PRAC Report: Assessment of Student Learning
IUPUI School of Science
2021-2022 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, computational, and psychological sciences to increase knowledge and advance the development of the 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 three programs (Artificial Intelligence, Forensic and Investigative Sciences and Neuroscience) of the school, there are over 125 full-time faculty members. The school is the academic home of ~2,600 undergraduate majors, ~400 graduate students, and ~100 post-baccalaureate pre-professional students.

Part I: Student Learning Outcomes for Each Academic Program

The School of Science has been utilizing the Student Learning Outcomes developed during the 2010-2011 academic year for assessing each academic program. In Fall 2021, each undergraduate program reviewed and reaffirmed their student learning outcomes. A comprehensive list of SLOs for both undergraduate and graduate education and degree programs can be found in the IUPUI Bulletin. In Spring 2019, each program mapped its program level learning outcomes to the new IUPUI Profiles of Undergraduate Learning. Over the last year, each program has mapped capstone courses and a mid-career course to the IUPUI Profiles.

Undergraduate SLOs (B.A. and B.S.)	**Graduate SLOs (M.S. and Ph.D.)**
• Artificial Intelligence • 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 • Computational Data Science • Forensic and Investigative Sciences

https://bulletins.iu.edu/iupui/2021-2022/schools/purdue-science/index.shtml

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

There are several ways that the school has been examining their curriculum and working on course improvement. They are organized in the sections below. First, we have continued to have our general education courses reviewed. Second, 3 departments/programs have gone through an external review.

Third, Science has developed specific learning outcomes related to the first-year seminar (Windows on Science) and has identified how the Profiles are addressed in the course. Finally, faculty share new and best practices in the classroom in our annual STEM education summer showcase.

Part II: Assessment and Continuous Improvement Plans in General Education Courses.

The main focus of this School of Science's annual report is on the efforts undertaken in the last year to assess and develop improvement plans related to student learning outcomes for our *general education* courses. The School of Science has ~80 courses on the general education list. Over the last five years, we have had all 80 courses reviewed. To gain reapproval, departments must submit a dossier that includes the learning outcomes, and evidence of student attainment of the outcomes. In addition, departments provide information and reflection on DWF rates and submit a plan for continuing improvement. The following data and information provide evidence that we are assessing our programs, and that we are addressing the IUPUI Profiles of Undergraduate Learning.

Below are excerpts from some of the dossiers submitted to the Gen Ed Review Process in AY 2021-2022. Various parts of the dossiers were selected to provide examples of the attention paid to learning outcomes, assessment, and continuous improvement throughout the Science curriculum. We made the decision to de-list some Chemistry lab courses during this last year because we realized that no-one would ever use the lab courses for their General Education requirement, because the associated lecture course would be used for that purpose.

Biology K101 – Concepts of Biology 1

The reflection prompt used in this course is below. This was a prompt I developed early in the start of the pandemic, and related to the IUPUI+ criteria, and included in the SP22 end-of-course student evaluation Instructor Added Questions.

"**Who Was I Before This Pandemic – And Who Am I Now**? Consider your life before and now during the pandemic. Has the pandemic personally changed you, or changed your ideas about school, work, priorities, family, healthcare, leadership, careers? How would you like the future (of your education, careers, or with your family & friends) to be different as a result of living through this experience? Please use the diagram on page 8 of our syllabus, relating the IUPUI+ (Principles for Learning in Undergraduate Success) to help answer this question."

A Special note: The Pandemic was a difficult time for students, and we will be seeing effects of the stress from the pandemic for many semesters to come –

- **Spring 2020** (Pandemic starts mid-semester) – **DFWI** rate of only **12%** due to my complete restructuring of K101 starting in mid-March 2020 with synchronous Zoom lectures, open- book and open-note weekly exams, a switch to completely on-line labs I developed quickly, and tremendous flexibility offered to all students to complete their work for the semester. I wanted to make sure students finished the class well under the extreme stress of the early pandemic. Overall, we maintained an active and engaged class on Zoom through early May.
- **Fall 2020** (Pandemic, but prior to vaccination) – **DFWI** rate of **20%** (No vaccinations available; strict pandemic precautions, hybrid course, Zoom lectures and recitations, alternating weeks of Labs-on-Line (LOLs) and lab in person with all students masked and distanced). I gave greatly increased flexibility for students in terms of exam dates and ability to complete alternate LOLs on

request. Many students were ill or quarantining weekly due to COVID. Typical freshman in this fall semester had an abrupt end to their high school senior year and started college in fall 2020 under these uncertain conditions.

- **Spring 2021** (Pandemic, vaccinations become available nationwide, mid-semester) – **DFWI** rate of **28%;** Hybrid course – Zoom lectures and recitations, alternating weeks of LOLs and lab in person, with all students masked, more emphasis on taking exams and completing assignments in time, but still had to grant much flexibility, due to many students struggling with family responsibilities, becoming ill, or quarantining with COVID.
- **Fall 2021** (Pandemic, with vaccines required to attend IU) – **DFWI** rate of **21%;** Lectures and recitations fully in person, but with options to attend lectures on Zoom, masks required, more emphasis on my part requiring students to take exams and complete assignments on time, but still much flexibility needed due to students ill or quarantining with COVID. Labs return to weekly schedule. Typical freshman in this fall semester had an abrupt end to their high school junior year and completed their senior year of high school in any number of ways, in-person, on-line, hybrid; many feeling academically unprepared. (As a note: Even the K102 Honors section had an unusually high DFWI rate of 12% rather than the usual 3%. While the numbers were small, I feel this demonstrates the overall stress levels and feelings of under- preparedness of this semester).
- **Spring 2022** (Back to "semi-normal") – **DFWI** rate of **23%;** Fully in-person lectures with in-class attendance expected; Zoom available only upon request, if ill. Labs fully in person, with masks required for first half of semester. Many students struggled academically due to a variety of high school and college experiences due to the pandemic, and many students struggled with mental health issues even though the daily stress of the pandemic is lessening. **This is the semester that is being considered for this Gen Ed Review.**

Course Improvement Activities
Lecture:

- **I am strongly committed to the pursuit of first year student success on all fronts**. I work
- diligently to review, revise and update lecture material, adding information about new scientific findings, new ways to make connections, and ways to streamline content to be able to go more in depth on key topics.
- **After each exam,** we look at the statistics for each question to determine where student misconceptions exist, whether to revise instruction, whether to modify a question to better address a topic.
- **After each semester**, I read and think about all student comments, and consider incorporating student suggestions. Students have given me very valuable feedback over the year that allows me to keep up with new tools to incorporate learning (ie: Top Hat)
- **As a result of student feedback, I have started options like K101 Breakfast Club**, a 1-hour drop in Office Hour / Help session every Friday before lecture for K101 and K102 students, held in a room adjoining K101 lecture. Light snacks provided. Typically, 30-50 students attend, depending on the week. I have also added evening Zoom office hours to my weekly schedule.
- **Since the pandemic started, I have realized the value of allowing students greater flexibility** to complete assignments and labs with a greater range of due dates to you allow for circumstances where students may not want to or be able to attend in person due to having been exposed to Covid, recovering from Covid, or being ill for other reasons. I have tried to balance this, however, by stressing the importance of being in class and present for labs and recitations, for students' academic benefit. Zoom lectures can be convenient, but are best in person, and labs on-line are a poor substitute for a hands-on lab. I am placing a greater emphasis on taking care of mental health, stress management, and seeking help as soon as it is needed so that students do not become overwhelmed by the many challenges of our modern lifestyle.

K101 Lab:

- K101 lab is routinely reviewed each semester to make sure all labs are working as expected, and new labs are piloted and swapped in as needed (usually about 1 lab per semester is 'freshened up'). That also necessitates a change in the lab manual and Canvas site.
- Several new K101 labs that were developed by necessity during the pandemic did turn out to be valuable in terms of bringing in new and timely bioinformatics approaches to studying biology. These worked so well during the pandemic that I have incorporated them into the in-person K101 lab (a COVID bioinformatics lab, a lab simulation on CRISPR-Cas technology).
- These new activities help students meet not only the general education learning in science and biology, but also advancement toward the IUPUI+ Profiles in the course?

K101 Recitation:

- In this peer-mentored section, I also make sure we have continuous quality review and improvement. I have worked with our mentors to add many features over the last few semesters such as Zoom hours in the BRC (biology resource center), and "Exam Jams" offered on zoom prior to each exam.
- The Bepko Learning Center has also added in additional supports such as "Survive and thrive in K101" poster session during Week 2 of the semester and Rebound Week offered in Week 5 of the semester to help students bounce back from a first round of science exams that can include Biology, Chemistry, Algebra/Calculus first exams all within a short timeframe.

Psychology B110 – Introductory Psychology

The B110 mile marker assignment is a personal reflection paper that aligns with the main themes of the course. The first theme is that Psychology is a science, and its goals are to describe, explain, predict, and change behavior. The second theme is that behavior is a result of person (internal) factors, environmental (external) factors, and the interaction between the two. The reflection paper asks students to identify a behavior of their own, describe it, explain where it came from by identifying both internal and external factors that led to its development, predict what will happen if they do nothing about it, and suggest ways they might change or improve it. Students are encouraged to pick simple, everyday problems or concerns as their topics. Instructors incorporate class activities throughout the semester so that students can begin to draft sections of the paper and receive feedback along the way. The final papers are evaluated by assessing whether the content is appropriate to the section (e.g., does the Describe section contain a description of the behavior, does the Explain section explain where it came from, etc.) and how well the student has incorporated the vocabulary of psychology and concepts learned throughout the semester into their writing.

Student learning

Many student comments directly address STGEC 5.4 - Evaluate evidence supporting conclusions about the behavior of individuals, groups, institutions or organizations and STGEC 5.6 - Identify examples of how social, behavioral, or historical knowledge informs and can shape personal, ethical, civic or global decisions and responsibilities. Students frequently mention how they have learned about factors that affect their behavior and the behavior of others. They discuss how they plan to apply this knowledge to make improvements in their own lives or how it has or will impact their interactions with others in both their personal and professional lives. Below are a few examples:

- The concepts I've learned in this course I will be able to apply to my own life when I may be struggling mentally and/or emotionally. I am better able to understand what influences my feelings and behaviors and how to deal/cope with them.
- I will apply these concepts in my teaching career. I now have knowledge of mental illnesses that my students may have. Because I am more educated on them I will be able to cater to them more efficiently.
- I can also use psychology throughout and after nursing school to help me better understand my patients from a different perspective.
- I realized that psychology is a part of a lot of topics in life like anatomy, mental health, public health, etc.
- I feel like my understanding of psychology has changed because of this course by a lot. I finally feel like learning some of the different terms in the book help explain why to a lot of behavior going on in my life and others.
- I will apply the concepts by being more patient with people. As I have learned more about the possible reasons to explain human behavior I discovered there is no one clear reason to explain a person's behavior. Therefore, I should not react in the same manner to all situations.
- Many of these comments also directly support student learning that maps onto the Problem Solver and Community Contributor Profiles. Students directly mention being able to better understand themselves and others and how they plan to apply the information learned in the course to their own lives. The Problem Solver profile indicates that students should be able to "collect, analyze, evaluate, and synthesize information to implement innovative solutions." Student comments indicate that as a result of taking the course, they can better identify the causes of behaviors and apply methods for change to improve their own lives and the lives of others. The Community Contributor profile states that students should be "active and valued contributors on the campus and in local and global communities." Students often mention how they plan to apply course content to their careers in fields like education and nursing and to the various roles they anticipate having in their lives, like becoming parents. It is also common for students to state that the course helped them to better understand mental illness and to reduce stigma. They comment on how they can apply this information in their interactions with others.

Course improvement

As the number of available, qualified instructors for B110 has decreased, we have had to increase the size of several sections. As discussed in Appendix A, in fall 2022 we are offering two larger sections capped at 138 students in contrast to our typical 75-student sections. To manage sections this large, the Mile Marker assignment has been modified to reduce the grading burden on the instructor. We will be assessing the impact of these changes on student learning and performance.

It is premature to draw strong conclusions about DFWI rates and grade distributions over the past several semesters given the multiple changes made to the course simultaneously. During AY20-21 several sections were taught in a hybrid-distance format. Attendance at synchronous class meetings was not required. During AY21-22 in-person sections were taught in a flexible format where students were allowed to complete class participation activities from home and were provided access to pre-recorded lectures. This led to reduced attendance, but students provided favorable feedback on this format. As described in Appendix A, beginning in summer 2020, we stopped using the testing lab to administer exams and permitted students to take exams at home with access to books and notes. We have continued this practice and will reassess the impact each semester. One hesitation with returning to the testing lab is the desire for the online sections to remain fully asynchronous for students who need this option. Before spring 2020, students enrolled in online sections were required to come to campus to take exams.

Student work and reflection responses indicate that the majority of students are mastering the course learning objectives and they see the relevance of the course to their general education. Students frequently comment that the course has helped them to better understand themselves and the behavior of others. Additional data indicating that students perceive the broad educational value of the course comes from responses to three closed-ended items that the course coordinator regularly adds to her end-of-semester course evaluations.

Math – 153 - College Algebra

Mile Marker Assignment "Flight of a Projectile"

The purpose of the Mile Marker Assignment, "Flight of a Projectile", was to assess the student learning outcomes related to working with polynomial functions (listed in Student Learning Outcomes #2 and #3 of the alignment form). In particular, the assignment assesses the student's understanding of the properties and the graph of the position function (a particular quadratic polynomial function often used in calculus and physics). The "Flight of a Projectile" assignment presented a combination of the mathematical concepts previously presented in the course.

The mile marker assignment links to the Profiles of Learning for Undergraduate Success – *Problem Solver* and the general education competencies for the Indiana College Core (formerly the STGEC) Foundational Intellectual Skill #3 "*Quantitative Reasoning*". Specifically, the assignment can be linked to the following Indiana College Core learning outcomes as follows:

Part a) 3.1 Interpret information that has been presented in mathematical form, and 3.2 Represent information/data in mathematical form as appropriate

Parts b, c, and d) 3.3 Demonstrate skill in carrying out mathematical procedures accurately and 3.6 Analyze the results in order to determine the reasonableness of the solution,

Part e) 3.2 Represent information/data in mathematical form as appropriate, for example with a graph.

Part f) 3.1 Interpret information that has been presented in mathematical form, 3.6 Analyze mathematical results in order to determine the reasonableness of the solution, and 3.8 Clearly explain the representation, solution and interpretation of the math problem.

The mile marker assignment was completed during the 12th week of classes. Based on the results of the graded assignment, students performed well overall on the first four parts (a, b, c, and d) of the assignment illustrating their ability to interpret and translate the information given in the application problem into a mathematical equation, to identify and analyze important properties of the quadratic equation, and to carry out the computations correctly. The scores indicate students

are learning the associated general education competencies related to these parts of the assignment. However, student performance on the last two parts (e and f) of the assignment showed the course needs to provide more attention to graphing equations accurately and extracting and interpreting the graph information correctly. Students showed difficulty in clearly and concisely explaining their method for determining the range of times the projectile would be at a height greater than 500 feet (part f).

These results are not surprising. Students in math as well as other disciplines often perform well on algebraic interpretation, manipulation, and computation and struggle with the ability to graph data accurately, interpret the information in a graph correctly, and explain clearly in words mathematical concepts. As a result of the student performance on the mile marker assignment, instructors of MATH 15300 this fall will be asked to provide additional explanation and encouragement to address these areas of weakness with graphing.

Based on the student performance of the mile marker assignments in Spring 2022, more attention and practice is needed on the careful graphing of mathematical equations and functions and the interpretation of the information from the graphs.

The course coordinator plans to discuss with the fall instructors how best to increase student practice of graphing skills throughout the semester. Furthermore, instructors will be asked to encourage students to give additional attention to the quality of their written responses to mathematical questions. Students will be asked to read carefully their written responses for clarity and correctness before submitting their work for evaluation.

It is common for math courses, like MATH 15300, 15400, and 15900, that are used to prepare in-coming students for STEM major calculus courses to have DFW rates that are among the highest on university campuses. This is not to say that work has not been done or is not ongoing to improve the DFW rate in these courses, but it should be said that it is considerably more difficult in first-year math courses where students are coming from various backgrounds with various levels of mathematical understanding. Dr. Watt, Chair of Mathematics, continually reviews the DFW rates on math courses and discusses the information with course coordinators, individual instructors, and the department as a whole.

As recently as Summer 2022, Dr. Watt has applied for funding for **several initiatives to address the DFW rates in math courses referred to as the "IUPUI MATH DFW Rate Intervention Planning Initiative"**. Funding for interventions fall into four broad categories: Professional Development; Peer Mentoring; Class Delivery and Structure; and Student Placement Processes. Pilot projects have been set up in two of the Fall 2022 MATH 15300 classes. If student performance in the pilot sections prove effective in lowering the DFW rates, the initiatives will be expanded to additional MATH 15300 sections and other courses like MATH 15400 and 15900.

CSCI N200 Principles of Computer Science

Evidence of Student Learning Being Used to Improve the Course

CSCI N200 is structured so that student learning is assessed continuously. A concept is presented, students work on an assignment which applies the concept, and then they take a quiz which demonstrates their understanding of the concept. This is a cycle that repeats nearly weekly, allowing instructors to frequently make small modifications to assignments, adjust the pace of the class if students are confused, and clarify expectations.

When the course is taught in-person, the instructor circulates among the students as they work, monitoring their progress and answering questions. Then, the instructor can tailor instruction according to individual student needs. If many students in the class seem to be struggling, the instructor can ask students to pause, and clarify a concept for the class before students continue working.

When the class is taught on-line, one instructor uses "Warm-Up Assignments" which are small assignments that students complete weekly, which are due several days before larger assignments. These smaller assignments are graded quickly, giving students a chance to correct any misunderstandings before they complete the more comprehensive assignment. These small

assignments are also an early indicator to the instructor of student understanding of the concept so that any gaps in understanding can be addressed. For example, in Spring 2022 students were asked to write a calculator app, which was due in stages. One of the warm-up assignments showed a broad misunderstanding which was clarified before the next assignment was due.

CSCI N200 is also a course that uses peer leaders. When the course is taught in-person, peer leaders attend class sessions and help answer student questions and work with students as they complete in-class assignments. Sometimes students are more comfortable asking a peer a question than they are asking the instructor, so frequent informal conversations with peer leaders ("How do you think the course is going? How are students doing with this assignment?") are invaluable for gauging student understanding and modifying the course appropriately.

Peer leaders also work with students when the course is taught online. The peer leaders constantly monitor student progress which is then reported back to the instructor. One instructor asks peer leaders to submit a weekly report. The other instructor requires students to meet with a TA weekly during the first part of the semester so students can ask questions and the TAs can gauge student understanding. The instructor checks in with the TAs regularly in order to address any concerns.

Both instructors of the course are committed to using student feedback to improve the course. For example, both instructors have modified the videos they use in the online course in response to student feedback that the videos were too long or supporting resources were unclear. One instructor extended the time spent covering the topic of Databases in the course in response to student feedback that the content felt too rushed.

Finally, end-of-semester evaluations are used to improve the course. For example, one instructor notes that in the past, for each module, the quiz is due before the assignment, but this semester, she is experimenting having the assignment due before quiz and will see if it has positive effect, because of course evaluation feedback from Spring 2022.

Part III: Department/Program Review

Approximately every 7 years, Departments (in conjunction with the campus) go through an external review process. In preparation for this review, each department generates a self-study for the review team. Below are excerpts from the self-studies focused on student learning and/or curricular developments from each of the 3 program reviews from this last year.

Earth Science

1. Student learning outcomes

Student learning outcomes are gathered via several metrics, including traditional course evaluation metrics, mentoring surveys, course specific efforts to gather information, and data associated with external efforts such as the Integrating Community Engaged Learning through Ethical Reflection faculty learning community (ICELER). Additional outcomes are gathered anecdotally via communications with graduates. Additionally, the department has been going through a phase of curricular reassessment and reevaluation of the marketing of our degrees to a more career-oriented outcome in order to both strengthen student preparedness for the professions students enter, and to expand access and relevance to a wider range of students to better reflect our urban demographics and broaden diverse student engagement in our field. Overall, we believe student outcomes in terms of employment and the reputation of our department in preparing students to be excellent.

Relationship between research/engagement activities and academic programs

A number of programs have emerged to support the relationship between research/engagement activities and the department's student success. Examples include the U.S. State Department-supported Diplomacy Lab, the NSF-supported GeoPaths Initiative, the NSF-supported ICELER Ethics programs, CEES and its outreach initiatives, and numerous field opportunities that uniquely exists for earth science students and are invaluable for expanding their toolsets for grappling with real world problems.

Two new programs are in development:

- A new effort has been the creation of 'GEMS' (GeoEquity Modules) for use across the Earth Sciences curriculum. This effort was funded through a seed grant from the IUPUI STEM Education and Innovation Research Institute (SEIRI). The pilot study resulted in student- created websites centered 3 around environmental problems with complex equity and ethics challenges designed to be self-contained and ready for use during a single class period by instructors. Based on preliminary success, this work has been expanded to include Schools outside Science along with SEIRI staff and submitted as a 5-year NSF proposal.
- Many undergraduates pursue careers that center on environmental work which typically occurs in urban areas. With this in mind, faculty from our department and staff at SEIRI are developing an NSF proposal for an urban field camp. The goals are to focus training in areas most relevant for our students and to create partnerships with local environmental companies and community groups for joint benefit.

Chemistry and Chemical Biology

General Chemistry Peer Mentoring

Roar in Chemistry (RIC) is a new program funded by the IUPUI STEM Education Innovation and Research Institute (SEIRI) that works with students who are underrepresented in chemistry and are enrolled in the first-year General Chemistry sequence to improve their self-efficacy and self-confidence. This volunteer mentoring program attempts to increase a student's self-efficacy in studying and introduce them to concepts of growth mindset and "failing" while learning (in other words, learning from mistakes). Peer mentors are selected from advanced chemistry majors who were successful in the general chemistry sequence and who have an interest in mentoring others.

Peer-led Team Learning

The department is a national leader in the use of Peer-Led Team Learning (PLTL) and has incorporated this high-impact practice into both general chemistry and organic chemistry I courses. PLTL engages recent students of the course, “peers”, as guides, coaches, or facilitators to direct small student groups towards more effective problem-solving strategies. This small-group activity (typically 8 – 10 students) guarantees time-on-task where sufficient attention and guidance can be provided to help develop problem-solving skills and occurs in addition to the lecture meeting that often contains 200 or more students. The “peers” are not content experts, but rather, are students who can suggest meaningful directions for understanding course material and are trained in small-group facilitation skills, pedagogical techniques, strategies for learning, and advanced content instruction.

Flipped Organic I and II Classes

The COVID-19 pandemic has required and given us the opportunity to examine our teaching practices and be creative in how course material is presented to our students. With the need to provide asynchronous lectures, especially for our large enrollment classes, many instructors recorded short lectures covering only one or two concepts. With these recorded lectures in hand, the organic chemistry faculty took the opportunity to “flip” their classrooms, where students are expected to view lecture recordings prior to the class meeting when the instructors engage the students in problem- solving activities. A realistic measure of the effectiveness of this innovation without pandemic-related interference has yet to be made.

Peer-Led Undergraduate Research Initiative Building on the strength of the PLTL program in our department, organic chemistry faculty members had an innovative course-based undergraduate research project funded by the IUPUI (SEIRI) in 2017. The Peer-Led Undergraduate Research Initiative (PLURI) aimed to provide undergraduates with an immersive research and educational experience in the organic teaching labs. Peer teaching assistants (PTAs) actively guided research projects, while students in the teaching laboratory contributed to project design, data collection, and analysis. The proof-of-concept project was carried out in one of eight sections of organic chemistry II laboratory for two semesters and was very well received by the students in the section and the PTAs. Unfortunately, the project proved to require a level of both human and material resources that cannot be supported by the departmental budget.

Approaches in Chemical Biology

A new writing-intensive advanced course, Approaches in Chemical Biology, has been developed and introduces Chemical Biology as a discipline and, through the use of case studies, examines how chemical and biological techniques are used to study biological systems. Topics are selected from the current literature and covers technologies such as genomics, transcriptomics, proteomics, metabolomics, (combinatorial) synthesis of chemical probes, high throughput screening, synthetic biology, and bioorthogonal ligation. A blended didactic and project-based approach enables students to develop skills in reading and understanding scientific literature, oral presentation, illustration of scientific concepts, and scientific writing. This course provides a high degree of intrusive mentoring, including mandatory milestones to be reached, for the students as they work on their case study over the semester and helps prepare students to work both independently and collaboratively with supervisors and senior scientists in their careers.

Biology

An estimated 50% of the undergraduate credit hours delivered by the Department of Biology fall into the category of service courses (this decrease compared to the previous review reflects an increase in the enrollment in majors' courses). These courses (with an "N" prefix for non-majors) primarily provide pre-requisite training for students targeting careers in the Allied Health Sciences, including Pre-Nursing, Pre-Dental, Pre-Physician Assistant, Pre-Dental Hygiene, Pre-Occupational and Pre-Physical Therapy, Pre-Pharmacy and Pharmacy Tech, Exercise Science and Athletic Training. Demand for our Human Anatomy and Human Physiology courses has been steadily increasing. However, our Human Biology anatomy and physiology lower-level sequence (N212- N215) has seen a dramatic loss of enrollment due to changes in the requirements of several pre- health career programs.

Human Anatomy (BIOL N261, 5 credits) is the largest enrolling course in the department with over 1200 students enrolling each year. A hybrid N261 lecture section has been successfully taught for a year and will be offered every semester (lectures in the hybrid N261 lecture section are recorded and may be viewed asynchronously online, *but all lecture exams, plus all labs and lab exams occur on campus*, with few exceptions that occur now and for the foreseeable future due to quarantine requirements, necessitating live-proctored online exams). Critical additions which have positively affected student success include access to the McGraw-Hill Anatomy and Physiology online Connect site, as well as active participation each semester by Peer Mentors, students who have recently earned a "B" or above in Human Anatomy, and who are on a scholarship program under the Bepko Learning Center at University College. These mentors provide both volunteer mentoring sessions as well as required mentoring sections for selected lab sections and provide one-on-one free Anatomy tutoring sessions at the Biology Resource Center at Taylor Hall each week. Another key service course, Human Physiology (N217, 5 credits), enrolls 800-850 students per year.

A critical addition since the last review is BIOL N461, Cadaveric Human Anatomy, a 5-credit hour totally lab-based class taught by Biology plus IU Medical School Anatomy faculty. This course counts for 2 laboratory hours for Biology majors, and 5-credit hours for others. It has been taught successfully for 4 years. Notably, demand has been increasing yearly.

Importantly, since the last review, we have added lecture-based and laboratory courses taught totally online for Health Information Management students as well as for those whose programs do not require an on-campus laboratory course. These new courses are 3-credit hours each and consist of BIOL N211 Anatomy for Healthcare Management and BIOL N207, Physiology for Healthcare Management. They began four years ago, have steadily increased in student load and student success, due to close coordination with the IUPUI School of Informatics and Computing as well as the hiring in the Department of Biology of a faculty lecturer with extensive online experience (Dr Brem).

Other non-major courses provide science electives as general education classes for Liberal Arts, Business, and other students. These courses include: BIOL N100 (Contemporary Biology), BIOL N107 (Exploring the World of Animals), BIOL N200 (Biology of Women), BIOL N225 (Urban and Suburban Gardening), BIOL N226 (Wildflowers and Ferns of Indiana Forests), BIOL N251 (Introduction to Microbiology), and BIOL N322 (Introductory Principles of Genetics). Enrollment in these classes (except for N107, which satisfies a science lab requirement) has steadily but slowly declined over more than a decade. This is partly due to increased competition from other general education offerings in SOS. We have revised course descriptions and titles and are using a modular structure for these courses to increase student interest.

We have also partnered with UCOL and other departments to develop Thematic Learning Communities (TLCs) involving our courses. Since the last review, Department faculty actively participated in the successful development and execution of several TLCs linked to the Human Anatomy N261 course. Due to a poor history of Anatomy scores for both Psychology and Exercise Science students, UCOL, Psychology faculty, Exercise Science faculty and Biology faculty worked to develop two TLCs – intense program whereby students from these disciplines took Anatomy as a group, including lecture and labs for both TLCs, with the addition of required mentoring for the Exercise Science students. Results were very positive, with the Exercise Science students finishing statistically equal to the other almost 400 students, and the Psychology students close behind. We plan to continue to improve this linkage, requiring mentoring for linked TLCs with Anatomy. We also experimented this semester with an honors TLC that linked honors freshman biology (Kl02) with chemistry and freshman seminar.

Additionally, Department faculty have worked with UCOL and other SOS faculty in the development and presentation of several First Year Seminars. Innovative pedagogical approaches incorporated in these first-year experiences include the use of electronic portfolios (ePDPs), which students work on during their class sessions. The importance of Diversity, Equity, and Inclusion as well as the essential impact of the students as part of the campus-based Global Learning Initiative are addressed in each First Year Seminar taught by Biology Department faculty, whether under the School of Science (Windows on Science) or under University College (Exploring Health Professions).

Our faculty also offer relevant extracurricular experiences to students in these non-majors classes. For example, in Human Anatomy, students may attend seminars/workshops during which faculty present brief classes on child abuse, homicide scene investigation, time of death analyses, and wound analyses, or may attend autopsies at the coroner's office, and visit the Cadaver Lab at IUSM during BIOL N461 classes, during which time the enrolled students discuss their "First Patient Project," describing their donor's clinical and anatomic findings.

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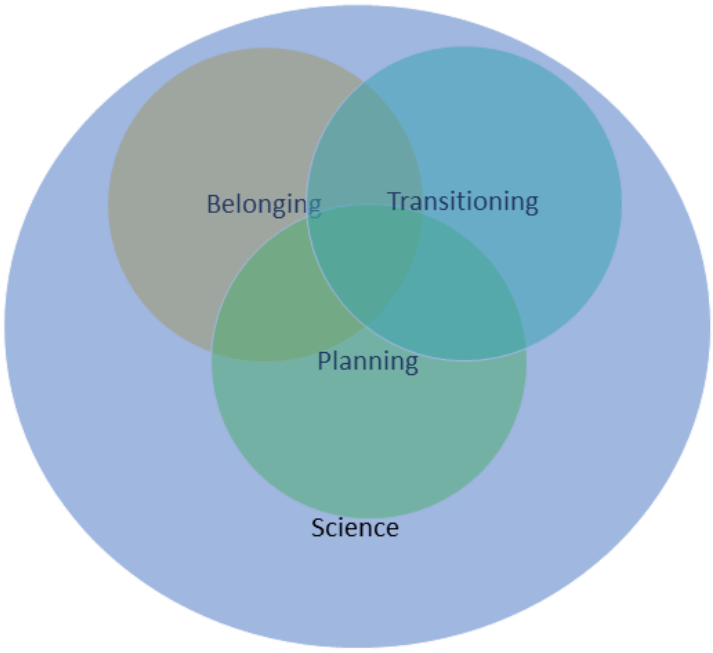
Part IV: Windows on Science

Science offered 29 sections of Windows on Science in Fall 2022. To ensure that all students have the same experience and outcomes, we have developed a set of learning outcomes and have now connected them to the IUPUI Profiles of Learning. Instructors work to create experiences and assignments throughout bridge and the First Year Seminar to ensure these are met.

Windows on Science prepares incoming students for college success and persistence to degree completion. The course is structured around the following goals and outcomes necessary for student achievement in college and beyond.



Goals:

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

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Learning Outcomes Mapped to Course Goals:

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 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)

Required Course Topics:

- Team project and/or group activities
- Career exploration/career development
- Time management
- Study habits
- Financial planning
- Academic advising and registration
- Academic integrity
- Ethics in science
- What is science and science disciplines
- Diversity
- Campus engagement
- Campus resources
- Information literacy and conducting research
- Academic and personal goals for college
- Faculty engagement

Windows on Science Outcomes Mapped to Profiles:

Windows on Science is structured to support science students as they transition to IUPUI as first year students and connect to their disciplines. IUPUI+ Profiles are central to the goals and outcomes of this course. More information on the IUPUI+ Profiles can be found at: https://profiles.iupui.edu/. While the Windows on Science course outcomes map to all profiles, primarily the course is connected to the problem solver and community contributor profiles. The course supports the problem solver profile by supporting students as they navigate campus structures, evaluate information sources, collaborate with new students to solve problems, and use campus resources to increase persistence. The course supports the community contributor profile with course goals and outcomes that facilitate belonging and community engagement, ethical behavior in science, social identity awareness, and an appreciation of the contributions of those historically underrepresented in science. The Windows on Science course outcomes are mapped to the profiles below.

- Problem Solver
  - Employ effective strategies for note-taking, studying, and test-taking
  - Apply time management techniques to manage schedules and commitments
  - Identify campus and science resources for academic success
  - Navigate the processes of academic advising, registration, and course enrollment
  - Use academic advising tools and resources
  - Demonstrate how to evaluate information sources and use academic inquiry tools

- Community Contributor
  - Differentiate between ethical and unethical behavior as an IUPUI student and scientist
  - Recognize differences in human experience and the ways differences enrich learning environments and contribute to science
  - Identify strategies to increase self-awareness and personal responsibility
  - Develop relationships with student peers in science

- Innovator
  - Develop a plan to achieve academic, career, and personal goals using personal strengths and challenges
  - Identify and prepare for research, international, service, and experiential (RISE) opportunities using campus resources
  - Explore co-curricular involvement in the campus and science communities
  - Identify connections between scientific disciplines
  - Define science and identify scientific traits within a discipline

- Communicator
  - Name the additional skills, training, and expertise required to meet goals
  - Describe the different mechanisms for paying for college (including jobs, scholarships, different types of loans) and explain the financial consequences of each
  - Explain how engagement assists in meeting academic, professional, and personal goals
  - Work effectively with others to create a collaborative project

Part V: STEM Education Showcase

For several years, Dr. Brenda Blacklock has organized and hosted a summer teaching showcase. Faculty who would like to share new innovations from their classrooms conduct short presentations.

Below is the slate of speakers and topics for Summer 2022.

Brenda Blacklock, CCB	Introductory Remarks
Tamiko Porter, CCB	Integrating Real-World Applications in a Sprint Biochemistry Class
Thomas Rossbach, ES	Going Beyond the Textbook: Teaching How Real Geologists Study the Earth in Introductory Geology
Aparajita Sengupta, PHYS	Use of Physics Tutorial Sheets and the Think-Pair-Share Method to Improve Cognitive Learning
Keith Anliker, CCB	Norms to Govern Teaching & Learning
Greg Druschel, ES	Integrating Ethical Reflection and Community Engagement in Science Courses.
Jim Marrs, BIOL	Creating a Culture of Care for Under-Resourced Students
Marie Nguyen, CCB	An Intervention Program to Improve Retention in General Chemistry
Ryann Workman, MS	5 Secret Ingredients (that actually work!!!) to Maximize Student Performance in STEM Courses at the 100 and 200 Levels
Pat Clark, BIOL	Syllabus Review and Revision with a Focus on DEI

Part VI: The Record

There are currently 4 experiences approved for the Record:
Principles of Hydrology/Surface Water Hydrology (GEOL-G 430/G550)
Laboratory Assistantship in Earth Sciences
Learning Assistant for B110 Introduction to Psychology
Internship in Science-Based Field (SCI-I 494)

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Admittedly, the school did not make progress on increasing the number of experiences that are on the record. Course sizes have increased due to an inability to replace faculty that have retired or resigned. In many departments, faculty are teaching overloads to cover required courses. This and the additional work being created by the transition to IUI in 2024 has impacted what faculty are able to achieve in other areas.

Part VII: Graduate Program Assessment

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;
(f) Communicating effectively to others in the field and to the general public; and
(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. 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 used as a form of program assessment.

Evaluation of these undertakings by the 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 actual numbers, approximately 1152tudents earned the M.S or Ph.D. in the School of Science in 2022-2022.

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Part VIII: Assessment Plans for 2023

There are several large assessment efforts currently going on in the school. First, we will continue to complete the dossiers to reapprove the general education courses located within science.

The other formal assessment effort, going on in the school, is the departmental or program reviews. Math and Psychology were reviewed in Fall 2021 and Biology and Chemistry were reviewed in Spring 2022, and Earth Science in Fall 2022. Physics, Computer Science and Neuroscience and Forensic and Investigative Sciences will be reviewed in 2023.

Finally, given the increase in the number of bridge sections that were required, we will be examining how well the bridge/first year seminars met the learning outcomes.

Admittedly, there are many challenges facing the faculty in the School of Science. First, financial challenges have not allowed us to replace faculty who have resigned or retired. This has forced us to increase class sizes in many departments and many faculty are teaching overloads to cover our courses. Secondly, the transition that will occur in Fall 2024 is generating a great deal of additional work for members of the school. All degrees except those in Earth Sciences and 1 doctoral degree in Psychology will be transitioning to Indiana University degrees. These challenges may limit the amount of new assessment work we are able to undertake.

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