

UNIVERSITY OF WISCONSIN MILWAUKEE DEPARTMENT OF BIOLOGICAL SCIENCES ASSESSMENT PROGRAM

NEW UWM DEPARTMENT OF BIOLOGICAL SCIENCES ASSESSMENT PROGRAM: The Department of Biological Sciences has designed a new plan to assess student learning in our undergraduate degree programs. We will initiate this action in the Fall 2005 semester. This plan is primarily the outcome of guidance we received by attending the two UWM workshops presented by Barbara Walvoord over the past year. We have now developed a 3-stage program to better assess how well our majors are learning at critical points: after completion of the Foundations coursework, after completion of the Gateway coursework, and just prior to graduation. The new assessment program is more formal and will include greater participation by the entire instructional staff. The tools we use to measure student learning have been refined so that the data collected can better help us determine the best strategies to continually enhance student learning. Additionally, we have added a component where we will be able to receive annual feedback from the Center of Instructional & Professional Development on our annual reports concerning student learning (e.g., our data analyses and action plans based on such analyses).

UNIVERSITY OF WISCONSIN MILWAUKEE DEPARTMENT OF BIOLOGICAL SCIENCES ASSESSMENT PROGRAM

Stage 1: Student learning assessment after completion of introductory level courses for the major, Biological Foundations I & II

Learning Objectives	Direct Measures	Indirect Measures	Uses of Assessment to Enhance Learning in Courses	Uses of Assessment to Enhance Program
<p>Upon successful completion of the Foundations courses, a biological science major will:</p> <ol style="list-style-type: none"> 1. be able to describe and apply a broad-based knowledge of biological information and concepts. 2. have developed the ability to apply the scientific method to biological questions and the ability to evaluate experimental design, as well as create & interpret numerical and graphical data. 3. be able to use basic laboratory skills to investigate scientific questions. This includes an understanding of the use and application of common biological instruments and procedures. 4. have developed the ability to use available resources e.g., the library, computer databases, etc. to obtain scientific information. 5. have begun to develop the ability to synthesize, integrate and communicate scientific information. 6. demonstrate an appreciation of the patterns and processes of life and understand why evolution is the unifying concept in biology. 	<ol style="list-style-type: none"> 1. Course Grades * 2. Exams ** 3. Sample Lab Reports from 150 or 152 *** 	<ol style="list-style-type: none"> 1. Course Evaluations 2. Teaching Assistant Evaluations 3. Student Assessment of Learning Gains Survey (SALG) 	<ol style="list-style-type: none"> 1. Individual faculty review courses (format, learning activities, resources, based on student performance) 2. Annual meeting of faculty involved in developing and teaching intro courses to discuss course & curricular reforms 	<ol style="list-style-type: none"> 1. Annual meeting of all faculty & teaching academic staff to discuss curriculum reforms. 2. Course & Curriculum Committee writes summary report based on this meeting. 3. Consultation with Center for Instructional & Professional Development (CIPD): Report submitted to CIPD for feedback

4/6/05

* In the past we relied on students passing required courses to assess their learning through the program. However, course grades, per se, are too 'blunt' to be used as diagnostic tools to determine which of our stated learning goals the students are achieving and where are there deficiencies in student learning. Instead, we can use the specific assessment tools with which we measure student performance on course assignments and tests to reveal which and how well the specific Learning objectives are being achieved. For example, see ** & *** below

** To use results of exams as diagnostic tools, questions are grouped according to which of the course and program learning goals they address (see examples below). Data can then be analyzed to determine which LOs are being achieved and for which ones we need to modify pedagogy &/or curriculum to enhance student learning of those LOs. For Example:

Learning Objective #1:

5. You are sick and have a fever (your temperature is 102°F instead of 98.6°F). A **REASON** for your symptoms may be:
- A. when temperature is abnormal, metabolic processes may not be able to proceed normally.
 - B. when conditions, such as temperature, vary too greatly, the shapes of proteins can be altered.
 - C. when you are well, homeostasis usually prevents conditions from deviating too far from normal so enzymes are not denatured.
 - D. denatured enzymes are not able to catalyze metabolic reactions normally.
 - E. **ALL** of the above are **TRUE**.

Learning Objective # 2:

3. Which of the following is **NOT** true of a **CONTROLLED EXPERIMENT**:
- A. The control group enables you to make comparisons to determine whether any changes occur in an experimental group.
 - B. It allows you to objectively test your hypothesis.
 - C. You always prove that your hypothesis is true.
 - D. Conclusions are based on analyzing data you collected in the experiment.
 - E. The control group receives the same attention as test groups, but is not influenced by the variable the other groups are testing.

Learning Objective #6:

33. **BIOLOGICAL EVOLUTION** involves all of the following **EXCEPT**:
- A. the ability of an individual to adapt to its environment.
 - B. change in the genetic make-up of a population over the generations.
 - C. an increase in the number of members in a population having a more adaptive ("fit") phenotype.
 - D. the fact that more offspring are produced than the ecosystem can sustain.
 - E. natural selection acts to keep the gene pool of geographically isolated populations the same over time.

*** A standard set of rubrics (see attached at end of document) will be used to grade the sample student lab reports. Evaluation of a report enables measurement of student achievement of Learning Objectives #s 1, 2, 3, 4 & 5 (and potentially 6 if the experimental topic required an that the student demonstrate an understanding of biological evolution).

Stage 2: Assessment after Gateway Courses for the major: Genetics, Cell Biology, General Ecology and Genetics & Cell Biology Laboratory

Learning Objectives	Direct Measures	Indirect Measures	Uses of Assessment to Enhance Learning in Courses	Uses of Assessment to Enhance Program
<p>Upon successful completion of the Gateway course, a biological science major will:</p> <ol style="list-style-type: none"> 1. be able to describe and apply a broad-based knowledge of biological information and concepts. 2. have developed the ability to apply the scientific method to biological questions and the ability to critically evaluate experimental design, as well as create and interpret numerical and graphical data. 3. be able to use field & laboratory skills to investigate scientific questions. This includes an understanding of the use and application of common biological instruments and procedures. 4. have developed the ability to use available resources e.g., the library, computer databases, etc. to obtain scientific information. 5. have developed their ability to synthesize, integrate, and communicate scientific information. 6. demonstrate an appreciation of the patterns and processes of life and understand why evolution is the unifying concept in biology. 	<ol style="list-style-type: none"> 1. Course Grades 2. Exams 3. Sample Lab Reports from 310 or 316 	<ol style="list-style-type: none"> 1. Instructor/ Course Evaluations 2. Teaching Assistant Evaluations 3. Student Assessment of Learning Gains Survey (SALG) 	<ol style="list-style-type: none"> 1. Individual faculty review courses (format, leaning activities, resources, based on student performance 2. Annual meeting of faculty involved in developing and teaching Gateway courses to discuss course & curricular reforms 	<ol style="list-style-type: none"> 1. Annual meeting of all faculty & teaching academic staff to discuss curriculum reforms. 2. Course & Curriculum Committee writes summary report based on this meeting. 3. Consultation with CIPD: Report submitted to CIPD for feedback.

Stage 3: Student learning assessed in students enrolled in the **Capstone Course, Senior Seminar**

Learning Objectives	Direct Measures	Indirect Measures	Uses of Assessment to Enhance Learning in Courses	Uses of Assessment to Enhance Program
<p>Upon successful completion of the major, our students will be able to:</p> <ol style="list-style-type: none"> 1. describe and apply a broad base of biological information and concepts including societal and ethical questions related to biology. 2. apply the scientific method to biological questions and the ability to critically evaluate experimental design, as well as create and interpret numerical and graphical data used in sophisticated research (e.g., as published in peer-reviewed journals). 3. use diverse field and laboratory skills to investigate scientific questions. This includes an understanding of and proficiency in the use and application of an array of biological instruments and procedures. 4. use available resources (e.g., the library, computer databases, etc.) to retrieve scientific information. 5. synthesize, integrate and communicate scientific information to other scientists, students, and the general public. 6. demonstrate an appreciation of the patterns and processes of life and clearly articulate why evolution is the unifying concept in biology. 	<ol style="list-style-type: none"> 1. Upper level course grade statistics 2. Overall evaluation of each student by Sr. Sem. faculty is required of all graduating seniors (see attached tool). 3. Performance in Senior Seminar projects, papers and presentations. 	<ol style="list-style-type: none"> 1. Course Evaluations 2. Graduation Questionnaire (see attached tool, after rubrics). 	<ol style="list-style-type: none"> 1. Individual faculty review courses (format, learning activities, resources) based on student performance. 2. Annual meeting of faculty involved in developing and teaching all upper level courses to discuss course & curricular reforms 	<ol style="list-style-type: none"> 1. Annual meeting of all faculty & teaching academic staff to discuss curriculum reforms. 2. Course & Curriculum Committee writes summary report based on this meeting. 3. Consultation with CIPD: Report submitted to CIPD for feedback

SAMPLE RUBRICS FOR ASSESSING LAB REPORTS:
Research Report Introduction Rubric

Introduction: Science Content

	Distinguished (5)	Proficient (3)	Unsatisfactory (0)	Score
Overall Quality	Presents a concise lead-in to the report. Exceptionally clear, concise, and insightful.	Gives some information.	Does not give any information about what to expect in the report.	
Purpose/Problem	Clearly stated	Some related issues introduced	Not clear.	
Background Information	Appropriate to the topic is clearly and accurately presented, providing precise examples, facts and details, while conveying both the depth and breadth of the topic.	Appropriate to the topic is accurately presented, providing selected examples, facts and details, but lacking the depth and richness of detail	Minimal scientific background is presented, using some examples that may or may not be appropriate or relevant.	
Topic Research	The topic is thoroughly researched, using an ingenious variety of high-level resources.	Research lacks variety, and some sources may or may not be appropriate.	Research is lacking in both variety and appropriateness.	
Context	Topic is supported by detailed references to current science/math research.	Paper mentions concepts and topics from recent research	No mention is made of relevant research.	
Terminology	Use of scientific terms and concepts reveals a deep understanding of underlying scientific ideas.	Scientific terms and concepts are used correctly.	Scientific terms and concepts are used incorrectly, or topic is discussed in completely non-scientific terms.	
			Total out of 30:	

Introduction: Writing Mechanics

	Distinguished (5)	Proficient (3)	Unsatisfactory (0)	Score
Overall Quality	Writing is precise and appropriate, conveying a command of the subject, while language is unflinching the student's own.	Although the language is mostly appropriate it may be somewhat conventional, conveying less of a sense of authority on the subject; other language is generally the student's own.	Writing exhibits limited use of appropriate language and lacks interest and/or self-confidence in the subject; there is doubt in the reader's mind as to whether the writing is student's own.	
Ideas	Ideas are clear, original and focused. Main idea stands out along with details.	Ideas are clear, but information may be somewhat general and predictable.	Ideas are unclear and more information is needed. Text is repetitious. No central theme.	
Conventions	Grammar and usage are correct and contribute to clarity. Punctuation is correct and paragraphing adds to organizational structure.	Very few mistakes in grammar and usage. Paragraphing may create minor problems. Spelling and punctuation are almost entirely correct.	Errors in grammar and usage affect meaning. Paragraphing is missing or does not relate to organization of text. Frequent spelling errors. Punctuation is often missing or incorrect	
Organization & Coherence	Organization enhances the central theme. Sequencing is logical and transitions are smooth.	Organization is adequate. Introduction may need more anticipation. Conclusion may lack closure.	Organization is not clear. Connections are confusing. Introduction and conclusion are present but are unclear or incomplete.	
			Total out of 20:	

Introduction: Science Content Points + Writing Mechanics Points = _____ out of 50

Methods Rubric

	5 POINTS	4 POINTS	2 POINTS	0 POINTS	SCORE
Description of Experiment	Includes all factors that may affect the experimental results, including independent variables, dependent variables, and control variables.	Includes most factors that may affect the results of the experiment.	Includes some factors that may affect the results of the experiment.	Lacks explanation of factors that affect results.	
Procedures	All special details & steps are listed.	All steps are listed.	Some steps are listed.	No steps are listed.	
Materials	All materials and equipment listed.	All materials listed.	Some materials listed.	Incorrect or no materials listed.	
Describes Control vs. Experimental Groups	The control variable – kept the same in both groups - is identified, & described.	Control variable is identified but not fully described.	A control variable is identified.	Control variable is not identified or described.	
	IDs the experimental group – the one composed of the independent variable.	IDs experimental group, but does not fully explain the independent variable.	IDs experimental group, but incorrectly explains the independent variable.	Experimental group is not identified.	
Describe Relevant Data to be Collected	Fully describes & justifies data to be collected in the context of testing the hypothesis.	Describes data but does not fully justify.	Briefly describes data.	Does not explain data.	
Data Analysis	Fully describes & justifies how data will be analyzed to test Ho.	Partly describes & justifies how data will be analyzed.	Poorly describes & justifies how data will be analyzed.	No discussion of data analysis.	
Validity of Method for Testing the Hypothesis	Clearly explains how this test will enable you to accept or reject your hypothesis.	Partly explains how this test will enable you to accept or reject your hypothesis.	Illogically explains how this test will enable you to accept or reject your hypothesis.	Does not explain how test leads you to accept or reject your hypothesis.	
Demonstrate Repetition	Fully describes & justifies either multiple trials or multiple experimental setups.	Does not fully describe & justify repetition.	Incorrectly describes repetition.	No account of repetition.	
Writing	Clearly written using correct grammar.	Some ambiguity and some grammatical errors.	Poorly written and poor grammar.	Not intelligible.	
				TOTAL OUT OF 50:	

RESULTS RUBRIC					
CRITERIA	8	4	2	0	score
Presentation	Professional presentation. Shows attention to detail. Clear summary of data & data analysis	Neat, easy to read. Summaries data & data analysis	Sometimes hard to read. Does not help reader understand data & data analysis	Little or no attention to presentation. Data/data analysis not explained or summarized.	
Data collection	Accurately displays data in both table & graph formats. Data is reasonable, thorough & includes values, labels, titles & appropriate scaling to demonstrate comprehension.	Displays data in table and graph formats. Data is reasonable and includes values, labels, titles, and appropriate scaling scales.	Data is reasonable and includes most of the values, labels, titles, appropriate scaling.	Inaccurately displays data in table and/or graph formats. Data is not reasonable &/or significant details are missing that interfere with comprehension.	
Data analysis	Precisely states hypothesis and accurately compares hypothesis to the actual results. Presents ample detail and data to support thesis statement. Accurately and thoroughly explains and states the type of relationship between input (independent) and outcome (dependent) variables.	Clearly states hypothesis and accurately compares hypothesis to the actual results. Presents sufficient data to support thesis statement. Accurately explains and states the type of relationship between independent and dependent variables.	Accurately compares hypothesis to the actual results. Generally refers to the data to support this relationship. Accurately explains or states the relationship between independent & dependent variables.	Inaccurately compares hypothesis to actual results. Does not refer or present data to support relationship. Inaccurately states relationship between independent & dependent variables as indicated by the data.	
Explanation of reasoning	Provides a clear, coherent, complete and organized explanation of math concepts (e.g., statistical models) and/or problem solving strategies.	Provides a clear and organized explanation of math concepts and/or problem solving strategies.	Provides a general explanation, which is organized but lacking in details.	Unclear or incomplete explanation of the problem solving process. Major steps or concepts may be omitted.	
Graphics	Easy to interpret. Clearly organize & summarize data/data analysis	Moderately easy to interpret. Reasonably organize & summarize data/data analysis	Somewhat confusing. Does not help reader to summarize data/data analysis	Absent &/or not clear,	
Logic	Accepts or rejects hypothesis based on evidence from this experiment.	Accepts or rejects hypothesis based somewhat on evidence from this experiment.	Not clear if hypothesis is accepted or rejected based on evidence from this experiment.	Does not explain if hypothesis should be accepted or rejected.	
				TOTAL out of 48:	

DISCUSSION RUBRIC					
CRITERIA	6	3	1	0	score
Opening	Clear focus on & thorough introduction of topic.	Topic is introduced with sufficient focus on topic.	Little focus on topic.	No focus on topic.	
Development of ideas	Interesting, sophisticated, insightful. Strongly supports thesis.	Development of ideas is clear, evident, and supports thesis.	Simplistic. Ideas do not support thesis.	Absent or ineffective.	
Paragraph development	Each paragraph clearly and consistently relates to the main idea, contributes to an effective argument, and reinforces content; with smooth transitions.	Many paragraphs relate to main idea, contribute to an effective argument, and reinforce the content; often uses smooth transitions.	Some paragraphs relate to main idea, contribute to an effective argument, and have transitions.	Fewer or no paragraphs relate to main idea, contribute to an effective argument or have transitions.	
Supporting evidence and details	Uses many examples, reasons, facts & explanations that are relevant, appropriate & convincing.	Uses examples, reasons, details, and explanations that are sufficient and accurate.	Some examples, reasons, details, etc. are sufficient and accurate.	Vague, missing, inaccurate evidence.	
Logic	Conclusions & inferences based on sound scientific reasoning.	Conclusions & inferences mostly based on sound scientific reasoning.	Logic not clear.	Illogical.	
Conclusion	Based on evidence collected & analyzed in this research project. Extends, connects, comments on key ideas and topics.	Refers to data collected & analyzed in this research project. Summarizes main ideas, echoes key concepts.	Not clearly connected to data collected & analyzed in this research project. Restates main idea.	Not based on data collected & analyzed in this research project. No mention of main idea or key concepts.	
Implications	Clearly illustrates significance of research & explains need & nature of follow-up studies.	Some explanation of importance of research & suggests follow-up studies	Relevance of research not clear.	Relevance of work not discussed.	
Suggested improvements	Provides clear, powerful, specific and logical discussion of the improvements that could be made to experiment.	Provides a specific and logical discussion of the improvements that could be made.	Provides a general but logical discussion of the improvements that could be made.	Provides an unclear and/or illogical discussion of the improvements that could be made.	
				TOTAL out of 48:	