Destination 2018: Sustainability Lesson Plan

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DISCIPLINE: MATHEMATICS

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)

The topic that my students struggle in MGF1106 College Mathematics that can be enhanced by infusing sustainability is calculating perimeter, area, surface area and volume. I feel that the students struggle with the topic because they do not see the connection to the real world and/or the reason why we need to calculate perimeter, area, surface area and volume.

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

I believe that infusing sustainability will help make a connection between the mathematics and the real world application for the students. It will also increase engagement which would help the students learn the material and be interested in solving the problem.

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

Put your response here

MGF1106 College Mathematics. The topic is calculating perimeter, area, surface area and volume.

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)*

Put your response here

1. Affordable and clean energy – We could find the affordability of clean energy that models the problem.
2. Sustainable cities and communities - We could find how sustainable the house is based on the community.
3. Responsible consumptions and productions - We could find consumption of electricity of the house and materials used for the renovation.

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…

The opportunity to engage students through sustainability and teach my mathematics topic.

b. I have questions about…

I have questions about if this will take more time during class and if I need to spend more time teach sustainability topics which will take away from teaching my mathematics concepts.

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 find the perimeter and area of 2 dimensional figures.

The students will be able to find the surface area and volume of 3 dimensional figures.

That will be based on sustainability scenario allowing the ability to make decisions based on the situation.

This is based on the MGF1106 College Mathematics competency:
The student will be able to calculate perimeter, area, surface area and volume.
Corresponding Evidence of Learning

- Calculated perimeter, area, surface area and volume.
- Apply these skills to application problems.

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)

Put your response here

-I liked this example: Hybrid vehicles are they worth it? (https://serc.carleton.edu/sisl/2012workshop/activities/110411.html). This example highlights using data and modeling as well as answering questions based on data. I believe my students would be interested in using real data and seeing the connection with the data, the equation, and the application.

-I liked this example: Sustainable Efforts on Our Campus: A Mathematical Analysis (https://serc.carleton.edu/sisl/2012workshop/activities/110459.html). This example highlights collecting data on sustainability efforts on a campus. I feel my student could be inspired and interested by activities they could do on campus to help the sustainability effort.

-I liked this example: Solar panel, statistical test (https://serc.carleton.edu/sisl/2012workshop/activities/70805.html) This is a great example to spark interest because the activity refers to solar as a source of renewable energy. We can use statistics and run same test to determine their efficiency.

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)

-Number 21 from the 50 CATs: 21. Documented Problem Solutions: students track in a written format the steps they take to solve problems as if for a "show & tell"
The students can document each mathematical step in symbols and in writing. This will allow the students to express themselves in written and symbolic format. It will also allow the students to help learn the material b documenting each step, improve retaining the information, and help when they use the activity to study later.

-Number 1 from the 50 CATs: Background Knowledge Probe: short, simple questionnaires prepared by instructors for use at the beginning of a course or at the start of new units or topics; can serve as a pretest; typically elicits more detailed information than CAT2.
The students can determine their baseline knowledge before we start the activity. There are prerequisite skills that are needed in order to calculate perimeter, area, surface area and volume (order of operation, formula retention and interpretation). This will help determine their readiness for the activity.

-Number 19 from the 50 Cats: Problem recognition task: students identify and recognize particular problem types. When we need to calculate perimeter, area, surface area and volume and what the units are. How is that used in an application? For example flooring will require a calculation of area not perimeter…

3 Pillars Activity Idea

Review the 3 Pillars Worksheet.

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

I will use the 3 Pillars (Environmental, Social, and Economic) as critical thinking reflecting questions at the end of my activity.

The questions could be:

1. What are the ENVIRONMENTAL concerns with this problem? Ex. Why is it important for use to use sustainable materials when we renovate the house?

2. What are the SOCIAL concerns with this problem? Ex. Impact of culture, ethical concerns, equity concerns

3. What are the ECONOMIC concerns with this problem? Ex. Impact of business, impact on finances, economic cost/benefit. Is it going to be cheaper in the long run for use to use the solar panels to heat up the pool?

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…

I'm excited about trying a new classroom technique and incorporating the 3 pillars into an activity because I think this will improve critical thinking in my course.

b. I have questions about…

I have questions about if I will need to have a lesson about the 3 pillars and how much time it will take to set up a new classroom assessment technique.

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)*

Put your response here

Affordable and clean energy – We could find the affordability of clean energy that models the problem

I believe the best way to approach that is to compare the cost of the solar panels and have a discussion if it is worth the investment. I will look for comments from the class to get their input on clean energy after they found out how expensive it is to acquire in a first place.

CAT Selection

12. Choose the CAT that aligns best with your Needs Assessment/Student Learning out come and explain why:
(*examples*)

The CAT that best aligns with my Needs Assessment and Student Learning Outcome is: Documented Problem Solving and Team Project. This is because my students can work together to solve the problem and have good discussions on the mathematics and sustainability concern. I also like the documented problem solving because the students can demonstrate their step and thinking.
This aligns to the Needs Assessment because they students will be connected and engaged with the topic which will improve understanding and critical thinking through an application real world problem.
This aligns to the Student Learning Outcome because the student will calculate perimeter, area, surface area and volume of 2 and 3 dimensional figures.

3 Pillars Activity

13. Describe how you will incorporate the 3 Pillars into your activity:
(examples)

1. What are the ENVIRONMENTAL concerns with this problem? Ex. Why is it important for use to use sustainable materials when we renovate the house?

2. What are the SOCIAL concerns with this problem? Ex. Impact of culture, ethical concerns, equity concerns

3. What are the ECONOMIC concerns with this problem? Ex. Impact of business, impact on finances, economic cost/benefit. Is it going to be cheaper in the long run for use to use the solar panels to heat up the pool?

Activity Draft

14. Create a draft of the activity using the SDG, CAT, and 3 Pillars:
(examples)

Here is a link to my draft activity.

https://drive.google.com/open?id=1clFPOjOQPXFFuRZkxKZp5dbx_a4hoJiR

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

Needs assessment- This activity aligns with the needs assessment to help students learn how to calculate perimeter, area, surface area and volume of 2 and 3 dimensional figures by engaging them in the sustainability topic of home renovation.

Student Learning Outcome- This activity aligns with the student learning outcome by allowing the students to calculate perimeter, area, surface area and volume of 2 and 3 dimensional figures and requiring critical thinking through this activity.

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…
   I am excited about trying this new activity because I feel like I have chosen an appropriate SDG, CAT, and 3 Pillars activity to engage my students while still teaching the mathematics content.
b. I have questions about…
   I have questions about how long this activity will take and the pacing of the activity.

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 need to following prior knowledge:

-How to find the perimeter of 2 dimensional figures

-How to find the area of 2 dimensional figures

- How to find the surface area of 3 dimensional figures

- How to find the volume of 3 dimensional figures

What needs to be setup prior to delivering the lesson?

The students will need for this activity:

-Partner

-Room organized so partners can work together

What resources and materials will you need?

The students will need for this activity:

- Calculator

-Activity handout

- Mobile device to do the *Calculate your ecological footprint assessment*

How do you plan to introduce the topic?

I will introduce the topic by asking students to complete the *Calculate your ecological footprint assessment*:

http://www.footprintcalculator.org/?gclid=EAIaIQobChMIrPTpqrX82gIVTFcNCh0QywN7EAAYASAAEgJKx_D_BwE

How will you keep students engaged?

The students will be engaged through:

-Working with a partner and having conversations

-Using the calculator to do the calculations

-Discussing the topic of home renovation

Step-by-step run of the activity

1) Have students complete the *Calculate your ecological footprint assessment*

2) Have the students pair up

3) Pass out the handout and overview the activity

4) Explain documented problem solving

5) Once the activity begins make sure you circulate the room and assist with the activity if anything is unclear

6) Allow the students to struggle so they can learn

7) The activity should be completed during class time.

8) One activity will be turned in for both students. Make sure both names are on the activity

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

Here is my activity with the directions on the last page.

https://drive.google.com/open?id=1v6Yt5IP3hDrA2deBJoXCOW-m0ULg7how

All of the questions were answered in the activity directions at the end of the document.

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…

I'm excited about trying this new critical thinking activity in my class. I really believe it will help teach my mathematics topic and improve critical thinking as well as be engaging for the students.

b. I have questions about…

I have questions about how long this activity will take and if part of the activity will be done outside of class.