Project-Based Learning Proposal

PCEP Michigan Department of Educational Models of Proficiency Grant

1. Unit/Course Title:

- Unit: Water Quality Course: Geophysical Science

2. Driving Question:

- How are citizens affecting the Rouge River watershed, and what can we do to improve water quality?

3. Project Summary:

- After an introduction to watersheds, water quality, and quantitative testing methods, students assessed the health of the Rouge River utilizing Vernier probes and graphing calculators. Within collaborative groups, students were charged with educating the public about their role in a watershed. Given a choice of project media, students worked together to create videos, children's books, websites, and public displays.

4. Teaching Team:

Teacher Name	**Course/Dept.**	**School**
Megan Fenech	Geophysical Science	Plymouth High School

5. Duration:

- May 3 – May 27

6. Student Data:

- Total number of students participating: 120
- Estimate of at-risk: 10

7. Learning Goals and Strategies:

<u>MCF Earth Science Content Standards</u>:

- **E4.p1A** Describe that the water cycle includes evaporation, transpiration, condensation, precipitation, infiltration, surface runoff, groundwater, and absorption.
- **E4.1C** Explain how water quality in both groundwater and surface systems is impacted by land use decisions.

- Project Activity(s) to specifically address the content standard:
  - Students will have various ways of acquiring this information and knowledge, including two Web lessons, a water cycle game, photo comparison, a short video, a current event readings, and direct instruction (e.g. a PowerPoint)

- UDL Strategy(s)
  - **Multiple means of engagement and presentation**

Content Standard:

- **E2.4B** Explain how the impact of human activities on the environment can be understood through the analysis of interactions between the four Earth systems.
- **E2.3b** Explain why small amounts of some chemical forms may be beneficial for life but are poisonous in large quantities

- Project Activity(s) to specifically address the content standard:
  - Students created a public awareness piece to education residents about what plagues the Rouge River watershed

- UDL Strategy(s)
  - **Multiple means of action and expression**

Content Standards:

- **E1.1A** Generate new questions that can be investigated in the laboratory or field.
- **E1.1C** Conduct scientific investigations using appropriate tools and techniques.
- **E1.1E** Describe a reason for a given conclusion using evidence from an investigation.

- Project Activity(s) to specifically address the content standards:
  - Student will work in collaborative groups to design and appropriately carry out a scientific investigation in regard to water quality.

- UDL Strategy(s)
  - **Multiple means of action and expression**

8. "Grabber" Activity to Generate Interest:

- Students will be engaged by examining aerial photos of the watershed, comparing land use in mid-twentieth century with aerial photos of today.
- Students will also have a mini-play to act out that broaches the idea the most water pollution cannot be easily seen or smelled.

9. Formative Assessments:

- We will assess students' prior knowledge with several open-ended questions: what do you know about watersheds, what might you know about the Rouge River, how do you think we assess water quality, and how might you be able to improve the health of the river?

10. Summative Assessment/Culminating Products

- Scientific investigation design and corresponding lab report
- Multimedia project (e.g website, video, children's book)
- Summative test

11. Resources/UDL Supports Requested and Budget:

Materials

Vernier probe ware:

- Conductivity probe x 2	$186
- pH sensor x 2	$158
- Dissolved oxygen probe x 2	$410
- Turbidity sensor x 2	$218
- Flow rate sensor x 2	$258
- Earth Science w/ Vernier book	$ 45
- TI-84 Plus Silver calculators x 2	$258

Misc testing supplies

- Nitrogen kit refill	$ 90
- Phosphorous kit refill	$50
- D-frame sampling net	$50
- Benthic identification flashcards	$40
- ColiQuant EZ test for Fecal coliform x 3	$96

Visual aids:

- Aerial photos	$100
- Up the Rouge: Paddling Detroit's Hidden River	$35
- Reclaiming the Rouge video	$ 4
- Flipcams for student projects x 2	$260

Training

– Already completed with a Wayne RESA grant	$0

Field trips

- River tributary runs through campus	$0

TOTAL Funding Request	$2,444

Project Data

In order to assess the outcome of this PBL unit, 50 random students who participated in the PBL unit were compared to students who did not. The other students learned the same content but in a "traditional" format. Below is the Likert-scale survey questions and the percent of students who chose each response.

PBL Student Survey: Hydrogeology

Directions: Please respond honestly and thoughtfully about your experiences during your hydrogeology: water quality unit. For each statement below, circle the number that corresponds to how you feel about your learning experiences during the hydrogeology unit.

	Almost Never	Seldom	Sometimes	Often	Almost Always
	1	2	3	4	5

1. My teacher used a variety of activities to help us learn the material.

Student not involved in PBL unit	O%	8%	18%	38%	31%
Students who participated in the PBL unit	0%	0%	14%	46%	40%

	1	2	3	4	5

2. My teacher allowed students to demonstrate their knowledge in a variety of ways besides a test.

Student not involved in PBL unit	10%	26%	37%	22%	9%
Students who participated in the PBL unit	0%	4%	26%	50%	20%

	1	2	3	4	5

3. My teacher used technology to enhance learning.

Student not involved in PBL unit	1%	9%	37%	30%	22%
Students who participated in the PBL unit	0%	0%	10%	50%	40%

	1	2	3	4	5

4. My teacher expressed enthusiasm about the material we were learning.

5. I collaborated with classmates on an assignment or project during class.

	1	2	3	4	5
Student not involved in PBL unit	1%	0%	17%	28%	48%
Students who participated in the PBL unit	0%	2%	6%	28%	64%

	1	2	3	4	5
Student not involved in PBL unit	7%	11%	26%	29%	23%
Students who participated in the PBL unit	0%	6%	32%	34%	32%

6. I asked questions or contributed to class discussions.

	1	2	3	4	5
Student not involved in PBL unit	13%	22%	28%	28%	9%
Students who participated in the PBL unit	10%	14%	26%	36%	14%

7. I worked on a project that required integrating ideas or information from various sources.

	1	2	3	4	5
Student not involved in PBL unit	76%	6%	9%	2%	1%
Students who participated in the PBL unit	0%	6%	12%	54%	28%

8. I worked on a project that required written communication skills.

	1	2	3	4	5
Student not involved in PBL unit	81%	6%	6%	9%	0%
Students who participated in the PBL unit	4%	2%	26%	42%	26%

9. I worked on a project that required me to access and analyze information

	1	2	3	4	5
Student not involved in PBL unit	72%	2%	11%	10%	4%
Students who participated in the PBL unit	0%	4%	10%	46%	40%

10. I worked on project that required be to be innovative or creative.

11. I learned how this topic is relevant to the world outside of school.

	1	2	3	4	5
Student not involved in PBL unit					
Students who participated in the PBL unit	0%	4%	20%	44%	32%
Student not involved in PBL unit	14%	6%	22%	31%	31%
Students who participated in the PBL unit	2%	2%	10%	38%	48%

12. I learned interesting things.

	1	2	3	4	5
Student not involved in PBL unit	8%	12%	20%	33%	26%
Students who participated in the PBL unit	4%	10%	20%	46%	18%

13. I constructed some of my own knowledge in this unit.

	1	2	3	4	5
Student not involved in PBL unit	8%	22%	32%	33%	9%
Students who participated in the PBL unit	2%	6%	42%	40%	10%

14. I used an electronic medium (chat group, Wiki, Internet) to discuss or complete an assignment.

	1	2	3	4	5
Student not involved in PBL unit	49%	19%	16%	9%	7%
Students who participated in the PBL unit	4%	4%	22%	34%	36%

Project Narrative

All students, including those with special needs benefitted from the project by being more engaged. They were given a variety of ways to demonstrate their knowledge as opposed to many traditional science units, which require students to demonstrate their knowledge

solely on multiple-choice tests. Being given a choice of projects allowed students with special needs to work with their peers and collaborate in varied ways. Some special needs students excelled in innovative ways as they put together creative children's books. Others demonstrated their strength of oral communication as they produced a video. Throughout the unit students' questions, contributions, and comments also increased. Additional gains, like increased relevancy, can also be seen in the survey data.

I learned a good a deal from my experience with Project Based Learning (PBL). I was reminded of proper backward unit design and the benefit of guiding questions. I was challenged to create alternative assessments, and consider whether or not they were authentic. I experienced how students are more engaged and eager when you allow them choice, and how students will gravitate toward using technology. Seeing the diverse products students created to demonstrate their knowledge of water quality was very rewarding, enjoyable, and reaffirming.

Time and lack of computer access at school were a couple challenges I encountered in the implementation of this project. With regard to time, I found it took me a good deal of time to develop project guidelines and a corresponding rubric. The most time consuming aspect was probably getting the lab supplies organized and prepared for our several days of water quality testing. Because the testing procedures were pretty complicated I also needed to carve out instructional time in order to teach students how to run the equipment. I wanted to give students a couple days to work on their project during the school day so that they could collaborate, ask questions, test technology, etc., but I was not able to provide them with this time due to lack of computer availability. With approximately 2,000 students in each building and just three computer labs, I cannot always get computer access even when I check several weeks in advance!