Destination 2018: Sustainability Lesson Plan

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CAMPUS: WEST (SUMMER 2018) AND EAST (FALL 2018)
DISCIPLINE: COMPUTER PROGRAMMING

The goal of this lesson plan is to help you decide why and where you will infuse sustainability to improve student learning. Remember that sustainability is not an "add-on" content area; rather, sustainability can be integrated into already existing lessons as in-class examples of concepts and as a context for activities and problem sets that promote critical thinking.

Week 1: Needs Assessment

This week you will write a needs assessment for your lesson, learn about SDG goals, and identify 3 goals that could align with your course and topic.

Needs Assessment

1. Write your Needs Assessment:
   (*examples*)

   *Students in COP 1000C Introduction to Programming Concepts learn to write computer programs in either C, C++, or Java. In advanced programming classes, it is very easy to connect what we are doing in class to real-world software solutions to problems. However, in an introductory class such as COP 1000C, we have to use very simple, contrived examples. One topic where this is most evident is when we introduce **arrays**. Providing students with artificial data sets is common and therefore students don't connect closely to the assignments.*

2. Explain why you think infusing sustainability will help this need:
   (*examples*)

   Infusing sustainability into a project in an introductory programming class could facilitate a connection between programming concepts and real-world situations about which students can and should be interested and concerned. The concept of arrays is a challenging one for new programming students. Typically, we illustrate this concept in class using test score data. Students will store the test scores in an array and then use a loop to add the scores to find the average. We will still use this example in class, but then for an assignment, students will utilize data relating to the rising sea level.

3. State where (course or area) you are infusing sustainability and the topic*:*
   (*examples*)

   I will be infusing sustainability into our second-to-last course unit, programming with arrays. Students will use sea level data that they will download from http://climate.nasa.gov/vital-signs/sea-level. They will store the sea level for each year from 1995 to 2015, find an average rate of change using a formula they will develop, and then use their computer programming skills to create a program that predicts where the sea level will be in 2020, 2025, 2030, 2035, 2040, 2045, and 2050.

Research SDGs

Visit the [Sustainable Development Knowledge Platform](#) to research the Sustainable Development Goals.

> 4. Choose at least 3 of the SDGs of interest that could align with your topic and share why:
> ([examples](#))

The topic I have selected (sea level rise) aligns with almost every SDG, but most closely with the following:

- *Climate Action (SDG 13): Sea level rise is directly affected by humans interacting with the planet.*
- *Life Below Water (SDG 14): Rising sea levels will create changes in the underweater ecosystem.*
- *Life on Land (SDG 15): rising sea levels will change coastal features and cause disruption in the ability to live on land in certain places over time.*

Week 1 Reflection

> 5. Now that you have completed this week's portion of the template, reflect on the following:

a. I'm excited about… adding an assignment to a computer programming class that is related to something students should (and in many cases do) care about.

b. I have questions about… how to be sure I am giving them the most simple yet correct data to work with.

Week 2: Learning Outcomes/Research

This week you will write the student learning outcome for your lesson, explore lesson plan examples, look at a variety of classroom assessment techniques, and consider how you could incorporate the 3 Pillars of sustainability with a learning activity.

Student Learning Outcome(s)

The Student Learning Outcome is a statement of what the student will learn or be able to do because of this lesson. For more information on how to write a measurable learning outcome, review the following resources:

[How to write a Student Learning Outcome (Slides 1 to 5)](#) | Bloom's Taxonomy Resources - [Bloom's Taxonomy Action Verbs](#), [Bloom's Interactive Graphic](#), [Bloom's Taxonomy of Learning Domains](#)

> 6. Write your Learning Outcome:
> ([examples](#))

The student will be able to create and use arrays of data.

Sustainability Lesson Plan Samples

Explore the following resources for lesson plan ideas:

- Sustainability teaching activities across the disciplines (Repository developed by Carleton College)
- Lesson plans organized according to conceptual Sustainability Systems: Water, Energy, Food, Waste, Landscape & Ecosystem, Supply Chain, and Quality of Life (Developed by ASU faculty)
- AASHE Curriculum Resources Hub (requires login)

7. Of the lesson plans you've explored, pick 3 and share why you selected those: *(examples)*

   1. *NASA has a worksheet to explore the data set I've chosen. It can be found here:*
      https://www.jpl.nasa.gov/edu/pdfs/sealevel_worksheet.pdf
   2. *There is an entire list of videos and teaching plans for sea level found here:*
      https://www.jpl.nasa.gov/edu/teach/activity/the-science-of-earths-rising-seas/
   3. *This lesson plan has a nice experiment that I can ask students to do as homework:*
      https://www.calacademy.org/educators/lesson-plans/global-climate-change-and-sea-level-rise

Classroom Assessment Techniques

Explore the following resource for Classroom Assessment Techniques:

- 101 Strategies to Demonstrate the Essential Competencies – a college of classroom assessment techniques aligned to the essential competencies of a Valencia educator prepared by Valencia faculty Donna Colwell and Kevin Colwell
- 50 CATs by Angelo and Cross
- Classroom Assessment Techniques by Northwest Evaluation Association

8. Of the CATs you've explored, pick 3 and share why you selected those: *(examples)*

   From the 50 CATs list by Angelo and Cross:

28. Classroom Opinion Polls: Students indicate degree of agreement or disagreement with a statement or prompt. (I will create a couple of questions about sea level rise and use pollanywhere.com.)

37. Process Analysis: Students outline the process they take in completing a specified assignment. (This will be part of the submission of the array assignment.)

49. Assignment Assessments: Students respond to 2 or 3 open-ended questions about the value of an assignment to their learning. (This will be added on to my end-of-course assessment.)

3 Pillars Activity Idea

Review the 3 Pillars Worksheet.

9. Describe an activity that incorporates the 3 pillars:
   (*examples*)

Online discussion: Students must respond to the following prompt and then respond to posts from at least two classmates.

Prompt: It has been suggested that constructing coastal barriers can help manage sea level rise. Consider the sea level crisis in Miami (http://www.businessinsider.com/miami-floods-sea-level-rise-solutions-2018-4). Use systems thinking and the three pillars to examine the possible solution of barriers in the Atlantic to protect Miami.

(Reference article about barriers in San Francisco: https://www.spur.org/publications/urbanist-article/2009-11-01/strategies-managing-sea-level-rise)

Week 2 Reflection

10. Now that you have completed this week's portion of the template, reflect on the following:

   a. I'm excited about… exploring sea level rise with my programming class.

   b. I have questions about… other good resources to help students understand this issue.

Week 3: Putting it All Together

The goal for this week is to create an activity that incorporates the SDG, CAT, and connection to the 3 Pillars of sustainability.

SDG Selection

11. Choose the SDG that aligns best with your Needs Assessment/Student Learning outcome and explain why:
    (*examples*)

   - *Life on Land (SDG 15): rising sea levels will change coastal features and cause disruption in the ability to live on land in certain places over time.*

CAT Selection

Process Analysis: Students outline the process they take in completing a specified assignment. (This will be part of the submission of the array assignment.)

3 Pillars Activity

Online discussion: Students must respond to the following prompt and then respond to posts from at least two classmates.

Prompt: It has been suggested that constructing coastal barriers can help manage sea level ride. Consider the sea level crisis in Miami (http://www.businessinsider.com/miami-floods-sea-level-rise-solutions-2018-4). Use systems thinking and the three pillars to examine the possible solution of barriers in the Atlantic to protect Miami.

(Reference article about barriers in San Francisco: https://www.spur.org/publications/urbanist-article/2009-11-01/strategies-managing-sea-level-rise)

Activity Draft

Online discussion: Students must respond to the following prompt and then respond to posts from at least two classmates.

This activity will address SDG 15 Life on Land.

Prompt: It has been suggested that constructing coastal barriers can help manage sea level rise. Consider the sea level crisis in Miami (http://www.businessinsider.com/miami-floods-sea-level-rise-solutions-2018-4).

1. *Explain how sea level rise could affect life on land in Miami.*
2. *Examine the possible solution of barriers in the Atlantic to protect Miami through the lenses of people, the economy, and the environment.*
3. *Explain how the data we used for our array program can assist in understanding the problem and solution.*

(Reference article about barriers in San Francisco: https://www.spur.org/publications/urbanist-article/2009-11-01/strategies-managing-sea-level-rise)

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15. Explain how the activity aligns with your Needs Assessment/Student Learning Outcome
(examples)

The activity will connect what we are doing in class (array development and processing) directly to solving a sustainability problem in the real world. Students will understand how the program they created could inform a solution to a real environmental problem (sea-level rise). Since the student learning outcome is focused on arrays, this is a perfect way to showcase how arrays are used to solve and support solutions to real-life sustainability problems.

Week 3 Reflection

16. Now that you have completed this week's portion of the template, reflect on the following:

a. I'm excited about… actually giving this project and discussion to my class.

b. I have questions about… how the students will feel about the discussion.

Week 4: Lesson Plan Draft

This week you will finalize your activity and create directions for students.

17. Prepare a set of instructions on how to facilitate this activity.
(examples)

Answer the following questions:

What prior knowledge will students need to be successful with this activity?

The students will be given links to websites with basic information about see level rise. They will also have to watch a video about the San Francisco barrier project before we meet in class.

What needs to be setup prior to delivering the lesson?

I will show the video about sea level rise in Miami in class, so I will set that up before students arrive.

What resources and materials will you need?

I have excellent resources and materials from NASA and NOAA that will be sufficient for activity completion.

How do you plan to introduce the topic?

On the very first day of class, I am going to let students know that we are going to focus on sustainability for some of our projects. I am going to define sustainability, talk about the SDGs, and create a focus on this topic form day 1. As we are also adding sustainability to our Capstone courses using Orlando's Smart Cities initiative as a partner, this will be a solid foundation so by the time students get to Capstone, they can really understand the possible projects they can pursue to help our community.

How will you keep students engaged?

We will have a 5 minute "sustainability news" start to every single class. If I am crunched for time, I will put it in Canvas and have them watch before we come to class.

Step-by-step run of the activity

1. *Students will read this article before coming to class: https://www.spur.org/publications/urbanist-article/2009-11-01/strategies-managing-sea-level-rise)*
2. *We will watch this video at the beginning of class: https://www.youtube.com/watch?v=0ecSN32E1Sw.*
   Students will complete this activity sheet after watching the video:
   https://www.jpl.nasa.gov/edu/pdfs/sealevel_worksheet.pdf.
3. *Students will use sea level data that they will download from http://climate.nasa.gov/vital-signs/sea-level. They will store the sea level for each year from 1995 to 2015, find an average rate of change using a formula they will develop, and then use their computer programming skills to create a program that predicts where the sea level will be in 2020, 2025, 2030, 2035, 2040, 2045, and 2050.*
4. *Students will participate in the discussion activity given in #14 in Week 3.*

Now that you have addressed the questions above, include directions in the draft of your activity

Directions are already provided for the discussion part of the activity, above.. Here are the directions for the program:

Download the sea level data from http://climate.nasa.gov/vital-signs/sea-level. Create a program that does the following:

1. *Tell the user that the program uses data from NASA to predict sea level from the years 2020 to 2050.*
2. *Store the sea level data in an array. You only need to use the first data point for each year from 1993 to the present year. Use the last column for each row (the Global Mean Sea Level GMSL with annual and semi-annual signal removed).*
3. *Find the average annual change in sea level over all the years specified in the data.*
4. *Assume a linear increase and compute the predicted sea level rise for the years 2020, 2025, 2030, 2035, 2040, 2045, and 2050. Store these results in their own array.*
5. *Display the results for the user and be sure to reference the data set as specified in the data file.*

Sample output:

The predicted Global Mean Sea Level is

2020   64.32

2025   68.98

2030   73.51

2035   78.12

2040   83.43

2045   88.12

2050   93.04

These predictions were made using data provided by XXXXXXXXXX

Week 4 Reflection

18. Now that you have completed this week's portion of the template, reflect on the following:

a. I'm excited about… seeing how students enjoy and learn from this assignment.

b. I have questions about… whether they will have questions on the instructions.