# Amplifying Students' Voices through Project-Based Learning

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What does "project-based learning" look like in our school?





Essential **Project Design Elements** based on the **Buck Institute** for Education Gold Standard PBL model





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Project-based learning at Summers-Knoll includes:

- Student learning goals
- Essential project design elements
  - Project-based teaching practices
- Flow of the day and scheduling project time



Project-based Learning at SK: One year of a two year rotation

- Four projects over the course of one year
- Two science-focused projects; two humanities-focused projects
- Math and literacy happen throughout

		Year 1			
		Project #1	Project #2	Project #3	Project #4
		Michigan Student	Arduino Robotics and	Detroit as Primary	Alternative Energy
		Caucus	the Engineering Design	Source	
			Process		
	Challenging Problem or	What are the most	How can we use the	How do we learn about a	How can "green" energy
	Question	important issues facing	engineering design	place? How do we	sources be employed to
		young people and	process to modify existing	conduct effective research	better serve the needs of
		students of all ages, today	technology for a specific	that engages multiple	various communities?
ho		and in the future and	purpose?	perspectives in order to	
ne		what can we do about		deepen our	
		them?		understanding of a place?	
d	Project	Students will participate	Using their understanding	After learning research	Students will create
	Description/Summary	in the Michigan Student	of physics, students will	protocols, students will	proposals for employing
		Caucus, an online	research about and then	apply their skills to a	solar power at SK. They
		platform that affords	build an autonomous	topic area of their	will also learn about how
		participants a chance to	robot from a kit and then	choosing related to the	modern methods of
		engage in dialog on issues	propose and design	study of the city of	power generation can be
		of importance to young	modifications to the kit to	Detroit. Through primary	used to support
		people in Michigan.	solve an assigned	and secondary source	historically underserved
		Through online	problem related to the	research in books and	communities. To motivate
		discussion, participants	use of autonomous	online and original	the project, students will
		will write and rank the	vehicles.	research done during	read The Boy Who
		top proposals and select		frequent trips to Detroit,	Harnessed the Wind and
		the best ones to become		students will create a	discuss the role energy
		part of the Michigan		presentation to share	plays in developing
		Student Caucus platform.		with peers, parents, and	nations.
				community members	
				about a particular aspect	
				of the city's history,	
				2	

# Detroit as Primary Source: Skill Objectives

- Developing a research question
- Using and analyzing resources
- Synthesizing research
- Engaging with multiple perspectives
- Writing a formal research paper

Key knowledge, understanding, and success skills





KEVIN BOYLE

# Challenging question

# What actually happened on the night that Dr. Ossian Sweet was charged with murder?



#### Mapping Inequality Redlining in New Deal America



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# Sustained inquiry





FURTHER INVESTIGATION

LIBRARY OF CONGRESS | L0C.gov/hachers





#### Authenticity





#### Reflection



## Example student topics from 2017

- Immigrant groups and food/restaurants
- Public art and its impact
- Motown music and segregation in the music industry
- Impact of gentrification on the ecosystem
- Racial inequality in education
- History and significance of monuments throughout the city
- The Purple Gang
- World War II production in Detroit





#### Topic: Purple Gang

Research question: What are the purple gangs origins, and what crimes did the purple gang commit before being caught/stopped?

Thesis statement: Throughout the existence of the Purple Gang, the group of men committed a variety of violent crimes that eventually led to their downfall.

10Ha

Main idea 1- The origins of the purple gang

- How many people and what type of people
- First meeting spots
- Crimes and other actions
- How they got their name/oakland sugar house

Main idea 2- Crimes and other actions during their reign

- Crime during and not during their heyday if any
- Cleaners vs dyers war
- Leaders/ or famous members

Main idea 3- How they were caught/stopped

- Collingwood Manor Massacre
- The aftermath
- When and how they were caught





#### Data Visualization

This map shows the losses from the fire.

Pink shows 0-1999 pounds

Orange shows 2000-4999 pounds

Yellow shows 5000-8000 pounds



Student voice and choice

# Sustained inquiry





















#### Authenticity









# Student voice and choice





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#### Reflection



#### Public product



#### Citations

Hooper, Ryan Patrick. "City of Detroit's new street art initiative hires artists to fight blight."

Detroit Free Press, 13/8/2017. Accessed 5/5/2018.

This is what spurred my whole paper. I was searching for stuff about the artistic side of Detroit

and this article came up. It seemed really interesting so I decided to base my project on it.

City of Detroit City Walls. Detroit City Government. www.detroitmi.gov/generalservices/citywal

ls. accessed 2/5/2018.

This is the official city government website, and it has a page about the city walls project. It was good for cold hard facts.

Alan, Dennis (text), and David Clements (photography). Art in Detroit Public Places. Wayne

State University press, 2008.

I originally used this book for the foreword; which spoke about the history of public art. But I also used it for my second main idea, Public Art in Detroit. As I bet you can see, this book was quite helpful in that.

Walt, Irene and Balthazar Korab (photography). ART IN THE STATIONS: THE DETROIT

PEOPLE MOVER. ART IN THE STATION, 2004





### Project assessment criteria



Critique and revision

- Research organization
- Research synthesis
- Research paper (including annotated works cited)
- Broad and deep understanding of topic; engagement with multiple perspectives
- Confident and clear oral presentation



#### Michigan Social Studies Standards

#### The Responsibilities of Civic Participation

Responsible citizenship requires active participation in our communities. Therefore, social studies instruction should engage students so they simultaneously learn about civic participation while being involved in the civic life of their communities, our state, and our nation. Social studies prepares students to participate in political life, to serve their communities, and to conduct themselves responsibly.

Being a responsible student in and beyond the classroom means:

 Using knowledge of the past to construct meaningful understanding of our diverse cultural heritage and inform their civic judgments (Historical Perspective)



- Understanding American government and politics to make informed decisions about governing and their community. (Civic Perspective)
- Using knowledge of the production, distribution, and consumption of goods and services to make personal, career, and societal decisions about the use of resources (Economic Perspective)
- · Using methods of social science investigation to answer questions about society (Inquiry)
- Knowing how, when, and where to construct and express reasoned positions on public issues (Public Discourse and Decision Making)
- Acting constructively to further the public good (Civic Participation)



#### Key knowledge, understanding, and success skills



# What does it look like, in practice, over 8 weeks?

#### Week 1:

- Whole class readings
- Direct instruction on research skills, primary/secondary sources
- Lecture on migration and segregation

#### Week 2:

- Whole class readings and map analysis
- Visit archives, visit Detroit

#### Week 3:

- Begin independent work
- Visit Detroit (whole class and individual destinations)

#### Week 4:

- Data visualizations
- Visit Detroit

#### Week 5:

- Direct instruction on presentations and citations
- Public product sharing with the community

#### Week 6:

- Research paper writing, editing, and revising
- Direct instruction on MLA format

#### Week 7:

- Research paper writing, editing, and revising

#### Week 8:

- Final research paper due
- Project reflection





# Key takeaways

- Balance of whole-class and independent work
- Place based, real world, authentic learning opportunities with a social justice lens
- Explicit skill outcomes + student-directed content





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# **Arduino Robotics and the**



2013)



- Documentation
- Communication
- Frustration Tolerance
- Public Speaking
- Traditional Content: circuits, electricity, coding

Key knowledge, understanding, and success skills



### **Experts as Role Models**

- Formally trained engineers, and others in related fields who do engineering/design
- Men and women
- Set stage for how they use the process and highlight importance of communication and note-taking -- (main goal of unit)
- Facilitate Safe Space for open ended brainstorm
- Students see that engineering isn't just one thing and that there are people from different backgrounds doing "engineering"
- Foreground importance of key goals for unit --Engineering Notebook (communication/documentation).

Key knowledge, understanding, and success skills

# 'Fail Fast, Fail Often" Time to 'Mess Around'

- Open ended time to learn the software and try out components and modifications (learning to modify code so the speaker played Never Gonna Give You Up)
- Burning out LEDs -- whoops forgot the resistor
- Backwards thermistor -- It gets really hot, but nobody got hurt.
- Translation for build task -- the parts come disorganized, possibly broken, with a half sheet of instructions in Mandarin -- mentor says, "this is typical."

#### Sustained Inquiry



Component Assignment -- Example -- Deeper Dives; student selected; comes from playing around with things [practice research and doc; makes them an expert in some small aspect,

# Everybody Solders -- Mandatory Role Rotation

Key knowledge, understanding, and success skills

**Role Cycling** 

-- Mitigates fear of risk-taking in group projects, and issues w/ stereotypically gendered roles.

-- Also everyone can/should be able to answer a question on any topic

- Note-taking
- Hands-On -- soldering, wiring
- Presenting



# The Engineering Open Ended Brainstorm:

**Promoting Voice and Generating Interest** 

- No one 'right' way to do things
- Everyone has something to contribute
- Stimulate student interest
- Description of task -- no critique or evaluation, just putting down ideas; no 'bad' or 'silly' ideas at this point; even the ridiculous may have something useful or give someone an idea
- Presence of mentor/moderator
- Voice -- Scaffolding Engineering brainstorms for functional goals and novel ideas

Student Voice & Challenging Problem

## Extension of Task

- Mandatory part of assignment
- Find an actual or proposed used of robots, think about how our robot could be modified or refitted to do that task
- Individually come up with interesting possibilities for further development of bot to do a task students find compelling (only some are pursued beyond initial pitch)
- Teacher narrows down the extension to a small, manageable piece of task (e.g. a depth sensor for a robot that would drill in the Martian soil or a retractable piston for killing invasive starfish)



Student Voice & Critique and Revision

# Public Product & Reflection

# Ending the Unit

- Finalizing documentation
- Final Presentation w/ Authentic audiences (engineers in addition to parents)
- Explicit Assessed Goal of Project was the quality of the reporting out, not the physical robot, not the brainstorming
- Rationales for Why and How decisions were made



### **Semi-Formal Presentations**

# Public Product & Reflection



#### Teamwork and Communication

- Our team would share our ideas by talking over each other.
- Our team struggled to resolve disagreements.
- We came to teamwide decisions by either voting or by playing Rock, Paper, Scissors.
- During the build phase we would rotate tasks to divide the work.
- Our communication was a major brick wall to progress.

"One of the greatest attributes of our group was the ability to adapt to new ideas and solve new issues, and then learn from them. As you might guess, there was a lot of these new issues and ideas within engineering. But with each one of these problems we were confronted with, we came up with a solution, and with each solution is another lesson that furthered our understanding of the project and engineering."

### Poster Fair

- Different audiences
- Type of performance
- It's what engineers do



#### Public Product & Authenticity





### Standards/Benchmarks

Awareness of NGSS and State Standards however emphasis on <u>NGSS Cross</u> <u>Cutting Concepts</u> and Practices foregrounded; Content Standards used but no attempt to cover every single standard.



# What does it look like, in practice, over 8 weeks?

Weeks 1-3 — Engineering Documentation, Skill Building w/ Arduino Kit, Field Trips, Reading/Discussion on Robots

Weeks 4-6 — Robot Building, Brainstorming for Modification/Additional Functionality

Weeks 7-8 — Finish Builds(if necessary), Presentation and Poster Preparation Rehearsals, Presentations

- Student analyzes and synthesizes information to create new (to the student) knowledge.
- Student consistently maintains an organized engineering notebook (physical or digital).
- Student applies physics concepts to building circuits. (polarization; Ohm's Law; series and parallel; safety)
- Student communicates clearly with teammates and resolve differences of opinion in how to proceed on group tasks (robot assembly).
- Student builds and troubleshoots practical circuits using the Arduino, breadboards, jumper wires, etc.
- Students modify computer code (for the Arduino) and explain the effect.
- Students research an assigned electronic component and present clear explanations of the structure and function thereof.
- Student identifies and researches a situation calling for the use of autonomous robots that is of personal interest.
- Student generates and evaluates ideas for modifying an existing robot to perform a specified task.
- Student works with team to evaluate and select a modification based on collaborative discussion and evaluation.
- Student works with group to create a presentation and poster summarizing the main goals and takeaways of the project.
- Student delivers presentation effectively (audibly, politely, knowledgeably).

### **Resources:**

#### From Oyvind Dahl:

https://www.build-electronic-circuits.com/ https://ohmify.com/



#### Engineering/Arduino Resources

Programming: https://www.arduino.cc/en/main/software

Hardware: https://www.sparkfun.com/products/retired/13844

Inspiration: Engineering the Future (Teacher's Edition): <u>Amazon Link</u>

Engineering Brainstorm https://www.teachengineering.org/activities/view/cub creative\_activity3

### Notes for Sam -- everything goes to promoting student voices by decentering authority

Project example 1: Arduino Robotics and the Engineering Design Process or: I For One Welcome Our New Robot Overlords

Documentation (why is it important) and Articulation as a presentation

Name(what) -- Goal(why) -- Impact (how)on Students for each:

- Experts -- Engineering Mentors and Models--(men and women, formal and informally trained engineers)
- Voice -- Scaffolding Engineering brainstorms for functional goals and novel ideas (Google 'voice safety')
- Role Cycling -- Everybody Solders (mitigates fear of risk-tasking in group projects, and issues w/ stereotypically gendered roles; also everyone can/should be able to answer a question on any topic)
- Individual Interest -- Choice in Extension as required part of assignment
- Autonomy and Time -- Tinkering -- 'fail fast, fail often' finding time to 'mess around'
- Example -- Deeper Dives:Component Assignment; student selected comes from playing around with things [practice research and doc; makes them an expert in some small aspect,
- Final Presentation w/ Authentic audience (experts/actual engineers in addition to parents) and Poster Fair [talk about reasons for having both: different

