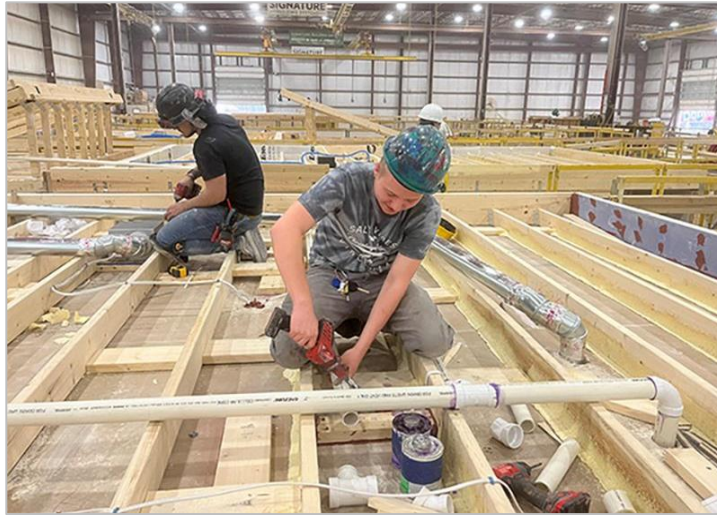


Construction Methodology Transformation for the Benefit of Workforce Development

Shop Class 2.0: Workforce Development for Offsite Construction



Momentum Innovation Group
Heather Wallace, PI
360-239-3993 | heather@miginnovation.com
EE0009744

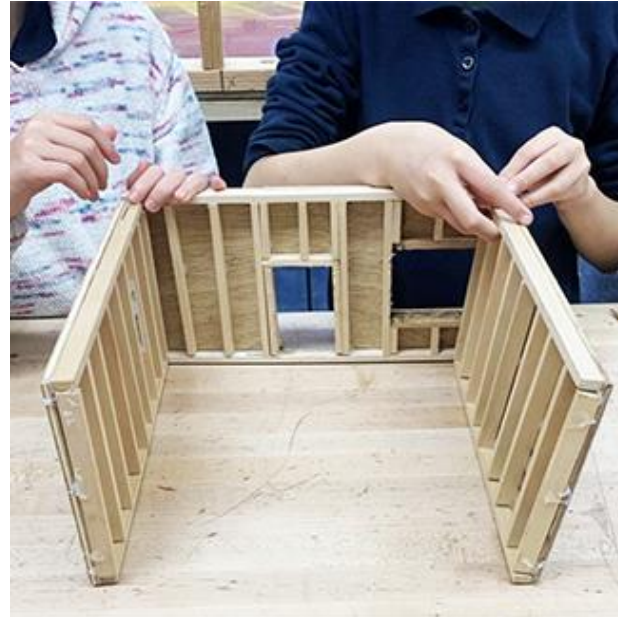
Colby Swanson, Executive
551.200.1500 | colby@miginnovation.com

Project Summary

Objective and outcome

Increase exposure and awareness of offsite construction to younger students to build pathways and careers.

- Create engaging offsite-focused construction curriculum targeted at **Middle and High School** students
- **Launch an online tool to scale-up** programming across the U.S.
- Provide a **job matching** function for students



Team and Partners

Colby Swanson, Executive PI - 25+ years experience at innovating in construction

Heather Wallace, PM, PI Project manager; writer and marketer

Dial Ventures, LLC - Curriculum developers; industrial training and culture experts

Partners:

Milton High School – PA

Mayfair School – PA

Moosic, PA

CTEC - OR

Ritz-Craft - Mifflinburg, PA

Signature Building Systems -

Modern Building Systems -

Stats

Performance Period: **10/1/21 - 12/31/24**

DOE budget: **\$699,699**

Cost Share: **\$37,460**

Milestone 1: Needs Assessment; Curriculum Dvlpmnt

Milestone 2: Pilots; Curriculum Testing

Milestone 3: Scale-up; Online Platform

Problem

While the U.S. continues to struggle to deliver projects affordably, the construction industry is being forced to change:

- 500,000+ construction worker shortage¹ and the workforce pool is **shrinking**
 - 41% of the current construction workforce will be retired within ten years²
 - More than 50% of hands-on “shop classes” have disappeared³

Both the **Education** and **Construction** sectors must work together to more quickly adapt to these systematic challenges.

- **Educators** need better and more modern construction methods to teach
- **Construction** industry needs to broaden its workforce diversity



Alignment and Impact

- Help grow the more energy and resource-efficient offsite construction industry
- Increase exposure of Middle and High School students to the modernizing construction sector
- Increase workforce diversity - more women and people with disabilities
- Better prepare students for careers in offsite construction
- Improve local industry job matching and opportunities in offsite construction



Approach

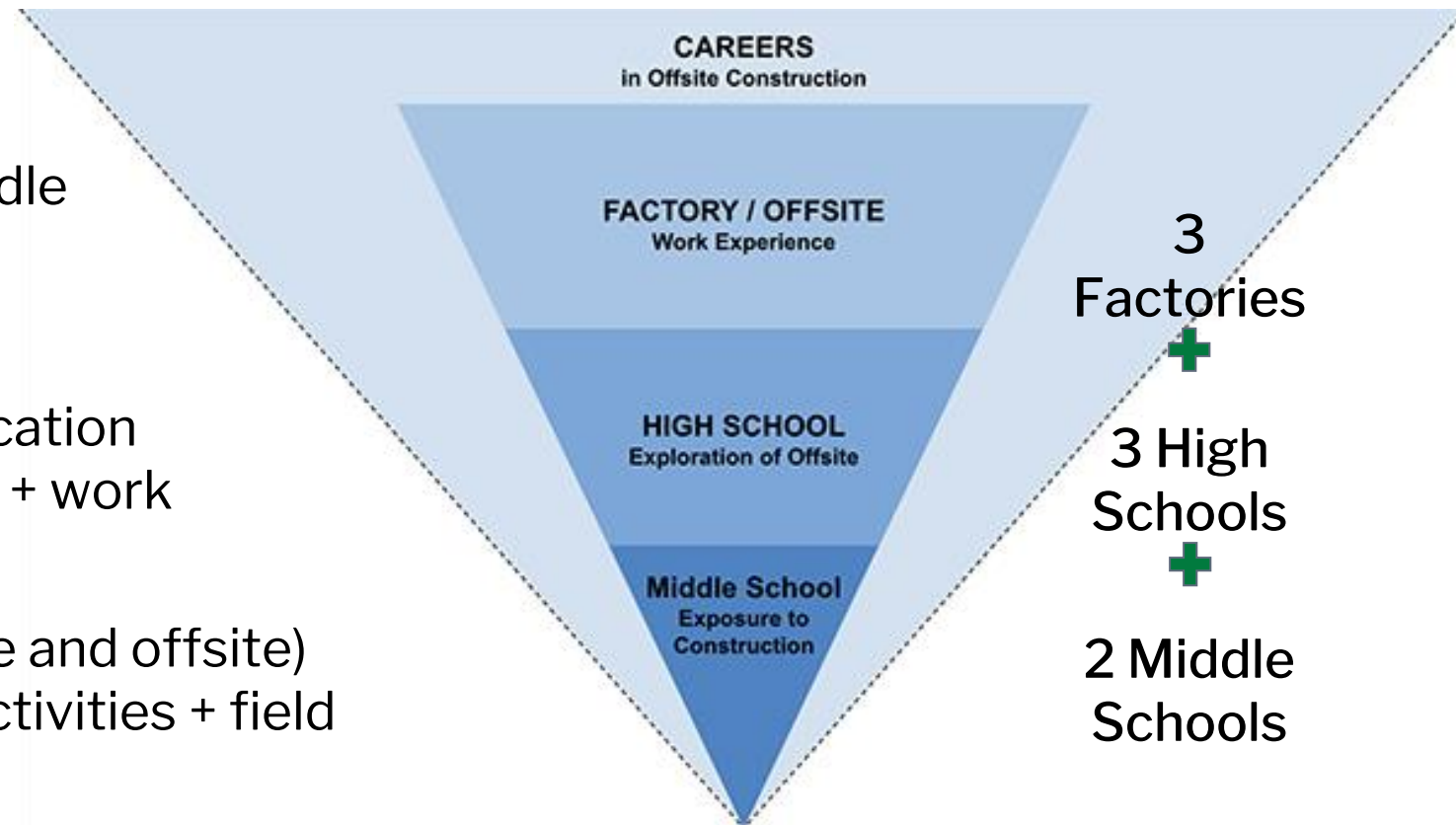
Middle and High School Partnerships with Local Offsite Construction Factories

- Combine in-classroom curriculum with in-factory exposure
- Develop offsite curriculum; highlight more women in construction
- Improve networking and collaboration between educators and industry

Factories: Provide exposure for middle schoolers; work experience for high schoolers

High Schools: Career Technical Education (CTE) offsite construction programs + work experience

Middle Schools: Construction (onsite and offsite) curriculum + interactive/hands-on activities + field trips



Approach

Platform/Online Tool

- Repository of offsite curriculum for educators and factories
- Job opportunity and matching
 - Ability for student to highlight “construction skills” they have based on classes taken
 - Ability for industry to post jobs, internships, etc.
- Resources to accelerate collaboration between schools and factories
 - Searchable database of contact information
 - Map search function to find local collaborators
 - Portal for private sector to connect with schools and programs



<https://youtu.be/Eeo3YSqaLFg>



Collaboration

Energy curriculum taught at career day



Factory Learning Environment

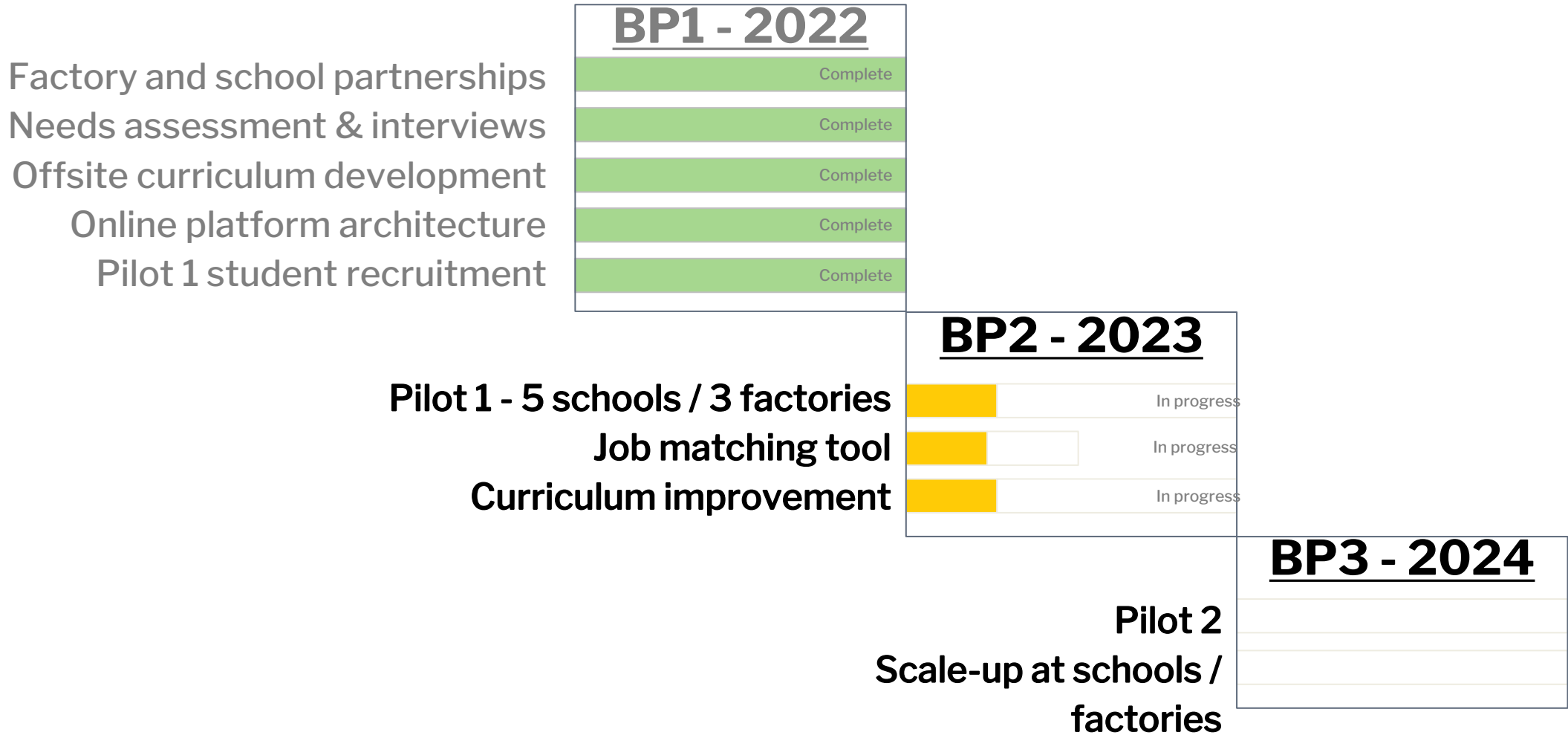


The Big Build



Model of prefabrication / Kit of parts

Progress and Future Work: Project Timeline

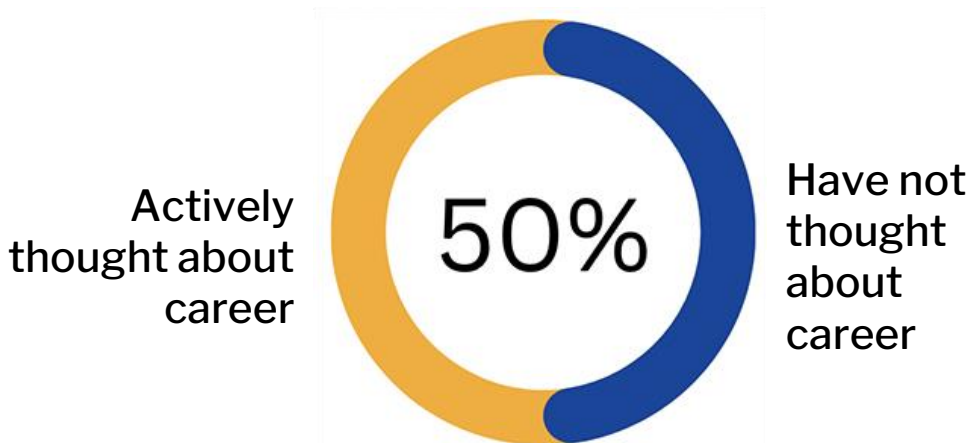


Progress and Future Work: Benchmarking and Assessment

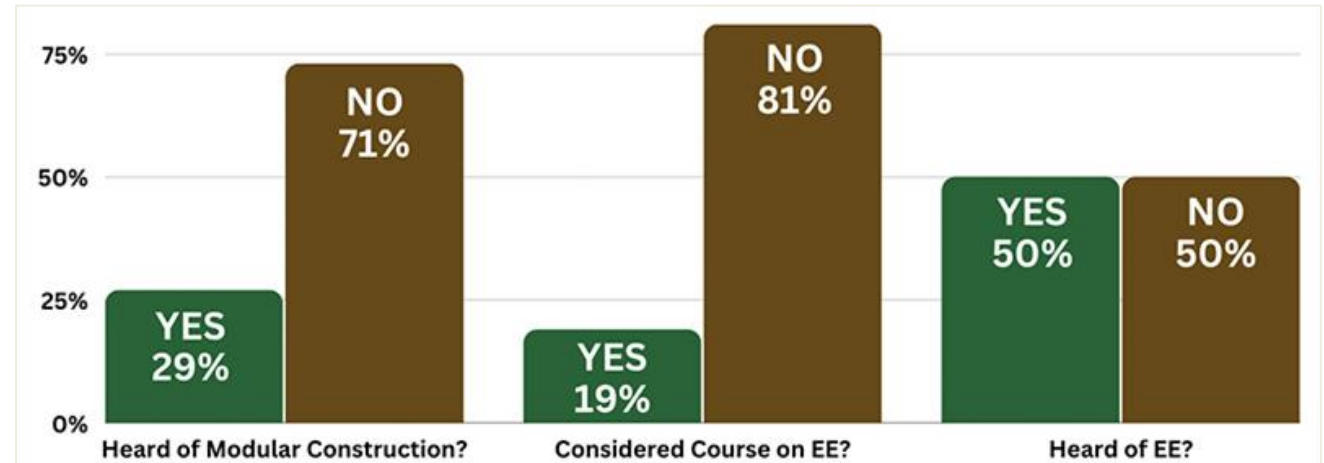
Stakeholder Surveys

- Recruiting, training and retention are the biggest challenges for offsite factories
- Student exposure to modern construction methods needs to start at a younger age
- Must update conventional construction curriculum to include offsite construction
- Workplace culture in factories needs to be addressed to help reduce turnover

500 Middle School students surveyed



1300 High School students surveyed



Progress: 100 Hrs of New Offsite Curriculum



Past, Present, and Future of Housing in the U.S.

AN INTERACTIVE CASE STUDY ON THE HISTORY AND FUTURE OF U.S. HOUSING.



The History of U.S. Housing Development

At one time homes lacked many safety features that are standard in current buildings. The **Tenement Act of 1901** was enacted in New York City to ban the construction of rooms without ventilation systems, require indoor plumbing for toilets and mandate better ventilation and lighting.

May of 1945 marked the end of World War II and sent 4 million service men and women home to the U.S. causing soaring marriage rates and a huge baby boom. While these newly formed families looked to settle down it resulted in an incredible demand for housing.

LEVITTOWN, USA

Levitt & Sons (founder Abraham and his two sons, William and Alfred) are credited with building the first mass-produced suburb

The Future of Affordable Housing

While many government-funded programs have been implemented to help solve affordable housing challenges, the real solutions will be found by becoming more efficient in how we build. Offsite methods provide the opportunity to build faster, with more efficiency and a high level of repeatability that allows us to reach greater **economies of scale**.

More **hotels are using offsite methods** to build as well, as well as **multifamily housing in both the U.S. and in other countries**.

The implementation of technology into offsite processes can also help create a safer environment for humans to work. Machines and robotics can be used to do the heavy lifting traditionally done by humans that may normally have caused injuries.

Economies of Scale

A proportionate saving in costs gained by an increased level of production.

ASSIGNMENT

Interactive Case Study

Vocabulary 1/9

A 3D structure produced in a controlled factory environment, prior to final installation.



Vocabulary Matching Game

Offsite Construction Technologies and Advanced Materials: 3D PRINTING



3D Printing a House



The **benefits** of 3D printing:

- Design (shape) possibilities
- Reduced construction waste (cement mixture can be made of recycled plastic, etc.)
- Reduced build time

Drawbacks include:

- Currently not adopted in building codes
- Limited materials have been tested

Teacher Topical Presentation

Progress: Online Tool

- Online tool will serve:

Educators

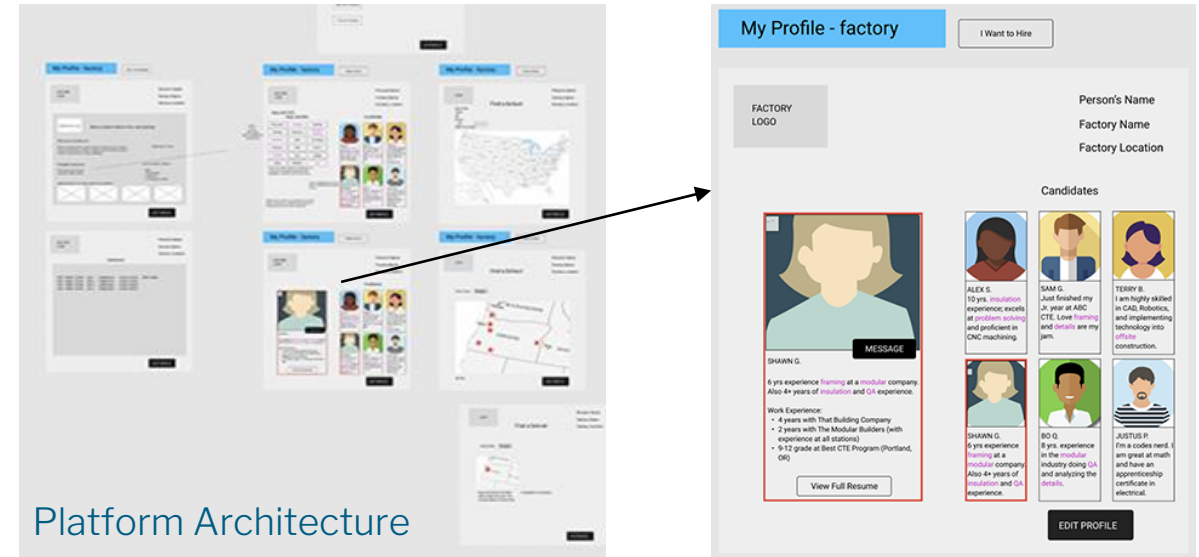
Offsite Factories

Students

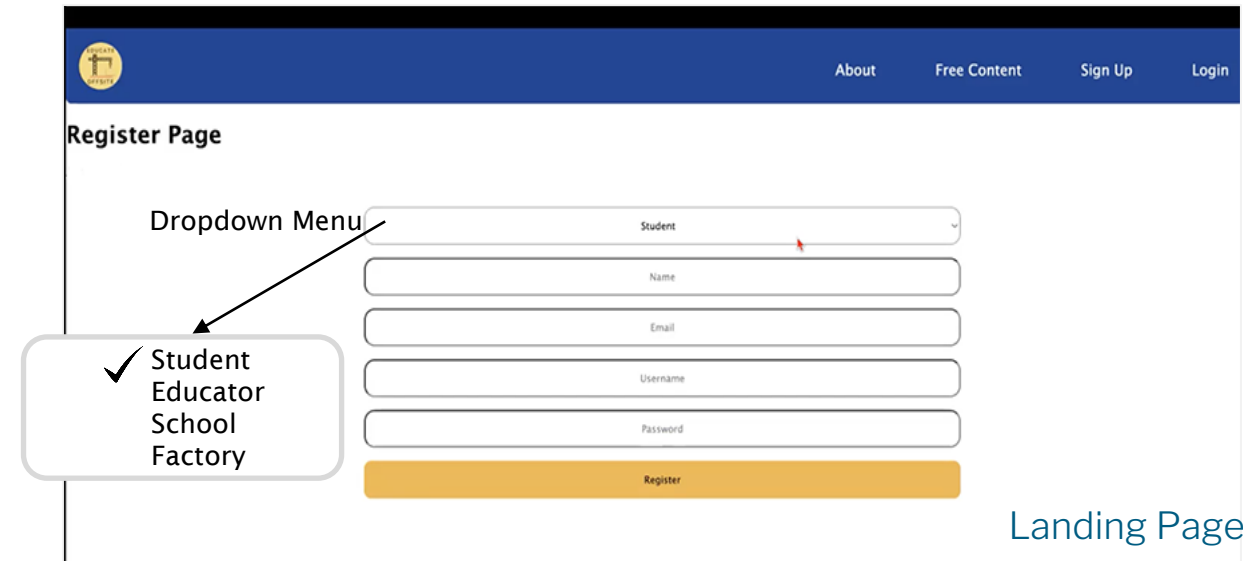
Workforce Development Groups

- Platform architecture has been completed

Let's collaborate...are you a private sector company with a relevant educational tool you'd like to get in front of middle and high school students and teachers?



Platform Architecture



Landing Page

Progress and Future Work: Student Learners

131 Middle schoolers completed new offsite curriculum

15 High schoolers with 44 more students “on deck”

1 Beta Minecraft Factory Learning Environment



https://youtu.be/07c__cU3R4I

Future Work – Lessons Learned...Thus Far

Lessons Learned

- Kids need earlier exposure to terminology of energy efficiency, offsite construction, home performance, etc.
- Lack of CTE and "shop class" like programs and space (seats) for students who are eager to participate
- High level of coordination required between factories and schools to accommodate factory schedules and limited bandwidth
- Need tracking mechanisms of relevant classes students are taking for better job placement

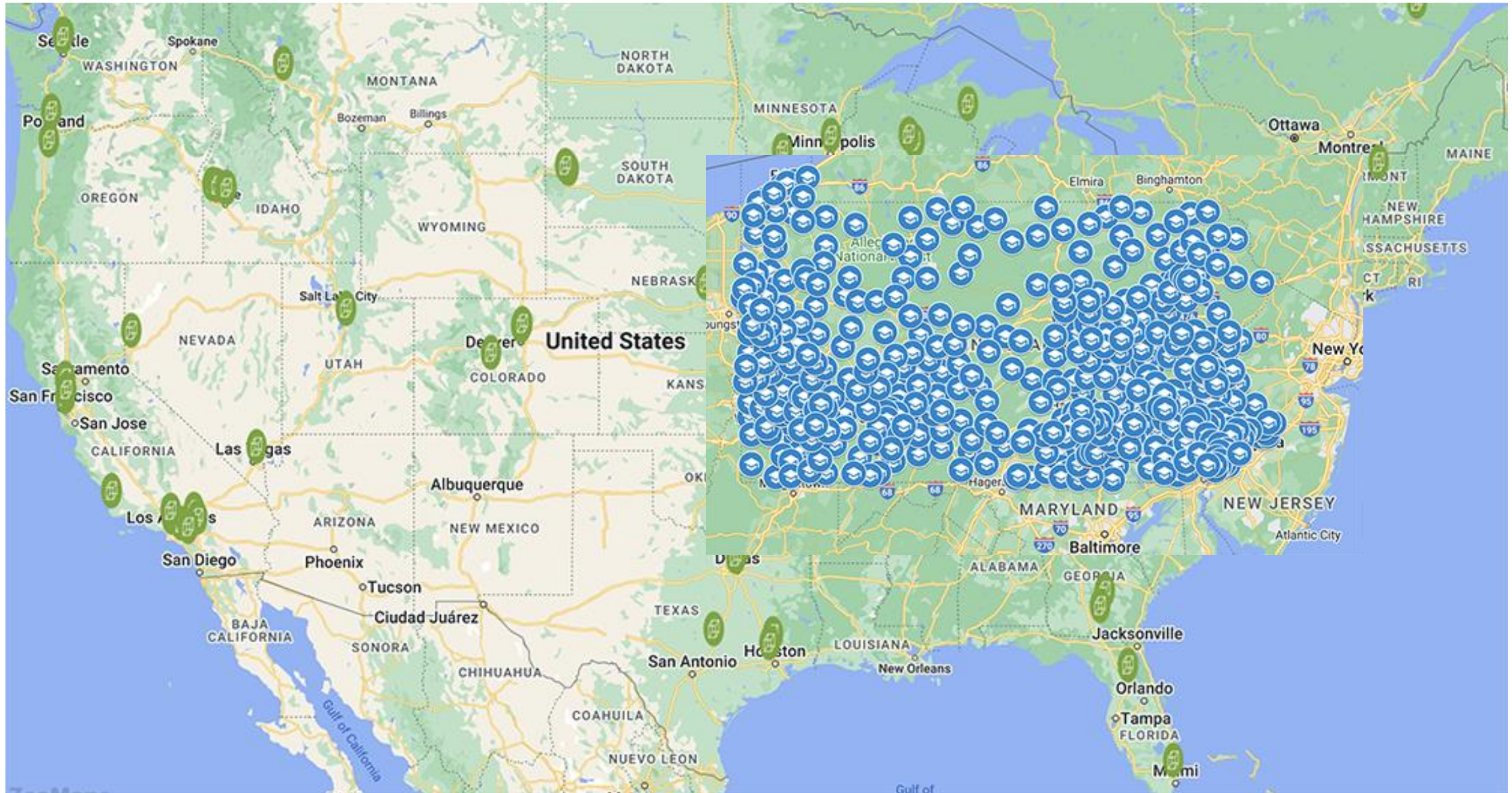
Future Work

2023

- Piloting curriculum and online platform at 5 partner schools and 3 offsite factories
- Modify or develop 50 additional hours of curriculum based on pilot feedback
- Conduct up to 5 factory field trips

2024

Future Work



Thank You

Momentum Innovation Group

Heather Wallace, PM, PI | 360-239-3993 | heather@miginnovation.com

Colby Swanson, Executive PI | 551-200-1500 | colby@miginnovation.com
EE0009744

¹<https://www.abc.org/News-Media/News-Releases/entryid/19777/construction-workforce-shortage-tops-half-a-million-in-2023-says-abc>

²<https://www.nccer.org/docs/default-source/pdfs/nccer-cornerstone-fall-winter-2017-final.pdf>

³The decline of shop classes in America are both a result of a shift in core academics (national education reform movement of the 80's) and the aging out of technical educators. Schools that wanted to continue shop class programs sometimes could not find a qualified educator to teach the class so they were discontinued. There is no national data on the original and existing number of shop classes in the U.S. although some fragmented data can be found in certain regions.

- As of 2019 [76% of the Seattle area shop classes no longer existed](#)
- Between 1978-1986 California has lost 1/3 of its high school shop classes (Board of Education report; [LA Times](#))

The National Renewable Energy Laboratory. *The Energy in Modular (EMOD) Buildings Method: A guide to energy-efficient design for industrialized construction of modular buildings*. June 2022.