Assessment of Student Learning
School of Science
Indiana University-Purdue University Indianapolis

Report for the Academic Year 2002-2003

General Context

The 2003 report is the sixth in a series of annual reports forming a layered narrative of the assessment of student learning in the School of Science. The 1998 seminal report detailed general education and discipline specific learning outcomes. The 1999 report presented an assessment plan of action. The 2000 report tracked the status of assessment activities and added a history of student learning projects occurring between the 1992 North Central Association visit and the 1998 report. The 2001 report listed the progress on assessment and a new initiative to link School and department level assessments. The 2002 report provided an update of assessment activities in anticipation of the North Central Association accreditation visit. The current report is another layer in the evolving story of the commitment to assessment and student learning in the School of Science.

School Level Assessment Activities and Implementation of the Principles of Undergraduate Learning

Prepared by Joseph E. Kuczkowski, Ph.D.
Associate Dean for Academic Programs and Student Development
June 1, 2003

General Education Curriculum

The Core Curriculum Committee of the School of Science and the School of Liberal Arts has focused on revising guidelines for junior/senior integrator courses. The Committee has also been seeking mechanisms to promote development of additional courses in this area to support the general education requirements for liberal arts and science majors.

Teaching and Learning Committee

As a byproduct of the Senior Reflection assessment project, the Teaching and Learning Committee of the School of Science has been addressing the area of student and professional ethics, which relates to one of the six IUPUI Principles of Undergraduate Learning. This will be a continuing focus for the 2003/04 academic year.

Windows on Science Freshman Experience Seminar

In response to continued assessment, updated activities have been generated covering the area of information retrieval and quality of information. A new activity, based on a biological model, has been developed to address the theme of diversity.

An individual was selected for a shared advisor/career specialist position with University College and the School of Science. This person was well received as a resource for career/major connections for students in the *Windows on Science* course.

Capstone Assessment Template

Data from departmental rubrics applied to capstone courses have been incorporated into a School template to achieve a School-level overview of the capstone experience. The template data will be presented for analysis and discussion at the Teaching and Learning Committee and at the Chair's Council in the upcoming fall semester.

Continuing Special Retention Project

Data were generated to identify courses at the sophomore level or higher that are particular barriers for students in progressing in degree programs. As a continuing project, the Teaching and Learning Committee will undertake the task of supporting departments in their efforts to address pedagogical strategies to enhance learning and to increase successful completion of the courses.

Integration of Students in Assessment Process

Under the guidance of Dr. Drew Appleby, students in the Senior Capstone Seminar in Psychology functioned as an assessment consultant team to the Dean's Office with the charge to evaluate the School of Science Senior Assessment Project. The team worked with raw data from the 2002 Graduating Student Surveys and the Senior Reflections. A detailed report was produced for each of the seven departments in the School and for overall School-level purposes. The Assessment Team made a number of suggestions to enhance the School Senior Assessment Project. These recommendations will be reviewed for implementation next year. This approach of involving students directly in the general assessment process was mutually rewarding and may have been unique in terms of how assessment of student learning is being addressed at many institutions.

Assessment of Student Learning
Department of Biology
Indiana University-Purdue University Indianapolis

Report for the Academic Year 2002-2003

Prepared by Kathleen Marrs, Ph.D.
June 20, 2003

Introduction

The teaching mission remains as stated in the previous reports from 2000-2002. The Department currently has 21 full-time faculty including two who hold the title of Lecturer. Three new faculty will be joining the Department soon, two lecturers as well as one tenure-track assistant professor. Departmental teaching responsibilities for all faculty include a large service component and a substantial undergraduate program with two degree options (Bachelor of Arts and Bachelor of Science), and graduate instruction for the 80 – 85 students enrolled in Master of Science and doctorate programs each year.

Enrolment patterns indicate that two thirds of the course credit hours (lectures, labs, and recitations) are in courses for non-Biology majors. These service courses satisfy specific or area requirements for students in pre-nursing, allied health, physical education, liberal arts, science, dental hygiene, and a few other programs. Several of the courses for undergraduate majors are also used by students in other programs or students who have aspirations that do not include a degree in Biology. Thus, some of those enrollments belong in the service category and a reasonable estimate is that 75% of our enrollments are in service courses.

The Department offers both a Bachelor of Arts (B.A.) and a Bachelor of Science (B.S.) degree in Biology. The former is utilized predominantly by students with an interest in professional school and offers sufficient science training for most purposes while allowing students a wider breadth of educational experiences across other disciplines. The B.S. degree is elected by students who see themselves as working biologists and by students who wish to pursue graduate training in Biology.

The Master of Science (M.S.) degree in Biology offers several options. The M.S. with thesis is a two-year degree for full-time students that involves original research culminating with a written thesis that must be defended. Students earning this degree typically gain employment in industry as research scientists or go on to doctorate (Ph.D.) study. The program has an excellent record for industrial placement most of which occurs with Indiana companies. A unique one-year non-thesis M.S. is offered for students who are just below the standard for professional schools and are seeking to upgrade their academic credentials and knowledge base for another application round. This program has also been highly

successful in its placement of students in professional schools such as medicine, dentistry, optometry, and, more recently, law. Finally, the Department offers a non-thesis degree over a varying time frame mostly for students who are already employed and can study only on a part-time basis. The Ph.D. degree is typical in that it is research intensive and leads to a substantial thesis.

In the process of addressing the teaching needs of such diverse programs, Biology offers instruction in the traditional lecture and laboratory, recitations with some unique components, and most importantly, in the form of individualized instruction. At the undergraduate level, the senior capstone experience for B.A. students is available through individual faculty on a one-on-one basis. Bachelor of Science students satisfy the capstone experience by enrolling in undergraduate research and senior thesis. This allows the student to do a limited research project with a faculty member and write the results as a formal thesis. Many students have given presentations of their work at local and national conferences and symposia and some have been listed as co-authors on peer-reviewed publications. Graduate students in thesis programs also receive considerable one-on-one instruction from faculty.

Learning Outcomes in the Department of Biology

1) Outcomes Related to General Education Principles (see report, 07-19-2000)

Principle 1: *Graduates will have knowledge of, and proficiency in, core communication and quantitative skills (writing, speaking, and quantitative reasoning).*
Principle 2: *Graduates will be proficient in analytical, critical, and creative thinking.*
Principle 3: *Integration of Knowledge.*
Principle 4: *Achievement of intellectual depth, breadth, and adaptiveness.*
Principle 5*: Understanding Society and Culture.*
Principle 6: *Values and Ethics.*

2) Discipline-Specific Outcomes (for more detail, see report dated 07-19-2000)

I. Basic Knowledge.

A. ***Molecular Biology:*** All topics relating to DNA, proteins, techniques relating to biotechnology and genetic engineering, etc.

B. ***Cell and Developmental Biology:*** All topics relating to cell structure and function, cell biology and biochemistry, development of cell types during growth of the embryo, use of cells and cell types to manufacture drugs, etc.

C. ***Physiology:*** All topics relating to the biochemical and physiological workings of a cell, tissue, organ, or organ system within a living plant, animal, or other organism.

D. ***Ecology:*** All topics relating to the effect of the environment and the ecosystem on the living organism.

E. ***Evolution****:* All topics relating to the descent with modification of organisms from common ancestors through the mechanism of natural selection.

II. Applied Skills.

A. Application of the Scientific Method: All topics that require a student to apply scientific process skills (questioning, development of a testable hypothesis, experimentation) to a particular problem and devise a way to test or solve that problem. Students must analyze background literature, interpret data, possibly modify a hypothesis or idea, and present their findings in a written or oral report.

B. Laboratory Skills: All techniques and protocols pertinent to lab safety, use of laboratory equipment, collection and analysis of data, interpretation of findings, development of a laboratory report or notebook, and proper protocol for disposal of hazardous materials if appropriate.

Assessment Activity Within The Department Of Biology

For course descriptions, please see the IUPUI Online Catalog at
http://www.indiana.edu/~enrolctr/iniupui/biol/
or at the Department of Biology website at
http://www.biology.iupui.edu/biocourses

Courses for Biology Majors:

BIOL K101 Concepts of Biology I (Dr. Robert Keck)

Student Learning is currently assessed by the following measures:

4 Lecture exams – multiple choice;
2 Laboratory exams – short answer;
3 Microessays;
Weekly concept maps;
Biomath problem solving.

For detailed description, see report dated 07-19-2000.

BIOL K103 Concepts of Biology II (Dr. Robert Yost)

Student Learning is currently assessed by the following measures:

4 lecture exams;
3 lab exams;
2 papers;
1 oral presentation;

Group projects (recitation);
6 Quizzes;
Mini-exam: an introduction to a typical laboratory practical exam.

For detailed description, see report dated 07-19-2000.

BIOL K322 / K323 Genetics and Molecular Biology
Lecture and Lab (Dr. Martin Bard / Dr. Kathleen Marrs)

Student Learning is currently assessed by the following measures:

3 Lecture exams – ~40% short answer, 60% problem solving;
Assigned genetics problems;
3 Laboratory exams – ~40% short answer, 60% problem solving;
1 Lab report – written in scientific publication format;
1 Genetics Case Study – open-ended investigation of a human genetic disease gene. Both a research and writing component are emphasized in this project.

Additional explanation by Dr. Bard:

In lecture there are three exams, approximately 40% of which is of the short answer variety (multiple choice, true-false, matching, etc) and 60% is problem solving. Generally, there are at least one and usually two review sessions before each exam. In order for students to learn how to solve problems in genetics, there are three kinds of problems assigned for each topic and these problems appear in the text. There are chapter integration (one to two) problems and solved problems (one to two) that appear at the end of each text chapter. These problems are followed by a more extensive number of problems at the end of each chapter. A solution's manual is required for the course and the solution's manual solves each assigned problem in great detail. The review sessions are designed to clarify lecture material and questions regarding problems that are still unclear. Review sessions are held the Thursday or Friday before the exam and during the review session, it is often obvious that students have not done their assignments. This formative assessment allows both students and faculty to become aware of student difficulties BEFORE the exam.

In lab there are three exams again with the bulk of each exam emphasizing problems and problem-solving skills. Students are asked to write two lab reports, one on an experiment in which the entire class participates. This experiment spans two-thirds of the semester. The second lab report requires that students access a genomic database to identify a gene from a partial nucleotide sequence.

All exams in both lecture and lab are graded by the instructors. This allows us to interpret exactly what students are able to do and what concepts are difficult.

The new textbook contains a CD disk with videos that will make learning particular concepts easier. We intend to increase the use of handouts and transparencies to improve understanding and retention.

For detailed description, see report dated 07-19-2000.

BIOL K356 / K357 Microbiology Lecture / Lab

Student Learning is currently assessed by the following measures:

4 Lecture exams – mixed format with some **objective** questions (multiple choice, fill-ins, matching, identification) and some **written** questions that may include compare & contrast, essay, data interpretation and analysis and problem solving. These instruments evolve more to the written / essay questions as the semester progresses.

Assigned "Problem Sets" (oxidation/reduction balancing, growth rates, genetic mapping) designed to assess mastery of the subject matter and the skills associated with its application.

3 Laboratory exams – mixed format with some **objective** questions (multiple choice, fill-ins, matching, identification) and some **written** questions that may include compare & contrast, essay, data interpretation and analysis and problem solving. Final exam is cumulative.

3 Performance Assessment assignments – require students to demonstrate mastery of a specific technique. These assessments require students to demonstrate the isolation of individual bacterial colonies from a mixed culture, successful differentiation of bacteria using the Gram Stain technique, and successful identification of Mycobacterium by the Acid Fast Stain.

2 "Bacterial Unknown" identification laboratories – students are given two cultures of bacteria and, using knowledge they have gathered over the semester as well as numerous bacteriological media, design an identification protocol that allows them to "key out" a bacterial genus and species.

BIOL K338 Immunology (Dr. Ruth Allen)

Student Learning is currently assessed by the following measures:

Exams (summative) - varied questions ranging from multiple choice to half-page essay answers requiring students to develop a coherent summary of a complex question.

BIOL K490 Senior Capstone Experience (All Faculty)

BIOL K493 Senior Independent Research (All Faculty)

BIOL K494 Senior Research Thesis (All Faculty)

Student Learning is currently assessed by the following measures:

- Written thesis of substantial length and result of extensive research.
- Survey instrument to assess the degree of success in achieving outcomes related to the *Principles of Undergraduate Learning* and biology-specific outcomes.

- This survey instrument has been extensively described in the assessment reports dated 07-19-2000 and 06-01-2001, and was used by the School of Science Teaching and Learning Committee as a template for developing a School of Science-wide assessment instrument for Senior Capstone courses.

Courses for Non-Science Majors:

BIOL N100 Contemporary Biology (Dr. Kathleen Marrs)

Student Learning is currently assessed by the following measures:

14 Warm-Up exercises (formative assessment);
14 "What is Biology Good For?" assignments (scientific reading, research and writing);
14 Cooperative Learning assignments (in class group work, formative assessment);
4 Exams – multiple choice, scan-tron.

Assessment of N100 using Just-in-Time-Teaching has been extensively described in the Assessment Report dated 06-15-2001.

BIOL N217 Human Physiology (Dr. Richard Pflanzer)

Student Learning is currently assessed by the following measures:

4 Lecture exams (objective / scan-tron);
2 Laboratory exams;
5 Laboratory quizzes (unannounced; lowest quiz dropped, formative assessment);
30 Lab reports.

For detailed description, see report dated 07-19-2000.

Graduate-Level Courses:

BIOL 507 Principles of Molecular Biology (Dr. Dring Crowell)

Student Learning is currently assessed by the following measures:

Written examinations, in an essay format, emphasizing problem solving, data interpretation, and experimental design.

BIOL 516 Molecular Biology of Cancer (Dr. Pamela Crowell)

Student Learning is currently assessed by the following measures:

3 exams: short answer, short essay, critical thinking;
1 paper summarizing 3 cancer research journal articles.

BIOL 540 Topics in Biotechnology (Dr. Kathleen Marrs)

Student Learning is currently assessed by the following measures:

3 Exams (objective plus short answer / problem solving questions);
14 Warm-Up assignments (formative assessment);
1 Group Project (collaborative research, written report and oral presentation).

What is Biotechnology Good For? Assignment: Each student is given guidelines on developing a Web page featuring a useful application of biotechnology to modern life. Graduate students must research and write an essay on a topic of their choice, develop a Web page with visuals and links to background material, and include end-of-essay questions to be answered by non-science majors taking N100.

Biotechnology Stock Portfolio Project: Each student is given two stock ticker symbols and, using a free website stock portfolio manager, "invest" $10,000 in their stocks to chart the progress of biotechnology stocks over the course of a semester. The description and results of this project, including assessment, are included in a manuscript written by Dr. Marrs recently submitted for publication (available upon request).

Assessment of BIOL 540 using Just-in-Time-Teaching has been extensively described in the Assessment Report dated 06-15-2001.

BIOL 548 Techniques in Biotechnology (Dr. Dring Crowell / Dr. Steve Randall)

Student Learning is currently assessed by the following measures:

Written reports of a series of laboratory exercises that together form a larger research project. Reports are expected to be equivalent in format and content to a published scientific paper.
Written examinations, in an essay format, emphasizing problem solving, data interpretation, and experimental design.
Students' lab notebooks are evaluated for content and quality.

BIOL 556 Physiology I (Dr. Pamela Crowell)

Student Learning is currently assessed by the following measures:

3 exams: short answer, short essay, critical thinking;
1 paper on scientific and ethical aspects of human stem cell research.

BIOL 559 Endocrinology (Dr. Simon Rhodes)

Course Goal: Comprehensive examination of the biology of endocrine organs, the hormones that they release, and the roles and target organs of these hormones. Both normal endocrine

function and diseases associated with endocrine glands and target tissues are examined. This course is aimed at upper-level undergraduates and graduate students.

Student Learning is currently assessed by the following measures:

3 examinations (33.3% of grade each) – a combination of essay, fill-in-the blanks, matching, and multiple-choice type questions.

BIOL 561 Immunology (Dr. Ruth Allen)

Student Learning is currently assessed by the following measures:

Exams (summative) – varied questions ranging from multiple choice to half-page essay answers requiring students to develop a coherent summary of a complex question.

BIOL 564 Molecular Genetics of Development

Course Goal: To examine how key regulatory genes and signaling pathways regulate development in lower eukaryotic organisms and mammalian organ systems.

Mechanism: The expanding volume of information in this field makes it impossible to examine the molecular pathways that regulate the development of every organism or organ system in detail. Students therefore concentrate on **one topic in detail** and should try to elucidate the general principles underlying the molecular development of this subject and the others covered in the course.

Student Learning is currently assessed by the following measures:

Presentations: Students select a research area from a list by a random drawing. On the assigned day, the student presents a ~45 minute review of the chosen subject and then lead a ~30 minute critical discussion of one or two relevant, recent research (not review) papers. On the day of class, students distribute a "top ten" list that lists the most important concepts to be discussed in the presentation to the class.

Paper: A ~2500 word written review of the research area due at the end of the semester. This paper should be written in scientific style with citations.

Examination: One examination during finals week.

Grades are assigned based upon the following:

Participation in class discussion	10%
Presentation	45%
Written paper	35%
Final Exam	10%

BIOL 571 Developmental Neurobiology (Dr. Teri Belecky-Adams)

Student Learning is currently assessed by the following measures:

3 exams: all short answer essay / multiple choice, true / false;
1 paper: 10-20 pages in length on a topic of their choosing;
6 journal clubs – responsible for leading the discussion for 1 journal club and participating in the others;
1 Panel Discussion: responsible for research and presenting a topic of instructor choosing related to stem cell research.

BIOL 697 Topics in Plant Biology (Dr. Dring Crowell / Dr. Steve Randall)

Student Learning is currently assessed by the following measures:

2 Oral presentations of recent research reports in plant biology.
Final exam – both written in-class exams and take-home exam formats have been used in previous years. Take-home exams are in the format of writing assignments in which students are asked to write a 1-2 page summary of each of several topics.

BIOL 697 Sensory Systems (Dr. Teri Belecky-Adams)

Student Learning is currently assessed by the following measures:

3 exams – multiple choice;
14 journal clubs – responsible for presenting 1 paper and leading discussion, participating in the other journal clubs.

Assessment of Student Learning
Department of Chemistry
Indiana University-Purdue University Indianapolis

Report for the Academic Year 2002-2003

Prepared by Raima Larter, Ph.D.
and Frank Schultz, Ph.D.
June 2003

Course Assessments, Modifications and Improvements

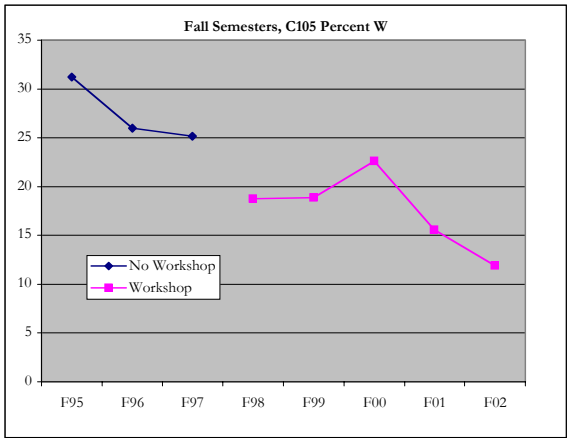
C100, *The World of Chemistry*
This course has served 100-150 students per semester over the past two academic years. The class provides a topically oriented, non-mathematical survey of chemical subjects of general interest including, for example, the environment, nuclear and fossil fuels, nutrition, and genetics. Drop+Withdraw+Fail (DWF) rates have averaged 25-30% over the last two years. Student learning has been assessed by administration of a pre- and post-semester survey, an example of which is attached as Appendix A. There are two student clienteles in the class: those with a general interest in chemistry and those who seek state certification in science education. Special "block" sections with a maximum enrollment of 30 have been created for the latter clientele. One such section (together with a parallel section offered as G107 by the Department of Geology) was taught in 2002-03. Two such sections are scheduled for 2003-04.

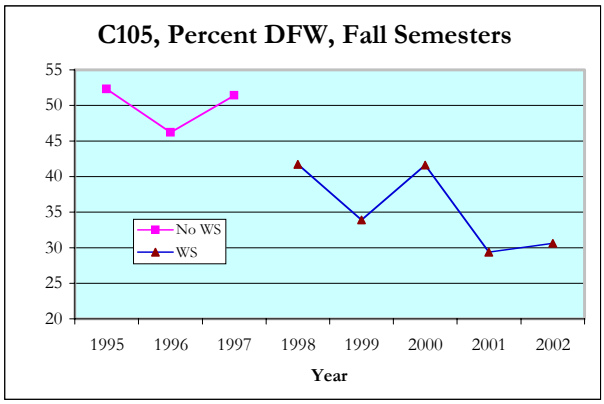
C101, *Elementary Chemistry 1*
The Just-in-Time-Teaching (JiTT) methodology was implemented in C101 during the Spring 2003 semester. The purpose of this modification was to encourage students to think about lecture-related content before attending class. A course web site has been created through which students are asked some questions that reinforce their learning and other questions that stretch their understanding of course materials. Responses are examined and used as part of the course discussion at the beginning of the next scheduled class. Other activities (e.g., "Our Chemical World") review course material in the context of real-world applications. Because JiTT was implemented in the most recent semester, no assessment is available. However, data were collected and will be reviewed prior to the Fall 2003 semester.

C110, *The Chemistry of Life*
C110 was created to replace C102 (a second semester of Elementary Chemistry), which had suffered a severe drop in enrollment (200 to 20 students) over the years. C101 was dropped as a prerequisite and course content was changed to reflect the growing interest in health sciences, hence the title *The Chemistry of Life*. An optional separate laboratory course, C115, has been created to accompany the lecture material in C110, although less than half the class typically opts for the laboratory class. Enrollments in C110 increased to 80-90 students per semester in 2002-03, indicating that course content is now better aligned with student needs.

C105, *Principles of Chemistry I*

Workshop Chemistry, a peer-led method of team learning, was introduced into the C105 course several years ago. We have studied the effect of this change on student performance by looking at both the DWF rate and student performance on the American Chemical Society (ACS) standardized final exam for C106, the second semester of this course sequence. The ACS exam covers topics from both semesters and is a measure of retention of learned material over time. This analysis showed that the DWF rate has, in fact, decreased as a result of the introduction of Workshop Chemistry. Further analysis shows that this is largely due to a drop in Ws; in other words, students are being retained at a higher rate without any drop in grade performance. At the end of fall 2002 semester, the withdrawal rate had fallen to less than 12%, the lowest it has ever been and much lower than the normal 30% rate (see accompanying graph).





Because Workshop Chemistry has been so successful, we plan to extend it to the second semester of the course sequence (C106). Performance on the ACS standardized exam has been consistently above the 50th percentile nationally since the introduction of this teaching method, whereas it often fell below the mid-point before we introduced Workshops. The effect in this measure is less dramatic, however. The previous instructor, Dr. Blake, had begun to introduce a second intervention technique, Just-in-time Teaching (JiTT), but left the university before this could be fully implemented. Thus, this additional intervention was dropped. The results observed in the Physics program, which has employed JiTT, are quite impressive. Therefore, we have implemented this technique in another course (C101).

C125/S125, *Experimental Chemistry I/Honors*

The laboratory portion of the C105 course (C125) was split off from the lecture several years ago to align our course-numbering scheme with that of other Indiana University campuses. We subsequently developed a separate honors section, S125, which has grown in popularity and proven to be an excellent recruiting tool for both the Department and the School. The larger laboratory course, C125, has undergone a curriculum revision under the direction of Professors Frank Schultz and David Malik. New experiments were developed and the laboratory manual for the course was rewritten. The new laboratory curriculum and manual were implemented in fall 2002. Also beginning fall 2002, the honors section, S125, was linked in a block with a new separate section of the School of Science freshman learning community, *Windows on Science*

(focused on Chemistry majors), providing a learning community experience for potential Chemistry majors that is tied directly to laboratory work. This connection has increased the engagement level of students in the *Windows* section and has enhanced the possibilities for retention of high-quality freshmen.

Upper-level Laboratory Courses

All upper-level laboratory courses have continuously updated curricula. The Organic Chemistry Laboratories (C343 and C344) have seen the introduction of group synthesis projects, which strive to increase the relevance of educational experiences to real-world situations. An example is the synthesis of Prozac from benzene (a simple starting material). Funds obtained in recent years from Student Technology Fees and from external grants for Instructional Laboratory equipment have been used to increase the number and quality of instruments available in laboratory classrooms. The Department's Industrial Advisory Committee commented favorably on the facilities available in these undergraduate laboratory classrooms during a recent tour of the department.

C495, *Capstone in Chemistry*

The Senior Capstone course continues to develop through the involvement of additional instructors in the department. One problem encountered early on in this course was the need for students to begin thinking about their independent project at least a semester before enrolling in C495. Advisors consistently and forcefully push this information on students: the Chair of the Department includes information about it in an annual letter to majors; colorful bulletin boards and website postings alert students to the need to plan ahead and develop a project well before their senior graduation semester – but students still register for the course claiming they have never heard or seen any of this information. The quality of the independent project, therefore, is quite low for this subset of students. We are considering ways in which we might require students to register for the course *before* their last semester and file reports regarding their progress in choosing a project and an advisor, beginning work on the project (usually, although not always, undergraduate research), etc. Students in C495 are evaluated by both their research mentor and the Capstone instructor and given extensive feedback on both their project and their course portfolio, prepared during the semester they are in C495. Other activities that occur during the semester include: oversight of the School of Science Graduating Student Survey (which includes reflection on the Principles of Undergraduate Learning), a few case studies involving ethical issues which may be encountered in a scientific career, preparation of a résumé and guidance on interviewing opportunities, job fairs, and so on. Appendix B is an example of the template used to give students feedback in this course with comments that might be given to a student (fictitious, here) who we would consider to have done "A" work in this course.

Appendix A

Chemistry C100 Assessment of Attitudes and Understandings
Pre- and Post-Survey Results

Percent of students who *agree* with the following statements:

1. It is best to eat only foods that contain no chemicals.
2. The items in the ingredients list that are bad for you are those which are hard to pronounce.
3. The hole in the ozone layer is a myth.
4. My body is made of chemicals.
5. I am happy with my level of understanding of the controversies which surround the use of food additives and supplements.
6. I have heard of CFCs.
7. I have heard of HDL and LDL cholesterol.
8. I can explain the difference between HDL and LDL cholesterol.
9. I am satisfied with my level of understanding of the natural world.

	1997			**1999**			**2000**		
Item #	**Pre**	**Post**	**iff**	**Pre**	**Post**	**iff**	**Pre**	**Post**	**iff**
1	8%	9%	+1%	1%	4%	+3%	23%	8%	-15%
2	8	9	+1	6	2	-4	2	1	-1
3	13	0	-13	10	4	-6	6	2	-4
4	79	91	+12	84	93	+9	92	99	+7
5	8	63	+55	9	68	+59	18	75	+57
6	67	100	+33	58	91	+33	63	100	+37
7	71	100	+29	26	93	+67	59	100	+41
8	4	81	+77	26	81	+55	16	92	+76
9	0	18	+18	16	62	+46	25	84	+59

	2001		
Item #	**Pre**	**Post**	**iff**
1	10%	3.5%	-6.5%
2	4	35	+31
3	65	40	-15
4	89	98	+9
5	16	67	+51
6	53	90	+37
7	64	75	+11
8	24	49	+25
9	16	67	+51

Appendix B

Chemistry C495 Student Feedback Template

Critique for Jennifer Q. Student
Capstone in Chemistry C495, Spring 2000

	Needs Improve-ment	Meets minimum Standards	Avg	Above avg, could benefit from additional work	Excellent, little-to-no improvement necessary
Academic Portfolio[1]					X
Résumé[1]					X
Writing skills[2]					X
Computer skills[3]					X
Presentation style					X
Ability to understand and communicate scientific information				X	
Knowledge of contemporary issues in science and their relation to society			X		
Overall comprehension of chemistry				X	

[1] includes hard copy and electronic versions
[2] based on senior reflection and research summaries
[3] includes word processing and graphics programs, web page construction, and database searching.

FINAL GRADE: A

Portfolio
Excellent portfolio. Less effort placed on web page construction.
Résumé
Good résumé. Both hard copy and electronic versions provided.
Writing skills
Senior Reflection was not submitted. Only assessment is based on independent project abstract– good writing skills noted.
Computer skills
Knowledge of word processing, spreadsheet and presentation programs. Ability to create web pages, including digital pictures. Some knowledge of CAS searching.
Presentation style
Good preparation seen for all presentations. Excellent overall skills, but could benefit from more attention to scientific detail.
Ability to understand and communicate scientific information
Excellent communication skills seen.
Knowledge of contemporary issues in science and their relation to society
Participated in roundtable discussions; appears to have good knowledge of contemporary issues in science.
Overall comprehension of chemistry
Appears to have good knowledge of chemistry and related fields, particularly biology.
Other comments
Jennifer did an excellent job in all requirements of the Capstone course. Her research and literature presentations were well organized and researched. She has an engaging presentation style and is able to think on her feet when presented with questions in front of an audience. At times, however, her answers seemed a little too glib and showed a hesitancy to think critically when questions went beyond her level of expertise. The instructors encourage her to address this tendency.

Assessment of Student Learning
Department of Geology
Indiana University-Purdue University Indianapolis

Report for the Academic Year 2002-2003

Prepared by Jeffrey Swope, Ph.D.
Edited by Joseph Thompson
June 2003

Using the strategy agreed upon in the School of Science's Teaching and Learning Committee, the Department of Geology developed a formal rubric to assess senior capstone courses and the effectiveness of geology courses on majors.

As described in the annual assessment report for 2001-2002, the Geology Department's Capstone Course is G420: Summer Field Camp. This course involves three weeks of fieldwork in mountainous in the West. In this experience, students make use of knowledge gained in every course required for the major: G110: Physical Geology, G209: Historical Geology, G221-222: Mineralogy and Petrology, G303: Field Methods, G323: Structural Geology, and G334: Sedimentation and Stratigraphy.

Students spend several days collecting data related to each subject area and incorporate the data into a report and a geologic map of the area studied. The geologic map represents a synthesis of their undergraduate experience because a satisfactory map contains information about the entire history of an area and shows how various geologic processes interact (e.g. rock type and kind of deformation; fossil assemblage and sedimentary history).

Using feedback detailed in the Department's 2001-2002 annual report, the Department is currently applying the results of the assessment to make substantive changes to improve certain courses.

The first group of students to go through the new and improved courses will be evaluated with the Department's rubric. This will occur at the end of summer 2003. This will enable the Department to compare before and after results to determine if implemented program changes have any effect(s).

Assessment of Student Learning
Department of Mathematical Sciences
Indiana University-Purdue University Indianapolis

Report for the Academic Year 2002-2003

Prepared by Robert Rigdon, Ph.D.
May 2003

As outlined in previous reports, the Department of Mathematical Sciences has in place ongoing assessment procedures for several courses.

Assessment procedures for service courses: MATH 111, M118, 163

These courses include a developmental course (111), a service course (M118) that is taken by a wide cross-section of students, and an introductory major's course (163) that is also taken by students in disciplines that require a considerable level of mathematical sophistication.

The assessment process for these three courses entails identifying Student Learning Course-Specific Outcomes for these courses. Data on each exam in these courses is collected and analyzed as follows. Problems are assigned to one or more of the course-specific outcomes for the given course. In this way, a score is determined on each exam for each student on each of the above outcomes. Aggregate class scores on the different outcomes can then be compared across sections and at different times of the semester providing feedback on the effectiveness of the instruction given. This information can be passed on to instructors and mentors so that they can increase emphasis on those topics that prove to be most problematical. Also, instructors and course coordinators can develop more consistent ways of presenting this material. For example, we have been able to identify:

Topics that give students the most trouble;
Topics for which there is an appreciable gap between students' performance during the semester and their performance on the final;
Topics that produce the greatest variation in performance from student to student;
Topics that produce the greatest variation in performance from section to section.

Assessment procedures for upper division major courses: MATH 351 and 492

Math 351 is a course in which the student acquires several skills that are required for success in upper-division courses in the major. We have developed an assessment form for this course in which a course instructor indicates the extent to which the math majors in his or her section have mastered these skills. However,

we are using these forms to determine areas of strength and weakness of individual students so that they can be advised of the areas that require strengthening.

Math 492 is the capstone experience. The questions asked on the 492 assessment form essentially assess attainment of the six IUPUI Principles of Undergraduate Learning (PUL) objectives while also assessing achievement of the discipline specific goals. The form is based on the template developed by the School of Science Teaching and Learning Committee. We are using this form to both assess how well the capstone experience is serving its intended purpose (requiring that students demonstrate growth in all the PUL's, and in discipline-specific outcome goals) and an assessment tool to assess how well our programs are achieving their goals. Results so far indicate that the projects are, as intended, requiring the students to display a variety of both quantitative and communication skills. We are planning to institute some kind of common experience for students in their capstone experience. Although students will continue to work on individual projects, we would like to get them together to present their projects to each other, so that they can benefit from each other's experience and gain additional experience in communication.

Assessment procedures for other courses

Student evaluations of instructors and courses: The Department has its own evaluation forms specifically designed for math courses.

Peer review of instructors: Periodically, a class of each math instructor is visited by another faculty member, who critiques the instructor's presentation.

Comparison of student performance in different sections on departmental exams: There are departmental exams for the courses with the highest enrollment.

Assessment of Student Learning
Department of Psychology
Indiana University-Purdue University Indianapolis

Report for the Academic Year 2002-2003

Prepared by Drew C. Appleby, Ph.D.
Director of Undergraduate Studies in Psychology
June 1, 2003

This report will be organized according to the answers to the following six questions.

A. How does the IUPUI Psychology Department want its students to change as a result of successfully completing its undergraduate program?
B. What methods did the Department use to assess how successfully its students accomplished these changes?
C. What were the results of these methods?
D. What has the Department learned from these results?
E. What has the Department concluded from these results?
F. What modifications in the Department have been made on the basis of these results?
G. What have been the impacts of these modifications on the Department and its students?
H. What are future plans for assessment in the department?

A. How does the IUPUI Psychology Department want its students to change as a result of successfully completing its undergraduate program?
   1. The American Psychological Association is in the process of creating a set of student learning outcomes (i.e., specific types of knowledge and skills) for undergraduate psychology programs. The Department's Undergraduate Committee has used the most recent draft of this document to construct a new set of student learning outcomes (SLOs) for the Department.
   2. This document will be presented to the psychology faculty next fall for their endorsement.

B. What methods did the department use to assess how successfully its students accomplished these changes?
   (The department is in the initial stages of assessing its SLOs, and the methods described below do not correspond directly with the department's new set of SLOs because of the recency of their existence.)
   1. Methods used.
      a. The School of Science (SOS) Senior Assessment Project
         1) The Senior Assessment Project is a package of four surveys that graduating SOS students are asked to complete and return. This package contains a written senior reflection on IUPUI's six Principles of Undergraduate Learning (PULs), a

graduating student survey, a mentoring faculty survey, and an academic advisor survey.

2) This assessment package is administered each year to potential SOS graduates, who are informed of its existence through the Candidate course (CAND 991) for which they must register during the semester prior to their graduation. In order to receive this instrument, seniors must report to the SOS Office (LD 222) by October 1. The materials in this package are to be completed and returned to the Dean's Office by March 1 for May/August graduates and November 1 for December graduates.
3) Data from the written senior reflections on the PULs and the graduating senior survey are collected to provide the SOS and its seven constituent departments with information that can be used to increase the effectiveness of their programs.
4) The resources necessary to compile, organize, and summarize these data have not existed in the SOS in the past and, therefore, a reporting of these data in a useable fashion (i.e., collated, organized, and summarized) to SOS and its constituent departments has not been done. Drew Appleby's B454 *Capstone Seminar in Psychology* class undertook the responsibility of compiling, organizing, and summarizing these data as part of the course work in this class. This project was approved and monitored by Joseph Kuczkowski, Associate Dean for Academic Programs and Student Development in the SOS, and the class presented him with the final report. One of the major purposes of the creation of this report is to provide these resources to the SOS. This report is composed of the following sections.
    a) The purposes of this report and the process used to create it.
    b) The nature, purpose, and administration of the SOS Senior Assessment Project.
    c) A set of suggestions from the assessment team to improve the instruments that comprise the Senior Assessment Project and the administration of these instruments.
    d) Individual reports for each of the seven SOS academic departments—and a report for the SOS summarizing the data for its seven departments—that summarize the following data collected from their 2002 graduates with the assessment project:
        - Their personal demographics;
        - Their academic demographics;
        - Their ratings of how well they have attained a set of 10 academic skills;
        - Their ratings of how satisfied they have been with 17 aspects of IUPUI;
        - Their reflections on their experiences with IUPUI's six PULs;
        - Their suggestions for the SOS to better serve its students in the future;
        - Appendices containing supporting materials.

b. The School of Science Capstone Template

The SOS Teaching and Learning Committee created a capstone assessment template that is completed by all SOS capstone instructors for each of their students. This template allows instructors to rate their students on a variety of dimensions related to the Principles of Undergraduate Learning (e.g., their ability to communicate, apply knowledge, solve problems, and utilize technology) and to the field of science in

particular (e.g., shows understanding of the scientific method, makes efficient use of scientific resources, shows knowledge of contemporary issues in science in their relation to society).

C. What were the results of these methods?
   1. The School of Science Senior Assessment Project
      a. When seniors were asked to rate themselves on a 1-5 scale of ability (1 = poor and 5 = excellent), they gave themselves high ratings (4.13 or above) on the following:
         1) Reading and understanding;
         2) Writing clearly and effectively;
         3) Speaking clearly and effectively;
         4) Working as a team;
         5) Thinking critically;
         6) Finding new ways to use skills;
         7) Having a general understanding of fields other than psychology;
         8) Having an in-depth understanding of psychology;
         9) Communicating effectively.
      b. Their average rating of their ability to use technology efficiently was below 4.00.
   2. The School of Science Capstone Template
      a. Over 90% of our graduating seniors appear to be:
         1) Skillful problems solvers;
         2) Proficient users of scientific resources, such as journals.
      b. Over 80% of our graduating seniors appear to:
         1) Make use of technological tools;
         2) Show understanding of the scientific method;
         3) Be able to communicate ideas about psychology in writing.
      c. Over 70% of our graduating seniors:
         1) Display overall comprehension of own discipline;
         2) Show knowledge of contemporary issues in science and their relation to society;
         3) Can apply knowledge from one area of own discipline to another area.
      d. Over 60% of our graduating seniors:
         1) Show ability to communicate ideas of discipline orally.
      e. Over 40% of our graduating seniors:
         1) Give experience in applying knowledge from own discipline to other disciplines;
         2) Display appreciation of the historical development of (an area of) the discipline.

D. What has the department learned from these results?
   1. The School of Science Senior Assessment Project
      The Department's graduating seniors are confident of the vast majority of their skills, with the exception of their ability to use technology effectively.
   2. The School of Science Capstone Template
      a. Taking 70% as a level of acceptability, it appears that our graduating seniors can be described as:
         1) Skillful problem solvers;
         2) Proficient users of scientific resources and technological tools;
         3) Having a strong grasp of the scientific method;

4) Good writers;
5) Possessing a satisfactory comprehension of psychology;
6) Knowledgeable of current issues in science in relation to society;
7) Able to apply knowledge from one area of psychology to another.

b. However, our graduating seniors fall short in their ability to:
1) Communicate orally;
2) Apply knowledge from psychology to other disciplines;
3) Display an appreciation of the history of psychology.

E. What has the Department concluded from these results?

1. The School of Science Senior Assessment Project
It appears that students who are finishing our program are confident of the vast majority of skills they have obtained during their undergraduate careers with one exception, which is their ability to use technology effectively.
2. The School of Science Capstone Template
a. It appears that students who are finishing our program do so in a relatively skillful and knowledgeable manner.
b. Two items on which our students scored relatively low are not a particular concern for the Department (applying knowledge from psychology to other disciplines and appreciating the history of psychology) because applying psychological knowledge to other disciplines is not an objective of our capstone laboratory classes and the Department does not offer a course in the history of psychology.
c. One concern that emerged from these results is that our seniors are not particularly skilled in oral communication.
3. Comparing these results of these two assessment measures leads me believe that graduating seniors and the faculty who teach them in senior capstone courses agree that seniors have developed a strong repertoire of skills during their undergraduate careers, but these two groups disagree on two of these skills.
a. The students are confident of their speaking ability, but their faculty are not.
b. The faculty are confident of students' technological skills, but their students are not.

F. What modifications in the Department have been made on the basis of these results?
These results will be brought to the attention of the Undergraduate Committee next fall. It will be up to that Committee to decide if these data are sufficiently compelling to warrant any modifications.

G. What have been the impacts of these modifications on the Department and its students?
There have been no modifications.

H. What are future plans for assessment in the Department?
The Assessment Subcommittee of the Undergraduate Committee has proposed the creation of a senior exit exam that would assess seniors' knowledge of the contents of psychology. The first proposal for this exam was approved for a $2,000 IUPUI Program Review and Assessment Committee grant, but was rejected by the Department faculty. A second proposal has been met with more enthusiasm by the Department faculty, but it still a great distance from completion and approval.