PRAC Report: Assessment of Student Learning
IUPUI School of Science
2017-2018 Report

Overview: The School of Science at IUPUI provides outstanding science education for all IUPUI students, education in depth for students in our School, and engages in fundamental and applied research in the physical, biological, mathematical, and psychological sciences to increase knowledge and advance the development of the life sciences at IUPUI and in the State of 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 and Neuroscience Programs, there are over 160 full-time faculty members. The School is the academic home of ~2,500 undergraduate majors and ~420 graduate students.

Part I: Student Learning Outcomes for Each Academic Program

The School of Science has been utilizing Student Learning Outcomes developed during the 2010-2011 academic year. A comprehensive list of SLOs for both undergraduate and graduate education and degree programs can be found in the IUPUI Bulletin.

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

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

The main focus of this 2017-2018 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.

Part II: Evidence of Continuous Assessment related to Student Learning Outcomes: Course and Curriculum Development or Redesign

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To prepare for the PRAC report, an email was distributed to all faculty in the SOS. The email explained the rationale for the PRAC report and requested faculty to share examples of curriculum redesign (no matter how big or small). They were asked to describe the course, the enrollment size, the change that they implemented and the noted outcome. Below are the responses received. While many of these examples do not represent highly formalized assessment, they do note ongoing adjustments and reflections that faculty are engaged in.

1. Psychology

Drs. Milena Petrovic and Robert Stewart are conducting a study to examine factors that lead students to perform poorly in a required research methods course. This course is typically the last taken in a sequence of courses; specifically, a require math course, Introduction to Statistics, and then Introduction to Research Methods. Are going to survey current students in the course and also collect archival data about the students. For instance, they are going to assess student demographics and the timing of the sequencing of classes to see if we can determine particular pathways that are effective or ineffective for students. The goal is to determine if there are any particular practices or pathways that lead to success which can be shared with students and advisors.

2. **Biology**

Title of the course: Biology K101
The change/revision/intervention you implemented: **"K101 Breakfast Club"**. With 300-600 students in a typical semester of Biology K101, meeting with students one-on-one in my office gets challenging. While I greatly enjoy the one-on-one time to help individual students, I often repeat myself as one student after another poses similar questions due to studying similar material, and I can only meet with 2-4 students in a typical hour. To create a more flexible open office hour and work time, and to be able to reach more students, I have reserved LE 104, a collaborative Mosaic classroom, every Friday from 9-10:15 am for the past 3 semesters. (K101 begins at 10:30 in the next room over, LE 101, making this an ideal location and time to meet). The average number of students at Breakfast Club weekly is between 40-60 students. We start with a quick introduction so students get to know each other (and I get to know the

students' names). We have a very informal structure of question & answer, collaborative activities that involve drawing or making visual models of K101 concepts, and having students take turns presenting solutions to problems (ie: genetics problems). I also provide light breakfast food (donuts are too expensive, but donut holes are just right in terms of size and my personal budget!) There is no lecturing and I make the topics as challenging as possible. One of the K101 Recitation leaders schedules his or her Biology Resource Center work time in that slot, so we have 2 instructors in the room, myself and the mentor. Students help other students as we circulate around the room, discuss answers to questions we pose, and whenever possible we have the students explain their work to the whole class to boost confidence.

How did the change impact your students experience or learning. This is not a scientific sampling, but from the end of course student satisfaction survey, there is an overwhelmingly positive response to Breakfast Club in course evaluation comments. Students who are unable to attend due to Chemistry or Math courses on Friday mornings at 9 am ask me for alternate times so they might attend (for those requests, I remind them that the Biology Resource Center hours, ~24 hours per week, offers almost the same set up to meet with our Recitation Leaders, minus the donut holes and me. I also keep an additional 6 hours of one-on-one regular office hours each week.) Many Academic Advisors have also let me know that they have heard about this very positively from their students. From my perspective, I learn a lot from watching the students work together and work with the material, so I can see instantly where they are struggling, and can even address common misconceptions in the bigger lecture class later that morning. I also feel very satisfied that I can meet with 40-50 more students each week in a semi-office hour setting.

3. Computer Science

CSCI 24000 (Computing II)

Traditionally we have turned in all assignments on Canvas as most classes do, and that process has served us well.

However, in the computing industry, files are shared through code management systems. The most important of these is a mechanism called 'github.' Github not only is widely used by industry, but it adds some really exciting capabilities for both students and graders, including these:

- Students can include 'save points' in their code and can reset to a save point if things go wrong
- The entire history of a project is saved, so we can 'go back in time' with students to watch how they were solving problems
- The history of each file is saved including additions, deletions, and changes, so you can see how every file in a project changes over time.
- Peer leaders and instructors can 'branch' the project to suggest or make changes without changing the original project.

- Almost every software company uses GitHub or something like it, so GitHub skills look great on a resume.

4. Psychology

Psych 340 – Cognition. Dr. Debbie Herold received a Curriculum Enhancement Grant to develop an online section of this course, which is being implemented this fall with 90 students. In addition, she participated in the TILT (Transparency in Learning and Teaching) pilot with CTL and is incorporating it in one assignment in this course. She intends to share data on its success at the end of the semester.

5. Earth Sciences

Title of the course Global Cycles (G488)

The change/revision/intervention you implemented

Adopted participating in the Diplomacy Lab as the key group effort that the course undertakes. Since joining the Diplomacy Lab, a partnership between the US State Department and participating Universities via problem-based research and learning, I have incorporated Diplomacy Lab projects every year, ranging from Environmental Management and Protection in Myanmar to Building Partnerships between US and Brazilian Universities in Recife.

How did the change impact your students experience or learning

Several students have noted that this experience is one of the key reasons that they were hired at their current positions--the fact that they participated in a group effort and with the State Department in addressing critical international issues.

6. Mathematical Sciences

Dr. Patrick Morton is investigating delivery methods for the introductory math curriculum. Specifically, he is seeing if adapting and adopting the best practices of the emporium math model into the algebra courses (Math 11100 and 15300) will lower the DFW rates and improve first year retention rates. The emporium model focuses on active learning and using commercially available adaptive software to build mastery of the material. He has visited two other universities currently using this approach and is currently running a pilot section this fall. Early feedback and assessment of student success is suggesting this may prove to be a powerful approach with our students.

Part III: General Education Course Review

The school of science has been involved in the campus wide efforts to review and assessment our general education courses. Each of the following courses has been reviewed and successfully renewed as a general education course.

Biology

- K101 – Concepts of Biology 1
- K103 - Concepts of Biology 2
- N213 – Human biology Lab
- N261 – Human Anatomy
- N200 – Biology of Women
- N100 – Contemporary Biology

Chemistry

- C101 – Elementary Chemistry 1
- C121 – Elementary Chemistry Lab 1
- C105 – Principles of Chemistry 1
- C106 -- Principles of Chemistry 2
- C125 – Experimental Chemistry 1
- C126 – Experimental Chemistry 2
- C100 – The World of Chemistry
- FIS 205 – Concepts of Forensic Science 1
- FIS101 – Investigating Forensic Science Lecture

Computer Science

- CSCI 230 - Computing 1

Earth Sciences

- Geol 107- Environmental Geology
- Geol 110 – Physical Geology
- Geol 115 – Intro to Oceanography

Math

- Math 153 – College Algebra
- Math 154 – Trigonometry
- Math 159 – Precalculus
- Math 118 – Finite Mathematics
- Math 119 – Brief Survey of Calculus 1

Physics

PHY152 – Mechanics
AST100 – The Solar System

Psychology

B110 – Introduction to Psychology

Part IV: Department Level Projects and Initiatives

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1. Psychology – Student Learning Outcomes Project:

Dr. Lisa Contino has been leading efforts to create program-level student learning outcomes (which was finalized a couple of years ago), and now she has worked with faculty who teach required courses to map their course level SLOs onto the program SLOs. This year, they are focusing on developing course assessment rubrics and reports for B110 and the capstone courses with the goal of a report from relevant instructors that provides both direct and indirect evidence of student learning with regard to these outcomes, as well as reflections on those data. Next year, we'll probably focus on either the foundation courses (B310, B320, B340 and B370), or the stats/research courses (B305, B311). Our hope, therefore, is to have a cycle of courses that will be assessed over time.

2. Biology – The biology department has organized a Curriculum Community of Practice in this department. They have been meeting to implement intentional alignment and assessment of the biology curriculum for the purpose of better student outcomes and preparation.

They are working to tie Vision and Change competencies (developed by AAAS in with support from NSF, HHMI and NIH) to our curriculum, creating a BioMAP and other assessment tools that we can use for continuous improvement of our program. The group hopes to develop complete vertical alignment of our core curriculum and develop the plans for rigorous assessments for the Biology program over the next 6-8 months. They expect to have a report on the overall plan available by Summer 2019 and implementation of specific improvement and assessment plans in place for Fall 2019.

3. **Physics Curriculum Revision**

<u>Overview</u>
The department of physics is undertaking a major revision of its undergraduate curriculum. The project is funded, in its initial stage, by a SEIRI Seed Grant.

<u>Objective</u>
The primary objective of this project is to "normalize" computation in the physics curriculum,

that is, to reach a point at which all of our students consider computational approaches to be a "normal" way of approaching problems.

Motivation

The use of computational methods in physics have been growing steadily for many years. At present, few physicists conduct their work without the use of computational methods. As a result, the importance of inculcating computational methods has been recognized at the national level. Two documents published by the American Association of Physics Teachers (AAPT)[1] and the American Physical Society (APS)[2] highlight the need to increase the quantity and quality of computational methods taught in the physics curriculum.

Outcomes

There will be two major outcomes of this project. The first outcome is the redesign of PHYS 29900 "Introduction to Computational Physics." This course will serve to give all physics majors an introduction to the use of computational methods, and to the MATLAB platform. The second outcome is the incorporation of computational assignments across all of our undergraduate courses.

Initial Results

Initially we are focusing on Revision of 29900, and the creation of a first round of computational assignments. Details are provided in the appendices.

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1 https://www.aapt.org/Resources/upload/AAPT_UCTF_CompPhysReport_final_B.pdf

2 Heron, P. and McNeil, L., PHYS21: *Preparing Physics Students for 21st Century Careers*, American Physical Society, College Park, MD (2016).

Computational Assignments in Physics Major's Courses

Course: PHYS 15200
Assignment: Introduction to EXCEL
Learning Outcome(s): Students gain basic skills in EXCEL including use of mathematical functions, filling a column based on a formula, making graphs, and fitting functions to data.

Course: PHYS 15200
Assignment: Motion with Air Resistance
Learning Outcome(s): Euler method to integrate a differential equation

Course: PHYS 25100
Assignment: AC Circuits
Learning Outcome(s): Visualize analytical solution and explore parameters, numerical integration

Course: PHYS 30000

Assignment: Light Propagation in Coupled Waveguides

Learning Outcome(s): In a six-week project, students learn to work with very large matrices with complex elements to find eigenvalues and eigenvectors, numerical solution of first order ordinary differential equations, implementing FFT algorithms, and graphical and visualization methods.

Course: PHYS 33000

Assignment: From physics to math: making equations dimensionless before numerically solving them, energy for discrete charges, Fourier series solutions (Laplace equation) numerical convergence studies.

Learning Outcome(s): MATLAB graphics, estimation techniques, back-of-the-envelope calculations.

Course: PHYS 40000

Assignment: Multiple matrices product

Learning Outcome(s): use MATLAB to calculate matrix products; use numerical computation to calculate Fourier transforms

Course: PHYS 40100

Assignment: (1) lens manufacturing; (2) Fourier Transformation; (3) 2nd order correlation.

Learning Outcome(s):

(1) Simulating the lens maker formula for a complex Cooke triplet lens system.
(2) Understand the frequency and space domains in optics and learn fundamental skills about digital image processing.
(3) Learn the photon statistics and understand the particle-wave duality of photons.

Course: PHYS 44200

Assignment: Implementation of finite differences for solving Schrodinger equation (see attached, problem 1 and 4b) Learning Outcome(s): Learn about numerical methods to solve differential equations. Implement finite differences method. Have a "work-horse" program to solve Schrodinger equation in 1D

4. **The IUPUI Stem Education and Innovative Research Institute Grant Program**

Several SOS Faculty groups have received a SEIRI Seed Grant. The purpose of these grants is to research innovative techniques for delivering STEM Education.

Kathy Marrs and James Marrs: “Research-based implementation of CUREs in Biology: Evaluating CUREs as a model for persistence and success in undergraduate science majors and as a model for accelerating departmental change among faculty teams”.

We are working on 4 aims: First, to build on the Biology Department's efforts to incorporate CUREs (Course Based Undergraduate Research Experiences) into a variety of laboratory courses, from introductory biology to the senior research capstone. Ideally, we would like to coordinate CUREs that span a common research topic throughout multiple courses in the undergraduate curriculum, and then examine their success in student retention and persistence using best practices in assessment. Finally, we would like to develop a shared plan for course and departmental transformation.

- **To date**, we have strengthened or developed CUREs in several undergraduate courses. We have also created a new K493 Senior Research Capstone Course, a year-long CURE for up to10 seniors, where we are focusing on the effects of alcohol on Zebrafish behavior.
- **In addition**, we have also started a Faculty Community of Practice (CoP) to examine and vertically align the curriculum throughout the Biology core curriculum using the national guidelines from the Vision & Change in Undergraduate Biology report, as part of developing a shared plan for course and departmental transformation.

Evava Pietri, Snehasis Mukhopadhyay, and Leslie Ashburn-Nardo. Peer Assistant Role Models in a Graduate Computer Science Course

This project aims to develop and test a new intervention to recruit terminal Master's students into computer science (CS) PhD programs and to enhance diversity in academic CS. We propose adding peer assistants (i.e., successful PhD students) to CSCI 549: Intelligent Systems, a popular course for Master's students with approximately 60% women and 90% international students. Although there is a fair amount of diversity in this course and in IUPUI's CS Master's program (i.e., international female students), many of these students do not continue to earn a PhD, or get involved in research during the Master's program. To address this issue, we anticipate that the PhD student peer assistants will not only help the Master's students with in-class research projects, but will act as role models to promote Master's students' interest in CS research and PhD programs. We plan to assess whether compared to those in a control course, the intervention course encourages the Master's students to have higher grades, feel more belonging and self-efficacy in academic CS, have greater value for CS research, and critically, report higher intentions to pursue a PhD in CS. Because role models are most effective when individuals feel similar to the role models, we also plan to explore whether certain PhD student peer assistants function as better role models for female international Master's students. It is possible that international female Master's students may be most inspired by PhD students who share multiple intersectional identities (i.e., are also international women).

Few studies have explored how to encourage diverse Master's students to pursue research opportunities and PhD programs. However, because increasing the diversity of CS professors is critical for enhancing the diversity of CS majors and the CS workforce, it is important to test new methods to recruit Master's students into academic CS. Moreover, much of the previous work exploring role model interventions for enhancing women's interest in STEM has had majority White female samples and White female role models. The current project will address this limitation in the literature by testing who functions as a beneficial role model for international female students. Thus, this project will test new and innovative techniques for an enhancing diversity in academic CS and STEM generally.

Yogesh Joglekar and Gautam Vemuri. Normalizing Computation in Undergraduate Physics Curriculum.

The physics department, with the strong support from all its faculty, is working to normalize computation in the undergraduate curriculum. Their goal is to make computing or numerical methods an indispensable part of the students' skill-set, to a degree where they think of it as naturally as Google. With input from the faculty and using MATLAB as the preferred software, we have developed a matrix of relevant concepts/ techniques and courses that use them. With a revamped introductory course on computing (taught by Gautam Vemuri), we are now implementing numerical methods/ calculations/ problems in every non-service course taken by Physics majors (see above).

Drs. Robert Minto and Sebastien Laulhé -Peer-Lead Undergraduate Research Initiative (PLURI)

Through funding by SEIRI, Profs. Minto and Laulhé have been developing a mechanism to provide undergraduate students with exposure to an authentic research problem in the CHEM C344 undergraduate teaching laboratory. This experience has occurred for three semesters in the later third of the semester for 10 lab periods. A research problem is provided by an involved faculty member in the department. This is currently the development of an organometallic chemistry method for borylating less reactive aryl bromides, which generally fits in the research program of Prof. Laulhé. This real-world, expectedly publishable problem is presented to an unselected group of C344 students and they work together, under the tutelage of peer-undergraduate teaching assistants to tackle the problem. The overarching goal of the project, which has been proposed to the National Science Foundation, is to provide a general framework for undertaking this type of experience with a range of research problems. We are trying to identify the features of this type of experience that promote success and functionality, both for the faculty, peer leaders, and students. Beyond insights garnered by the faculty with respect to the operation of the lab, we working with SEIRI to have high quality evaluation of the student experiences. Analysis of the problem-solving and affective changes in both the students and their peer leaders occurs across the semester.

The laboratory immerses students in a less-scripted, authentic laboratory research problem. The peers have experience with the basic chemistry being developed, so they can be effective managers training students in the necessary analytical and preparative techniques, which modern methods such as air-sensitive chemistry and organometallic catalysis. For a portion of the semester, the chemistry is directed by Drs. Laulhé and Minto through the leaders and, later in the semester, the lab members will devise their own (approved) experiments. At all stages, while the experiments may be well reasoned, they may also fail and we believe that, with the proviso that the students can during the course of the lab show skill and knowledge growth, they should experience the wobbly path of scientific advancement. Additionally, a portion of the effort serves to ensure that students maintain appropriate lab records, consider scientific ethics, have the opportunity to explore their perceptions of scientific research. The semester culminates with a public poster presentation prepared by the entire lab. We have observed that many students from the lab find the experience stimulating and later approach research labs to further their interests. Also, some do not; this we view to be valuable in the exploration of their future career paths.

Part IV: Evidence of assessment and changes made towards continuous improvement in student success initiatives and student support services.

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1. Continuation and Expansion of Summer residential STEM Bridge program designed for students who will be residents on campus. There were several positives to the residential 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. The number of students participating in the STEM, Science and Psychology Bridge programs continues to increase each year. Recent data indicates that STEM and other bridge participants have higher GPAs compared to non-participants; students participating in Summer Residential STEM Bridge have lower DFW rates compared to non-participants; and minority students (especially African Americans) participating in Summer STEM Bridge obtained higher GPAs, lower DFW rates and higher Fall-to-Fall retention rates compared to non-participating AA students. Based on an end of the semester assessment for Science Bridge participants, students are meeting the stated IUPUI Bridge Learning Outcomes:

- Develop a perspective on higher education
- Develop a community of learners
- Develop communication skills
- Develop critical thinking skills
- Develop study skills
- Develop college adjustment skills
- Understand the demands and expectations of college
- Understand information technology
- Understand and use university resources

2. Continuation of the Physics Learning Space (PhyLS)

In order to reduce the DFW rates in Physics, PhyLS has adopted the "assistance center" model that has proven successful in Math, Chemistry and Biology. Since its opening, the PhyLS or "Phyllis" as it is known, has proven to be a popular destination for many students. Students are able to interact with mentors and faculty in small groups or one-on-one, focus on the areas that cause them the most trouble, receive individual support, guided access to computer simulations, video analysis software, and other online tools that support learning in physics.

Department of Physics expanded the hours (the PhyLS is now open 42 hours/week) after its initial success, and has made an attempt to increase physical space by adding an “overflow whiteboard” to the corridor outside (unfortunately, no larger rooms are available) and by adding a second mentor during peak hours. Students, faculty and tutors have all had positive reactions to the PhyLS. Typical student comments focused on the “peer” aspect, fining that the help they get from other students is often more accessible than that from faculty.

Student use of the learning space has remained rather constant across the first 5 years. Visits to the PhyLS typically number 700-800/semester and just over 300 in the summer, with the mean stay being over one hour. Initial assessment showed that students are highly positive about almost all aspects of PhyLS, based on a Likert scale survey was conducted in May 2013 by a campus evaluator.

3. School of Science PREPs (Pre-Professional and Career Preparation for Science Students):
The Science Career Development Services moved to the new University Tower space (HO 200) in July 2013, launching their name as “PREPs” Pre-Professional & Career Preparation for Science Students” (SciencePREPs.iupui.edu), which has positioned the center as a key resource for Science students. One of the initial goals of the new Director was to increase the awareness of the center, its location, and services provided. The center was promoted through various programs and methods. Although only two employees initially staffed the center, outreach to hundreds of undergraduate and pre-professional students, has been successful. As of fall 2018, the office continues to have 4 full-time staff and several part-time student workers.

There were several goals in the SOS Strategic Plan that are directly related to the PREPS office

2) 664 students were served in 905 one-on-one student advising sessions.
3) PREPs staff made more than35 club and classroom presentations
4) Preps brought in approximately 200 employers and graduate/professional school representatives for career fairs, information sessions and programming.
5) Partnered on Career Connection STEM Fair and coordinated the School of Science Next Step fair reaching more than 900 students through both events.
6) 68 students completed an experiential learning course (science-based internship or healthcare shadowing)

4. Development of Learning Outcomes for School of Science RBLC’s.

The SOS currently has 4 unique living and learning locations for students;

STEM Floor – North Hall

WISE (Women in Science and Engineering) Wing – North Hall
WISH (Women in Science House)
Purdue House

We have developed both common and unique learning outcomes for each location.

As a result of living in a STEM RBLC, residents will be able to:

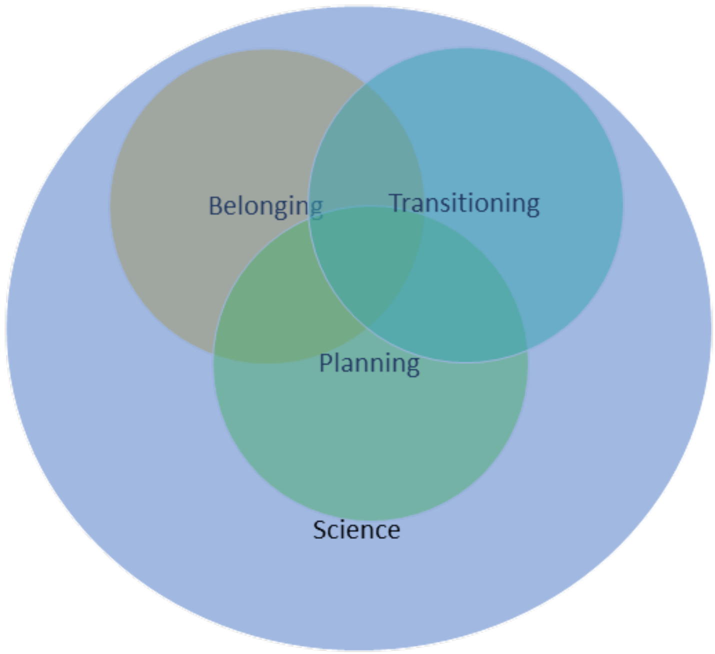
- Choose at least one School of Science and/or School of Engineering and Technology involvement opportunity of interest (school student organization, school social event, school lecture, etc.)
- Examine STEM career opportunities
- Identify STEM research opportunities
- Describe STEM campus and community resources
- Name a new STEM faculty, staff member, and/or industry leader they met as a result of an RBLC program

<u>Community Specific Outcomes:</u>

- *STEM Floor*
    - Discuss college level academic expectations of a STEM major (study skills, time management, etc.)
    - Identify a social issue that STEM research and work can influence
- *STEM Floor WISE Wing*
    - Connect with a new female STEM faculty, staff member, and/or industry leader
    - Identify issues facing women in STEM on college campuses and/or in the workplace
- *WISH:*
    - Connect with a new female science faculty, staff member, and/or industry leader
    - Identify issues facing women in science on college campuses and/or in the workplace
    - Describe a contribution of a women scientist in their field of study
- *Purdue House*
    - Describe the influence of STEM research and work on a community issue
    - Develop an academic plan for their remaining semesters of coursework

5. **Windows on Science updates**

The science specific first year seminar, titled, "Windows on Science" is taught by several science faculty and staff. Some of the sections (N = 24 with ~25 students) are stand-alone while others are part of a themes learning community. We held a retreat over the summer with these instructors to reinforce the common learning outcomes associated with the course, share best practices and resources, and discuss some challenges associated with the course. One of the most prominent challenges is to engage students in the goals for the course. They often do not see why the activities in the course have been chosen and how they all fit together. We developed the visual below to try and better communicate the course goals to the students. Our goal for next fall is to connect the learning goals to the IUPUI+ to help students begin to identify how their education will support them becoming an innovator, problem solver, community contributor and communicator.



Goals:

1. Belonging
    a. The course will facilitate students' belonging to the IUPUI and IUPUI Science communities.
2. Transitioning
    a. The course will support students' transition to IUPUI.
3. Planning
    a. The course will develop students' planning strategies.
4. Science
    a. The course will explore what it means to be a scientist.

Learning Outcomes:

At the conclusion of this course, students will be able to:

- Employ effective strategies for note-taking, studying, and test-taking (2, 3)
- Apply time management techniques to manage schedules and commitments (2, 3)

- Identify campus and science resources for academic success (1, 3, 4)
- Demonstrate how to evaluate information sources and use academic inquiry tools (2, 4)
- Navigate the processes of academic advising, registration, and course enrollment (3)
- Use academic advising tools and resources (3)
- Develop a plan to achieve academic, career, and personal goals using personal strengths and challenges (1, 2, 3, 4)
- Name the additional skills, training, and expertise required to meet goals (2, 3, 4)
- Identify and prepare for research, international, service, and experiential (RISE) opportunities using campus resources (1, 3, 4)
- Describe the different mechanisms for paying for college (including jobs, scholarships, different types of loans) and explain the financial consequences of each (3)
- Differentiate between ethical and unethical behavior as an IUPUI student and scientist (2, 4)
- Explore co-curricular involvement in the campus, local, and science communities (1, 2, 3, 4)
- Explain how engagement assists in meeting academic, professional, and personal goals (3, 4)
- Work effectively with others to create a collaborative project (1)
- Develop relationships with student peers in science (1, 4)
- Identify connections between scientific disciplines (4)
- Define science and identify scientific traits within a discipline (4)
- Recognize differences in human experience and the ways differences enrich learning environments and contribute to science (1, 2, 4)
- Identify strategies to increase self-awareness and personal responsibility (2, 4)

Part V: Graduate Program Assessment

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1. 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.

2. Program Outcomes: 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 assessed on 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.

The School of Science has been working for several years to have the doctoral program site approved on this campus. Previously, doctoral work completed on this campus was partially overseen (this varied by department) by faculty from Purdue and the graduates were counted as Purdue graduates. Given the development and increasing quality of our graduate programs in our school, we were encouraged to seek sight approval from the Indiana Higher Education Commission. After a two-year process, all Purdue doctoral programs (e.g., Biology, Chemistry, Computer Science, Mathematical Sciences, Physics and Psychology) in the School of Science are independent and site approved for our campus. In addition, a new IU doctoral program in the department of psychology, Applied Social and Organizational Psychology, was approved and brought in its inaugural class this fall. This program joins IU doctoral programs from earth science and bio-statistics that are offered within the school of science.

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. In terms of final numbers, approximately 169 students earned the M.S or Ph.D. in the School of Science in 2016-2017.