Rising to the Transportation Challenge—Students Applying STEM Solutions to Improve Transit

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Executive Summary

• What is the transportation challenge?

• What did we do?

• What are the results?

• How does it continue?
Fresno State Youth Transportation Challenge

• The goal is to create a project around the topic of transportation so that youth can research an issue, take action and have a positive impact on our community.
Background

- THE FUTURE OF EDUCATION?
- -> PROJECT-BASED LEARNING

FOR
- K-12 STUDENTS, UNIVERSITY STUDENTS AND OTHERS INVOLVED
Participants

K-12

Community

University

Industry
K-12 STUDENTS...

- develop their knowledge and sensitivity in regards to transportation related issues,
- develop awareness of transportation related careers (e.g. law, policy, engineering, advocacy...),
- practice their academic skills (e.g. literacy, STEM),
- develop their 21st century skills: critical thinking, communication, collaboration, and creativity,
- develop their leadership and citizenship skills,
- develop an agile, growth mindset,
- increase their overall sense of hope and self-efficacy to create a healthier and more prosperous future for themselves, their community, and their planet.
K-12 TEACHERS...

- develop their knowledge and sensitivity in regards to transportation related issues,

- develop awareness of transportation related careers (e.g. law, policy, engineering, advocacy…),

- learn state of the art pedagogy to support the development of 21st century skills: critical thinking, communication, collaboration, and creativity

- teachers passion for project-based learning and service learning

- develop an agile, growth mindset

- develop teachers’ mindset as change agents and interrupters of negative cycles.
UNIVERSITY STUDENTS...

- learn to work with youth
- develop an agile mindset and agile teamworking skills
- potentially increase their own interest for teaching profession
- give back to community
- increase interest in transportation related careers, the engineering paths, and potentially support recruitment for Fresno State
COMMUNITY...

• learn to work with youth

• develop an agile mindset and agile teamworking skills

• potentially increase their own interest for teaching profession

• give back to community

• increase interest in transportation related careers, the engineering paths, and potentially support recruitment for Fresno State
INDUSTRY...

- learn to work with youth
- Opportunity to engage with youth
- Give back to community
- increase interest in transportation related careers
Methodology

• Engineering design process, Design Thinking

• Agile learning methods: eduScrum

• The action civics pedagogy is rooted in service-learning, youth participatory research and human-centered design thinking.
Phases of the Challenge

• Phase 0) Explore what is transportation, modes of transportation, how do students get to school?

• Phase 1) Identify the problem, presentation of challenge: Walking: How many walk? Conduct a walkability audit, conduct a safety audit

• Phase 2) Explore, Research, Ideate solutions: What can we do? Design, create what have others done? how can it be solved

• Phase 3) Design and Create solutions, test, improve

• Phase 4) Action: present, exchange with others, civic action
Identify the Problem

Practice
1: Defining problems

Examine Information Systematically

Practice
8: Obtaining, evaluating, and communicating information

Create a Model

Practice
2: Developing and using models
5: Using mathematics and computational thinking
6: Designing solutions
7: Engaging in argument from evidence
8: Obtaining, evaluating, and communicating information

Problem
Research
Prototype
Test
Solution

Improve

Practice
4: Analyzing and interpreting data
5: Using mathematics and computational thinking
7: Engaging in argument from evidence

Determine if Model Meets Criteria

Practice
3: Planning and carrying out investigations
4: Analyzing and interpreting data
5: Using mathematics and computational thinking

Solve the Problem

Practice
6: Designing solutions
8: Obtaining, evaluating, and communicating information

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• eduScrum is an active education process developed by the Dutch chemistry teacher Willy Wijnands.

• The way software teams manage their work is adapted to school environment. -> Students learn critical career skills, how to work in a team, how to manage a project.

• Students work in teams, manage their learning activities and their progress in a project based component.
<table>
<thead>
<tr>
<th>Project</th>
<th>Team name</th>
<th>Team Members</th>
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<tr>
<th>Stories</th>
<th>Celebration Criteria</th>
<th>To Do</th>
<th>Busy</th>
<th>Done</th>
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<tr>
<th>D.o.D.</th>
<th>D.o.F.</th>
<th>Run Up Chart</th>
<th>Impediments</th>
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1st PROJECT - After School Program

• The research question for this innovation grant was: Can we leverage the expertise and resources of the Fresno State Transportation Institute to bring high quality educational experience to underserved students and help them improve their communities?

• We found strong support that the “Fresno State Transportation Challenge” can teach elementary students about transportation, about transportation-related careers, and get them to apply this to a transportation related issue in their community in the context of an action civics-oriented project.

• The pedagogical approaches of action civics and eduScrum that we used are very promising. We found strong evidence that the students develop an agile mindset
How can we make walking safer?
- How do you get to school?
- Is walking safe?
• How can we make walking safer?
How can we make walking safer?
How can we make walking safer?
How can we make walking safer?
How can we make walking safer?
2nd PROJECT—SUMMER SCHOOL

3 Weeks Summer school

3rd grade

5th grade

7th grade
Transportation conference
3rd Project
Fall during the school year

• During the school year with teachers and engineering students visiting the students

• How can we increase safety of walking to school?
Participants

- 7\textsuperscript{th} grade classes from a rural school district (Selma Middle School) 3 teachers, 60 students

- 3\textsuperscript{rd} grade classes from an urban school district (Washington Elementary School) 1 teacher, 20 students
Example: Projects 7th grade

- Makerspace class: Designed an electric and remote controlled skateboard, an underground tube transportation system...

- Computer Science Class: Designed an app to increase safe walking to school (app has a map linked to crime data, emergency button, videos to learn self-defense for kids)
Example: Projects 3\textsuperscript{rd} grade

- Protective necklace that takes care of intruders
- Autonomous electric sports car
- Flying unicorn transport
- Self-defense chewing gum
- ...
Capstone: Showcase and visits to Fresno State Campus

- 7th grade classes from a rural school district visited and presented on Camus 12-12-2019
- 3rd grade classes from urban school district visited and presented on Camus 1-24-2020
Presentations at Fresno State
7th Graders
Presentations at Fresno State

7th Graders
Presentations at Fresno State

7th Graders
Visit at Local Transportation related Manufacturer
7th Graders
Presentations at Fresno State
3rd Graders
Quantitative Results 7th graders

Transportation related learning, comparison between groups
"I learned about..."

<table>
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<tr>
<th>Category</th>
<th>Student perception</th>
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<td>Transportation issues.</td>
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<tr>
<td>Transportation careers.</td>
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<tr>
<td>Going to university.</td>
<td>3.5</td>
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<tr>
<td>Engineering related careers.</td>
<td>3.0</td>
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ELA was a comparison group
Outcomes: self-efficacy beliefs
Outcomes:
knowledge about careers
CONCLUSION

• The Transportation Challenge is an effective way to engage students and teachers in transportation related learning and focus on improving their community.

• Future

  - Fresno State challenge 2020

  - Central Valley challenge 2020
THANK YOU!

Do you want to do this with your students?