



WPI

Project-Based Learning

Paula Quinn

Center for Project-Based Learning

Pan African Materials Institute

MS4SSA: Mathematics and Science for Schools in Sub-Saharan Africa

July 13, 2017

African University of Science and Technology [AUST] | Abuja, Nigeria

Project-Based Learning...

- ...is a pedagogical approach that has been shown to improve student learning in higher education and in K-12 classrooms
- ...has been used at WPI for almost 50 years
- ...has key features that are present on a continuum, depending on the context and purpose of the project
- ...requires teachers and students to take “non-traditional” approaches towards working together

Essential Project Design Elements

Buck Institute for Education

- **Challenging Problem or Question** - Heart of the project: engage without intimidation
- **Sustained Inquiry** - An extended process of asking questions, finding resources, and applying information
- **Authenticity** - Real-world context, tasks and tools, quality standards, or impact
- **Student Voice & Choice** - Students make decisions, including how they work and what they create
- **Reflection** - Students reflect on learning, the effectiveness of their inquiry, the quality of their work, and obstacles
- **Critique & Revision** - Students receive and use feedback to improve their process and products
- **Public Product** - Students make their project work public by explaining, displaying and/or presenting it beyond the classroom

Project-Based Teaching Practices

Buck Institute for Education

- **Design & Plan** - Create a project for your context and your students; include student voice and choice when planning
- **Align to Standards** - When planning, make sure the project addresses key knowledge and understanding from relevant subject areas
- **Build the Culture** - Foster student independence and growth, open-ended inquiry, team spirit, and attention to quality
- **Manage Activities** - Working with students, organize tasks & schedules, set deadlines, find & use resources, create products & make them public
- **Scaffold Student Learning** - Support all students in reaching project goals using various lessons, tools, and instructional strategies
- **Assess Student Learning** - Determine what students know, understand, and can do using various formative and summative approaches
- **Engage & Coach** - Learn and create with students; give them support when they need skill building, redirection, encouragement and celebration

Some Notes on Projects

- All projects should yield products, BUT
- **Products do not have to focus on design or engineering!**
- Products could be the following:
 - Written papers
 - Posters
 - A performance, such as dance, music, stories, poems
 - Preparation of a meal
 - Something else?

Project Examples

- **Design of Community Gardens**
 - Working with a local non-profit, students designed community gardens and developed a plan for their maintenance
- **Boutique Marketing Plan**
 - Working with a local bridal consignment shop, students conducted a market analysis and developed a marketing strategy and materials for the shop
- **Promoting Sustainable Transportation**
 - Working with multiple campus groups, students developed a successful proposal to implement a bike share on campus
- **Franchising Plan for Mobile Tutoring Services**
 - Working with a Kenyan entrepreneur, students developed a franchising model and business plan to address unmet educational needs in Africa

Steps to Effectively Plan and Assess a Project

1. Decide what learning outcomes the project will address.
2. Decide what evidence will allow you to determine the extent to which a student achieved each learning outcome.
3. Explain what varying levels of achievement of a learning outcome look like.
4. Design a project that will give students opportunities to produce evidence that they are achieving the learning outcomes.

What is a learning outcome?

A learning outcome...

- ...is a statement that describes **significant and essential learning** that students will **achieve** and can reliably **demonstrate** at the end of a project, lesson, course, or program
- ...identifies what a learner will know or be able to do by the end of a project, lesson, course, or program

Examples of Learning Outcomes

- By the end of this project, students will be able to explain the factors that affect the growth of plants
- By the end of this project, students will be able to classify objects and count the number of objects in each category
- By the end of this project, students will be able to show that addition is putting together and adding to, and they will be able to show that subtraction is taking apart and taking from

What is “evidence” of achieving a learning outcome?

- Evidence that a student achieved a learning outcome is **information a student conveys that indicates the student’s knowledge or ability**
- Evidence can take many forms. Some examples:
 - Test score
 - Demonstration or performance: dance, prepared meal
 - Created product: painting, poem, essay, research paper
 - Others?

Rubrics are a good way to assess student achievement

- A rubric is a document that articulates the expectations for an assignment
 - Lists the criteria
 - Describes levels of quality from excellent to poor
- Often used to grade student work
- Can be used to assess and teach
 - Teachers and students can make dependable judgments about the quality of work or performance
 - Can guide ongoing feedback about progress towards standards

Example of A Rubric for Writing

Outcome: Produce writing that uses proper mechanics

Excellent	Good	Fair	Unacceptable
Writing shows no or very few errors in spelling, grammar, syntax, punctuation, capitalization, or paragraph and sentence structure.	Writing shows several errors in spelling, grammar, syntax, punctuation, capitalization, or paragraph and sentence structure, but they do not interfere with the reader's ability to understand the writing.	Writing shows many errors in spelling, grammar, syntax, punctuation, capitalization, or paragraph and sentence structure, and those errors make the reader's ability to understand the writing a significantly effortful process.	Writing shows significant errors in spelling, grammar, syntax, punctuation, capitalization, or paragraph and sentence structure such that they impede the reader's ability to understand the writing.

More Project Examples

- Not engineering or design projects
- Done with students at the primary or middle school level (below grade 9)
- Rely on local context
- Low or no cost

The Maize Project



The Maize Project



Students
grew maize
in a
garden...

The Maize Project



...harvested
the maize...

The Maize Project



...popped it
into
popcorn...

The Maize Project



...and
shared it!

The Maize Project

- How long did it probably take to complete this project?
- What is one math or science learning outcome that the teachers might have had when they developed this project?
- What sources of evidence might the teachers have used to determine if students achieved that learning outcome?

The Junior Naturalist Field Trip Project



A school
had a pond
across the
street from
it.

The Junior Naturalist Field Trip Project



The school
had young
students.

The Junior Naturalist Field Trip Project



And the
school had
older
students.

The Junior Naturalist Field Trip Project



The older students planned a field trip to the pond for the younger students.

The Junior Naturalist Field Trip Project



They spent
a lot of time
planning.

The Junior Naturalist Field Trip Project



www.alamy.com - GD25EF

On the day of the field trip, the older students paired up with the younger students.

The Junior Naturalist Field Trip Project



And they all
took a walk
together to
the pond.

The Junior Naturalist Field Trip Project



www.shutterstock.com · 411736462

The older students guided the younger students.

The Junior Naturalist Field Trip Project



And the
younger
students
learned...

The Junior Naturalist Field Trip Project



...and
learned
from the
older
students.

The Junior Naturalist Field Trip Project



And the
older
students
learned,
too.

The Junior Naturalist Field Trip Project



And after they all got back, the younger students...

The Junior Naturalist Field Trip Project

...and the older students shared their experiences with others who did not go on the field trip.



The Junior Naturalist Field Trip Project

- How long did it probably take to complete this project?
- What is one math or science learning outcome that the teachers might have had when they developed this project?
- What sources of evidence might the teachers have used to determine if students achieved that learning outcome?

The Salad Project



The Salad Project



The Instrument Project

Shekere



Djembe



An Instrument Project

What is one math or science learning outcome that a teacher might want to teach using a project related to an African instrument?

An Instrument Project

What is one source of evidence that a teacher could use to determine if students achieve that learning outcome?

An Instrument Project

What kind of project might a teacher develop around this learning outcome and instrument?

Project-Based Learning in Africa

How do you think African students would react to having projects like these in their classes?

What are your ideas about using these types of projects in your schools in Africa?

Resources for Project-Based Learning

- Buck Institute for Education
<https://www.bie.org/>
- WPI Center for Project-Based Learning
<http://wp.wpi.edu/projectbasedlearning/>
Paula Quinn – pquinn@wpi.edu