

Environmental Science, Bachelor of Science Program 2008 yearly assessment report by Dr. Mike Little

As Environmental Science (ES) BS students take the same set of core courses in technology, computer and analytical methods as do Integrated Science and Technology (IST) students, the assessment plan developed for the IST department will be applied for the ES program administered by IST.

I. Program's Student Learning Outcomes

We have grouped assessment into two areas.

1-3 are from the Core Technology, Computer and Analytical Methods Curriculum

- 1) Capacity to apply appropriate technology to problem solution
- 2) Capacity to analyze numeric data
- 3) Capacity to use and develop software for problem resolution

4-8 are higher learning skills associated with the departmental capstone experience

- 4) Capacity of students to demonstrate discipline-specific content knowledge
- 5) Capacity of students to clearly identify and define an issue
- 6) Capacity of students to design an experiment or project employing appropriate scientific and technical methods
- 7) Capacity of students to analyze and present data in appropriate format
- 8) Demonstration by student of originality and creativity

II. Assessment Activities

A. Assessment Measures (Tools)

For 1-3 we developed pre-Core Curriculum exams for the department in August of 2008 and we are in the process of developing post core curriculum exams to assess student's knowledge.

For 4-8 assessment is by the qualified faculty members who participate in the design, mentoring and assessment of the capstone project and public presentation. Benchmarks for planning, development and presentation of capstone projects were developed in August 2008.

B. Benchmarks

For #1, Capacity to apply appropriate technology to problem solution, we are looking for a significant increase in the ability to use technology in problem resolution between pre curriculum and post curriculum learning.

For #2, Capacity to analyze numeric data, we are looking for a significant increase in the ability to use analytical skills for problem resolution between pre curriculum and post curriculum learning.

For #3, Capacity to use and develop software for problem resolution, we are looking for a significant increase in the ability to use appropriate software in problem resolution between pre curriculum and post curriculum learning.

For #4, Capacity of students to demonstrate discipline-specific content knowledge, we are looking for the student to demonstrate significant discipline-specific knowledge.

For #5, Capacity of students to clearly identify and define an issue, we are looking for whether students have clearly identified and defined an issue in the field.

For #6, Capacity of students to design an experiment or project employing appropriate scientific and technical methods, we are looking for whether the students has developed a well designed and functional experiment or project.

For #7, Capacity of students to analyze and present data in appropriate format, we are looking for whether the students has demonstrated significant and appropriate analysis and presentation of data.

For #8, Demonstration by student of originality and creativity, we are looking for whether the student's experiment or project demonstrates sufficient level of originality and is not mostly copied from the work of others.

C. Results/Analysis

For 1-3 we will analyze the difference between pre and post curriculum scores for individual students.

For 4-8 there will be departmental assessment of each student project from planning, through implementation, and final presentation.

D. Analysis/Planned Action

For 1-3 administer, collect and record pre-curriculum exam scores. Need to develop a post curriculum exam for this group of students.

For 4-8 we will check this semester to see if students have achieved the benchmarks for planning and development for their first semester of capstone preparation (IST 490: Senior Project I). For the spring, we will need to assess whether students have met benchmark for presentation in May '09 as part of their IST 491 (Senior Project II) requirements.

Marshall University
Assessment of Program's Student Learning Outcomes
for the Environmental Science BS Degree 2008

Program's Student Learning Outcomes	Assessment Measures (Tools)	Benchmarks	Results	Analysis/Planned Actions
1-3 Outcomes from Assessment of competencies from Core Technology, Computer, and Analytical Methods Curriculum				
1 Capacity to apply appropriate technology to problem solution	Pre and Post core curriculum multiple choice test developed by Department	Significant increase in ability to use technology in problem resolution between pre curriculum and post curriculum learning	Analyze significance of difference between pre and post curriculum scores for individual students	Pre Curriculum exam developed 8/15/08
2 Capacity to analyze numeric data	Pre and Post core curriculum multiple choice test developed by Department	Significant increase in ability to use analytical skills for problem resolution between pre curriculum and post curriculum learning	Analyze significance of difference between pre and post curriculum scores for individual students	Pre Curriculum exam developed 8/15/08
3 Capacity to use and develop software for problem resolution	Pre and Post core curriculum multiple choice test developed by Department	Significant increase in ability to use appropriate software in problem resolution between pre curriculum and post curriculum learning	Analyze significance of difference between pre and post curriculum scores for individual students	Pre Curriculum exam developed 8/15/08
4-8 Outcomes assessed for higher learning skills associated with departmental capstone experience				
4 Capacity of students to demonstrate discipline-specific content knowledge	Faculty evaluation of project	Student is judged to have demonstrated significant discipline-specific knowledge	Departmental assessment by qualified faculty of each student project from initial planning, through implementation, and final presentation	Complete format for capstone work with planning, development and presentation benchmarks developed 8/15/08
5 Capacity of students to clearly identify and define an issue	Faculty evaluation of project	Student is judged to have demonstrated significant discipline-specific knowledge	Departmental assessment by qualified faculty of each student project from initial planning, through implementation, and final presentation	Complete format for capstone work with planning, development and presentation benchmarks developed 8/15/08

6 Capacity of students to design an experiment or project employing appropriate scientific and technical methods	Faculty evaluation of project	Student is judged to have developed a well designed and functional experiment or project	Departmental assessment by qualified faculty of each student project from initial planning, through implementation, and final presentation	Complete format for capstone work with planning, development and presentation benchmarks developed 8/15/08
7 Capacity of students to analyze and present data in appropriate format	Faculty evaluation of project	Student is judged to have demonstrated significant and appropriate analysis and presentation of data	Departmental assessment by qualified faculty of each student project from initial planning, through implementation, and final presentation	Complete format for capstone work with planning, development and presentation benchmarks developed 8/15/08
8 Demonstration by student of originality and creativity	Faculty evaluation of project	Student's experiment or project demonstrates sufficient level of originality and is not mostly copied from work of others	Departmental assessment by qualified faculty of each student project from initial planning, through implementation, and final presentation	Complete format for capstone work with planning, development and presentation benchmarks developed 8/15/08

The Integrated Science and Technology (IST) and Environmental Science (ES) Program Core Education Assessment

Introduction to students:

This is an assessment to help your department determine the efficiency of a critical component of your education. During your early learning experiences with us, you will complete four IST courses that are critical to your capacity to use knowledge efficiently. These four courses, identified as the IST Core Course sequence, focus on basic computer applications and relationship of computing to technology (IST 160 Introduction to Programming and IST 260 Instrumentation I) and the integration of calculus and other math applications to problem solving in the practical world (IST 131 Analytical Methods II: Differential Calculus and IST 230 Analytical III: Integral Calculus/Series). From these IST Core courses, we have selected three critical areas of learning for this assessment: application of mathematics in problem solving, application of instrumentation and associated technology in measurement, and application of computers and associated software in the use and analysis of knowledge.

How important are the skills and knowledge of the IST Core? Critically! While we all tend to look for and properly value the substantive content of learning experiences, e.g. how to write a computer program, how to replicate DNA, or how to digitally map an environmentally sensitive area, if any of us cannot effectively first accurately measure our efforts and successfully use them to solve the problems we encounter, then our learning is functionally inert and of little use to us.

What exactly are these assessments of Core Learning?

The assessment consists of two exercises. The first is taken at the beginning of the IST Core Course sequence and consists of thirty questions involving the integration of mathematics, computer applications and technology in the solution of practical problems. This assessment is identified as the "Pre-Core Assessment". The second assessment is completed and each student has completed the IST Core Course sequence of IST 160, IST 260, IST 131, and IST 230. This examination is identified as the "Post-Core Assessment, and with an appropriate level of difficulty, tests for the student performance on the same types of problems experienced on the Pre-Core Assessment. The assessment consist of 25 multiple choice questions.

Who must complete the Core Education Assessment?

All students enrolled as majors in the Integrated Science and Technology and Environmental Science (Undergraduate) Degree Programs must complete both the Pre-Core Assessment and Post-Core Assesment. This includes all students completing majors in Integrated Science and Technology, Computer Information Technology, Biotechnology, and Environmental Science.

When should I complete the Pre-Core and Post-Core Assessment Exercises?

All students attempting to graduate with a major in Integrated Science and Technology, Computer Information Technology, Biotechnology, and Environmental Science must complete the Pre-Core Assessment Exercise during their enrollment in IST 160 Introduction to Programming. The Pre-Core Assessment Exercise must be completed prior to the recipient of your grade for this course. After completing IST 160 Introduction to Programming, IST 260 Instrumentation I, IST 131 Analytical Methods II, and IST 230 Analytical Methods III must complete the Post-Core Assessment Exercise as prerequisite for permission to enroll in IST 231 Analytical Methods IV, which is a required course for all IST and ES graduates.

What's the Big Deal?

The skills and knowledge of the IST Core Course sequence are critical to your efficient learning of content in your strategic sectors in IST and content courses in the other disciplines on campus. We need to know that the objectives of the Core Courses are effective and the learning has been meaningful to you. We need to accurately know what you know at the beginning and we need to know what you have learned at the end of this experience.

How do I complete this requirement?

Easy! While enrolled in IST 160 for the "Pre-Core Assessment" select "Assessment" on the IST webpage and then select "Pre-Core Assessment". Follow instructions and you should easily complete the exercise. After completing IST 160, 260, 131, and 230, you will receive notification by email that you should complete the "Post-Core Assessment". Remember, completion of this assessment is prerequisite to enrollment in IST 231, which is a requirement for graduation. As before, select "Assessment" on the IST webpage. Only this time, select "Post-Core Assessment" and then complete the exercise.

Pre-assessment of core learning skills for the Integrated Science and Technology Program

1. Computer functions are dependent on operating systems that really do just that...they operate the systems you use. Which of the statements below identifies an operating system:
 - A) DOS
 - B) Excel
 - C) Lennox
 - D) RAM
 - E) Two of these are a type of operating system
 - F) Honestly, my best answer would only be a guess
2. An operating system would perform which of the following functions:
 - A) Manage hardware
 - B) Manage files
 - C) Powers on a computer
 - D) An operating system would perform two of these functions
 - E) Honestly, my best answer would only be a guess
3. Which of the following is not a part of a sensor?
 - A) Transducer
 - B) Signal conditioner
 - C) Output device
 - D) All 3 above are parts of a sensor
 - E) None of these are parts of a sensor
 - F) Honestly, my best answer would only be a guess
4. What does the acronym GPS stand for?
 - A) Geographic Performing Subsystem
 - B) Global Positioning System
 - C) Group Policy Selection
 - D) Grand Prix System
 - E) Honestly, my best answer would only be a guess
5. What does the acronym GIS stand for?
 - A) Geographic Information System
 - B) Global Information System
 - C) Geocoded Instructional System
 - D) Geographic Information Service
 - E) Honestly, my best answer would only be a guess

6. Why do environmentalists use “electro-fishing” in rivers and lakes?
- A) To reduce the population of a particular fish species
 - B) For gathering information on a significant number of fish
 - C) To see which fish have been caught in the past
 - D) To test water temperature
 - E) Honestly, my best answer would only be a guess

Use the following information to complete questions 7-9

A critical step in the solving any problem that has a mathematical application is the choice of the correct math tool. During your work in the IST Core Course sequence you have had experience with a number of math tools including (1) the prediction of two factors occurring randomly in a population using the binomial theorem, (2) the prediction of the significance of difference between two means of data in a scientific experiment, (3) the calculation of a regression line using $y = mx + b$, (4) the calculation of one event occurring predictably with another by calculation of correlation, and (5) the calculation of a regression line in which one event changes exponentially relative to another

An environmental scientist wants to produce a graph that would enable him/her to predict how much calcium carbonate would be needed to raise the pH of a mountain stream from 4.5 to 6.7. She/he has set up an experiment in which varying amounts of calcium carbonate are added to samples of water at a pH of 4.5 and the changes in pH recorded. The graph is then read to determine the correct amount of calcium carbonate to be added to raise the pH to 6.7.

7. The functional math tool for this work would be:
- A) the prediction of two factors occurring randomly in a population using binomial theorem,
 - B) the prediction of the significance of difference between two means of data in a scientific experiment,
 - C) the calculation of a regression line using $y = mx + b$,
 - D) the calculation of one event occurring predictably with another by calculation of correlation,
 - E) the calculation of a regression line in which one event changes exponentially relative to another
 - F) Honestly, my best answer would only be a guess
8. In this work the independent variable would be by definition:
- A) the variable that is changed by the experimenter during the course of the experiment
 - B) the variable that changes in response to the manipulations of the experimenter
 - C) measured as factor x in subsequent calculations
 - D) two of these are true
 - E) Honestly, my best answer would only be a guess
9. In this work the independent variable would be:
- A) pH of the water after the addition of calcium carbonate
 - B) the amount of calcium carbonate added to change the pH
 - C) Honestly, my best answer would only be a guess

Use the following information to complete questions 10-11

In a small community a crime has been committed and by analysis of crime scene evidences it is known that the assailant had two different types of PGM at that critical forensic location. This person was classified as PGM1/PGM2. The only other variant of PGM is PGM2 and all suspects must be either PGM1/PGM2 (as is the perpetrator of the crime), PGM1/PGM1, or PGM2/PGM2. A forensic geneticist needs to calculate the probability of these three combinations of PGM1 and PGM 2 in this small community.

10. The math tool to be used would be:

- A) the prediction of two factors occurring randomly in a population using binomial theorem,
- B) the prediction of the significance of difference between two means of data in a scientific experiment,
- C) the calculation of a regression line using $y = mx + b$,
- D) the calculation of one event occurring predictably with another by calculation of correlation,
- E) the calculation of a regression line in which one event changes exponentially relative to another
- F) Honestly, my best answer would only be a guess

11. This work:

- A) would require the production of a graph with a regression line
- B) would not require the production of a graph with a regression line
- C) Honestly, my best answer would only be a guess

An experimenter determined that mice eating fudge brownies with a sugar substitute would weigh significantly less than those eating brownies with a sugar base. She/he baked the two above mentioned type of brownies and fed each type to a population of 30 mice. After 30 days of eating brownies each mouse was weighed and the data entered into two columns in Excel and analyzed.

12. The appropriate math application to determine whether the use of a sugar substitute reduced the rate of weight gain would be:

- A) the prediction of two factors occurring randomly in a population using binomial theorem,
- B) the prediction of the significance of difference between two means of data in a scientific experiment,
- C) the calculation of a regression line using $y = mx + b$,
- D) the calculation of one event occurring predictably with another by calculation of correlation,
- E) the calculation of a regression line in which one event changes exponentially relative to another
- F) Honestly, my best answer would only be a guess

13. What is the limitation keeping you from editing an intense scene from a family-oriented Harry Potter film?

- A) open source prohibitions against such modification
- B) U.S. laws against such modifications, even for private viewing
- C) the illegality of creating backups of CDs
- D) copy protections on DVDs
- E) Honestly, my best answer would only be a guess

14. Which of the following is NOT an example of open source application software?
- A) Firefox
 - B) Avast!
 - C) PowerPoint
 - D) Thunderbird
 - F) Honestly, my best answer would only be a guess
15. Data is processed in the ____.
- A) Central processing unit (CPU)
 - B) storage unit (SU)
 - C) memory chip (MC)
 - D) personal digital assistant (PDA)
 - E) Honestly, my best answer would only be a guess
16. ____ is an area of a computer that temporarily holds data that is waiting to be processed, stored, or output.
- A) Memory
 - B) Storage
 - C) Input
 - D) Output
 - E) Honestly, my best answer would only be a guess
17. Most computers store data in a(n) ____ format as a series of 1s and 0s.
- A) Analog
 - B) Digital
 - C) Logical
 - D) Executable
 - E) Honestly, my best answer would only be a guess
18. Using a technology called ____, a processor can begin executing an instruction before it completes the previous instruction.
- A) Serial processing
 - B) Pipelining
 - C) Multitasking
 - D) Benchmarking
 - E) Honestly, my best answer would only be a guess
19. A computer ____ is a set of program instructions that attaches itself to a file, reproduces itself, and spreads to other files.
- A) Lurker
 - B) Horse
 - C) Virus
 - D) Worm
 - E) Honestly, my best answer would only be a guess

20. The operating system's small ____ program is stored in ROM and provides the instructions needed to load the core parts into memory when the system starts.
- A) Jolt
 - B) Bootstrap
 - C) Control
 - D) Energizer
 - E) Honestly, my best answer would only be a guess
21. By keeping the operating system small in PDAs, the operating system can be stored in ____.
- A) EEPROM
 - B) RAM
 - C) ROM
 - D) Virtual Memory
 - E) Honestly, my best answer would only be a guess
22. Files with a(n) ____ extension contain word processing documents.
- A) .xls
 - B) .doc
 - C) .ppt
 - D) .exe
 - E) Honestly, my best answer would only be a guess
23. The most popular wireless LAN technology is ____.
- A) Ethernet
 - B) FCC
 - C) Wi-Fi
 - D) WiMAX
 - E) Honestly, my best answer would only be a guess
24. _____ allows telephone-style conversations to travel over the Internet to virtually anywhere in the world.
- A) E-commerce
 - B) Broadcasting
 - C) IP telephony
 - D) Multicasting
 - E) Honestly, my best answer would only be a guess
25. Which of the following is supported by the iPod?
- A) MP3
 - B) AIFF
 - C) WAV
 - D) All of the above
 - E) Honestly, my best answer would only be a guess

26. A+ Certification provides good credentials for employment ____.
- A) as a security specialist
 - B) in the Web development department of a company
 - C) in the networking department of a company
 - D) in a computer store or computer repair shop
 - E) Honestly, my best answer would only be a guess
27. Which of the following has the most limited versatility?
- A) database software
 - B) spreadsheet software
 - C) custom software
 - D) dedicated software
 - E) Honestly, my best answer would only be a guess
28. Which of the following designates that records meet one criterion or the other, but not both?
- A) inclusive OR
 - B) exclusive OR
 - C) AND
 - D) NOT
 - E) Honestly, my best answer would only be a guess

Scientific and Critical Thinking Domain Standards and Rubrics

This Assessment is applicable to student projects submitted for credit in IST 491 Senior Project II. This course is one of three options used by IST students as specified by IST Department to complete the departmental requirement for Capstone. Assessment is expressed as mean score submitted by participating faculty. Faculty qualified for assessment must be full time faculty within the COS and must review all documents submitted by the students as specified by departmental standards and attend the student's final presentation of the work.

Standard # 1: Capacity of student(s) to demonstrate discipline-specific content knowledge.

1. Does not possess any measurable content knowledge.
2. Has some, but incomplete and inaccurate, understanding of content knowledge.
3. Has significant understanding of content knowledge.
4. Displays a full understanding of content knowledge.

Standard # 2: Assessment of ability to clearly identify an issue and relate the goals and objectives of the project to this issue.

1. Issue not clearly defined. Purpose of work and Has limited use of scientific vocabulary. There are major flaws in understanding and interpretation.
2. Uses appropriate vocabulary, but presents only partial understanding of the problem and has minor flaws in the interpretation.
3. Uses appropriate scientific vocabulary, shows complete understanding of a discussed scientific issue, and correctly identifies the conclusions.

Standard # 3: Assessment of ability to design an experiment or project employing the appropriate scientific or technical methods:

1. Conceptual flaws in the design of the experiment.
2. Work contains a design of the experiment with logical procedural problems.
3. Work contains a complete and correct design of the experiment.

Standard # 4: Assessment of ability to analyze data and present data in appropriate tabular and numeric form.

1. No evidence of data analysis.
2. Major flaws in the analysis of the data; data is not clearly connected to stated purpose or hypothesis
3. Analysis of the data is present with minor flaws; data is adequate but its analysis and use is not
4. Data is clearly presented and subjected to appropriate statistical tests where appropriate. Data "proves the point" of the work and is connected to the hypothesis or stated purpose.

Standard # 5: Extent to which student work shows originality in both development of purpose for the work and creativity in the design of the methods for the work.

1. Objectives of the work and the methods used are relatively mundane and repetitive to the work of others.
2. Work shows some originality but clearly follows the purpose of methods of others.
3. Work shows some original thought and some of the purposes and methods are unique to the study and clearly the creation of the student(s) producing the work.
4. Work is original and both the purpose of the work and the methods used to fulfill are highly creative and original to the student(s) producing the work.

Assessment Form Capstone Work: Fall 08

Department of Integrated Science and Technology and Environmental Science BS Program

Student Name _____

Faculty Advisor Name _____

Date Planning Initiated _____

Projected Date for Completion _____

Project Title:

Project Objective(s):

Schedule

Dates for submission of Progress Reports

Dates for submission of Final Product

Project Reporting

Outline (1 page single space traditional 11 pt font)

(Scope of Project Work)

(Deliverables of Product of Project Work)

(Identification of Benchmarks of Project Work)

(Schedule of Benchmarks of Project Work)

PowerPoint Presentation (following content of outline plus report of work product)

Summary of work: (2 pages single space traditional 11 pt font)

Must include: (1) Objective, (2) Scope of work/Methods, (3) Deliverable(s)/Produce of work

IST Capstone Student Assessment Form

Please indicate the extent to which these elements of the IST Core were useful in preparation for your IST Capstone Work. These assessments include the critical thinking processes that were involved in the development of your work, integration of technology and computing into your work, and preparations for writing and public speaking during the presentation of your work:

Assessment of Preparation for Presentation: How useful were each of the following in helping you develop, organize, and present your Capstone work?

1. IST120 Connections I

very useful helpful did not contribute useful knowledge or skills for this

work

2. IST220 Connections II

very useful helpful did not contribute useful knowledge or skills for this

work

3. ENG 101

very useful helpful did not contribute useful knowledge or skills for this

work

4. ENG 102

very useful helpful did not contribute useful knowledge or skills for this

work

5. CMM 103

very useful helpful did not contribute useful knowledge or skills for this

work

6. Presentations that I made during IST courses in my focus area (computing, environmental studies, or biotechnology)

very useful helpful did not contribute useful knowledge or skills for this

work

Assessment of Technology and Computing: How useful were each of the following in helping you develop, organize, and present your Capstone work?

7. IST 260 Instrumentation

very useful helpful did not contribute useful knowledge or skills for this

work

8. IST 160 Programming

very useful helpful did not contribute useful knowledge or skills for this

work

9. Integration of computer applications and instrumentation from my IST coursework in my focus area

of computing, environmental studies, or biotechnology

very useful helpful did not contribute useful knowledge or skills for this

work

Assessment of critical and creative thinking inclusion in planning, development, and presentation of Capstone work. In each of the queries below indicate to what extent your powers to analyze and process knowledge and to apply it creatively were developed in the specified curricular element:

10. How useful was the content of Connections I and II in development of thinking skills

very useful helpful did not contribute useful knowledge or skills for this work

11. How useful were the Analytical Methods courses (131, 230, 231) in developing thinking skills

very useful helpful did not contribute useful knowledge or skills for this work

12. How useful were the basic computing and technology courses of IST Programming and Instrumentation in developing thinking skills

very useful helpful did not contribute useful knowledge or skills for this work

13. How useful were the integrated IST courses of my area of study (computing, environmental studies, or biotechnology) in developing thinking skills

very useful helpful did not contribute useful knowledge or skills for this work