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Webinar: Investigations in Transportation: Partnering Industry Professionals and Elementary Teachers in a STEM Unit of Study

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Investigations in Transportation:
Partnering Transportation Industry
Professionals and Elementary
Teachers in a Targeted STEM Unit of
Study

May 24, 2016 Webinar Presentation

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National Institute for Transportation
and Communities



*Oregon
Department
of Transportation*



Grant Premise and Participants

A Collaborative Partnership for Creating a Place-Based Standards Aligned Interactive Unit

Through an Oregon Transportation and Research Consortium Grant, the *Elementary Investigations in Transportation* project harnessed the professional expertise, experience, and enthusiasm of transportation sector STEM workers by creating a mechanism and set of protocols by which they engaged with elementary school teachers to develop and implement an instructional unit. This STEM connected instructional unit and lessons allowed students to explore and investigate issues central to transportation.

Session Focus

- Share the process for creating partnerships between industry professionals and schools to support STEM unit development that connects the various aspects of standards based work and a place-based context
- Provide resources for replicating the process

Parking Lot Dilemma

Fifth grade students at Chehalem Elementary (three classrooms with 22-24 students per class) were taken on a tour of the school grounds and asked to notice areas that were problematic to both students and community. Upon completion of the tour students decided that the most impacted area of the campus was the parking lot. Hence, the “Parking Lot Dilemma” was created.

Two fifth grade classrooms at Tobias Elementary with 22-24 students per class and one sixth grade class of 35 students together determined that their parking lot was problematic as well. So an investigation began to solve the “Parking Lot Dilemma” for Tobias students and the community.



Initial Project Planning:

- Grant Coordinator
- Grant Researcher
- Partnership and Development Director
- ODOT Assistant Project Manager

Participants	Number	Role in Grant
Lead Teachers	2	Plan, share, implement and reflect on transportation unit
Collaborating Teachers	4	Implement and reflect on transportation unit
Transportation Professionals	7 2	Support unit planning Work with students during unit implementation
Portland State University Staff	2	Design and coordinate programming
Transportation Partnering Agencies or Transportation Consultant Firms	4	Recruit and release grant transportation volunteers
Students	160+	Engage in unit activities



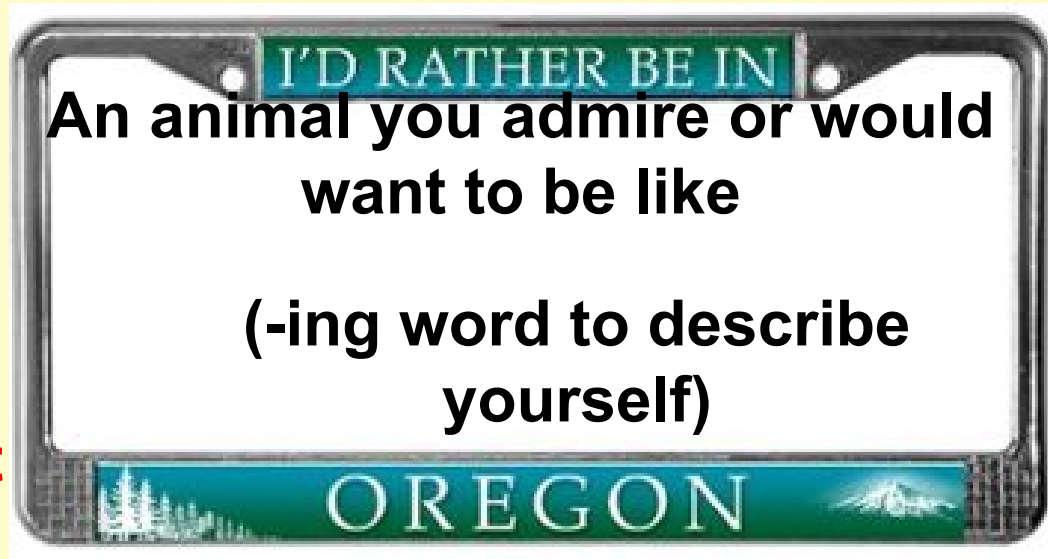
Planning Between Transportation Professionals and Educators:

Building Relationships,
trust and a shared sense
of community

**A person you
admire or would like
to be like**

**Someplace you've been
and didn't want to leave**

**Most
memorable
math or
science
experience
as a student**

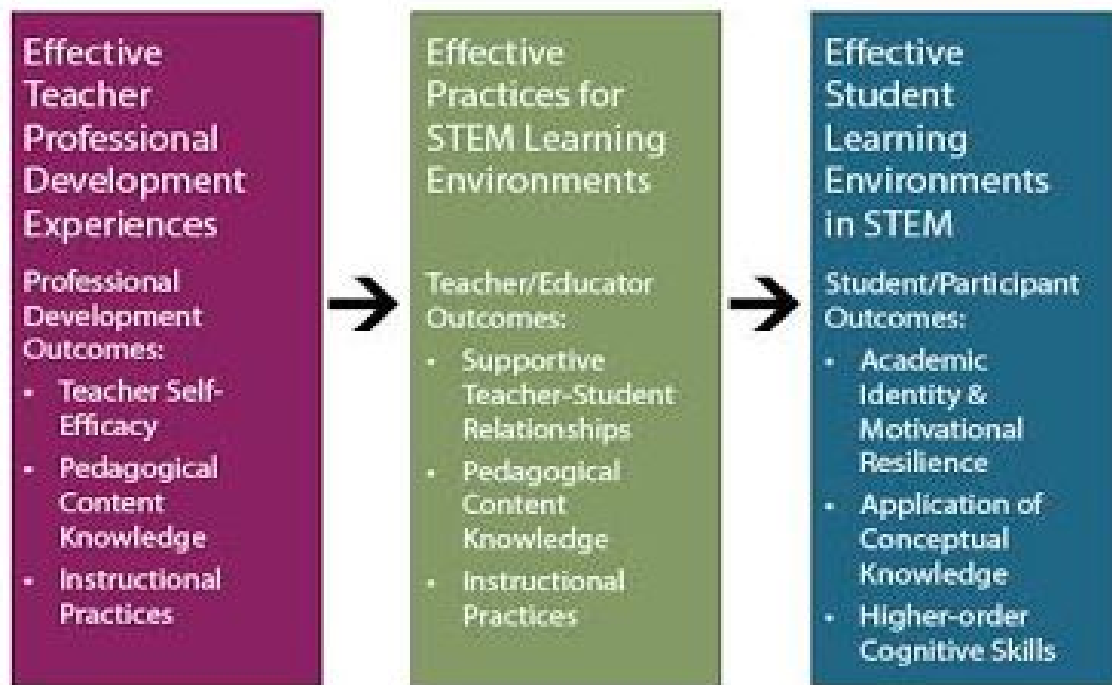


**Experience
or person
that
affected
your career
decision**

**If you had two hours to do
anything with no limits what
would you do?**

**What do you see
yourself doing in
10 years?**

Connection to Research



Theory of Change Diagram

Grant Goals: Connection to Standards

Teacher Effective Instructional Practices:

- Emphasize deep content knowledge and higher order cognitive skills by addressing learning goals
- Create and implement multiple and diverse opportunities for students to develop conceptual knowledge

Grant Goals: Connection to Strategies

Teacher Pedagogical Content Knowledge:

Understanding and use of the effective strategies for math and engineering design

Making connections within the content to all areas of the grade level curriculum

Showing learners the “real-world” connections

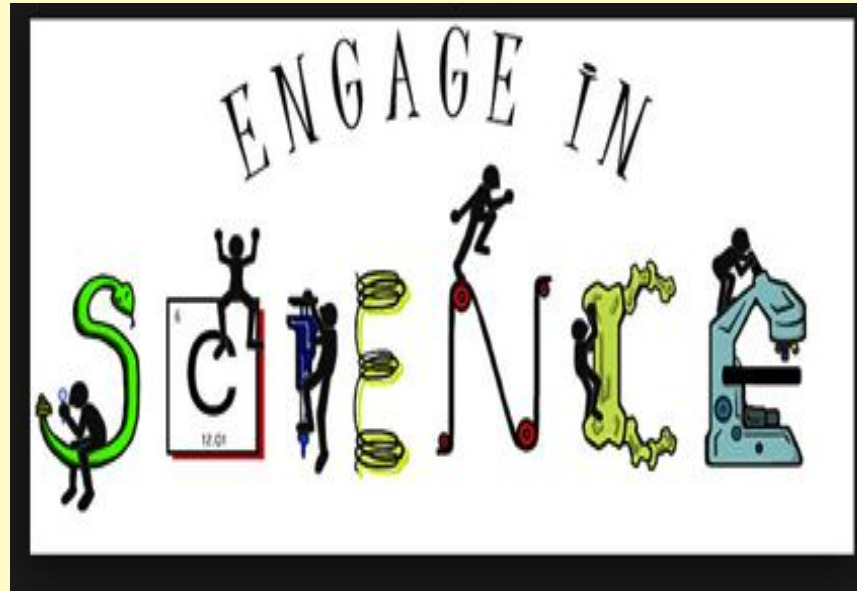
Grant Goals: Student Outcomes

Student Academic Identity and Motivational Resilience: Characterized by students' enthusiastic hard work and persistence in the face of challenging STEM coursework

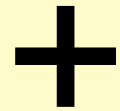
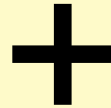
Application of Conceptual Knowledge: Students' understanding and thinking about ideas, theories and perspectives considered critical within an academic discipline.

Creating Effective STEM Learning Environments

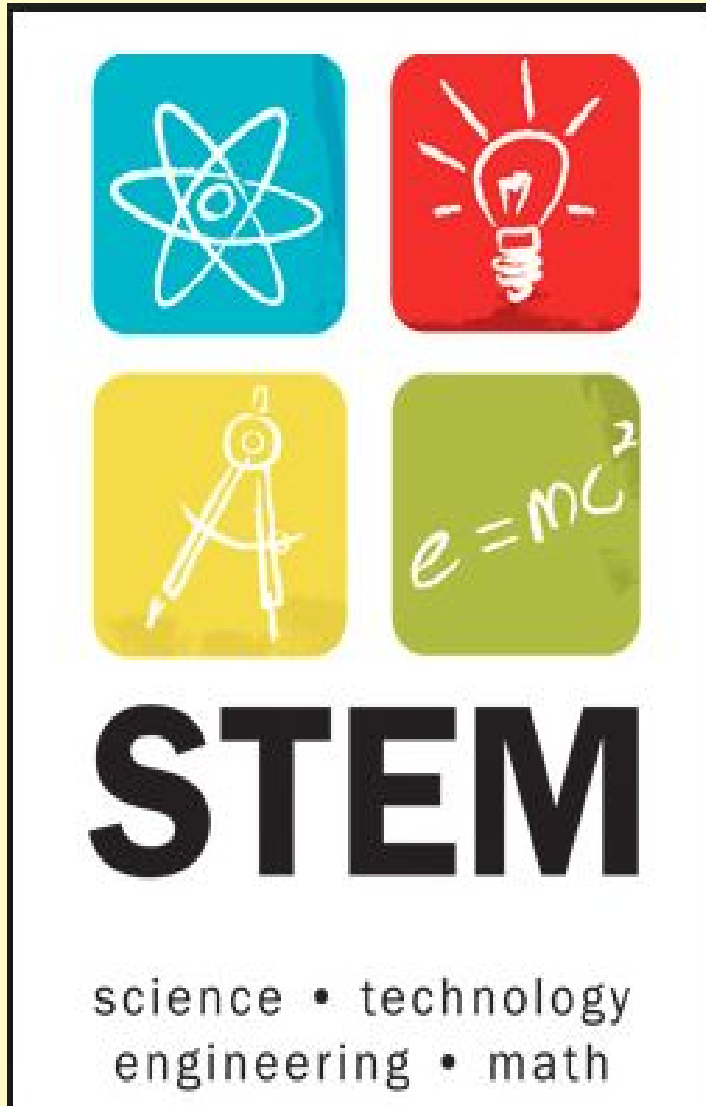
Connecting and Inspiring: STEM



Investigations in Transportation



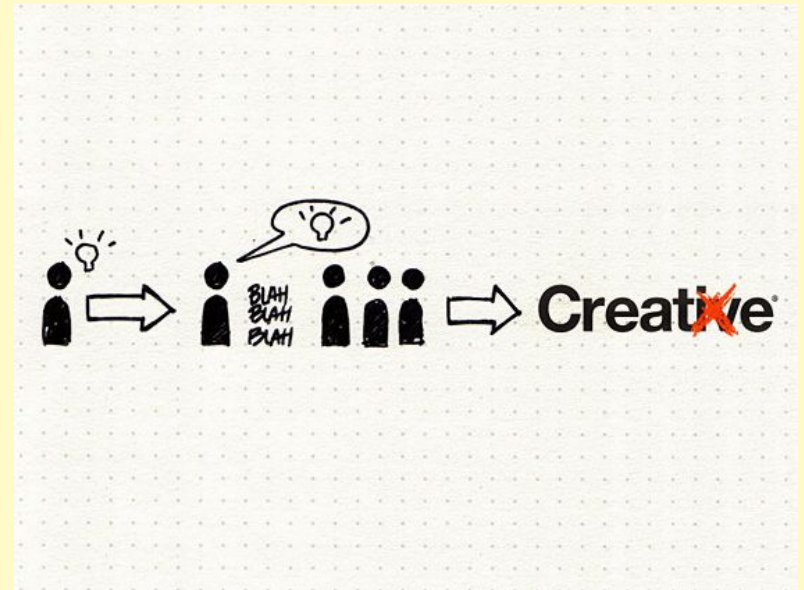
Standards Sense-making



The easiest way to integrate is when a teacher has equal expertise in both math and science and when he or she teaches both subjects.

- Muscovici & Newton, 2006

Initial Connections to Real World Work and Dilemmas



Transportation Connections

Grade Level Relevancy & CCSS-M

Table 1. Key topics relevant to science, and the grade at which they are first expected in CCSSM. See CCSSM for exact statements of expectations.

Number and Operations	Grade First Expected
Multiplication and division of whole numbers	3
Concept of a fraction a/b	3
Beginning fraction arithmetic	4
The coordinate plane	5
Ratios, rates (e.g., speed), proportional relationships	6
Simple percent problems	6
Rational number system / signed numbers—concepts	6
Rational number system / signed numbers—arithmetic	7
Measurement	Grade First Expected
Standard length units (inch, centimeter, etc.)	2
Area	3
Convert from a larger unit to a smaller in the same system	4
Convert units within a given measurement system	5
Volume	5
Convert units across measurement systems (e.g., inches to cm)	6

What Makes an Effective Unit?

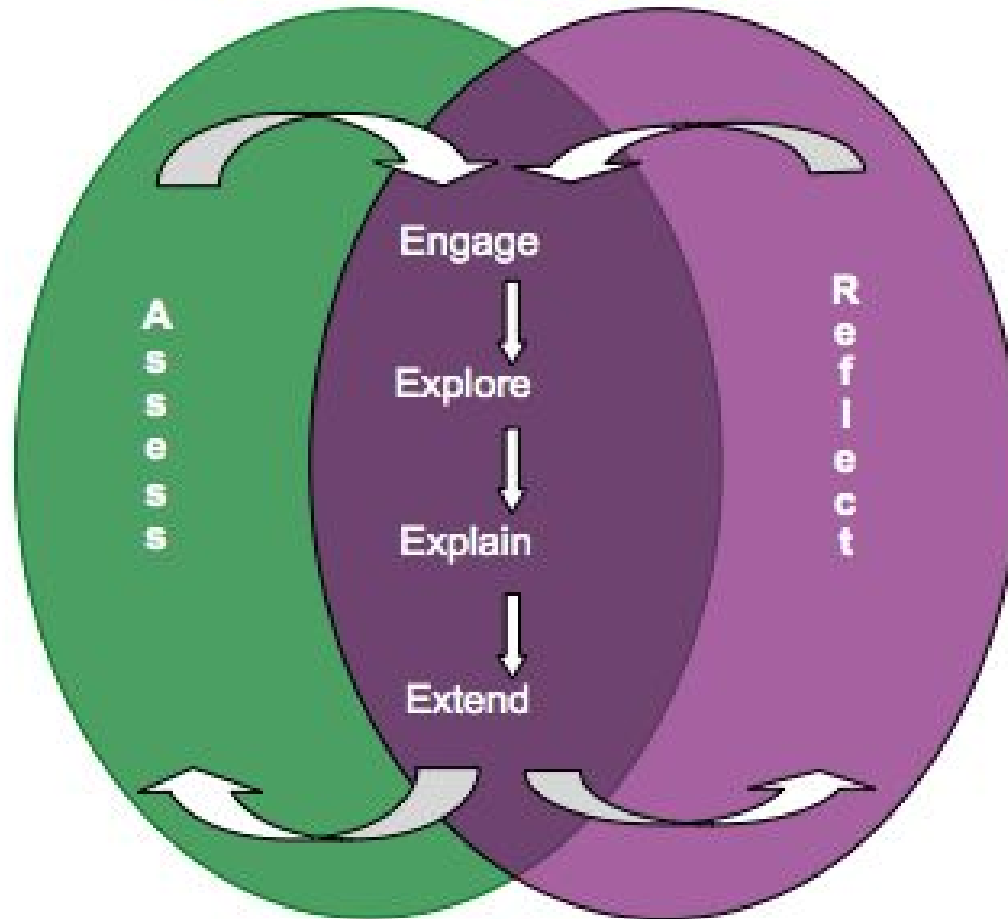
- Create Context and Relevancy
- Identify Desired Results
- Assessment Evidence
- Learning Plan
- Assess and Reflect

- Alignment to Standards
- Conceptual and Instructional Shifts
- Instructional Supports
- Monitoring Student Progress

Investigations in Transportation Unit Plan	
<p>Session #2: Lesson Title/Activity: Engineering in Elementary Maglev Lesson 2: Act out an Intersection Building Career Connections to Transportation Engineering</p> <p>Lesson Assessments:</p> <p>Objective or Focus:</p> <p>Using Tools Data Collection</p> <p>Standards/Targets Addressed:</p> <p>5-PS1-3 Make observations and measurements to identify materials based on their properties.</p> <p>5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.</p> <p>5.NBT.3 Read, write, and compare decimals to thousandths.</p> <p>5.MD.H Represent and interpret data.</p> <p>Assessment:</p> <p>Transportation Professional Connection: "Meet the Transportation Professionals" via Skype or Google Hangout if can't come to person. Other Option: E-mail picture of observations and introduce class to professional, ask professional to send back picture in work site and mini-bus.</p> <p>Resources Needed:</p> <p>Google Hangout or Skype set-up Stop Watches</p>	<p>Lesson Summary: (Describe the lesson flow, including beginning, middle and end)</p> <p>Using the Maglev lesson plan, students will interact with the problem associated with traffic flow around an intersection. Students will use the pre-designed format to construct solutions to a student-focused problem.</p> <p>Transportation issues related to our campus.</p> <p><i>Since you have been in expert groups, have just done a simulation and have experience, what types of questions do you have or what type of problems would you see in a parking lot. (Use to create observational survey)</i></p> <p>Reflection Notes: (To be filled out at completion of lesson. Reflect on what worked well, what would you change, further supports needed? Include notes to support your instruction next year when doing the same session.)</p>

Effective Instructional Model

4E x 2 Model



Industry professionals brainstorm possible “dilemmas” to narrow down our group discussions which leads to project selection.



Creating the Unit Plan

UNIT OVERVIEW BY WEEK

Week #1: Introduction: Understanding the relationship between decimals, fractions, and percents; data collection; interpreting data; seeing patterns in data; analyzing data sets of professionals; career pathways-student identity;

Science: Awareness/Community Connection

Math: Create Survey (student) tools; data collection

Language Arts: Picture Book (Career, connection to transportation) Writing Journal, letter home to tell parents about our learnings

Art: Journal Covers (Make it personal)

Transportation Professionals:

Session #2: Meet the Professionals

Week #3: Auto-Cad Info from Professionals; spreadsheet for traffic count and initial analysis:

Week #2: Choosing Appropriate Tools; Intersection Count App; Parking Lot Dimensions Google; Turning radius, width of aisle; constraints; for engineering design; Task: Car dimension--minimum, maximum, (average) most frequent dimensions; embed reasoning; how to blueprint parking lot; impact on watershed (bring in expert from water services); Tualatin Water Services; road density within watershed; larger world context

Science: Awareness of Our School Campus (observe Kindy Pick-up)

What have we learned? What do we Need?

Video survey (professionals)

Math: Discussion of Data from survey (weekend); data (map) represent (formats)

Language Arts: Pressing needs/improve traffic flow; safety; compare to other designs

Art: Journal Covers (Make it personal)

Transportation Professionals:

Session #7: Support for Initial Data

Session #8: Data Analysis Discussion

Week #4: Power Point presentation of project or Propz

Part 2: Unit Implementation & Participation



Bringing Colleagues on Board Unit Revision at Chehalem

Lesson Plan: [Session #1 Example](#)

Originally, this unit was scheduled to be delivered in the fall. Due to scheduling, curriculum and group constraints, the unit was delivered in January and in a shortened format. The students and staff devoted half a day for 16 days. The result was a compacted delivery model with some reduction in both time and content. The results of these lessons were evaluated and changes were made to improve the lessons for delivery during the following years.

Bringing Colleagues on Board Unit Revision/Plan at Tobias

Transportation Unit 1.0

Monday

Tuesday

Wednesday

Thursday

Friday

Jan. 5

Jan. 6

Jan. 7

Jan. 8

Jan. 9

Week One Focus: How to Collect and Interpret Data/Career Pathways

Session 1 –
Parking lot walking
field trip.
~Record
observations and
issues from
different POV's. ~
Reflection Essay
titled "Parking Lot
Dilemmas"

Session 2—*meet
the professional*
~EIE MagLev
Lesson

Session 3—Indian
Hills Walking Field
Trip
~Record data
~Slideshow?

Session 4—
Formulate survey
questions from IH
data.

~Read: Rosie
Revere
Engineer

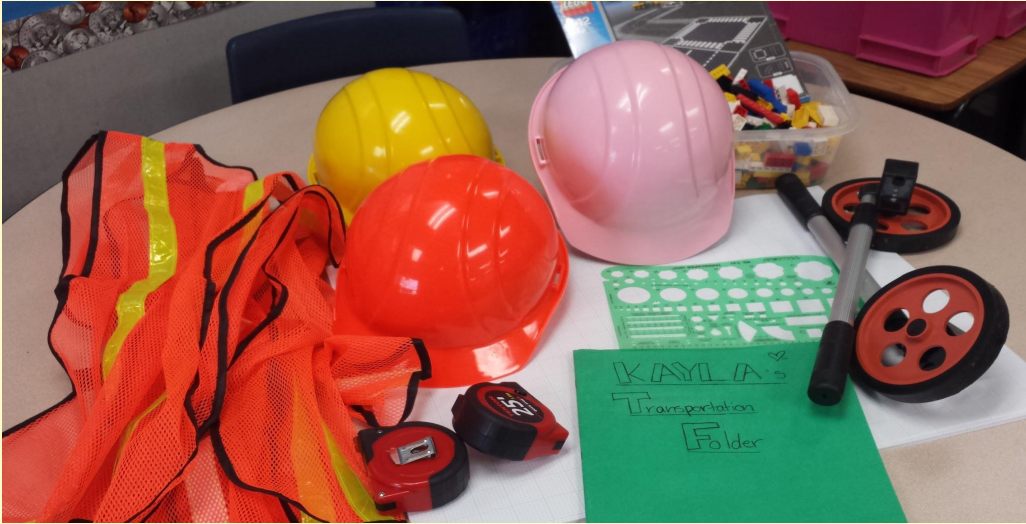
~Read: This is the
Way We Go to
School

Read: Modes of
Transportation ABC
Book of Rhymes

Read:
Transportation
Inventions Which
came first?

Read: parts of
Tomorrow's
Transportation pg.
18 What Kind of
Person are You?

Student Materials and Resources



Students were able to use real world tools and relevant text in order to enhance their learnings and connections.

Some journal entries were focused on building background knowledge and connecting with informational text.



Transportation Professional: Partnerships and Relationships



Students met with professionals who brought both expertise and a “sense of authenticity” to student’s work.

Spending Time with Professionals



Gathering information and asking questions of a professional was powerful.

Implementation: Data Collecting Crew



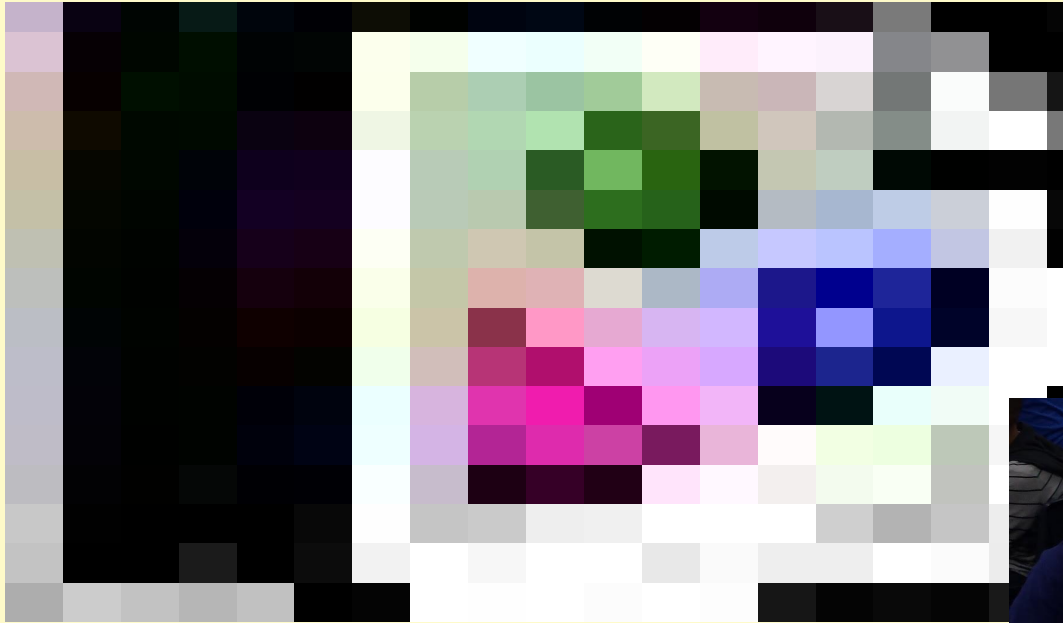
Students preparing to measure, record and report their findings.

Collecting Further Data



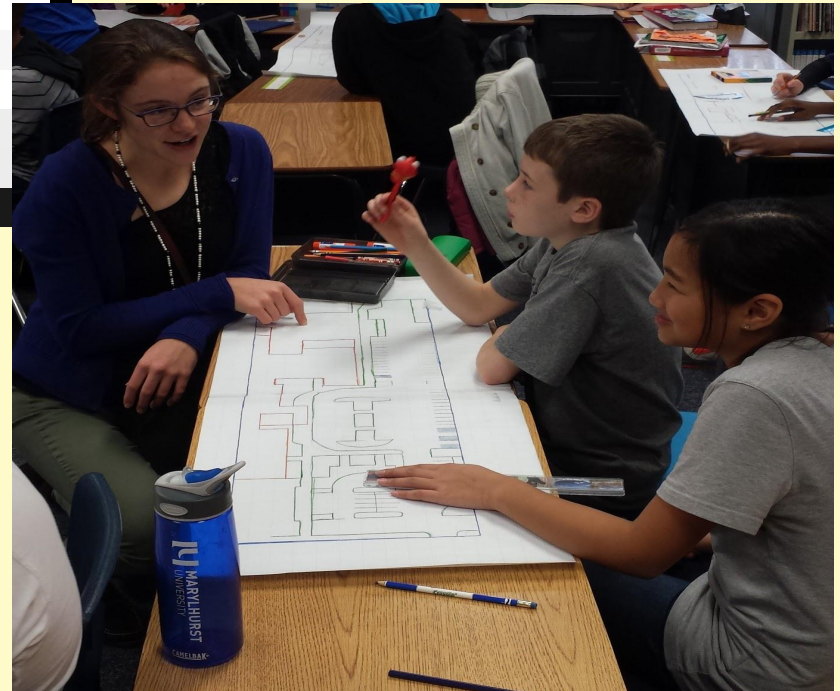
Students interact with the physical environment to aid in the group “dilemma” solution.

Working on “Dilemma” Solutions



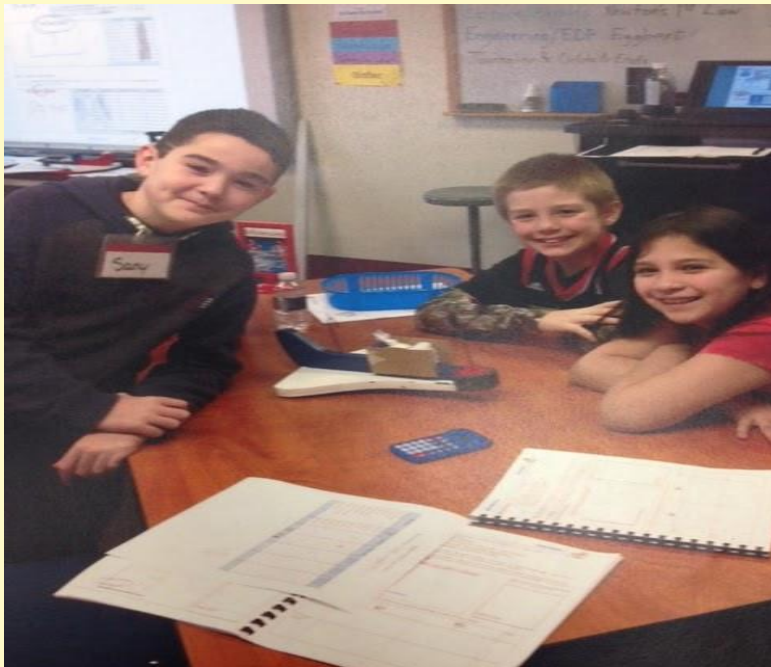
Together we will learn and grow!

Teamwork is an important aspect of solving a dilemma. Students learned that both at school and in the workplace, working together is essential.



Student Presentations: Chehalem

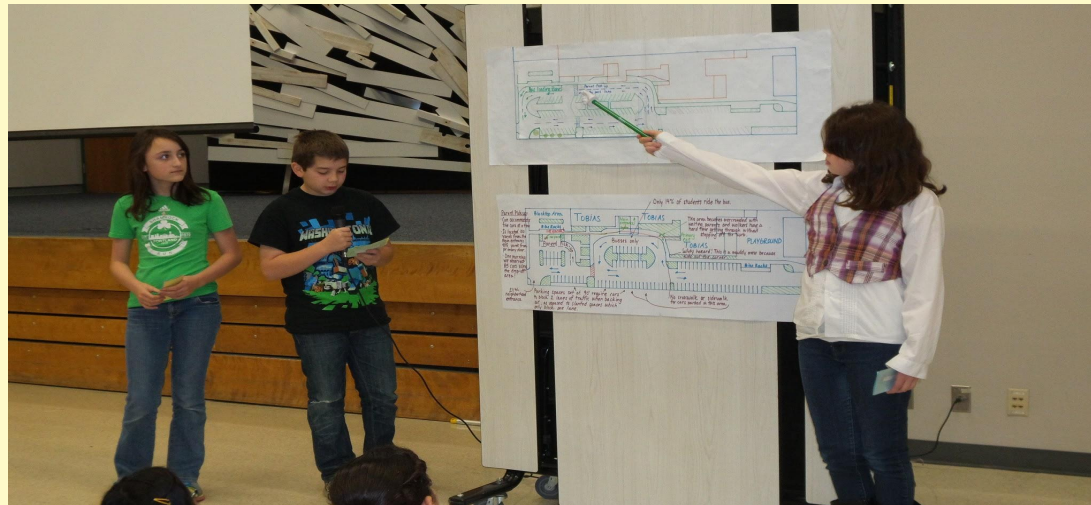
Students were given opportunities to research, gather information and data and finally, to prepare a small-group presentation. The end product or outcome was to persuade a group of stakeholders to make a “real world” change in the current “dilemma” situation. Presentations included: slide shows, presentation boards and essays.



Students at Work: Chehalem



Student Presentations: Tobias



Students Reflect on Learnings (During and After Unit)

What Chehalem Students had to say when asked “What did you most enjoy about the Parking Lot Dilemma Project?”

“The most fun part was getting to use the measuring tools”

“I enjoyed measuring the parking lot with my team.”

“I liked working with my team on the presentation job.”

“ Presenting to the principal and the stakeholders was FUN!”

“Being able to work as a team was so much fun!”

What Tobias Students had to say when asked “What did you most enjoy about the Parking Lot Dilemma Project?”

“The professionals were very helpful.”

“I enjoyed measuring the cars with the measuring wheel.”

“It was fun working in partnerships.”

*“I enjoyed the process because the professionals gave us key points.
It was a fun learning experience.”*

Teachers Reflect on Learnings:

Both Chehalem and Tobias teachers were excited about the lessons and were pleased with the amount of student involvement and enthusiasm. Teachers commented on the fact that students were invested in the outcomes and were willing to work hard toward completion of group presentations. Parents were pleased to see that their students were “challenged” to help solve a “Real World Problem” or dilemma.

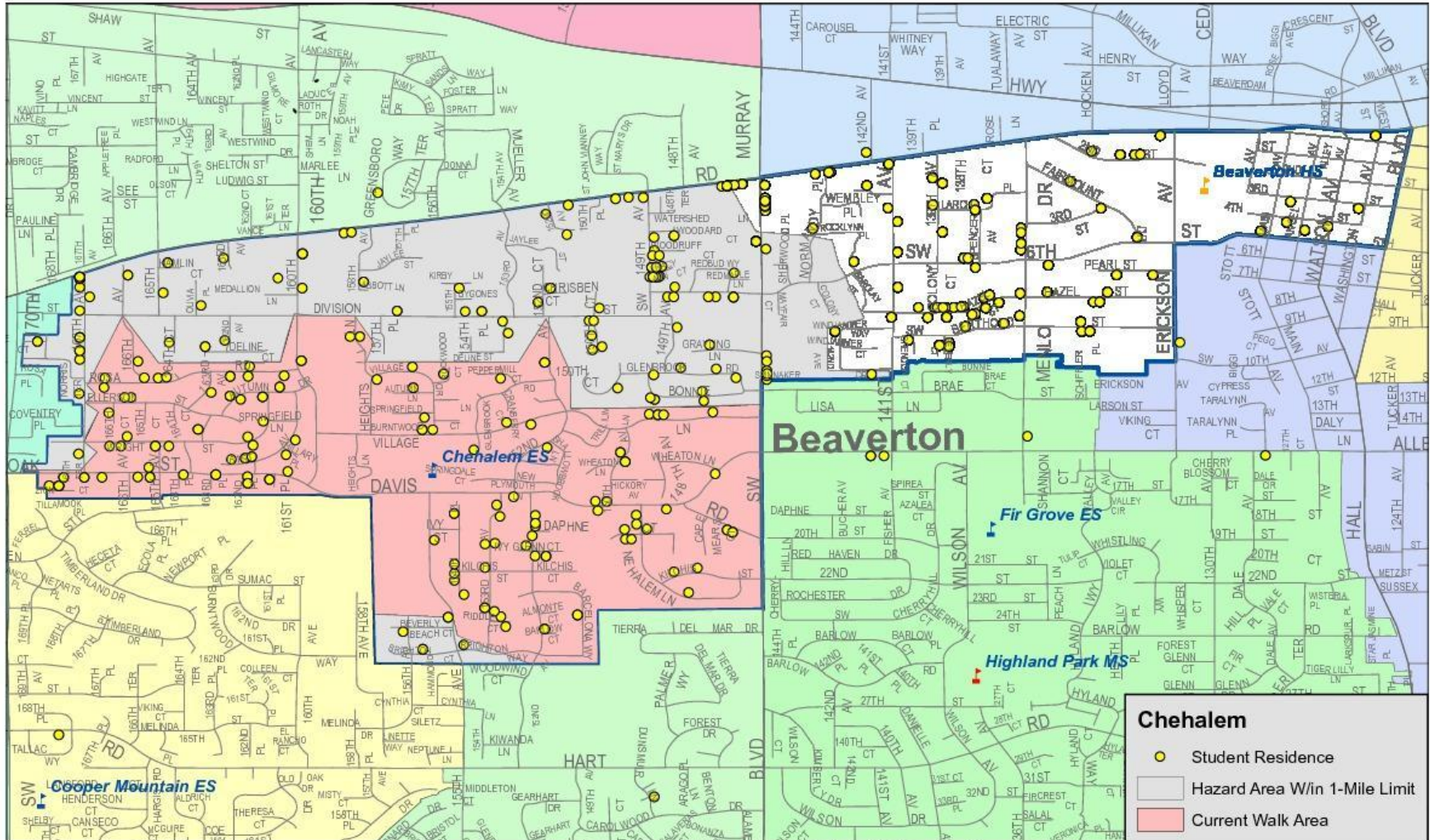
STEM Professionals Reflect on Learnings:

I really enjoyed the experience. I loved how excited the students got about the project to redesign their parking lot and how much ownership they took over it. Both the teachers and students took the project seriously and really embraced the opportunity to be engineers for their school. I enjoyed getting to tell the students about what I do as an engineer and appreciated how well they listened. They asked great questions and it was so refreshing to spend a few hours with them! I'd love to participate in something similar in the future.

Volunteering was really fun at Chehalem; made me decide to continue to support Tobias. Really enjoyed the student presentations to see learning come to fruition!

Moving Forward School Level: Results

Chehalem Elementary School



Moving Ahead: Principal's Comment at Chehalem

After meeting with the stakeholders:

- 1 - Determine who is coming by car, and what part of our boundary they represent. (If they are driving to school, then the question is "why?". If we know that, we can try a resolution that addresses their motivation to drop off and pick up.)
- 2 - Continue the work from three years ago to create viable walking paths for people on the other side of Murray.
- 3 - Determine the legal lengths and widths for parking spaces AND two lanes within the front lot.

Data Reflection Session

Math Performance Task

The parking lot redesign needs to allow for the following uses:

- Parked cars
- Drive through
- Car Pick-up Lane
- Bike path
- Sidewalk
- Water run-off

One design team has determined the following fractional portions for each:

- Parked cars= $\frac{1}{3}$
- Drive through= $\frac{1}{5}$
- Car Pick-up Lane= $\frac{1}{6}$
- Bike path= $\frac{1}{10}$
- Sidewalk= $\frac{1}{10}$
- Water run-off= $\frac{1}{15}$

Use the diagram below to show what fraction of the entire parking lot will be used for each purpose. Is there any room left for a dedication plaque/flower area? Defend your diagram using a mathematical equation and written explanation.



|

Project Impact

- The authentic learning experiences were critical to the unit's success
- Students demonstrated higher levels of engagement compared to other units or learning experiences
- Students benefited from opportunities to learn from each other
- Placed-based learning, in this case at the school itself, results in higher levels of ownership and relevancy for both the teachers and the students

Lessons Learned: School Level

Although all participants were in agreement that both the process and the unit were worthwhile additions to the curriculum, there are adjustments and changes that will be made.

- All teachers will be part of the refinement and delivery model decisions
- Foundation lessons will be taught before unit begins (measurement)
- Additional supplies and supports will be added to unit
- A stronger focus on Engineering Design and Math
- Predetermined alignment with math and science target
- Ongoing formative assessments

Lessons Learned: Project Level

Project Design

Strengths: Clear, cohesive plan; unique premise of direct partnership with transportation professionals; collaborative nature of professionals, teachers, researchers, and curriculum specialists

Challenges: Change in grant staffing; school scheduling and conflicting priorities;

Lessons Learned: Maintain timeline; closer research monitoring

Project Partnerships

Strengths: Strong STEM connections; variety in transportation agencies; volunteered hours

Challenges: Only female engineers; limited number of volunteers for school site due to timing.

Lessons Learned: Provide extensive amount of time for recruiting of volunteers

Questions?



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