Engaged Engineering
...It’s Elementary
Clark Creek ES STEM Academy
Acworth, Georgia

Principal – Joey Moss
Odyssey Lab Teacher – Teresa Bailey
Fifth Grade Teacher – Cindy Reeves
Professional Development for STEM

- STEM 21 Certification
- Engineering Design, Technology, Robotics
- Center for STEM Excellence: Chris Anderson
- STEM for Elementary Teachers
- Etowah HS Math/Science Teachers
- Differentiation in Mathematics: Dr. Carol Ann Tomlinson
- Microsoft Innovative Educator: County Instructional Technology Specialist
- Peer Classroom Visits
- STEM Committee Strategic Planning
- Kennesaw State University I-Teach – Project Based Learning
How did CCES compare to other Cherokee County Title 1 Schools on the 2015 Milestones?

Observations:
• For 3rd, 4th, and 5th grades CCES’s average scale score exceeds all other schools except for Woodstock ES.
SY2015 to SY2016 Georgia Milestones End of Grade Assessment Comparison Grades 3, 4, and 5

Observations:
- CCES has fewer Beginning and Developing Learners than the state average as well as more Proficient and Distinguished Learners in 2015 and 2016.
- CCES has a decline in the total Beginning and Developing Learners, with an increase in Distinguished Learners from 2015 - 2016
Summary

- Math scores at CCES as a whole are improving each year in comparison with the county and state scores.
- Math scores at CCES as a whole exceed those of the other STEM Academies in Cherokee County.
- Math scores at CCES as a whole exceed those of the other Title 1 Schools in Cherokee County except for Woodstock ES.
- The achievement gap in math scores by ethnicity is minor.
- The achievement gap in math scores by gender is non-existent.
Key Components of Our STEM Program

- GA STEM Certified 2016
- Integrated Science, Technology, Engineering and Math (STEM) Curriculum
- Specialized District-developed STEM curriculum (K-8)
- Engineering Design Loop taught as problem-solving model for all content areas
- High quality collaborative professional development
- Innovative Teaching Strategies focused on authentic real-world math and science application
- District STEM Academy with highest enrollment of school choice students
Unique strengths of Clark Creek STEM Academy

- Odyssey Engineering Lab
- Quest Science Lab
- STEM Field Trips
- First Lego League Robotics Team
- Maker Space Lab
- Global/Virtual Learning Classroom
- 3-D Printing
- RedHawk Cooking Lab
- WCCE Student News Program
- Outdoor Learning Center
Project Based Learning

The Product Based Learning ideas used with the Cherokee County STEM Units are completely done in class.

They are NOT homework assignments.

A risk free environment for generating solutions is the goal and therefore evaluation does not penalize for an unsuccessful design, but can reward a successful solution with a few extra points.

Benefits

• Engages student interest and motivation
• Designed to solve a problem
• Reflects the types of learning and work people do in the everyday world outside of a classroom
• Teaches communications, presentation skills, organization, time management, social skills, group participation, and leadership skills
The Cherokee County STEM Engineering Design Process discussed today was developed in 2012 and serves as the basis for the EDP used by the middle and high schools.
CC STEM Engineering Design Loop

ASK
What is the problem?
ASK: What is the problem?

• Engineering design occurs in response to a human need. Before you can develop a problem definition statement for a design problem, you need to recognize the need for a new product, system, or machine.

• In the CC STEM Engineering Design Loop the teacher will specify what the challenge will be and define the criteria, but the students should be able to state the task in their own words:

How can I design a __________ that will __________.
CC STEM Engineering Design Loop

ASK
What is the problem?

IMAGINE
What are possible solutions?
IMAGINE:
What are possible solutions?

• Solutions to engineering design problems do not magically appear. Ideas are generated when people are free to take risks and make mistakes.

• Brainstorming at this stage is often a team effort in which people from different disciplines are involved in generating multiple solutions to the problem.

• Ideas can also be brief drawings or words.
CC STEM Engineering Design Loop

ASK
What is the problem?

IMAGINE
What are possible solutions?

PLAN
What will your solution look like?
PLAN: What will your solution look like?

- Time to apply logic/reasoning.
- Evaluate all the solutions from the imagine stage and select the best one. (It can be one of the ideas or a combination.)
- Discuss what the solution will look like, materials it will require,
- Make sure the solution will fulfills the criteria and constraints.
- Make a drawing with labels and arrows to identify parts, specify quantities, provide dimensions.

This is the hardest part of the process for kids.
CC STEM Engineering Design Loop

**ASK**
What is the problem?

**IMAGINE**
What are possible solutions?

**PLAN**
What will your solution look like?

**CREATE**
Follow your plan and build your solution.
CC STEM Engineering Design Loop

ASK
What is the problem?

IMAGINE
What are possible solutions?

PLAN
What will your solution look like?

CREATE
Follow your plan and build your solution.

EXPERIMENT
Test your solution.
EXPERIMENT: Test your solution

• Include safety procedures.
• Testing and verification are important parts of the design process. At all steps in the process, you may find that your potential solution is flawed and have to back up to a previous step to get a workable solution.
• Informal testing during the process is recommended, but a formal whole class test should be used for results.
• Test all criteria of the challenge. A simple “yes/no” result for each of the criteria will visually show the strength of the design.

For elementary schools we have one official “experiment” or testing stage.

• Test only the solution from your plan.
• Test in front of the whole class.
• Facilitate a dialogue with the class about what worked, what didn’t work, what could be changed, what was different about the solution from other solutions, etc.

Engineers learn as much, or more, from failure as success!
CC STEM Engineering Design Loop

ASK
What is the problem?

IMAGINE
What are possible solutions?

PLAN
What will your solution look like?

CREATE
Follow your plan and build your solution.

EXPERIMENT
Test your solution.

IMPROVE
How could you make your solution better?
IMPROVE: How could you make your solution better?

- Did your design meet the criteria?
- Did you build your design differently from what you drew? Why?
- How would you make your project better? Draw a picture showing how it would look after you have made changes to it.
- How could you have managed your time better?
- What strategies did you use (or would you use) with your partners to help you work better together?
- Is your design safe for living creatures and the environment? What issues did you need to consider?
- Would your solution be economically feasible? Why?
Objective: To engage students in the engineering design process by collaborating with Etowah High School to maximize the use of the 3D printer while covering multiple math, science, literacy and social studies standards.

Project Summary: Students will design a 3-dimensional toy to test calculating the area, perimeter and liquid volume of irregular shapes. This toy will also test partitioning a shape into equal parts and expressing those parts as fractions. Students will collaborate with EHS Architecture & Engineering Design students and the CCES Engineering Lab teacher to design and build the 3-dimentional game pieces. Students will collaborate with each other to design game names, packaging, instructions and commercials to be presented to the EHS “Shark Tank” for investment consideration.
STAGE 1 – CAD Training with Local High School

STAGE 2 – Geo Design
STAGE 3 – High School
Prints 3D Designs

STAGE 4 – Meeting
With Experts
STAGE 5 – Designing Games with 3D Figures

STAGE 6 – Presenting Game Advertisement to High School Students
We Built This City

Driving Question – How does the population of a city and the size of buildings determine the amount of energy needed to support the city?

Enercon Engineering Collaboration (plan, introduce, monitor, judge)

- Civil Engineers
- Mechanical Engineers
- Electrical Engineers

We Built This City PBL Website with resources: http://webuiltthiscitypbl.weebly.com/
We Built This City

Introduction – Enercon Engineers

Student Responsibilities and Collaboration
• City Council Representatives – roads, schools, recreation, public safety
• Specifications based on population
• Measurement – scale models, area, volume

Evaluate Plan and Make Recommendations for Modifications – Enercon Engineers
• Build with function and aesthetics in mind
• Determine energy requirements
• Light it up!

Evaluate Models and Choose the Design Team winners
Beyond the classroom walls…

Mrs. Vance’s class Mystery Skyping with a 3rd grade class in California and another one in Delaware.

Mrs. Eidson’s 3rd grade class is Skyping with The Turtle Hospital in Marathon, Florida and Cape Town, South Africa.

STEM EXPO

<table>
<thead>
<tr>
<th>Who?</th>
<th>What?</th>
<th>Where?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kindergarten</td>
<td>I am a Scientist</td>
<td>Cafeteria</td>
</tr>
<tr>
<td>1st Grade</td>
<td>Wild About STEM</td>
<td>212, 219, 223</td>
</tr>
<tr>
<td>2nd Grade</td>
<td>Science Extravaganza</td>
<td>104, 107</td>
</tr>
<tr>
<td>3rd Grade</td>
<td>STEM in Action</td>
<td>409, 411, 413, 415</td>
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<tr>
<td>4th Grade</td>
<td>Rock and Roll Hall of Fame</td>
<td>304, 306, 311</td>
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<tr>
<td>5th Grade</td>
<td>Clark Creek City Project</td>
<td>5th Grade Hall</td>
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<tr>
<td>Odyssey Lab</td>
<td>BeeBots</td>
<td>502</td>
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<tr>
<td>Media Center/ABM</td>
<td>Mini Maker-Faire</td>
<td>Media Center</td>
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<tr>
<td>Music</td>
<td>GarageBand Fun!</td>
<td>506</td>
</tr>
<tr>
<td>Art</td>
<td>Art on iPads</td>
<td>507</td>
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<tr>
<td>PE</td>
<td>TrashcanMath Ball</td>
<td>Gym</td>
</tr>
<tr>
<td>Quest Science Lab</td>
<td>Bonkers for Birds</td>
<td>423</td>
</tr>
<tr>
<td>SLAM</td>
<td>Strategic Learning Games</td>
<td>422</td>
</tr>
</tbody>
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Resources

Constructive and Destructive Forces of the Earth – http://earthsciencewebquest.weebly.com/
Research and STEM design project -

Family Vacation Math and Social Studies Project – http://pblsite.weebly.com/

Classification of Living Things - http://thescienceofclassification.weebly.com/
Science Unit and STEM design project - This year the class discovered a lack of birds in the schoolyard, so they use the EDL to design and build cedar bluebird houses to be set around the perimeter of the property.

Teachers at Clark Creek enjoy developing teaching resources. Our resources website will continue to be updated in the future. http://engagedengineeringitselementary.weebly.com/
STEM 2.0
Clark Creek ES STEM Academy
Six Tribes...One Nation!