Center for Pre-College Programs
New Jersey Institute of Technology
Cloud Computing Workshop
Standards-Based Lesson Planning

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Keys to Productive Instruction

Within the topic or focus of instruction:

• Identify specific skills/knowledge that students are expected to acquire as result of instruction.

• Learning objectives, containing these skills/knowledge, must be stated in terms of a measurable student behavior.

• Instruction must provide students the opportunity to acquire the identified skills/knowledge.

• Assessment must measure the student achievement of the skills and knowledge defined in the learning objectives.
Key Questions for Planning a Learning Experience for Students

- What do I expect students to learn?  
  - Expectations
- What experiences will contribute to learning? What must I include?  
  - Experiences
- How will I know that they've learned it? How do I design my assessment to measure the learning that I want?  
  - Assessment

Elements of Lesson/Course Design
Student learning and assessment must be an on-going process. We have to make sure that students are required to process the learning that has taken place during an instructional session.

Instruction planned from learning objectives are essential for student achievement & assessment.
Define the learning objectives

GOAL: Define Objectives achievable by students and documented through each student work that can be evaluated!

- Statements of observable and measurable student actions that can serve as evidence of the knowledge and skills acquired by students.
- Learning objectives use **behavioral verbs** to indicate, and communicate to others, specific, observable student behavior (skills and knowledge).
- Behavioral verbs describe an observable student product or action that allows inferences about student learning.

### Instructional Objectives (Student Learning)

- Statements of observable and measurable student actions that can serve as evidence of the knowledge and skills acquired by students.
- Explicit states of what students should know and be able to do to demonstrate what they have learned.
Learning Objectives stated in terms of anticipated change in student behavior leads to more accurate evaluation of student achievement.

Verbs open to many interpretations

- To know
- To understand
- To fully appreciate
- To grasp the significance of
- To enjoy
- To believe
- To trust

Verbs open to few interpretations

- To state
- To identify
- To differentiate
- To solve
- To contrast
- To construct
- To list
- To compare

REASONS FOR STATING OBJECTIVES

- When clearly defined objectives are lacking, there is no sound basis for the selection or designing of instructional materials, content, or methods.
- Clearly defined objectives make it possible to determine whether the objective has, in fact, been accomplished. Test or examinations are the mileposts along the road of learning and are supposed to tell instructors AND students whether they have been successful in achieving the course objectives.
- Clearly defined objectives provide students with a means to organize their own efforts toward accomplishment of those objectives.
Bridging the Standards with desired student outcomes!

• Standards are meant to define what students should know (content) and be able to do (process).
• Learning objectives, aligned with standards, must be stated in terms of a measurable student behavior.
• Assessment must measure student achievement of the skills & knowledge defined by the learning objectives.
• Textbooks are resources, not the curriculum.
• Standards do not mandate a particular curriculum, or textbook, and may be achieved in a variety of ways.

Standards-Based Instruction (Alignment) is not --

SCIENCE CONTENT AREA:
• Biology

N.J. CORE CONTENT STANDARDS:
• 5.1.4; 5.1.9.
• 5.2.1; 5.2.2; 5.2.6; 5.2.8; 5.2.9.
• 5.5.2; 5..5.3.
• 5.6.3; 5.6.9.
• 5.7.7.
Assessment - Provide assessment tools/activities for teachers to assess the learning objectives described earlier.

How do you know if the students “got it” during the lesson and after the lesson? Assessments should gauge what the students know about the topic at the beginning, and whether the students met the learning objectives at the end.

Educational Standards and Indicators

- List up to 4 indicators of the standards that students would learn as a result of completing this lesson or activity.
- Treat the indicators like learning objectives, and it should be clear in the curriculum where students will learn them.
- Listing skills and/or knowledge from the indicators that students will actually learn from the educational experience.
Basic Components of a Standards-Based Lesson Plan: Learning Objectives and Outcomes

• Specification of desired skills and knowledge.

• Opportunities for students to acquire desired skills and knowledge.

• Assess and document acquisition of desired skills and knowledge.

Lesson Topic: Discover the Science of Archaeology

• Objectives:
  – Students will demonstrate an understanding of the goals and methods of the science of archaeology.
  – Students will use multimedia sources to present their research to audiences in and beyond the classroom.

• Learning Outcomes:
  – Students will research archaeology and one ancient culture using the Internet.
  – Students will write a magazine article about an archaeological dig associated with a specific culture.
Lesson Topic:
Discover the Science of Archaeology

• Classroom activities:
  – Students take on the role of an archaeologist who makes an important discovery at an ancient site. They will create a multimedia article for an archaeology magazine to announce their discovery to the world. To do this, the students will:
    • Explore the science of archaeology and an ancient culture.
    • Write the magazine article.
    • Publish their article.

Lesson Topic:
Discover the Science of Archaeology

• Learning Objectives:
  – Students will research archaeology and one ancient culture using the Internet.
  – Students will write a magazine article about an archaeological dig associated with a specific culture.

• Assessment (Student Work Product):
  – ?
Common Core Standards – English/LA

CCS-ELA.W.8. Gather relevant information from multiple authoritative print and digital sources.

CCS-ELA.W.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

EXTENSION

- Have students present their articles about their discoveries to the class directly.
- Make the magazine articles available online to all of the students and to the wider community.
- Hold a “scientific symposium” in which each student/archeologist presents his or her discoveries to fellow students/archeologists, answering questions about goals, methods, and interpretation and about the discovery itself.
- Publish the papers of the symposium and a summary of the discussion on a class-built archaeology website.
<table>
<thead>
<tr>
<th>Topic Title</th>
<th>Discover the science of archaeology</th>
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</thead>
</table>
| Learning Objective(s)  
Students will be able to: | Students will:  
• research archaeology and one ancient culture using the Internet.  
• write a magazine article about an archaeological dig associated with a specific culture. |
| Standard(s) & Performance Indicator(s) | CCS-ELA.W.8. Gather relevant information from multiple authoritative print and digital sources.  
CCS-ELA.SL.4. Present information, findings, and supporting evidence clearly, concisely, and logically. |
| Learning Experience  
(Instructional Plan - Summary) | Students take on the role of archaeologists who make an important discovery at an ancient site. They will create a multimedia article for an archaeology magazine to announce their discovery. |
| Student Assessment  
(Demonstration of Acquired Skills & Knowledge) | An article describing the student's discovery is created. |

**Lesson Topic: Communication and Documentation in Science**

- **Learning Objectives:**  
  - Students will be able to create and maintain a scientific journal with activities and experimental data that will be submitted for review.

- **Standards and Indicators**  
  - NJCCCS 5.1.12.D1  
  - NJCCCS 5.1.12.D2
Lesson Topic: Communication and Documentation in Science

• Classroom activities:
  – Each team will be given a bag of materials to be used for construction
  – Teams are to document how they made their construction
  – Teams will exchange directions on how to make their respective construction
  – Teams will try to recreate the construction of the other team.
  – Peer review of instructions by classmates.

Lesson Topic: Communication and Documentation in Science

• Learning Objectives:
  – Students will be able to construct a device or object using given bag of materials.
  – Students will be able to describe the construction of the device or object that will allow other students to create that product.
Standards and Indicators – NJ Adopted 2009
NJCCCS 5.1.12.D1: Engage in multiple forms of discussion in order to process, make sense of, and learn from others’ ideas, observations, and experiences.
NJCCCS 5.1.12.D2: Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams.

Common Core Standards – English/LA
CCS-ELA.W.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

NJIT – Center for Pre-College Programs
MODULE DEVELOPMENT – OUTCOMES MATRIX

<table>
<thead>
<tr>
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Problem Solving

- **The Key to Problem Solving** – Asking the right questions and answering them in the most coherent manner is at the heart of any problem solving process.
- Problem solving skills can be incorporated into all academics.
- Process of problem solving may differ according to discipline. For example:
  - Scientific Inquiry
  - Engineering Design

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Polya - four basic steps to solving problems
http://home.comcast.net/~mrtwhs/mash/polya.pdf

- **UNDERSTANDING THE PROBLEM**
  - What is the unknown? What are the data? What is the condition?
- **DEVISING A PLAN**
  - Find the connection between the data and the unknown.
  - Could you restate the problem? Could you restate it still differently?
- **CARRYING OUT THE PLAN**
  - Carrying out your plan of the solution, check each step.
- **Looking Back**
  - Examine the solution obtained.
  - Can you use the result, or the method, for some other problem?
Comparisons of Problem-Solving Methods

<table>
<thead>
<tr>
<th>Engineering Design</th>
<th>G. Polya, How to Solve It</th>
<th>Scientific Inquiry</th>
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<tbody>
<tr>
<td>1. Identify the need or problem</td>
<td>Understand the problem</td>
<td>1. Formulate the problem</td>
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<td>2. Research the need of problem</td>
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<td>2. Information gathering</td>
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<td>3. Develop possible solutions</td>
<td>Devise a plan</td>
<td>3. Make hypotheses</td>
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<tr>
<td>4. Select the best possible solution</td>
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<td>4. Plan the solution</td>
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<tr>
<td>5. Construct a prototype</td>
<td>Carry out the plan</td>
<td>5. Test solutions (perform experiments)</td>
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<tr>
<td>6. Test and evaluate the solution</td>
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<td>6. Interpret data, Draw conclusions</td>
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<tr>
<td>7. Communicate the solution</td>
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<td>7. Presentation of results</td>
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<tr>
<td>6. Redesign</td>
<td>Looking Back</td>
<td>8. Develop new hypotheses</td>
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SOLVING A REAL-WORLD PROBLEM

Climate Change

Is it Real?
Recent Severe Weather Events

- Consider the following –
  - Wildfires in CO, NM, UT, CA at the same time as flooding rains in Northern FL.
  - Spring tornados – some of them were earlier than usual, in places not normally hit by tornados; e.g., MI, AL, AR.
  - Earthquakes in Japan, Hawaii, Italy, among others – VA.
  - Severe weather systems in mid-west and mid-atlantic region this past weekend.
  - Star-Ledger 6/25/2012: “Sea levels rising much faster (3 to 4x faster) than around the globe in a 600 mile swath from NC to Boston, MA.

Posing the Problem

- Students can take a stance on whether global warming is real, or a fabrication.
- Students (perhaps in teams) research and present, verbally and/or in writing, their arguments for or against the question.
- The Internet will serve as a resource.
  - NASA has built a supercomputer (located in Wyoming), named “Yellowstone”, which has 100 racks of servers and 72,000 core processors, capable of performing 1.5 quadrillion calculations (1 x 10[15] power.)
Lesson Topic: Severe Weather

Learning Objectives:
Students will be able to:

- Research severe weather using the internet and library resources.
- Create a severe weather presentation for the class on a specific type of severe weather in different locations.

Standards and Indicators
CCS-ELA.W.8. Gather relevant information from multiple authoritative print and digital sources.
CCS-ELA.SL.4. Present information, findings, and supporting evidence clearly, concisely, and logically.

Lesson Topic: Severe Weather

• Classroom activities:
  - Students will select a "severe weather" event to research.
  - Students will gather relevant information from multiple authoritative print and digital sources.
  - Students will assess the strengths and limitations of each source, and avoid plagiarism and overreliance on any single source of information.
  - Students will prepare and present a report regarding the “severe weather” event, including how the weather pattern originated and the factors that influence the weather pattern.
Lesson Topic: Severe Weather

Standards and Indicators – NJ Adopted 2009
5.4.8.F.1. Determine the origin of local weather by exploring national and international weather maps.
5.4.12.F.2. Explain how the climate in regions throughout the world is affected by seasonal weather patterns, as well as other factors, such as the addition of greenhouse gases to the atmosphere and proximity to mountain ranges and to the ocean.

Common Core Standards – English/LA
CCS-ELA.W.8. Gather relevant information from multiple authoritative print and digital sources.
CCS-ELA.SL.4. Present information, findings, and supporting evidence clearly, concisely, and logically.

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DROP BOX

- A tool that allows one to store, access and share files on multiple computers and Internet-ready devices.
- A place to collect student files.
- Allows for sharing and collaboration on projects.
  - Within the same subject.
  - Across disciplines.

Assignment #1

- Identify a science, technology, engineering, or mathematics concept taught in your classroom that you believe could be relevant to using the Cloud as a tool.
- Analyze your curricular and instructional approach.
- Propose a revision to how you would improve the planning and implementation of the concept based on the information presented in this workshop on standards-based lesson planning that is student-centered.
Assignment # 2

• **Compose** an Outcomes Matrix to present your thoughts on this revision of your selected concept.

• **Analyze** a written lesson plan you originally prepared or used for the prior instruction of this concept.
  
  – Does the written lesson or activity have a stated learning objective with the components of behavioral verb, content skills and knowledge, performance criterion, and specific student work product? Is the learning objective grade level appropriate based on specified state or common core standards?
  
  – Does the learning experiences give students an opportunity to acquire the skills and knowledge specified in the learning objective(s)?
  
  – Are the performance criteria for mastery clearly stated in the assessment section of the lesson plan? Are alternative assessment tools used to evaluate student’s mastery?

Assignment # 2 (Continued)

• **Write** a 2-3 paragraph analysis of how you would revise the prior lesson plan based on standards-based lesson planning. Submit your analysis and original lesson plan.
Selected References

Learning Objectives


Cloud Computing

• How Learning Platforms Support the Business of Teaching and Learning
  – http://www.itslearning.net/whitepapers

• NMC Horizon Report > 2012 K-12 Edition
  – http://www.nmc.org/publications/2012-horizon-report-k12

• Technology Integration Across Curriculum Fall 2011