Emphasis (100-Level & Lower)

PUL – Moderate Emphasis	Mean [2]	Not Effective	Somewhat Effective	Effective	Very Effective	Total
1A. Written, Oral, & Visual Communication Skills	153 2.82	28 18.3%	22 14.4%	53 34.6%	50 32.7%	153 100.0%
1B. Quantitative Skills	327 2.85	61 18.7%	38 11.6%	118 36.1%	110 33.6%	327 100.0%
2. Critical Thinking	509 2.61	95 18.7%	128 25.1%	164 32.2%	122 24.0%	509 100.0%
3. Integration and Application of Knowledge	477 2.50	79 16.6%	150 31.4%	178 37.3%	70 14.7%	477 100.0%
4. Intellectual Depth, Breadth, and Adaptiveness	169 3.13	25 14.8%	19 11.2%	34 20.1%	91 53.8%	169 100.0%
5. Understanding Society and Culture	44 3.00	11 25.0%	3 6.8%	5 11.4%	25 56.8%	44 100.0%
6. Values and Ethics	203 3.37	15 7.4%	16 7.9%	50 24.6%	122 60.1%	203 100.0%
Total [1]	1,882 2.78	314 16.7%	376 20.0%	602 32.0%	590 31.3%	1,882 100.0%

[1] Combined number of student ratings in all 100-level courses sampled in Spring 2010, Fall 2010, Spring 2011, Fall 2011, and Spring 2012. A student may be evaluated more than once if he or she is taking more than one 100-level course.

[2] Scale: 1 = “Not Effective”, 2 = “Somewhat Effective”, 3 = “Effective”, 4 = “Very Effective”

Faculty Ratings of School of Science Student Performance on PULs with Major Emphasis (200-Level)

PUL – Major Emphasis	Mean [2]	Not Effective	Somewhat Effective	Effective	Very Effective	Total
1B. Quantitative Skills	111 3.12	13 11.7%	14 12.6%	31 27.9%	53 47.7%	111 100.0%
2. Critical Thinking	363 2.92	76 16.7%	53 12.7%	59 14.0%	175 56.5%	363 100.0%
3. Integration and Application of Knowledge	2,859 2.61	566 19.8%	725 25.4%	825 28.9%	743 26.0%	2,859 100.0%
4. Intellectual Depth, Breadth, and Adaptiveness	248 3.19	32 12.9%	24 9.7%	56 22.6%	136 54.8%	248 100.0%
Total [1]	3,581 2.70	687 19.2%	816 22.8%	971 27.1%	1,107 30.9%	3,581 100.0%

[1] Combined number of student ratings in all 200-level courses sampled in Spring 2010, Fall 2010, Spring 2011, Fall 2011, and Spring 2012. A student may be evaluated more than once if he or she is taking more than one 200-level course.

[2] Scale: 1 = “Not Effective”, 2 = “Somewhat Effective”, 3 = “Effective”, 4 = “Very Effective”

Faculty Ratings of School of Science Student Performance on PULs with Moderate Emphasis (200-Level)

PUL – Moderate Emphasis	Mean [2]	Not Effective	Somewhat Effective	Effective	Very Effective	Total
1B. Quantitative Skills	557 3.16	45 8.1%	59 10.6%	217 39.0%	236 42.4%	557 100.0%
1C. Information Resource Skills	288 3.22	42 14.6%	30 10.4%	38 13.2%	178 61.8%	288 100.0%
2. Critical Thinking	806 2.52	131 16.3%	277 34.4%	247 30.6%	151 18.7%	806 100.0%
3. Integration and Application of Knowledge	160 2.66	17 10.6%	41 25.6%	82 51.2%	20 12.5%	160 100.0%
4. Intellectual Depth, Breadth, and Adaptiveness	1,263 2.58	291 23.0%	323 25.6%	277 21.9%	372 29.5%	1,263 100.0%
Total [1]	3,074 2.73	526 17.1%	730 23.7%	861 28.0%	957 31.1%	3,074 100.0%

[1] Combined number of student ratings in all 200-level courses sampled in Spring 2010, Fall 2010, Spring 2011, Fall 2011, and Spring 2012. A student may be evaluated more than once if he or she is taking more than one 200-level course.

[2] Scale: 1 = “Not Effective”, 2 = “Somewhat Effective”, 3 = “Effective”, 4 = “Very Effective”

Faculty Ratings of School of Science Student Performance on PULs with Major Emphasis (300-Level)

PUL – Major Emphasis	Mean [2]	Not Effective	Somewhat Effective	Effective	Very Effective	Total
1A. Written, Oral, & Visual Communication Skills	19 3.79	0 0.0%	2 10.5%	0 0.0%	17 89.5%	19 100.0%
1B. Quantitative Skills	348 3.18	38 10.9%	40 11.5%	90 25.9%	180 51.7%	348 100.0%
2. Critical Thinking	949 3.02	99 10.4%	203 21.4%	223 23.5%	424 44.7%	949 100.0%
3. Integration and Application of Knowledge	748 2.78	148 19.8%	136 18.2%	196 26.2%	268 35.8%	748 100.0%
4. Intellectual Depth, Breadth, and Adaptiveness	616 2.82	103 16.7%	134 21.8%	147 23.9%	232 37.7%	616 100.0%
Total [1]	2,680 2.94	388 14.5%	515 19.2%	656 24.5%	1,121 41.8%	2,680 100.0%

[1] Combined number of student ratings in all 300-level courses sampled in Spring 2010, Fall 2010, Spring 2011, Fall 2011, and Spring 2012. A student may be evaluated more than once if he or she is taking more than one 300-level course.

[2] Scale: 1 = “Not Effective”, 2 = “Somewhat Effective”, 3 = “Effective”, 4 = “Very Effective”

Faculty Ratings of School of Science Student Performance on PULs with Moderate Emphasis (300-Level)

PUL – Moderate Emphasis	Mean [2]	Not Effective	Somewhat Effective	Effective	Very Effective	Total
1A. Written, Oral, & Visual Communication Skills	147 2.74	28 19.0%	29 19.7%	43 29.3%	47 32.0%	147 100.0%
1B. Quantitative Skills	321 3.05	33 10.3%	72 22.4%	62 19.3%	154 48.0%	321 100.0%
1C. Information Resource Skills	166 3.33	17 10.2%	22 13.3%	16 9.6%	111 66.9%	166 100.0%
2. Critical Thinking	420 2.91	45 10.7%	117 27.9%	90 21.4%	168 40.0%	420 100.0%
3. Integration and Application of Knowledge	466 3.05	67 14.4%	74 15.9%	95 20.4%	230 49.4%	466 100.0%
5. Understanding Society and Culture	58 2.67	13 22.4%	6 10.3%	26 44.8%	13 22.4%	58 100.0%
6. Values and Ethics	25 3.36	2 8.0%	5 20.0%	0 0.0%	18 72.0%	25 100.0%
Total [1]	1,603 3.00	205 12.8%	325 20.3%	332 20.7%	741 46.2%	1,603 100.0%

[1] Combined number of student ratings in all 300-level courses sampled in Spring 2010, Fall 2010, Spring 2011, Fall 2011, and Spring 2012. A student may be evaluated more than once if he or she is taking more than one 300-level course.

[2] Scale: 1 = “Not Effective”, 2 = “Somewhat Effective”, 3 = “Effective”, 4 = “Very Effective”

Faculty Ratings of School of Science Student Performance on PULs with Major Emphasis (400-Level)

PUL – Major Emphasis	Mean [2]	Not Effective	Somewhat Effective	Effective	Very Effective	Total
1A. Written, Oral, & Visual Communication Skills	4 3.00	0 0.0%	1 25.0%	2 50.0%	1 25.0%	4 100.0%
1B. Quantitative Skills	24 2.33	4 16.7%	9 37.5%	10 41.7%	1 4.2%	24 100.0%
2. Critical Thinking	310 2.96	32 10.3%	44 14.2%	138 44.5%	96 31.0%	310 100.0%
3. Integration and Application of Knowledge	154 3.58	9 5.8%	6 3.9%	25 16.2%	114 74.0%	154 100.0%
4. Intellectual Depth, Breadth, and Adaptiveness	113 2.81	14 12.4%	19 16.8%	54 47.8%	26 23.0%	113 100.0%
Total [1]	605 3.07	59 9.8%	79 13.1%	229 37.9%	238 39.3%	605 100.0%

[1] Combined number of student ratings in all 400-level courses sampled in Spring 2010, Fall 2010, Spring 2011, Fall 2011, and Spring 2012. A student may be evaluated more than once if he or she is taking more than one 400-level course.

[2] Scale: 1 = “Not Effective”, 2 = “Somewhat Effective”, 3 = “Effective”, 4 = “Very Effective”

Faculty Ratings of School of Science Student Performance on PULs with Moderate Emphasis (400-Level)

PUL – Moderate Emphasis	Mean [2]	Not Effective	Somewhat Effective	Effective	Very Effective	Total
1A. Written, Oral, & Visual Communication Skills	73 3.37	1 1.4%	2 2.7%	39 53.4%	31 42.5%	73 100.0%
1B. Quantitative Skills	65 2.83	6 9.2%	12 18.5%	34 52.3%	13 20.0%	65 100.0%
2. Critical Thinking	37 3.08	3 8.1%	7 18.9%	11 29.7%	16 43.2%	37 100.0%
3. Integration and Application of Knowledge	87 2.84	11 12.6%	17 19.5%	34 39.1%	25 28.7%	87 100.0%
4. Intellectual Depth, Breadth, and Adaptiveness	29 3.17	1 3.4%	2 6.9%	17 58.6%	9 31.0%	29 100.0%
5. Understanding Society and Culture	34 3.29	4 11.8%	3 8.8%	6 17.6%	21 61.8%	34 100.0%
6. Values and Ethics	8 3.13	1 12.5%	1 12.5%	2 25.0%	4 50.0%	8 100.0%
Total [1]	333 3.06	27 8.1%	44 13.2%	143 42.9%	119 35.7%	333 100.0%

[1] Combined number of student ratings in all 400-level courses sampled in Spring 2010, Fall 2010, Spring 2011, Fall 2011, and Spring 2012. A student may be evaluated more than once if he or she is taking more than one 400-level course.

[2] Scale: 1 = “Not Effective”, 2 = “Somewhat Effective”, 3 = “Effective”, 4 = “Very Effective”