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

2006-2007 Progress Report
for the Six-Stage Assessment Strategy

Submitted Patricia Clark, Ph.D., Trustee's Lecturer
(Edited by Joseph L. Thompson)
June 2008

Introduction
The IUPUI School of Science Assessment Committee endorsed the following six-stage plan in 2005 to assess the academic programs of its eight undergraduate programs (Biology, Chemistry, Computer Science, Earth Science, Forensic Science, Mathematics, Physics, and Psychology).

Stage 1 → Identify the program's student learning outcomes (SLOs).
Stage 2 → Link these SLOs to specific components of the program's curriculum.
Stage 3 → Identify or create methods to measure these SLOs.
Stage 4 → Collect data to determine if the SLOs are being accomplished successfully.
Stage 5 → Use the data collected in Stage 4 to make curricular changes.
Stage 6 → Repeat Stage 4 to determine if the curricular changes were effective.

These stages are comparable to the following stages in the Planning for Learning and Assessment table that has been approved and distributed by IUPUI's Program Review and Assessment Committee,

1. What general outcome are you seeking?
2. How would you know it (the outcome) if you saw it? (What will the student know or be able to do?)
3. How will you help students learn it? (in class or out of class)
4. How could you measure each of the desired behaviors listed in #2?
5. What are the assessment findings?
6. What improvements have been made based on assessment findings?

Current State of Assessment in the IUPUI Department of Biology Undergraduate Program

The Biology Department had previously accomplished the first two stages of the School of Science's strategies and initiated the third stage. However, revision of stage 2 was deemed necessary in order to include additional courses, new instructors, and to update methods of assessment utilized in courses. This revision of stage 2 will allow us to reassess and complete the work previously begun on the third stage.

Stage 1 → Identification of the Department's Student Learning Outcomes (SLOs)

The Department of Biology has historically had a Departmental set of SLOs in place. These include:

A. Basic knowledge: "Biology graduates will have an understanding of fundamental concepts from each of the biological areas listed below, as well as the relationships among them, i.e. the continuum from the ecosystem to the molecular level. This does not imply that the student will be equally well versed in all areas, because the individual's interest in a particular part of Biology is expected to drive him or her to greater achievement in an area."

1) ***Molecular Biology****:* how biomolecules carry out functions, control processes, and dictate inheritance

a) Structure of nucleic acids, proteins, lipids, and carbohydrates
b) Synthesis and metabolism of biomolecules, e.g. cellular respiration, DNA replication, mRNA transcription, protein synthesis and modification
c) Functions of biomolecules, e.g. DNA replication and recombination in the inheritance of genetic traits, roles of cholesterol and phospholipids in biological membranes

2) ***Cell and Developmental Biology:*** cell structure and function; mechanisms regulating the development of multicellular organisms

a) Cell membranes and receptors
b) Cytoplasmic structure and function
c) Nuclear structure and function
d) Extracellular matrix synthesis, structure, and function
e) Cell responses to external signals, e.g. hormones, antigens, or growth factors
f) Intracellular signaling pathways
g) Metabolic pathways
h) Gamete formation and fertilization
i) Cell division: mitosis and meiosis
j) Cell differentiation, pattern formation, and morphogenesis

3) ***Physiology:*** how tissues, organs, and systems within an organism operate and interact in order to maintain short-term homeostasis of the individual and long-term survival of the species

a) Knowledge of animal and plant physiological systems, their interactions, and their control

b) Acclimation and adaptation of these systems to different physiological conditions, e.g. heat stress vs. cold stress, iso-osmotic vs. hypo-osmotic/hyper-osmotic environments

4) ***Ecology:*** how organisms interact with each other and their physical environment

a) The growth of populations and the mathematical models that describe population growth dynamics
b) The organization of populations of multiple species into communities and levels of emergent characteristics
c) Characteristics and dynamics of ecosystems and the evolutionary future of the biosphere

5) ***Evolution:*** how the incredible diversity of life on earth has evolved over the course of several billion years

a) Origin of organic molecules and the evolution of life
b) Evolution of cellular organization
c) Evolution of functionally specific biomolecules for carrying out processes of heredity, growth and development, and homeostasis
d) Mechanisms of evolution including natural selection
e) The effect of evolution on allelic frequencies
f) Microevolution of species and its relationship to organism survival and diversification as a function of adaptation
g) Variability of evolutionary rates

B. Applied skills

1) ***Application of scientific method***

Biology graduates will understand the theory of, and be able to apply the scientific method in a Biology setting. For this purpose, the scientific method is defined as:

a) Making an observation about a poorly understood phenomenon and researching available related information from textbooks, journals, and databases
b) Forming an hypothesis (a testable statement explaining the observation)
c) Designing an experiment to test the hypothesis
d) Analyzing and interpreting experimental data, and forming conclusions about accepting or rejecting the hypothesis
e) Retesting the hypothesis if necessary, so as to reinforce the conclusions
f) Publication of results and/or oral presentation of the results and ideas through appropriate vehicles of communication

2) ***Biotechnology***

Biology graduates will be competent in selected techniques and equipment commonly used in field and laboratory studies. The following are examples, but the list is expected to change with the advent of new technologies:

a) Microscopy
b) Culture growth of selected organisms, e.g. bacteria, fruit flies
c) Dissection
d) Enzyme assays

e) Biological staining techniques
f) Separation procedures for biological molecules, e.g. gel electrophoresis of protein or DNA, ultracentrifugation
g) Aseptic technique

Stage 2 → Link These SLOs to Specific Components of the Department's Curriculum

Faculty members in the Biology Department were asked to identify the SLOs addressed in individual courses and indicate the level of presentation of each SLO. The analysis of this information was then used by the Department to determine where each SLO was being taught in the curriculum and at what level students were expected to understand the concept addressed in each SLO.

Faculty members were asked the following questions:

1) Is this topic specifically addressed in your course?
2) If addressed, how do you determine whether students understand the concept?
   EX: Exam questions: multiple choice, fill in the blank, true/false or other forms
   ES: Exam questions: essay or short answer
   Q: Quizzes
   W: Writing assignment (lab report, research paper)
   L: Laboratory exercise
   P: Presentation to class
   IC: In-class activity (group or individual): lecture activity or recitation of lecture
   O: Other (please list)

The results of this curriculum audit are given in **Appendix A**.

Stage 3 → Identify or Create Methods to Measure These SLOs

As part of a BIOL K493 Research Project, Dr. Marrs and undergraduate student Winta Haile developed a senior Biology major exit survey. This survey simply reproduced the Biology Department's SLOs in the form of a user-friendly "Survey Monkey" designed for student use. Students were able to select whether they had experienced each of the SLOs in their classes and at what 'level' they felt they understood this topic, based on a Lickert scale. The link for this survey was sent to all prospective May 2007 and August 2007 graduating Biology majors, and over 125 student responses were generated. One interesting finding is that while Biology faculty place a high emphasis on research and applied skills, students did not feel like they received emphasis on this in their undergraduate curriculum.

In the future, the Department would like students completing a similar but more refined survey to be able to provide written feedback on the SLOs they experienced - for example, identifying particular classes or assignments that helped them to accomplish certain SLOs and to provide feedback to the Department that would help future biology majors to accomplish the SLOs that they indicated they had not successfully accomplished. These data would provide the Department with information to answer the following questions.

1) Do Biology majors perceive an assignment or course as helpful with regards to achieving the department's SLOs identified within the course?
2) How does the student's assessment of an assignment compare to the faculty member's expectations of mastery of SLOs in their course?
3) How could the Biology Department curriculum be examined or revised in light of these perceptions and potential differences?
4) Could the disparity between student and faculty perceptions of the SLOs and student suggestions be used to improve the Biology curriculum in ways that would increase student identification and achievement of SLOs?

The answers to these questions could be used to fine tune the Department of Biology's SLOs and improve the curriculum to be more effective.

Appendix A	K101 Biology I	K103 Biology II	K322 Genetics	K323 Genetics Lab	K324 Cell Biology	K325 Cell Biology Lab	K331 Embryology	K333 Embryology Lab
I. Biological Concepts								
1) *Molecular Biology*: how biomolecules carry out functions, control processes, and dictate inheritance								
a) Structure of nucleic acids, proteins, lipids, and carbohydrates	EX, Q, L, I		EX, P	ES	EX, ES	EX, ES, L		
b) Synthesis and metabolism of biomolecules, e.g. DNA replication, mRNA transcription, proteins	EX, Q, L, I		EX, P	ES, L	EX, ES	EX, ES, L		
c) Functions of biomolecules, e.g. DNA replication and recombination in the inheritance of genetic traits, roles of cholesterol and phospholipids in biomembrane	EX, Q, W, L, I	EX	EX, P	ES, L, W	EX, ES	EX, ES, L	EX, ES	
2) *Cell and Developmental Biology:* cell structure and function; mechanisms regulating the development of multicellular organisms		EX, Q, L	EX, P				EX, ES	
a) Cell membranes and receptors	EX, Q, L, I	EX, Q				EX, ES, L	EX, ES	EX, W, L
b) Cytoplasmic structure and function	EX			ES, L			EX	EX, W, L
c) Nuclear structure and function	EX, Q,		EX, P	ES, L		EX, ES, L		
d) Extracellular matrix synthesis, structure, and function	EX						EX, ES	EX, W, L
e) Cell responses to external signals, e.g. hormones, antigens, or growth factors	EX, Q, W, L, I	EX, Q, P	EX, P		EX, ES	EX, ES, L	EX, ES	EX, W, L
f) Intracellular signaling pathways	EX, Q	EX, Q, P	EX, P		EX, ES	EX, ES, L	EX	
g) Metabolic pathways	EX, Q, L, I	EX, Q, P	EX, P	ES, L	EX, ES		EX	
h) Gamete formation and fertilization	EX, Q, L, I	EX, Q	EX, P	ES, L	EX, ES		EX, ES	
i) Cell division: mitosis and meiosis	EX, Q, L, I	EX, Q	EX, P		EX, ES	EX, ES, L	EX	
j) Cell differentiation, pattern formation, and morphogenesis		EX, Q			EX, ES		EX, ES	EX, W, L

	K101 Biology I	K103 Biology II	K322 Genetics	K323 Genetics Lab	K324 Cell Biology	K325 Cell Biology Lab	K331 Embryology	K333 Embryology Lab
3) *Physiology*: how systems within an organism operate and interact to maintain short-term homeostasis of the individual and long term survival of the species								
a) Knowledge of animal and plant physiological systems, their interactions and control	EX, Q, L, I	EX, Q, L, I			EX, ES	L		
b) Acclimation and adaptation of these systems to different physiological conditions, e.g. heat stress vs. cold stress, iso-osmotic vs. hypo-osmotic/hyper-osmotic environment	EX, Q, L, I				EX, ES	L		
4) *Ecology:* how organisms interact with each other and their physical environment								
a) The growth of populations and the mathematical models which describe that behavior								
b) The organization of species population into communities and levels of emergent characteristics		EX, Q						
c) Ecosystems dynamics and the evolutionary future of the biosphere								
5) *Evolution*: how the incredible diversity of life on earth has evolved over the course of several billion years		EX, Q						
a) Origin of organic molecules and the evolution of life	EX	EX, Q						
b) Mechanisms of natural selection and their effect on gene frequencies		EX, Q						
c) Evolution of cellular organization		EX, Q	EX, P		EX, ES			
d) Evolution of functionally specific biomolecules for carrying out processes of heredity, growth and development, and homeostasis					EX, ES		EX	
e) Microevolution: organism survival and diversification as a function of adaptation		EX, Q						
f) Variability of evolutionary rates								

	K101 Biology I	K103 Biology II	K322 Genetics	K323 Genetics Lab	K324 Cell Biology	K325 Cell Biology Lab	K331 Embryology	K333 Embryology Lab
II. Applied skills								
1) *Application of Scientific Method:* Biology graduates will understand the theory of, and be able to apply, the scientific method in a Biology setting. For this purpose, the scientific method is defined as:								
a) Making an observation about a poorly understood phenomenon and researching available related information from textbooks, journals, databases	L, Q, I,							EX, W, L
b) Forming an hypothesis (a testable statement explaining the observation	L, Q			L, W	EX, ES		ES	EX, W, L
c) Designing an experiment to test the hypothesis	L, Q				EX, ES			
d) Analyzing and interpreting experimental data, and forming conclusions about accepting or rejecting the hypothesis	EX			ES, W, L	EX, ES	ES, L	EX, ES	EX, W, L
e) Retesting the hypothesis, if necessary, so as to reinforce the conclusions								
2) Biotechnology: Biology graduates will be competent in selected techniques and equipment commonly used in field and laboratory studies. The following are examples, but the list may change with the advent of new technologies								
a) Microscopy	EX, Q, L	EX, Q, L		L	EX, ES	ES, L		
b) Culture growth of selected organisms, e.g. bacteria, fruit flies	EX, Q, L			L	EX, ES			
c) Dissection		EX, Q, L		L	EX, ES	L		
d) Enzyme assays	EX, Q, L			L	EX, ES	EX, ES, L		L
e) Biological staining techniques	L			L	EX, ES	EX, ES, L		L
f) Separation procedures for biological molecules, e.g. gel electrophoresis of protein or DNA, ultracentrifugation	EX, Q, L			L, ES	EX, ES	EX, ES, L		
g) Aseptic technique	L			L	EX, ES			L

	K332 Plant Growth & Development	K338 Immunology	K339 Immunology Lab	K341 Ecology & Evolution	K342 Ecology & Evo. Lab	K350 Comparative Animal Phys	K356 Microbiology	K357 Microbiology Lab
I. Biological Concepts								
1) *Molecular Biology*: how biomolecules carry out functions, control processes, and dictate inheritance								
a) Structure of nucleic acids, proteins, lipids, and carbohydrates	EX, ES	EX, ES	EX, W, L				EX, ES	
b) Synthesis and metabolism of biomolecules, e.g. DNA replication, mRNA transcription, proteins	EX, ES	EX, ES	EX, W, L				EX, ES	
c) Functions of biomolecules, e.g. DNA replication and recombination in the inheritance of genetic traits, roles of cholesterol and phospholipids in biomembrane	EX, ES	EX, ES	EX, W, L			EX, ES	EX, ES	
2) *Cell and Developmental Biology:* cell structure and function; mechanisms regulating the development of multicellular organisms								
a) Cell membranes and receptors		EX, ES	EX, W, L			EX, ES		
b) Cytoplasmic structure and function							EX, ES	
c) Nuclear structure and function		EX, ES	EX, W, L			EX, ES		
d) Extracellular matrix synthesis, structure, and function		EX, ES	EX, W, L					
e) Cell responses to external signals, e.g. hormones, antigens, or growth factors	EX, ES	EX, ES	EX, W, L					
f) Intracellular signaling pathways	EX, ES	EX, ES	EX, W, L					
g) Metabolic pathways	EX, ES						ES	
h) Gamete formation and fertilization	EX, ES							
i) Cell division: mitosis and meiosis	EX, ES							
j) Cell differentiation, pattern formation, and morphogenesis	EX, ES							

	K332 Plant Growth & Development	K338 Immunology	K339 Immunology Lab	K341 Ecology & Evolution	K342 Ecology & Evo. Lab	K350 Comparative Animal Phys	K356 Microbiology	K357 Microbiology Lab
3) *Physiology*: how systems within an organism operate and interact to maintain short-term homeostasis of the individual and long term survival of the species								
a) Knowledge of animal and plant physiological systems, their interactions and control	EX, ES			EX	EX, ES	EX, ES		
b) Acclimation and adaptation of these systems to different physiological conditions, e.g. heat stress vs. cold stress, iso-osmotic vs. hypo-osmotic/hyper-osmotic environment	EX, ES			ES	ES	EX, ES		
4) *Ecology:* how organisms interact with each other and their physical environment								
a) The growth of populations and the mathematical models which describe that behavior				ES	EX, ES, W, L, P			
b) The organization of species population into communities and levels of emergent characteristics				EX	EX, ES, W, L, P			
c) Ecosystems dynamics and the evolutionary future of the biosphere				ES	EX, ES, W, L, P			
5) *Evolution*: how the incredible diversity of life on earth has evolved over the course of several billion years								
a) Origin of organic molecules and the evolution of life				EX, ES	EX			
b) Mechanisms of natural selection and their effect on gene frequencies				ES	EX, ES, W, L, P		EX, ES	
c) Evolution of cellular organization				EX				
d) Evolution of functionally specific biomolecules for carrying out processes of heredity, growth and development, and homeostasis				ES	EX, ES, W, L, P			
e) Microevolution: organism survival and diversification as a function of adaptation					EX, ES, W, L, P			
f) Variability of evolutionary rates					EX, ES, W, L, P			

	K332 Plant Growth & Development	K338 Immunology	K339 Immunology Lab	K341 Ecology & Evolution	K342 Ecology & Evo. Lab	K350 Comparative Animal Phys	K356 Microbiology	K357 Microbiology Lab
II. Applied skills								
1) *Application of Scientific Method:* Biology graduates will understand the theory of, and be able to apply, the scientific method in a Biology setting. For this purpose, the scientific method is defined as:								
a) Making an observation about a poorly understood phenomenon and researching available related information from textbooks, journals, databases					W, L, P			
b) Forming an hypothesis (a testable statement explaining the observation				EX	EX, ES, W, L, P			
c) Designing an experiment to test the hypothesis				ES	EX, ES		EX, ES	
d) Analyzing and interpreting experimental data, and forming conclusions about accepting or rejecting the hypothesis					EX, ES, W, L, P		EX, ES	
e) Retesting the hypothesis, if necessary, so as to reinforce the conclusions					EX, ES, W, L, P			
2) Biotechnology: Biology graduates will be competent in selected techniques and equipment commonly used in field and laboratory studies. The following are examples, but the list may change with the advent of new technologies								
a) Microscopy					L		ES, L	
b) Culture growth of selected organisms, e.g. bacteria, fruit flies							ES, L	
c) Dissection								
d) Enzyme assays							ES, L	
e) Biological staining techniques							ES, L	
f) Separation procedures for biological molecules, e.g. gel electrophoresis of protein or DNA, ultracentrifugation								
g) Aseptic technique							ES, L	

	K483 Biological Chemistry	K484 Cellular Biochemistry	K490 Capstone: Dependent upon Faculty Sponsor W expected	K493 Independent Research: Dependent upon Faculty Sponsor W, L, P expected	K494 Sr Research Thesis: Dependent upon Faculty Sponsor W, L, P expected
I. Biological Concepts					
1) *Molecular Biology*: how biomolecules carry out functions, control processes, and dictate inheritance					
a) Structure of nucleic acids, proteins, lipids, and carbohydrates	EX, ES	EX, ES			
b) Synthesis and metabolism of biomolecules, e.g. DNA replication, mRNA transcription, proteins	EX, ES	EX, ES			
c) Functions of biomolecules, e.g. DNA replication and recombination in the inheritance of genetic traits, roles of cholesterol and phospholipids in biomembrane	EX, ES	EX, ES			
2) *Cell and Developmental Biology:* cell structure and function; mechanisms regulating the development of multicellular organisms					
a) Cell membranes and receptors					
b) Cytoplasmic structure and function					
c) Nuclear structure and function					
d) Extracellular matrix synthesis, structure, and function					
e) Cell responses to external signals, e.g. hormones, antigens, or growth factors					
f) Intracellular signaling pathways					
g) Metabolic pathways					
h) Gamete formation and fertilization					
i) Cell division: mitosis and meiosis					
j) Cell differentiation, pattern formation, and morphogenesis					

	K483 Biological Chemistry	K484 Cellular Biochemistry	K490 Capstone: Dependent upon Faculty Sponsor W expected	K493 Independent Research: Dependent upon Faculty Sponsor W, L, P expected	K494 Sr Research Thesis: Dependent upon Faculty Sponsor W, L, P expected
3) *Physiology*: how systems within an organism operate and interact to maintain short-term homeostasis of the individual and long term survival of the species					
a) Knowledge of animal and plant physiological systems, their interactions and control					
b) Acclimation and adaptation of these systems to different physiological conditions, e.g. heat stress vs. cold stress, iso-osmotic vs. hypo-osmotic/hyper-osmotic environment					
4) *Ecology:* how organisms interact with each other and their physical environment					
a) The growth of populations and the mathematical models which describe that behavior					
b) The organization of species population into communities and levels of emergent characteristics					
c) Ecosystems dynamics and the evolutionary future of the biosphere					
5) *Evolution*: how the incredible diversity of life on earth has evolved over the course of several billion years					
a) Origin of organic molecules and the evolution of life					
b) Mechanisms of natural selection and their effect on gene frequencies					
c) Evolution of cellular organization					
d) Evolution of functionally specific biomolecules for carrying out processes of heredity, growth and development, and homeostasis					
e) Microevolution: organism survival and diversification as a function of adaptation					
f) Variability of evolutionary rates					

	K483 Biological Chemistry	K484 Cellular Biochemistry	K490 Capstone: Dependent upon Faculty Sponsor W expected	K493 Independent Research: Dependent upon Faculty Sponsor W, L, P expected	K494 Sr Research Thesis: Dependent upon Faculty Sponsor W, L, P expected
II. Applied skills					
1) *Application of Scientific Method:* Biology graduates will understand the theory of, and be able to apply, the scientific method in a Biology setting. For this purpose, the scientific method is defined as:					
a) Making an observation about a poorly understood phenomenon and researching available related information from textbooks, journals, databases					
b) Forming an hypothesis (a testable statement explaining the observation					
c) Designing an experiment to test the hypothesis					
d) Analyzing and interpreting experimental data, and forming conclusions about accepting or rejecting the hypothesis					
e) Retesting the hypothesis, if necessary, so as to reinforce the conclusions					
2) Biotechnology: Biology graduates will be competent in selected techniques and equipment commonly used in field and laboratory studies. The following are examples, but the list may change with the advent of new technologies					
a) Microscopy					
b) Culture growth of selected organisms, e.g. bacteria, fruit flies					
c) Dissection					
d) Enzyme assays					
e) Biological staining techniques					
f) Separation procedures for biological molecules, e.g. gel electrophoresis of protein or DNA, ultracentrifugation					
g) Aseptic technique					

Assessment of Student Learning
Department of Chemistry and Chemical Biology
Indiana University-Purdue University Indianapolis

2007-2008 Progress Report
for the Six-Stage Assessment Strategy

Submitted by John V. Goodpaster, Ph.D.
(Edited by Joseph L. Thompson)
June 2008

Introduction
The IUPUI School of Science Assessment Committee endorsed the following six-stage plan in 2005 to assess the academic programs of its eight undergraduate programs (Biology, Chemistry, Computer science, Earth Science, Forensic and Investigative Sciences, Mathematics, Physics, and Psychology).

Stage 1 → Identify the program's student learning outcomes (SLOs).
Stage 2 → Link these SLOs to specific components of the program's curriculum.
Stage 3 → Identify or create methods to measure these SLOs.
Stage 4 → Collect data to determine if the SLOs are being accomplished successfully.
Stage 5 → Use the data collected in Stage 4 to make curricular changes.
Stage 6 → Repeat Stage 4 to determine if the curricular changes were effective.

These stages are comparable to the following stages in the Planning for Learning and Assessment table that has been approved and distributed by IUPUI's Program Review and Assessment Committee,

1. What general outcome are you seeking?
2. How would you know it (the outcome) if you saw it? (What will the student know or be able to do?)
3. How will you help students learn it? (in class or out of class)
4. How could you measure each of the desired behaviors listed in #2?
5. What are the assessment findings?
6. What improvements have been made based on assessment findings?

Current State of Assessment in the Department of Chemistry and Chemical Biology

Stage 1 → Identify the Department's Student Learning Outcomes (SLOs)

Based on prior efforts in the Department to codify the key knowledge, skills and abilities to be possessed by our graduates, the following SLOs were devised and approved by the department:

Proficiencies for Introductory Chemistry

- Properties of matter and their molecular basis
- Theories of composition, structure, and bonding of matter
- Composition and reaction stoichiometry
- Energetic and kinetic basis of chemical reactivity
- Chemical equilibrium and its applications
- Nuclear decays and their kinetics
- Basic laboratory practice and techniques

Proficiencies for Analytical Chemistry/Instrumentation

- Have the requisite laboratory skills for making quantitative measurements
- Understand the concept of reliability of quantitative measurements, and relevant statistical methods
- Know how to objectively and correctly evaluate the reliability of one's own data
- Be able to apply principles of chemical equilibria taught in General Chemistry to the solution of higher-level problems of solubility, potentiometry, and ionic activity
- Be familiar with the basic electronic and optics underpinnings of instrumentation
- Understand fundamental principles of chromatography, spectroscopy and electrochemistry as applied to the solution of analytical problems
- Be proficient with instrumentation commonly utilized for identification and quantization tasks in academic, industrial and clinical laboratories
- Have knowledge of modern concepts in analytical chemistry including proteomics, biosensors, metabolomics, etc.
- Demonstrate effective written communication skills needed for professional documentation and reporting of analytical studies

Proficiencies for Biological Chemistry/Biochemistry

- Be able to apply principles from other disciplines of chemistry to biomolecules
- Understand the structure of proteins, nucleic acids, lipids, and other complex biomolecules including their three dimensional conformations, organization, and stabilizing interactions
- Understand the function of proteins, nucleic acid and lipids
- Be able to use appropriate mathematical equations to characterize ligand binding and catalysis
- Understand how structure and function are related on 4 levels: proteins and nucleic acids, organelles, cells, and multicellular organisms

- Understand the inter-relatedness of biological processes and systems including details of cellular energy production and storage, precursor synthesis, catabolism, and signaling
- Understand the dependence of biological/biochemical processes on the fundamental laws of physics and chemistry that govern them
- Understand the methodologies appropriate for purification, separation, and structural and functional characterization of biomolecules
- Understand the evolution of living systems, their interconnection with the evolution of their environment, and how such studies further the understanding of the biological systems/processes themselves

Proficiencies for Inorganic Chemistry

- Understand principles of electronic and molecular structure of inorganic and coordination compounds
- Understand principles of chemical bonding in inorganic and coordination compounds
- Understand the principles of symmetry and group theory as they apply to inorganic compounds
- Understand structural and compositional basis for properties and reactivities of inorganic compounds in the solid state, in the gas state and in solution
- Understand the principles of acid/base, oxidation/reduction, and coordination reactions as they apply to inorganic compounds
- Understand the molecular basis of electronic and vibrational spectroscopic properties of inorganic compounds
- Understand the systematic chemistry of transition element compounds
- Know how to synthesize and characterize a representative selection of main group and transition element compounds
- Know how to carry out and interpret a representative selection of physical measurements inorganic compounds

Proficiencies for Organic Chemistry

- Understand the principles of valence bond, molecular orbital, hybridization theories
- Recognize and perform transformations between key functional groups
- Identify stereochemistry and three-dimensionality in organic molecules
- Understand the kinetic and thermodynamic principles of organic reactions
- Understand, recognize and apply the following reaction types: substitution, addition, elimination, rearrangement
- Predict the direction of acid-base chemistry, identify nucleophilic and electrophilic centers
- Understand and apply “arrow pushing” to one and two electron movement
- Identify organic molecules by spectroscopic analysis
- Understand the bonding and reactions of aromatic and conjugated systems
- Understand the properties and use of simple organometallic molecules in organic synthesis
- Develop a multistep synthesis of organic molecules
- Understand the structure and reactions of selected biomolecules
- Demonstrate proficiency in informatics, including retrieval and use of information for molecules and reactions
- Demonstrate proficiency in basic laboratory techniques, including preparation, separation, purification, and characterization of organic molecules

Proficiencies for Physical Chemistry

- Understand the principals of thermodynamics including the first and second laws and the meaning and calculation of various thermodynamic parameters
- Understand principles of kinetic molecular theory which are used to explain the properties of gases, liquids and solids
- Understand principles of quantum mechanics and its application to atomic structure, chemical bonding and molecular structure
- Understand principles of statistical mechanics and its application to chemical systems
- Comprehend principles of reaction rate theory and its application to chemical mechanisms and reaction rates
- Understand principles of electrochemistry in regard to electrode and electrochemical processes
- Know principles of transport processes
- Comprehend principles of spectroscopy and apply them to determine molecular structure
- Perceive the properties of macroscopic and microscopic structures including: surfaces, macromolecules and electric and magnetic properties of molecules
- Be able to derive physical chemical mathematical equations from fundamental chemical principles
- Be able to apply knowledge to solve physical chemical problems
- Demonstrate competence in using methods of analysis
- Understand the physical and spectroscopic techniques needed to characterize the macroscopic and microscopic behavior of atoms and molecules

Plans to Accomplish the Next Stage During School Year 2008 - 2009

Stage 2 → Link SLOs to specific components of the program's curriculum.

The primary responsibility for continuing the assessment process will remain with the Undergraduate Teaching Committee in the Department of Chemistry and Chemical Biology. The SLOs will be assigned to specific courses in the Department using representatives from each of the major divisions (i.e., introductory, analytical, biological, inorganic, organic, and physical). These SLO assignments will then be circulated amongst the teaching faculty for comments.

Multiple files are bound together in this PDF Package.

Adobe recommends using Adobe Reader or Adobe Acrobat version 8 or later to work with documents contained within a PDF Package. By updating to the latest version, you'll enjoy the following benefits:

- Efficient, integrated PDF viewing
- Easy printing
- Quick searches

Don't have the latest version of Adobe Reader?

Click here to download the latest version of Adobe Reader

If you already have Adobe Reader 8, click a file in this PDF Package to view it.

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

2007-2008 Progress Report
for the Six-Stage Assessment Strategy

Prepared by Chris W. Thomas, M.S., Lecturer
Submitted by Jennifer A. Nelson, M.S., Lecturer
(Edited by Joseph L. Thompson)
June 2008

Introduction

The IUPUI School of Science Assessment Committee endorsed the following six-stage plan in 2005 to assess the academic programs of its eight undergraduate programs (Biology, Chemistry, Computer science, Earth Sciences, Forensic and Investigative Sciences, Mathematics, Physics, and Psychology).

Stage 1 → Identify the program's student learning outcomes (SLOs).
Stage 2 → Link these SLOs to specific components of the program's curriculum.
Stage 3 → Identify or create methods to measure these SLOs.
Stage 4 → Collect data to determine if the SLOs are being accomplished successfully.
Stage 5 → Use the data collected in Stage 4 to make curricular changes.
Stage 6 → Repeat Stage 4 to determine if the curricular changes were effective

These stages are comparable to the following stages in the Planning for Learning and Assessment table that has been approved and distributed by IUPUI's Program Review and Assessment Committee,

1. What general outcome are you seeking?
2. How would you know it (the outcome) if you saw it? (What will the student know or be able to do?)
3. How will you help students learn it? (in class or out of class)
4. How could you measure each of the desired behaviors listed in #2?
5. What are the assessment findings?
6. What improvements have been made based on assessment findings?

Current State of Assessment in the IUPUI Department of Earth Sciences in Regard to These Stages

The Earth Sciences Department has accomplished the first stage and is in the process of accomplishing the second and third stage as we review existing and new course curriculum. The following sections describe this progress.

Stage 1 → Identify the department's student learning outcomes (SLOs)

The Earth Sciences Department synthesized IUPUI's Principles of Undergraduate Learning with new Student Learning Outcomes (SLOs). In the spring 2007, as a faculty the Department agreed the current learning objectives were out of date and not reflective of the outcomes expected of students. As part of this process, the required curriculum was revised for students earning a B.S. or B.A. in Geology. This new curriculum will be aligned with these new learning objectives. Ten new outcomes were agreed upon, which also incorporated some old outcomes. These ten outcomes are broken down into further detail in Appendix A.

1. Appraise the significance of fossil material and interpret the ancient environments in which the organisms lived.
2. Relate and understand geologic timescales and Earth history.
3. Explain fundamental processes of tectonics and deformation and relate them to surficial processes and features.
4. Identify common earth materials and describe how crystal chemistry predicts their behavior.
5. Evaluate surficial and near-surface processes as a function of geochemical cycles and systematic processes.
6. Relate and interpret processes of the Rock Cycle to modern and historical environments.
7. Solve earth science problems using the scientific method and advanced technologies of earth science.
8. Spatially describe Earth processes through modeling, mapping, observation, and measurement.
9. Demonstrate competence in communicating earth science problems to a broad audience.
10. Compile and demonstrate competence in advanced disciplines of earth sciences.

To revise the curriculum, the Department decided to change the status of some required courses to elective courses, and to eliminate some required courses completely. To replace the dropped required courses, three new courses will be created (tentatively titled Earth Evolution and History, Earth Materials, and Earth Processes) that will provide students with appropriate depth and focus on all the key concepts of Earth Sciences. These three courses will prepare students to follow a tract or choose ala carte a set of advanced courses that will prepare them for graduate school or the job market.

Stage 2 → Link these SLOs to specific components of the department's curriculum

The Department of Earth Sciences is currently performing an audit of its required courses and new required courses to determine in what courses and at what developmental levels its SLOs are being taught and assessed. Currently, faculty are determining which courses accomplish the stated learning objectives from Stage 1. The current status of this audit is given in Appendix B. Additionally, faculty are debating how these objectives will translate into course-specific learning objectives and assignments in our new courses. The next stage is to examine syllabi and assignments in each course and categorize by the critical thinking skill(s) required to successfully complete it.

Stage 3 → Identify or create methods to measure these SLOs.

The Department has reached this stage yet; however, as the revision of the curriculum is finished, the Department will move into this stage in the 2008-09 academic year.

Appendix A

2007-2008 Draft for Curriculum Revision

IUPUI Department of Earth Sciences Learning Objectives

These objectives are drafted for a B.S. in Geology starting in 2007-08 School Year

1. **Appraise the significance of fossil material and interpret the ancient environments in which the organisms lived.**
    a. Describe and illustrate fundamentals of biological evolution as revealed by the fossil record.
    b. Recognize the range, quality, and quantity of information preserved in the fossil record, particularly the fundamental similarities of all living things through geologic history, as well as the systematic differences that distinguish major groups.
    c. Explain basic genetics and evolutionary theory, including the Darwin/Wallace concept of natural selection as well as neo-Darwinian reformulations and the impact of molecular biology.
    d. Describe the concepts of microevolution and macroevolution, and comparisons (timing, patterns, & possible causes) between normal, background, and mass extinction events that have punctuated the history of life.

2. **Relate and understand geologic timescales and Earth history.**
    a. Describe the nature of the temporal and spatial variations in transfers of mass and energy at Earth's surface as they relate to Earth's history.
    b. Relate geologic features to the geologic time scale and the true length of geologic time, including methods of relative and absolute dating.
    c. Appraise the fossil record for relative age dating of the rocks in which they occur, hence for corroborating the succession of events comprising the physical evolution of our planet.
    d. Evaluate changes to both the physical and biological structure of the earth within a geologic framework in order to demonstrate the rate of change of earth processes, patterns of change of the physical world, relationships of developing life forms, and patterns of sedimentation through time.
    e. Summarize the theoretical foundations of material behavior as it pertains to the short- and long-term deformation processes occurring in the Earth.

3. **Explain fundamental processes of tectonics and deformation and relate them to surficial processes and features.**
    a. Identify the earth processes that sustain plate tectonics and differentiate the surficial processes and features that result.
    b. Apply the concept of stress (how the internal state of stress is related to external loadings).
    c. Apply the concept of strain (the physical and chemical phenomena related to deformation).
    d. Explain the mechanics of fracture (from small-scale crack growth to large-scale development of joints and faults).

e. Explain the mechanics of folding (the physical and chemical changes related to buckling of layered media).

4. **Identify common earth materials and describe how crystal chemistry predicts their behavior.**
    a. Apply principles of inorganic chemistry to describe the formation and behavior of mineral crystals.
    b. Use crystal chemistry to predict how a mineral will form or evolve in different contexts (crystallization, weathering, soil development, metamorphism) to create rocks, sediment, and soils.
    c. Identify and describe the most abundant minerals in Earth's crust, including the mineralogy of common igneous, sedimentary, and metamorphic rocks.

5. **Evaluate surficial and near-surface processes as a function of geochemical cycles and systematic processes.**
    a. Define the transfers of mass and energy at or near the Earth's surface.
    b. Differentiate the erosion and deposition of sediments by mass movements, glaciers, rivers, and wind.
    c. Explain the physical interactions between the atmosphere, hydrosphere and lithosphere, and chemical fractionation associated with incongruent weathering reactions leading to the diversity of sediments.
    d. Diagram and interpret the cycling of major and trace elements in the particulate and aqueous phases.
    e. Use the hydrologic cycle to describe the movement of water over short- and long-term time scales.
    f. Relate the fundamental ways that life impacts modern geochemical cycles and systems, and describe how ancient life influenced Earth's geochemical environment (origin of the oxidizing atmosphere, biogeochemical cycles, sedimentary cycles of erosion and deposition).

6. **Relate and interpret processes of the Rock Cycle to modern and historical environment**s.
    a. Apply basic chemical thermodynamics and actualistic principles to interpret environments of rock formation.
    b. Diagram and interpret the physical processes of material transfer and chemical fractionation involved in the Earth's formation and differentiation, as illustrated by the rock cycle.
    c. Describe the mechanical and chemical weathering of rocks and minerals into sediment and soils.
    d. Explain the processes of partial melting and fractionation leading to the formation of igneous rocks.
    e. Apply actualistic analogy to interpret environments of deposition of sedimentary rocks.
    f. Associate the dynamics of the rock cycle with orogenesis and lithospheric plate kinematics.

g. Use solid-state chemical reactions to describe environments of isochemical metamorphism.

7. **Solve earth science problems using the scientific method and advanced technologies of earth science.**
    a. Demonstrate competence at applying each step of the scientific method through a major project or several minor projects
    b. Operate or apply modern geologic field and laboratory instrumentation, such as high precision mapping with GPS and total stations, remote imagery, physical and geochemical analytic instrumentation.
    c. Operate and apply fundamental computational technologies for data collection, processing, analysis, and presentation (e.g., GIS or CAD, data-sheet and statistical manipulations, construction of graphical representations of data and analytic results).
    d. Search, evaluate, and compile geologic literature using information technologies and databases.

8. **Spatially describe Earth processes through modeling, mapping, observation, and measurement.**
    a. Measure, describe, and interpret earth materials in context, meaning the ability to analyze rock and sediment in the field and laboratory, and to relate those observations to natural processes and environments of formation.
    b. Conceptualize geologic relationships and processes in three-dimensions and through time, meaning the ability to visualize geologic phenomena (e.g., crystallography, geomorphology, earth structure, sedimentology) at many spatial and temporal scales, and to manipulate data in three-dimensions.
    c. Create and interpret geologic problems by constructing maps and cross sections.
    d. Analyze remotely sensed data and describe how geologic phenomena can be remotely measured and mapped.

9. **Demonstrate competence in communicating earth science problems to a broad audience**.
    a. Create graphs, diagrams, and maps that reduce complex geologic concepts into simplified and clear visual representations.
    b. Summarize geologic problems in professional abstract, poster, and/or oral presentation format.
    c. Describe geologic problems using professional writing skills.

10. **Compile and demonstrate competence in advanced disciplines of earth sciences.**
    a. Develop a knowledge base of advanced disciplines of earth sciences and evaluate interrelationships between disciplines.
    b. Demonstrate competence to create, evaluate, and apply earth sciences to discipline specific problems in graduate school or industry.

Assessment of Student Learning
Forensic and Investigative Sciences Program
Indiana University-Purdue University Indianapolis

2007-2008 Progress Report
for the Six-Stage Assessment Strategy

Submitted by Kristin A. Shea, M.S.
(Edited by Joseph L. Thompson)
June 2008

Introduction

The IUPUI School of Science Assessment Committee endorsed the following six-stage plan in 2005 to assess the academic programs of its eight undergraduate programs (Biology, Chemistry, Computer Science, Earth Science, Forensic Science, Mathematics, Physics, and Psychology).

Stage 1 → Identify the program's student learning outcomes (SLOs).
Stage 2 → Link these SLOs to specific components of the program's curriculum.
Stage 3 → Identify or create methods to measure these SLOs.
Stage 4 → Collect data to determine if the SLOs are being accomplished successfully.
Stage 5 → Use the data collected in Stage 4 to make curricular changes.
Stage 6 → Repeat Stage 4 to determine if the curricular changes were effective.

These stages are comparable to the following stages in the Planning for Learning and Assessment table that has been approved and distributed by IUPUI's Program Review and Assessment Committee,

1. What general outcome are you seeking?
2. How would you know it (the outcome) if you saw it? (What will the student know or be able to do?)
3. How will you help students learn it? (in class or out of class)
4. How could you measure each of the desired behaviors listed in #2?
5. What are the assessment findings?
6. What improvements have been made based on assessment findings?

Current State of Assessment in the IUPUI Forensic Science Undergraduate Program in Regard to These Stages

The Forensic and Investigative Sciences Program (FIS) has completed Stages 1 and 2 and is actively working on Stage 3. The FIS Program has created an Assessment Committee that includes the entire program faculty and staff. The Committee decided it needed to define the direction of the FIS Program before it could create student learning outcomes. The Committee did this by creating the FIS mission, vision and values statements.

Mission
To develop professional, ethical graduates with the highest quality education in the natural, physical, and forensic sciences, law and criminal justice to successfully prepare them for advanced degrees, employment and research in forensic science and related fields.

Vision
To become a leading forensic science educational program that has regional, national and international recognition for excellence.

Values
The Forensic and Investigative Sciences Program at IUPUI is committed to the highest standards for our students, faculty, and staff. We value the highest ethical and professional behavior with high standards of excellence and objectivity in academic work and lifelong commitment to education. For our faculty and staff we value striving for the highest standards of excellence in teaching and learning and a commitment to providing the best education to every student. We value commitments to continuing professional development and for continuous improvement of our programs and services. For all the members of the FIS Program, students, faculty and staff, we value a commitment to excellence in developing collaborative and mutually beneficial relationships with our criminal justice constituents and the community as a whole.

Stage 1 → Identify the program's student learning outcomes (SLOs).

Stage 2 → Link these SLOs to specific components of the program's curriculum.

The FIS Assessment Committee chose to organize its subject matter into seven categories that each has their own set of SLOs, which were then linked to the specific courses within the program's curriculum. This was accomplished using a similar method as one used by the Department of Psychology who used "The Three Levels of the Developmentally Coherent Curriculum" based on the work of Anderson & Krathwohl, 2001. These three levels were used to analyze the syllabi of the FIS program and then link the SLOs with specific courses by placing them into one of three categories (see below).

A. Basic Level → Retaining and Understanding

1. the ability to retain specific information in the way it was originally presented
   a. being able to recognize or recall the definitions of psychological terms and concepts in an accurate manner
   b. questions it can be used to answer: Who, what, where, and when?
2. the ability to understand information when it is presented in a different manner than it has been originally presented
   a. being able to identify a principle or concept when presented with an example that has not been previously encountered
   b. questions it can be used to answer: How and why?

B. Intermediate Level → Analyzing and Applying

1. the ability to analyze (i.e., reduce) a complex whole into its constituent parts and their functional relationships
   a. being able to break down a complex whole into its component parts and explain how they interact or are related to one another
   b. questions it can be used to answer: Of what is this complex whole composed, and how are its parts related to one another?
2. the ability to produce and apply original and useful solutions to solvable problems
   a. being able to use psychological concepts, theories, and methods to solve real world problems
   b. questions it can be used to answer: How can this problem be solved?

C. Advanced Level → Evaluating and Creating

1. the ability to evaluate the effectiveness and/or merit of the products of application
   a. being able to used established criteria to judge the success of problem-solving methods (e.g., the scientific method and psychotherapy)
   b. questions it can be used to answer: What is the validity or value of a particular principle, theory, or method?
2. the ability to create (i.e., synthesize) new wholes from previously unrelated parts
   a. being able to combine previously unassociated elements into new, creative, meaningful, and/or useful wholes
   b. questions it can be used to answer: What new conclusions can you reach on the basis of what you have learned?

In the following table, **B** refers to the Basic Level of retaining and understanding, **I** refers to the Intermediate Level of analyzing and applying and **A** refers to the Advanced Level of evaluating and creating.

Student Learning Outcomes	B	I	A
1. Forensic Science System – Understand the general overview of the forensic science system			
a. Explain and describe areas in forensic science	205	206	
b. Understand the fundamentals of crime laboratory culture and organization	205		305
c. Understand the role of forensic science in crime scene investigation	205		
d. Explain and be able to classify evidence	205	206	
e. Explain and describe quality assurance and control used in forensic science laboratories	205		305
2. Forensic Chemistry – Understand how chemical and instrumental techniques can be applied to forensic chemical evidence			
a. Describe the possible job functions of a chemist in a forensic science laboratory	205	206	
b. Describe how statistical techniques can be used to describe the quality of data, classify samples or determine proper sampling protocol	401		
c. Explain the chemical principles behind acid-base, liquid-liquid, liquid-solid and solid-vapor extractions		401	
d. Explain the principles, instrumentation and applications of chromatographic techniques such as TLC, HPLC, and GC		401	
e. Explain the principles, instrumentation and applications of spectroscopic techniques such as UV/vis/fluorescence, FTIR and Raman		401	
f. Explain the principles, instrumentation and applications of mass spectrometry using EI and ESI ionization		401	
g. Demonstrate the ability to prepare and examine samples using analytical techniques such as TLC, GC/MS, Pyrolysis-GC/FID, LC/MS, FTIR, Raman, and UV/vis/fluorescence		401	404
h. Explain the principles, instrumentation and applications of microscopic techniques such as light microscopy, polarized light microscopy, hot stage microscopy and microspectrophotometry			*micro class
i. Demonstrate the ability to prepare and examine samples using microscopic techniques such as light microscopy, polarized light microscopy, hot stage microscopy and microspectrophotometry			*micro class
j. Describe the chemical composition, origins and significance of the most commonly encountered types of trace evidence such as ink, paint, fibers, explosives, ignitable liquids, glass and hairs		401	
k. Determine the appropriate chemical analytical scheme to be used on physical evidence			404
l. Successfully apply the chemical and instrumental techniques described above on mock case work			404
3. Pattern Evidence – Understand pattern evidence in forensic science and the appropriate analytical techniques			
a. Explain, evaluate, and identify characteristics of fingerprints	205	401	404
b. Understand the application of firearm and toolmark analysis used in forensic science	205	401	404
c. Describe forensic techniques used on questioned documents	205	206, 401	404
d. Understand the application of impression evidence such as tiretreads and footwear	205	401	404

*This class will be taught in the spring of 2009 once it has been developed and approved.

Student Learning Outcomes	B	I	A
4. Forensic Biology - Understand how to identify and analyze forensic biological evidence			
a. Describe the possible job functions of a forensic biologist in a forensic science laboratory	206	402	403
b. Describe how to recognize, collect and preserve biological evidence	206	402	
c. Describe the principles and techniques of blood spatter pattern analysis	206	402	
d. Describe the principles and techniques of identification of body fluids	206	402	
e. Describe the principles and techniques of identification of the species of biological evidence		402	
f. Describe the principles and techniques of DNA isolation from various biological evidence	206		403
g. Explain the principles, instrumentation and applications of DNA typing techniques	206		403
h. Describe how statistics and population genetics can be used for data interpretation			403
5. Photography and Imaging - Explain and implement the basic and advanced principles of photography and imaging in the processing of a crime scene			
a. Describe the basic elements of the theory of photography	250	251	251
b. Understand and describe the photographic process	250	251	251
c. Describe and apply the principles of photography to crime scene analysis	251		251
d. Describe how the techniques and methods of processing images are used on photographic evidence obtained at a crime scene	260	261	261
6. Ethics - Understand the importance of ethics in the practice of forensic science			
a. Define ethics	205		
b. Describe how ethics are applied in the analysis of forensic evidence	205	305	305
c. Describe how ethics are applied to the presentation of expert testimony in court	305		305
d. Describe the major features of the Code of Ethics of the American Academy of Forensic Sciences and of other major forensic science organizations	205		
7. Forensic Science and the Law - Understand how criminal and civil laws and procedures are applied to Forensic Science			
a. Apply the evidentiary rules and law of evidence in the collection of evidence, examination of the evidence, and preparation of scientific reports and testimony	415	415	415
b. Describe the kinds of evidence that require a scientific foundation for its admission	415	415	415
c. Demonstrate the ability to conduct accurate, comprehensive and focused scientific investigations and apply appropriate rules of evidence	415	415	415
d. Interpret and implement standards of forensic practice as established by the rules of evidence	415	415	415
e. Apply knowledge of forensic science to case scenarios	415	415	415

Resource

Anderson, L.W., & Krathwohl, D.R. (Eds.) (2001). *A taxonomy of learning, teaching, and assessment: A revision of Bloom's taxonomy of educational objectives*. New York: Longman.

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

2007-2008 Progress Report
for the Six-Stage Assessment Strategy

Submitted by Jeffrey X. Watt, Ph.D.
(Edited by Joseph L. Thompson)
June 2008

Introduction

The IUPUI School of Science Assessment Committee has endorsed the following six-stage plan in 2005 to assess the academic programs of each of its seven academic departments.

Stage 1: Identify the department's student learning outcomes (SLOs).
Stage 2: Link these SLOs to specific components of the department's curriculum.
Stage 3: Identify or create methods to measure these SLOs.
Stage 4: College data to determine if the SLOs are been accomplished successfully.
Stage 5: Use the data collected in Stage 4 to make curricular changes.
Stage 6: Repeat Stage #4 to determine if the curricular changes were effective.

Current State of Assessment in the Department of Mathematical Sciences in Regard to These Stages

The Department of Mathematical Sciences has accomplished the first two stages and is in the process of beginning the third stage in 2008. Unfortunately, the MATH Department has two full-time faculty members on medical leave this year, so some work was started on stage 3, but we were not able to complete this stage this year. In addition, the foundation sequence MATH 163, 164, 261, 262, and 351 went through a significant overhaul. The content objectives were updated and re-organized, new courses were created, meetings with other science and engineering departments that require these courses had to participate and sign-off on these changes. Therefore, some of the completed work in Stage 2, required significant updating. (These changes in Stage 2 are reflected below.) The following sections describe this progress.

Previous Foundation Sequence	New Foundation Sequence	
MATH 163 (5 cr)	MATH 165 (4 cr)	Content re-organized
MATH 164 (5 cr)	MATH 166 (4 cr)	Analytic Geometry removed
	MATH 171 (3 cr)	Analytic Geometry added with intro to Linear Algebra
MATH 261 (4 cr)	MATH 261 (4 cr)	No changes
MATH 262 (3 cr)	MATH 266 (3 cr)	Linear Algebra removed and Diffy-Q increased
MATH 351 (3 cr)	MATH 351 (3 cr)	Objectives changed to match new prerequisites

Stage 1 → Identify the Department's Student Learning Outcomes (SLOs)

The Department of Mathematical Sciences synthesized the IUPUI's Principles of Undergraduate Learning, the National Council of Teachers of Mathematics Standards, and the Mathematics Association of America's competencies for undergraduate mathematics majors to create the following 10 SLOs for the Department.

1. Understand and critically analyze mathematical arguments.
2. Understand, appreciate, and identify connections between different areas of mathematics.
3. Understand, appreciate, and solve some applications of mathematics to other subjects.
4. Develop a deeper knowledge and competence of at least one area of mathematics.
5. Develop and demonstrate abstract reasoning in a mathematical context.
6. Develop and demonstrate the principle modes of discovery in mathematics.
7. Develop and demonstrate careful and ethical analysis of data.
8. Develop and demonstrate problem-solving skills.
9. Demonstrate effective communication skills of mathematical ideas precisely and clearly, both orally and in writing.
10. Utilize a variety of technological tools (CAS, statistical packages, programming languages, etc.) in analyzing and solving mathematical problems.

In pursuit of the above SLOs, students should be exposed to courses in several of the following areas:

Analysis (not including differential equations)
Differential Equations
Discrete Math (other than algebra and geometry)
Modern or Abstract Algebra
Geometry
Probability and Statistics
Deterministic Modeling
Stochastic Modeling

Ideally, areas studied by a student should include a number of contrasting, but complementary points of view:

Continuous and Discrete
Algebraic and Geometric
Deterministic and Stochastic
Theoretical and Applied

All majors should work on a senior-level project that requires them to analyze and create mathematical arguments and leads to a written or oral report (capstone).

Stage 2 → Link These SLOs to Specific Components of the Department's Curriculum

The Department of Mathematical Sciences performed an audit of its course syllabi to determine in what courses and at what developmental levels its SLOs are being taught and assessed. Each assignment that provided data for these assessments was categorized by the critical thinking skill(s) required to successfully complete it. Assignments requiring retention and comprehension were labeled Basic, those requiring application and analysis were labeled as Intermediate, and those requiring evaluating and creating were labeled as Advanced. This audit enabled the Department to determine if (1) where its SLOs are being taught and assessed and (2) if its curriculum is "developmentally appropriate" so that students who progress through it are required to experience its SLOs in a developmentally coherent manner. The model that was used to define this developmental coherence is given in Appendix A. The results of this curriculum audit are given in Appendix B.

Stage 3 → Identify or Create Methods to Measure These SLOs

The Department of Mathematical Sciences is beginning to identify and consider creating instruments to measure the SLOs. The Department has tried to make contacts with math faculty at our peer institutions to identify what instruments they use to measure the SLOs. Of the five institutions contacted, none had instruments beyond departmental final exams to measure student outcomes. In the next academic year, the Department will continue to search for instruments; however, the results from this year are very discouraging, and it may be necessary to default back to traditional methods of measuring student learning in mathematics.

Appendix A

Three Levels of the Developmentally Coherent Curriculum

A. Basic Level → Retaining and Understanding

1. the ability to retain specific information in the way it was originally presented
   a. being asked to recognize the definition of a bold-faced term in a textbook
   b. questions it can be used to answer: Who, what, where, and when?
   c. Bloom calls this "knowledge"

2. the ability to understand information when it is presented in a different manner than it has been originally presented
   a. being asked to recognize a principle, concept, or method when presented with an example that has not been previously encountered
   b. questions it can be used to answer: How and why?
   c. Bloom calls this "comprehension"

B. Intermediate Level → Analyzing and Applying

1. the ability to analyze (i.e., reduce) a complex whole into its constituent parts and their functional relationships
   a. being able to recognize the parts of a complex whole and how they interact or are related to one another
   b. questions it can be used to answer: Of what is this complex whole composed, and how are its parts related to one another?
   c. Bloom calls this "analysis"

2. the ability to produce and apply original and useful solutions to solvable problems
   a. being able to recognize how the products of retention, comprehension, and analysis can be used to solve real world problems
   b. questions it can be used to answer: How can this problem be solved?
   c. Bloom calls this "application"

C. Advanced Level → Evaluating and Creating

1. the ability to evaluate the effectiveness and/or merit of the products of application
   a. being able to recognize how established criteria can be used to judge the success of problem-solving methods (e.g., the scientific method and psychotherapy)
   b. questions it can be used to answer: What is the validity or value of a particular principle, theory, or method?
   c. Bloom calls this "evaluation"

2. the ability to create (i.e., synthesize) new wholes from previously unrelated parts
   a. being able to recognize how elements that have been previously unassociated can be combined into new and meaningful/useful wholes
   b. questions it can be used to answer: What new conclusions can you reach on the basis of what you have learned?
   c. Bloom calls this "synthesis"

Reference

Bloom, B.S., Englehart, M.D., Furst, E.J., & Krathwohl, D.R. (1956). *Taxonomy of educational objectives: Cognitive domain*. New York: McKay.

Appendix B

Results of the Department of Mathematical Sciences Syllabus Audit to Determine the Developmental Coherence of Its Curriculum

	Basic	Developmental	Advanced
1. Content Analysis	165, 276, 375, 426, 561, S350, S472, S473	166, 171, 261, 266, 510, 511, 520, 522	300, 351, 333, 414, 417, 441, 442, 453, 456, 462, 463, 505, 525, S511
2. Math Connections	165, 166, 261, 375, 561	171, 266, 276, 462, S350, S472, S473	300, 351, 414, 417, 426, 441, 442, 453, 456, 463, 505, 510, 511, 520, 522, 525. S416, S417, S511
3. Math Applications	165, 166, 300	171, 261, 266, 351, 453, 462, 505, S416, S417, S472, S473	276, 333, 375, 414, 417, 426, 510, 511, 520, 522, 561, S350, S511
4. Depth of Knowledge	165, 276, 300, S472, S473	166, 171, 261, 266, 333, 375, 414, 417, 426, 510, 511, 520, 522, S350, S416, S417	351, 441, 442, 453, 456, 462, 463, 505, 525, 561, S511
5. Abstract Reasoning	165, 166, 171, 261, 262, 375	276, 300	351, 441, 442, 453, 456, 462, 463, 505, 525
6. Modes of Discovery	165, 166, 266, 375, 510	261, 276, 333, 414, 417, 456, 463, S350, S416, S417, S472, S473, S511	300, 351, 426, 441, 442, 453, 505
7. Data Analysis	276	300, 426, 561, S472, S473	375, 414, S350, S416, S417, S511
8. Problem Solving	165, 171, 266, S472, S473	164, 261, 375, 414, 417, 510, 511, 520, 522, 561, S350	276, 333, 351, 426, 441, 442, 453, 456, 462, 463, 505, 525, S416, S417, S511
9. Communication Skills	165, 166, 266, 426, S472, S473	261, 276, 453, 505, S350	300, 351, 456, 462, S416, S417
10. Tech Competence	165	166, 300, 375, 417, S350	261, 414, 462, 561, S416, S417, S511

NOTE: Entries in this table have changed from the 2007 Report to reflect the curriculum changes being implemented in 2008. See first page of this report.

Appendix C

Mathematical Areas Covered in Courses

DI = Discrete Math
DQ = Differential Equations
AL = Algebraic
GE = Geometric
AP = Applied
TH = Theoretical
AN = Analysis
ST = Probability and Statistics
DM = Deterministic Modeling
SM = Stochastic Modeling

Course	Title	DI	DQ	AL	GE	AP	TH	AN	ST	DM	SM
165	Calculus I		X			X					
166	Calculus II					X					
261	Multivariate Calc					X					
266	Diffy-Q		X			X					
276	Discrete	X				X					
300	Logic + Proof						X				
333	Dynamical Syst									X	
351	Linear Algebra						X				
375	Theory of Interest	X									X
414	Numerical Method	X				X					
417	Discrete Model	X				X					X
426	Math Model		X			X				X	
441	Analysis I						X	X			
442	Analysis II						X	X			
453	Abstract Algebra			X			X				
456	Number Theory	X					X				
462	Diff Geometry				X		X	X			
463	Euclid Geometry				X		X				
504	Real Analysis						X	X			
505	Abstract Algebra			X			X				
510	Vector Calculus							X			
511	Linear Algebra					X					
520	BVP Diffy-Q		X								
522	Diffy-Q		X								
525	Complex Analysis							X			
561	Projective Geom				X						
S350	Intro Stats								X		X
S416	Probability								X		X
S417	Statistical Theory								X		X
S472	Actuarial Mod I								X		X
S473	Actuarial Mod II								X		X
S511	Stat Methods I								X		X

NOTE: entries in this table have changed from 2007 Report to reflect the curriculum changes being implemented in 2008. See first page of this report.

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

2007-2008 Progress Report
for the Six-Stage Assessment Strategy

Submitted by Brian A. Woodahl, Ph.D.
(Edited by Joseph L. Thompson)
June 2008

Introduction

The IUPUI School of Science Assessment Committee endorsed the following six-stage plan in 2005 to assess the academic programs of its eight undergraduate programs (Biology, Chemistry, Computer Science, Earth Science, Forensic Science, Mathematics, Physics, and Psychology).

Stage 1 → Identify the program's student learning outcomes (SLOs).
Stage 2 → Link these SLOs to specific components of the program's curriculum.
Stage 3 → Identify or create methods to measure these SLOs.
Stage 4 → Collect data to determine if the SLOs are being accomplished successfully.
Stage 5 → Use the data collected in Stage 4 to make curricular changes.
Stage 6 → Repeat Stage 4 to determine if the curricular changes were effective.

These stages are comparable to the following stages in the Planning for Learning and Assessment table that has been approved and distributed by IUPUI's Program Review and Assessment Committee,

1. What general outcome are you seeking?
2. How would you know it (the outcome) if you saw it? (What will the student know or be able to do?)
3. How will you help students learn it? (in class or out of class)
4. How could you measure each of the desired behaviors listed in #2?
5. What are the assessment findings?
6. What improvements have been made based on assessment findings?

Assessment in the IUPUI Department of Physics

Last year, the Physics Department completed Stage 1, identifying eight unique Department-specific SLOs.

Stage 1 → Identify the Department's Student Learning Outcomes (SLOs)

The Physics Department's Student Learning Outcomes:

1. Understand the basic and advanced concepts of classical and modern physics.
2. Master the mathematical skills relevant to the study of physics.
3. Apply his or her knowledge of physics and mathematics to solve physical problems.
4. Design and perform laboratory experiments in physics.
5. Use computers and software to solve physics problems and to obtain and analyze experimental data.
6. Successfully collaborate with peers, attain the necessary skills, and develop the work ethic to perform and complete physics research.
7. Prepare a written technical document and deliver an oral presentation relevant to physics.
8. Apply his or her skills to other areas or problems.

This past academic year, the Department has undertaken the task of identifying physics courses that specifically address these SLOs. Therefore, in following the School of Science's strategy, the Department has completed Stage 2.

Stage 2 → Link These SLOs to Specific Components of the Department's Curriculum

The Physics Student Learning Outcomes linked to physics courses are detailed in the table on the next page. Beginning-level skills are denoted by the letter "B," intermediate-level skills are denoted by the letter "I," and the advanced-level skills are denoted by the letter "A."

Physics Student Learning Outcomes (SLOs) Linked to Courses

Course	Title	Hrs	1 -- Understand basic and advanced concepts of classical and/or modern physics	2 -- Master the mathematical skills relevant to physics	3 -- Apply the knowledge of physics and mathematics to solve problems in physics	4 -- Design and perform laboratory experiments	5 -- Use computers and software to solve problems and/or obtain experimental data	6 -- Develop skills and work ethic to independently perform physics research	7 -- Prepare and orally deliver technical presentations	8 -- Apply the skills from the field of physics to solve problems in other areas
Phys 152	Mechanics	4	B	B	B	B				
Phys 251	E&M, Optics	5	B	B	B	B				
Phys 300	Mathematical Physics	3	I	I	I		B	B		
Phys 310	Intermediate Mechanics	4	I	I	I			B		
Phys 330	Intermediate E&M	3	I	I	I			B		
Phys 342	Modern Physics	3	I	I	I			B		
Phys 353	Electronics Lab	2				I	B	B	B	
Phys 400	Physical Optics	3	I	A	A			I		
Phys 401	Optics Lab	2				I	B	I	B	
Phys 416	Thermal Physics	3	A	A	A			I		
Phys 442	Quantum Mechanics	3	A	A	A			I		
Phys 490	Capstone	1-3			A	A	I	I	I	I

Key	
B	Beginning
I	Intermediate
A	Advanced

Stage 3 → Identify or Create Methods to Measure These SLOs

Recently, the Department has begun to identify those courses that would benefit the most by implementing methods to measure the success of the course-related SLOs. Physics 152 and Physics 251 are likely to have the greatest impact on the largest number of students. Because of this, the Physics 152 course is undergoing a new restructuring, which will be implemented in the fall 2008 semester. The course will be broken up into two different sections, an Honors section and the normal (non-honors) section. With this change, the Department is hoping to present the material in a format that is best suited for each group of students. The challenge will be to identify new techniques of data collection to measure the success of this curriculum change.

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

2007-2008 Progress Report
for the Six-Stage Assessment Strategy

Submitted by Drew Appleby, Ph.D.
Director of Undergraduate Studies in Psychology
(Edited by Joseph L. Thompson)
June 2008

Introduction

The IUPUI School of Science Assessment Committee endorsed the following six-stage plan in 2005 to assess the academic programs of its eight undergraduate programs (Biology, Chemistry, Computer Science, Earth Sciences, Forensic Science, Mathematics, Physics, and Psychology).

Stage 1 → Identify the program's student learning outcomes (SLOs).
Stage 2 → Link these SLOs to specific components of the program's curriculum.
Stage 3 → Identify or create methods to measure these SLOs.
Stage 4 → Collect data to determine if the SLOs are being accomplished successfully.
Stage 5 → Use the data collected in Stage 4 to make curricular changes.
Stage 6 → Repeat Stage 4 to determine if the curricular changes were effective.

These stages are comparable to the following stages in the Planning for Learning and Assessment table that has been approved and distributed by IUPUI's Program Review and Assessment Committee,

1. What general outcome are you seeking?
2. How would you know it (the outcome) if you saw it? (What will the student know or be able to do?)
3. How will you help students learn it? (in class or out of class)
4. How could you measure each of the desired behaviors listed in #2?
5. What are the assessment findings?
6. What improvements have been made based on assessment findings?

Current State of Assessment in the IUPUI Psychology Undergraduate Program in Regard to These Stages

The Psychology Department has accomplished the first three stages of the School of Science's strategies and is in the process of accomplishing the fourth and fifth stages. The following sections of this report describe this progress.

Stage 1 → Identify the Department's Student Learning Outcomes (SLOs)

The Psychology Department synthesized IUPUI's Principles of Undergraduate Learning and the American Psychological Association's Competencies for Undergraduate Psychology Majors to create the following 16 SLOs for the Department.

1. Understand the major concepts, theoretical perspectives, empirical findings and historical trends in psychology.
2. Understand and use basic research methods in psychology, including design, data analysis, and interpretation.
3. Understand and generate applications of psychology to individual, social, and organizational issues.
4. Understand and abide by the ethical principles of psychology.
5. Recognize, understand, and respect the complexity of socio-cultural and international diversity.
6. Develop self-awareness by identifying your own personal strengths, weaknesses, values, goals, etc.
7. Understand the behavior and mental processes of others.
8. Work effectively as a member of a group to accomplish a task.
9. Identify and prepare for a career in psychology or a related field.
10. Demonstrate effective speaking skills.
11. Demonstrate effective writing skills.
12. Demonstrate information competence by identifying, locating, and retrieving written and electronic information sources.
13. Utilize technology for many purposes.
14. Demonstrate creative thinking skills.
15. Demonstrate problem-solving skills.
16. Demonstrate the critical thinking skills of retention, comprehension, application, analysis, synthesis, and evaluation.

Stage 2 → Link These SLOs to Specific Components of the Department's Curriculum

An extensive audit of the Department's course syllabi was undertaken by the students of Drew Appleby's PSY-B454 *Capstone Seminar in Psychology* (in collaboration with the faculty who produced these syllabi) to determine in what courses and at what developmental levels the Department's SLOs are being taught and assessed. Each assignment that provided data for these assessments was categorized by the critical thinking skill(s) required to successfully complete it.

- Assignments requiring retention and comprehension were labeled Basic.
- Assignments requiring application and analysis were labeled Intermediate.
- Assignments requiring evaluating and creating were labeled Advanced.

This audit enabled the Department to determine (1) where its SLOs are being taught and assessed and (2) if its curriculum is "developmentally appropriate" so that students who progress through it are required to experience its SLOs in a manner that requires ever-increasing levels of critical thinking. The model that was used to define this developmental coherence is contained in Appendix A. The full results of this curriculum audit appear in Appendix B, a summary table of these results are presented in Appendix C, and a discussion of these results appears in Appendix D.

Stage 3 → Identify or Create Methods to Measure These SLOs

Method 1

The Psychology Department offers the following three types of capstone experiences.

- An empirical research project, which can be conducted (a) in a laboratory class dedicated to the study of a particular sub-discipline of psychology (e.g., social or developmental) or in an honors research class in which students choose their own research topics. The classes that will currently satisfy the research capstone requirement are PSY-B461 *Capstone Laboratory in Developmental Psychology*, PSY-B471 *Capstone Laboratory in Social Psychology*, PSY-B481 *Capstone Laboratory in Clinical Rehabilitation Psychology*, and PSY-B499 *Honors Capstone Research*.
- An on-the-job practicum, which allows students to apply what they have learned about a particular sub-disciple of psychology (e.g., industrial/organizational or clinical rehabilitation psychology) in the workplace. The classes that will satisfy the practicum capstone requirement are PSY-B462 *Capstone Practicum in Industrial/Organizational Psychology* and PSY-B482 *Capstone Practicum in Clinical Rehabilitation Psychology*.
- A scholarly seminar, which provides students with the opportunities to (a) perform an in-depth examination of a sub-discipline of psychology in which they have an occupational interest, (b) engage in a collaborative research project with their classmates, and (c) create a professional planning portfolio designed to facilitate their transition to life after college (i.e., employment or graduate school). The class that will satisfy the seminar capstone requirement is PSY-B454 *Capstone Seminar in Psychology*.

While it is important to use subjective, self-report data from our students to assess our SLOs (e.g., Method 2), it is also important to involve faculty evaluations of student performance because these measures are assumed to be more objective. To do this, a matrix has been created (see Appendix F) that will be completed by each capstone instructor for each student in her/his class after the class has been completed. The data from this matrix for all capstone classes will be aggregated and used to identify the degree to which capstone faculty believe that senior psychology majors have accomplished the Department's SLOs.

Method 2

All students enrolled in psychology capstone classes were surveyed to determine the "grade" they would give themselves in regard to their accomplishment of each of the department's SLOs. The instrument used to collect this data appears in Appendix E, the data collected appears in the right column of the table presented in Appendix C, and a discussion of these data is included in Appendix D.

Method 3

The School of Science has been using a paper-and-pencil senior exit survey for many years. One component of this survey requires students to write one or two paragraphs about how they have experienced the university's six Principles of Undergraduate Learning (PULs) during their undergraduate education at IUPUI. While this has produced an abundance of data, it has never been fully utilized because of the time-intensive nature of the qualitative research methods necessary to analyze these data. The Psychology Department collaborated with the School of Science office to create an electronic version of this survey. This survey will enable the Psychology Department to incorporate its unique set of SLOs into this survey by asking its seniors to use a Likert scale to indicate how successfully they have accomplished each of these

SLOs. Students will then be asked to identify the experiences that helped them to accomplish the SLOs they indicated that they had successfully accomplished and to provide suggestions to the Department that would help future psychology majors to accomplish the PULs and SLOs that they indicated they had not successfully accomplished. These data will provide our Department with information to answer the following questions.

1. How do psychology majors perceive their ability to accomplish the Department's SLOs?
2. Which of the SLOs do our students perceive they have accomplished successfully, and what aspects of their undergraduate educations enabled them to do so?
3. Which of the SLOs do our students perceive they have not accomplished successfully, and how can we use their suggestions to enable future students to accomplish them more successfully?

We can use the answers to these questions to make data-driven changes to our curriculum. It will be interesting to compare the results of this method to results of Method 1 to determine the similarities and differences between how students and their faculty assess the accomplishment of the Department's SLOs.

Method 4

Students enrolled in PSY-B311 *Introductory Laboratory in Psychology* and PSY-B454 *Capstone Seminar in Psychology* were surveyed to determine their experience with the transition from PSY-B305 *Statistics* to PSY-B311. PSY-B305 is a prerequisite for PSY-B311, and certain statistical skills are assumed to exist in students who enter PSY-B311 after successfully completing PSY-B305. One of these skills is the ability to use SPSS to analyze statistical data. The purpose of this method was to determine the validity of the assumption that students entering PSY-B311 possess this skill.

Method 5

Using information from the course syllabus audit presented in Appendix B, members of Drew Appleby's Fall 2007 PSY-B454 *Capstone Seminar in Psychology* worked with psychology faculty to identify one assignment in each of their courses that can provide data to be used to assess one of the SLOs at a particular level of critical thinking (as presented in Appendix C). The purpose of this study was to evaluate how successfully psychology students have accomplished the Student Learning Outcomes (SLOs) from the Psychology Department at IUPUI. This assessment project consisted of three goals: to identify specific assignments in each undergraduate psychology class at IUPUI that address a particular SLO; to determine at which cognitive level each SLO was achieved; and to find evidence showing whether instructors modified their curriculums to improve students' accomplishment of the SLOs. To achieve these goals, 28 full-time psychology professors were contacted for interviews regarding SLO accomplishment. Of these 28, 6 participated in the study, some providing data from 10 classes. The data collected was arranged in table form and is presented in Appendix H.

Stage 4 → Collect Data to Determine if the SLOs Are Being Accomplished Successfully

Data Collected with Method 1
Only 28 capstone templates were completed and returned by June 15. The data from these templates are presented in Appendix G.

Data Collected with Method 2
Data collected from the senior self-grading project are presented in the far right column of Appendix C.

Data Collected with Method 3
Data collected from 121 psychology majors who completed the electronic senior exit survey concerning the Department's SLOs are presented in Appendix J.

Data Collected with Method 4
Data collected from students entering PSY-B311 *Introductory Laboratory in Psychology* indicated a very wide range of competency in the ability to use SPSS to analyze data. PSY-B305 *Statistics* is a prerequisite for PSY-B311 and is the course in which data analysis is learned.

Data Collected with Method 5
The data collected are presented in Appendix H and summarized in Appendix I. Not a great deal can be safely deduced from these data because they represent a sample of only 21% of the faculty and 31% of the classes offered. However, several conclusions can be drawn from the data that was collected.

1. The assignments used to assess the SLOs were most frequently (12) at Level 1 (retaining and understanding), less frequently (8) at Level 3 (evaluating and creating), and infrequently (3) at Level 2 (analyzing and applying).
2. Some of the SLOs are being assessed more often than others in psychology classes.
    a. Content was assessed with 6 assignments.
    b. Ethics was assessed with 3 assignments.
    c. Research, Application, Career Planning, and Speaking Skills were assessed with 2 assignments each.
    d. Diversity, Self-Awareness, Understanding Others, Collaboration, Writing Skills, and Critical Thinking were assessed with 1 assignment each.
    e. The remaining SLOs were not assessed.
3. 87% of the SLOs that were assessed with assignments were being accomplished successfully.
4. 3 of SLOs were judged not to be accomplished on the basis of assignment results.
5. 3 interventions were initiated to bring about positive changes in assignment results.

Stage 5 → Use the Data Collected in Stage 4 to Make Curricular Changes

Curricular Changes Made on the Basis of Data Collected with Method 3

- A set of standardized SPSS modules was created and required in all sections of PSY-B305 *Statistics* during the 2006-07 school year to insure that all students who enroll in PSY-B311 *Introductory Laboratory in Psychology* in the future will enter the course with a fundamental competence in SPSS.
- An in-depth discussion was implemented in PSY-B310 *Lifespan Development* on a topic that only 4% of the class were knowledgeable of during the previous semester. After the in-depth discussion, 90% were knowledgeable the next semester.
- Three items on the PSY-B104 *Psychology as a Social Science* end-of-semester evaluation were rated lower than desired. After the implementation of a new teaching technique called "5-minute trainer," the scores on all three of these items increased the following semester.
- The number of PSY-B105 *Psychology as a Biological Science* students not passing the cumulative final exam was not acceptable. A more active learning approach to the class was introduced, and this transformation was piloted in 2 out of 5 sections during both the Fall 07 and Spring 08 semesters. For the two semesters, the average on the cumulative final exam has been no different for the traditional vs. transformed sections: 73.1% vs. 72.8%, respectively. It must be kept in mind that all sections take the same exams. These exams are based on material from the textbook and the multiple-choice questions are generated from the publisher's test bank. The traditional sections are given this material in lecture format during class periods, whereas the transformed sections do not receive traditional lectures over the material. The students are responsible for reading the material and instructors go over some of the material during one session per week, and the students engage in application exercises during the other weekly session. The next step in the course transformation is to adapt the exams to more closely assess the objectives of the transformed course. This should provide a better measure of the success of the transformation in improving retention and understanding of course material. Dr. Neal-Beliveau taught one traditional and one transformed section in Fall 2007. The overall class average was higher for the transformed section (81% vs. 76%); however, those sections have 200 more points available to them during the semester (700 vs. 500) and exams make up 46% of their final grade compared to 64% for the traditional sections. The DFW rate was 19.7% for the transformed section vs. 21.4% for the traditional section. Class attendance was also much higher for the transformed sections, which has been shown to be very important for success in gateway courses.

Curricular Changes Made on the Basis of Data Collected with Method 5

Three instructors reported that an assignment in their class produced data that indicated an SLO was not being accomplished. All of these instructors implemented or are in the process of implementing interventions to increase their students' accomplishment of an SLO. The two interventions that have been implemented (the introduction of an in-depth classroom discussion and the implementation of a new technique called "5-minute trainer") resulted in improved performance on assignments. The intervention that is in the process of being implemented has not yet produced data that can confirm or disconfirm the efficacy of the intervention.

Appendix A

Three Levels of the Developmentally Coherent Curriculum

(based on the work of Anderson & Krathwohl, 2001)

A. Basic Level → Retaining and Understanding

1. the ability to retain specific information in the way it was originally presented
   a. being able to recognize or recall the definitions of psychological terms and concepts in an accurate manner
   b. questions it can be used to answer: Who, what, where, and when?

2. the ability to understand information when it is presented in a different manner than it has been originally presented
   a. being able to identify a principle or concept when presented with an example that has not been previously encountered
   b. questions it can be used to answer: How and why?

B. Intermediate Level → Analyzing and Applying

1. the ability to analyze (i.e., reduce) a complex whole into its constituent parts and their functional relationships
   a. being able to break down a complex whole into its component parts and explain how they interact or are related to one another
   b. questions it can be used to answer: Of what is this complex whole composed, and how are its parts related to one another?

2. the ability to produce and apply original and useful solutions to solvable problems
   a. being able to use psychological concepts, theories, and methods to solve real world problems
   b. questions it can be used to answer: How can this problem be solved?

C. Advanced Level → Evaluating and Creating

1. the ability to evaluate the effectiveness and/or merit of the products of application
   a. being able to used established criteria to judge the success of problem-solving methods (e.g., the scientific method and psychotherapy)
   b. questions it can be used to answer: What is the validity or value of a particular principle, theory, or method?

2. the ability to create (i.e., synthesize) new wholes from previously unrelated parts
   a. being able to combine previously unassociated elements into new, creative, meaningful, and/or useful wholes
   b. questions it can be used to answer: What new conclusions can you reach on the basis of what you have learned?

Appendix B

Results of the Psychology Department's Syllabus Audit to Determine the Developmental Coherence of Its Curriculum

	Basic	Intermediate	Advanced
Content	B105a; B105b*; B311a; B344a; B344b*; B356*; B358a; B380c; B360a*; B360b; B368; B396; B422*; B252a; B252c	B104; B105c; B305b*; B310a; B340; B358b; B370a; B380a*; B380b; B322*; B365*; B366; B376; B386; B420; B472; B252b	B305a; B311b; B307*; B310b; B320; B370b; B424; B375; B394; B454; B461; B481*; B499*
Research	B105b*; B305a; B310b; B340; B344a; B358b; B370a; B360b; B365*; B366; B375; B376; B422*	B311a; B310a; B320; B344b*; B370b; B380a*; B322*; B360a*; B396	B305b*; B311b; B307*; B472; B461; B462*; B482; B499*; B252a
Application	B103a; B105c; B310b; B340; B380c; B365*; B482	B103b*; B105a; B105b*; B305a; B311a; B320; B344b*; B356*; B358a; B358b; B370a; B370b; B380b; B424; B360a*; B368; B375; B376; B386; B396; B422*; B472; B481*; B252b; B252c	B305b*; B311b; B307*; B310a; B344a; B380a*; B322*; B360b; B366; B394; B454; B461; B462*; B499*; B252a
Ethics	B103a; B105b*; B305a; B310b; B340; B344b*; B356*; B358b; B370a; B370b; B380b; B360a*; B360b; B365*; B366; B375; B376; B386; B482; B252b; B252c	B103b*; B305b*; B311b; B307*; B310a; B320; B344a; B380a*; B322*; B461; B462*; B499*	B394; B472; B252a
Diversity	B103b*; B305a; B310a; B310b; B340; B358b; B370b; B360a*; B396; B252b	B320; B380a*; B375; B422*; B472; B454; B481*; B499*	B365*; B386
Self-Awareness	B305a; B340; B370b; B360a*; B365*; B376	B104; B310b; B344b*; B358b; B370a; B380a*; B375; B396; B422*; B472; B454; B481*	B103a; B103b*; B380b; B322*; B360b; B366; B368; B386; B394; B461; B482; B499*; B252b; B252c
Understand Others	B103a; B103b*; B305a; B340; B380b; B380c; B424; B360a*; B365*; B366; B368; B482; B252b	B310b; B320; B370b; B380a*; B375; B386; B396; B422*; B472; B454; B462*; B481*; B252c	B344a; B322*; B394; B461; B499*
Collaboration Skills	B105a; B307*; B370a; B360b; B365*; B462*; B482	B104; B305b*; B310b; B320; B344a; B358b; B380a*; B375; B394; B396; B422*; B454; B481*; B499*	B103b*; B310a; B322*; B386; B472; B461; B252a
Career Exploration	B305a; B370a; B380a*; B368; B375; B376; B394; B252c	B360a*; B481*	B103b*; B104; B358b; B461; B499*
Writing Skills	B105a; B105b*; B305a; B356*; B360b; B365*; B481*; B482	B103a; B305b*; B310b; B320; B340; B344a; B344b*; B358a; B358b; B370b; B380b; B360a*; B366; B368; B375; B386; B394; B396; B420; B252b; B252c	B103b*; B104; B311b; B307*; B370a; B380a*; B322*; B376; B422*; B472; B454; B461; B462*; B499*; B252a
Speaking skills	B103b*; B104; B310b; B360b; B376; B422*; B482	B344a; B358b; B370a; B322*; B360a*; B375; B386; B394; B472; B454; B461; B462*; B481*	B499*; B252a
Information Competence	B103a; B311b; B310b; B356*; B358b; B370b; B365*; B366; B376; B454; B481*	B104; B105b*; B305b*; B320; B340; B380b; B322*; B360a*; B360b; B368; B375; B396; B420; B422*; B472; B482; B252b; B252c	B103b*; B307*; B310a; B380a*; B386; B461; B462*; B252a
Technological Competence	B105a; B105b*; B305a; B310b; B360b; B365*; B366; B376; B394; B422*; B454	B103a; B103b*; B104; B305b*; B311a; B311b; B320; B344a; B344b*; B356*; B358b; B370b; B380a*; B380b; B380c; B360a*; B375; B386; B396; B472; B462*; B482; B499*; B252b; B252c	B307*; B322*; B461; B252a
Creative Thinking	B105a; B105b*; B305a; B358b; B365*	B103a; B104; B344b*; B370b; B380a*; B380b; B322*; B360a*; B360b; B375; B420; B481*; B482; B252b; B252c	B103b*; B311b; B307*; B310b; B366; B386; B394; B422*; B472; B454; B461; B462*; B499*; B252a
Problem Solving	B105a; B310b; B370a; B376	B104; B311a; B320; B344b*; B358b; B380a*; B360a*; B360b; B375; B386; B394; B396; B422*; B454; B481*; B482	B103a; B103b*; B305b*; B311b; B307*; B310a; B380b; B322*; B366; B472; B461; B462*; B499*; B252a; B252b; B252c

* Indicates courses whose instructors could not be reached to discuss the students' syllabus audits.

Appendix C

Summary Table of Curriculum Audit and Self-Reported GPA

Learning Outcome	Number of Total Assignments	Beginning Level	Intermediate Level	Advanced Level	Mean Self-Reported GPA
Application	47	7	25	15	3.41
Career Exploration	15	8	2	5	3.32
Collaboration Skills	28	7	14	7	3.37
Content	45	15	17	13	3.10
Creative Thinking	34	5	15	14	3.20
Diversity	20	10	8	2	3.10
Ethics	36	21	12	3	3.54
Information Competence	37	11	18	8	3.41
Problem Solving	36	4	16	16	3.24
Research	31	13	9	9	2.98
Self-Awareness	32	6	12	14	3.56
Speaking skills	22	7	13	2	3.07
Technological Competence	40	11	25	4	3.20
Understand Others	31	13	13	5	3.39
Writing Skills	44	8	21	15	3.34
	Total = 498	Total = 146	Total = 220	Total = 132	Mean = 3.28

Appendix D

Discussion of the Results of the Syllabus Audit and Self-Grading Data Presented in Appendices B and C

Data Gathered During the Syllabus Audit

It appears that the Department's SLOs are being addressed in many classes and at all three cognitive levels. Each SLO was taught an average of 33 times across all audited psychology classes and levels. The SLOs were taught at the Beginning level an average of 9.7 times, 14.6 times at the Intermediate level, and 8.8 times at the Advanced level. The three SLOs addressed the least number of times were Career Exploration (15 times**),** Diversity (20 times), and Speaking Skills (22 times). All the other SLOs were addressed 28 times or more. The three most often targeted SLOs were Application (47 times), Content (45 times), and Technological Competence (40 times). Some potential concerns about the cognitive level at which the SLOs are targeted emerged when it was discovered that Speaking Skills, Diversity, Ethics, Understand Others, and Career Exploration were all targeted fewer than six times at the Advanced level. These results have not yet been addressed by the Department, so no curriculum changes have been recommended at this time.

Data Gathered When Capstone Students "Graded" Themselves

The average grades students gave themselves for the extent to which they had successfully accomplished each of the SLOs were high. All were above a 3.0 (B, which indicated above average attainment) with the exception of Research, which was a 2.98. Although this data reflect that our students are confident in their attainment of our SLOs, they may not necessarily reflect their actual level of attainment of our SLOs. As Kruger and Dunning (1999, p. 1121) found in research on the relationship between competence and confidence, "People tend to hold overly favorable views of their abilities in many social and intellectual domains." It will be necessary to compare these subjective, self-reported data with more objective data gathered from faculty observations of student performance.

Appendix E

Please grade yourself on your attainment of each of the following 15 student learning outcomes of the IUPUI Psychology Department. Use the grading scale of A-F as described below.

A = Outstanding
B = Above Average
C = Average
D = Below Average
F = Unacceptable

Please perform this task as honestly as possible. The grade you give yourself in this situation should reflect both the Department's ability to provide opportunities for you to develop these sets of knowledge and skills and your willingness to take advantage of these opportunities.

Essential Skills	**Grade** (A-F)
Understand the major concepts, theoretical perspectives, empirical findings and historical trends in psychology.	
Understand and use basic research methods in psychology, including design, data analysis, and interpretation.	
Understand and generate applications of psychology to individual, social, and organizational issues.	
Understand and abide by the ethics of psychology.	
Recognize, understand, and respect the complexity of socio-cultural and international diversity.	
Develop self-awareness by identifying your own personal strengths, weaknesses, values, goals, etc.	
Understand the behavior and mental processes of others.	
Work effectively as a member of a group to accomplish a task.	
Identify and prepare for a career in psychology or a related field.	
Demonstrate effective writing skills.	
Demonstrate effective speaking skills.	
Demonstrate information competence by identifying, locating, and retrieving written and electronic information sources.	
Utilize technology for many purposes.	
Demonstrate creative thinking skills.	
Demonstrate problem-solving skills.	

Appendix F

IUPUI Psychology Department Capstone Assessment Template

Instructions to the Capstone Instructor:

Please make a copy of this double-sided document for each student who completed your capstone class. Fill in each of the four lines below and complete the Capstone Assessment Template that appears on the other side of this page for each of your students. Please return your completed templates to Drew Appleby at your earliest convenience.

Class Number and Title:

_____

Instructor's Name:

_____

Semester and Year:

_____

Student's Name:

_____

Place an X in the box below the descriptor that most accurately describes the extent to which this student accomplished each of the Psychology Department's 16 SLOs in your capstone course.

Student Learning Outcome	Did Not Accomplish this SLO	Accomplished this SLO at an Acceptable Level	Accomplished this SLO at an Exemplary Level	This SLO was not addressed in this class
Content of Psychology → Student shows familiarity with the major concepts, theoretical perspectives, empirical findings, and historical trends in psychology.				
Research in Psychology → The student understands and uses basic research methods in psychology, including design, data analysis, and interpretation.				
Application of Psychology → The student understands and generates applications of psychology to personal, social, and organizational issues.				
Ethics in Psychology → The student understands and abides by the ethics of psychology.				
Diversity → The student recognizes, understands, and respects the complexity of socio-cultural and international diversity.				
Self-Awareness → The student has developed self-awareness by identifying her/his personal strengths, weaknesses, values, and goals.				
Understanding Others → The student understands the behavior and mental processes of others.				
Collaboration → The student can work effectively as a member of a group to accomplish a task.				
Career Planning → The student has developed realistic ideas about how to pursue careers in psychology and related fields.				
Writing Skills → The student demonstrates effective writing skills.				
Speaking Skills → The student demonstrates effective speaking skills.				
Information Competence → The student demonstrates information competence by identifying, locating, and retrieving written and electronic information sources.				
Technological Proficiency → The student can utilize technology for many purposes.				
Creative Thinking → The student can demonstrates the ability to combine existing information into new, creative, and useful ideas and hypotheses.				
Problem Solving → The student can use the scientific method to solve problems.				
Critical Thinking → The student can retain, comprehend, apply, analyze, synthesize, and evaluate information.				

Appendix G

Data Collected With the Capstone Templates

Completed templates were collected from 28 students (24 enrolled in PSY-B461 *Capstone Lab in Developmental Psychology* and 4 enrolled in PSY-B499 *Honors Research*). Two of the SLOs were generally ranked as "not addressed in these classes" by the instructors. (Self-Awareness was ranked as "not addressed" for 24 students and Career Planning was ranked as "not addressed" for 26 students.) A mean accomplishment rating was computed for the remaining 14 SLOs by assigning a 0 to "Did Not Accomplish this SLO," a 1 to "Accomplished this SLO at an Acceptable Level," and a 3 to "Accomplished this SLO at an Exemplary Level. These mean ratings appear in descending order of magnitude below.

1.71 = Information Competence
1.68 = Technological Proficiency
1.44 = Collaboration
1.32 = Writing Skills
1.32 = Problem Solving
1.25 = Application of Psychology
1.21 = Research in Psychology
1.15 = Diversity
1.14 = Understanding Others
1.07 = Content of Psychology
0.98 = Critical Thinking
0.96 = Speaking Skills
0.93 = Ethics in Psychology
0.86 = Creative Thinking

Another way to analyze these data is to use modal scores. When the SLOs are arranged in order of the magnitude of their modes, the results are as follows.

3 = Technological Proficiency
3 = Information Competence
3 = Collaboration
2 = Writing Skills
2 = Understanding Others
2 = Research in Psychology
2 = Problem Solving
2 = Ethics in Psychology
2 = Diversity
2 = Critical Thinking
2 = Creative Thinking
2 = Content of Psychology
2 = Application of Psychology
0 = Speaking Skills

The results of this modal analysis indicate that the plurality of senior psychology majors enrolled in capstone classes are able to demonstrate to their faculty that they have accomplished the following SLOs in an exemplary manner.

- Information Competence
- Technological Proficiency
- Collaboration

These results indicate that the plurality of senior psychology majors enrolled in capstone classes are able to demonstrate to their faculty that they have accomplished the following SLOs in an acceptable manner.

- Writing Skills
- Understanding Others
- Research in Psychology
- Problem Solving
- Ethics in Psychology
- Diversity
- Critical Thinking
- Creative Thinking
- Content of Psychology
- Application of Psychology

These results indicate that the plurality of senior psychology majors enrolled in capstone classes are unable to demonstrate to their faculty that they have accomplished the following SLO in an adequate manner.

- Speaking skills

Appendix H

Data collected from professors concerning accomplishment of SLOs

SLO, Level, Class, & Teacher	Assignment	Data Collected with the Assignment and Interpretation of these Data	Intervention Implemented	Data Collected with the Assignment after the Intervention and Interpretation of these Data
Content Level 1 B310	Self-report…asked the students, "You have a friend who is pregnant. What two pieces of information from the text book or lecture would you like to tell her?"	4% of 200 students during fall 2006 semester were knowledgeable of the positive implications of breastfeeding. This % is too low.	Lead an in-depth discussion on the benefits of breastfeeding.	90% of 200 students were knowledgeable of the positive implications of breastfeeding in the spring 2007 semester.
Content Level 1 B104	Questions on end-of-semester student evaluation: "sessions clarify course content" / "class helps me understand difficult concepts" / "class session helps me learn material."	In fall 2004, scores for these 3 items on a 5-point scale (with 5 as Strongly Agree were 3.96/3.69/3.93.	Implementation of a new teaching technique, "5 minute trainer."	Scores after the intervention rose to 4.08/4.03/4.03.
Content Level 1 B481	Quizzes over reading material.	Average quiz grades: all but 2 of 12 students had an average score of C- or higher. The vast majority of students accomplished the SLO of knowledge base of psychology.		
Ethics Level 1 B454	To pass the IUPUI Human Subjects Protection Test with at least a score of 70%.	15 out of 15 students passed the quiz in the fall of 2006. Students of this class have accomplished the ethics SLO at a very basic level.		

Content Level 3 B454	Students are to write a term paper in a particular area of psychology in which they have an occupational interest; this paper will consist of sections on the history, theories, research methods, and empirical findings of this area.	11 students out of 15 earned an A; 2 students earned a B; 2 students earned grades below C-. The vast majority of students in this class accomplished this SLO.		
Collaboration Level 3 B454	Students and the instructor rate all students in class with a merit pay system that reflects the level of collaboration that each student has reasonably exhibited.	In the fall of 2006, 7 out of 15 students earned a grade of A; 7 earned a grade of B; 1 earned a grade of C. All students accomplished the collaboration SLO.		
Career Planning Level 3 B454	Students are to create a Professional Planning Portfolio in which they gather or create all of the documents they will need to enter the next stage of their professional development (i.e. entering the job market or applying to graduate school).	In the fall of 2006, 13 students earned the grade of A; 1 student earned a B; 1 earned a grade of C. All students accomplished this SLO.		
Oral Communication Level 2.5 (applying and creating) B103	Students are to create and present a collaborative oral report in which they research a campus opportunity for psychology majors, create a PowerPoint presentation, and give the presentation to the class.	In the spring of 2007, 39 out of 42 students earned an A, 2 students earned a C, and one earned an F. The vast majority of students accomplished this SLO.		
Career Planning Level 3 B103	Students wrote a book that identified, examined, and clarified their professional and educational goals and created a comprehensive and realistic plan to accomplish these goals.	In the spring of 2007, 37 out of 42 students who completed the course earned an A; 1 earned a B, 3 earned a C; 1 earned an F. The vast majority of students accomplished this SLO.		

Research Level 3 B481	Students performed a research project of which they designed, collected, analyzed and interpreted data as well as presented this in a professional format.	In the spring of 2006, 8 students out of 12 earned an A; 3 earned a B; 1 earned a C. The vast majority of students accomplished this SLO.		
Ethics Level 1 B307	Students took a quiz over ethics and legal issues. (It should be noted that it was possible to replace one low quiz score with a 100%.)	Out of 18 students, 17 passed with a C or higher. The vast majority of this class understood the ethics in psychology at the basic level of learning.		
Research Level 1.5 B307	Students took 4 quizzes that covered testing procedures, constructing tests, reliability and validity. (It should be noted that it was possible to replace one low quiz score with a 100%.)	Out of 18 students: Testing Procedures: 14 passed with a C or higher Constructing Tests: 11 passed with a C or higher Reliability: 17 passed with a C or higher Validity: 9 passed with a C or higher Although these test scores did not reflect a uniform accomplishment of this SLO, they were an improvement over the more comprehensive test scores obtained during past semesters the same material.		
Understanding Others Level 1 B307	Students took a quiz over special populations. (It should be noted that it was possible to replace one low quiz score with a 100%.)	12 out of 18 students passed with a C or higher. The majority of students accomplished this SLO.		

Diversity Ethics Level 1 B307	Students took one quiz over special populations, and one quiz over technical, ethical and legal issues, which both demonstrate ethics and diversity.	Out of 18 students: Special Populations: 12 students passed with a C or higher Technical…: 16 passed with a C or higher. The majority of students accomplished these SLOs.		
Critical Thinking Level 2 B307	Students took a comprehensive final exam, which required them to retain, understand, comprehend, synthesize, apply, and evaluate information pertaining to psychological testing and measurement.	8 out of 18 students passed with a C or higher.		
Self-Awareness Level 1.5 B307	All students had the opportunity to take the MBTI in lab and have their results interpreted for them, or were taught how to interpret the results themselves.			
Application Level 2 B386	Students were to utilize skills learned in class and practiced in triads. Triads consisted of a listener, person with problem, and observer. Assignment consisted of listening to a person's problem and practicing basic counseling skills, never giving advice, asking open-ended questions, showing empathy, understand what is being said, and paraphrasing when appropriate. This session was to be audiotaped and typed out verbatim.	In spring 2007, 21 out of 35 students received A's, 10 students received B's, and 3 students received C's, with 0 students receiving a C-. All students accomplished SLOs to satisfactory of professor.		
Application , Writing Skills, Speaking Skills Level 3 B482	Students are to come up with a presentation on their experience in their practicum, creating a poster, writing a paper, and presenting it to the class and professor.	In spring 2007, 14 out of 16 students received A's, and 2 students received B's, all successfully accomplishing these SLOs.		

Content Level 1 B380	Students are to take 5 exams covering textbook material.	In spring 2007, 45 out of 48 students received grades of C or better. The vast majority of these students have successfully accomplished this SLO.		
Content Level 1 B105	Students took a cumulative exam over the whole semester.	In fall 2007, although the mean was 75% for the class, the low score was 44 out of 100. The percentage of students who did not pass the cumulative final is not satisfactory.	We have decided to move to a more active learning model for teaching B105 in an attempt to engage our students more fully in the course.	This is the first semester. The professor feels that the students are grasping the material better than with the old model; however, she will not have any data to prove this until the end of the semester.

Appendix I

Student Learning Outcome	Level 1	Level 2	Level 3	SLO Accomplished Satisfactorily	Intervention Implemented	Intervention Successful
Content of Psychology	5	0	1	3	3	2
Research Methods	1	0	1	2	0	0
Application of Psychology	0	1	1	2	0	0
Ethics in Psychology	3	0	0	3	0	0
Diversity	1	0	0	1	0	0
Self-Awareness	1	0	0	1	0	0
Understanding Others	1	0	0	1	0	0
Collaboration	0	0	1	1	0	0
Career Planning	0	0	2	2	0	0
Writing Skills	0	0	1	1	0	0
Speaking Skills	0	1	1	2	0	0
Information Competence	0	0	0	0	0	0
Technological Proficiency	0	0	0	0	0	0
Creative Thinking	0	0	0	0	0	0
Problem Solving	0	0	0	0	0	0
Critical Thinking	0	1	0	1	0	0
Totals	12	3	8	20	3	2

Appendix J

Ratings by 121 Psychology Majors Who Completed the School of Science Senior Exit Survey to the Item "Please use the following scale to rate your current level of proficiency in each of the following skills."

Student Learning Outcome	Far Below Average	Below Average	Average	Above Average	Far Above Average	Mean Rating
Self-Awareness	0	2	16	59	44	4.20
Understanding Others	0	1	16	62	42	4.20
Ethics in Psychology	0	1	22	52	46	4.18
Writing Skills	0	0	23	58	40	4.14
Diversity	0	1	29	52	39	4.07
Problem Solving	0	1	30	52	38	4.05
Information Competence	0	0	31	54	36	4.04
Creative Thinking	0	2	29	55	35	4.02
Application of Psychology	0	0	25	72	24	4.00
Technological Proficiency	0	4	31	49	37	3.98
Collaboration	0	3	31	54	33	3.97
Content of Psychology	0	1	33	64	23	3.90
Career Planning	1	7	31	47	35	3.89
Speaking Skills	0	4	43	45	29	3.82
Research Methods	1	6	41	51	22	3.72
Critical Thinking*						
Totals	2	33	431	826	523	4.01

*Mistakenly omitted from the survey.

References

Anderson, L.W., & Krathwohl, D.R. (Eds.) (2001). *A taxonomy of learning, teaching, and assessment: A revision of Bloom's taxonomy of educational objectives*. New York: Longman.

Kruger, J, & Dunning, D. (1999). Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology, 77*(6), 1127-1134.