App Maker Pro (AMP)
Motivating STEM Study Through App Development

NSF# 1509105

Project AMP Administration Presenting Today

- **Carole Greenes, Principal Investigator**

  Professor, Ira A Fulton Schools of Engineering; College of Liberal Arts and Sciences; and PRIME Center Director, ASU.

- **Mary Cavanagh, Project Director**

  Research Assistant Professor, Mary Lou Fulton Teachers College, and PRIME Center Executive Director, ASU.

AMP Goals for Students

Goal: Increase student interest in and commitment to study of STEM subjects in high school through the use of software development principles to create apps that address problems in a variety of fields.

- **Objective 1: Increase student understanding of computational design processes.**
- **Objective 2: Increase student understanding of software development processes of requirements analysis, design, implementation, and validation, through work on STEM app projects, with an emphasis on agile software engineering methodology.**
- **Objective 3: Increase student understanding of project-specific domain knowledge.**
- **Objective 4: Improve student communication, collaboration, and presentation skills.**

AMP Goals for Teachers

Goal: Increase teacher interest in and commitment to use of software development as a vehicle for engaging students in solving real-world problems in a variety of fields.

- **Objective 1: Increase teacher understanding of computational and design processes.**
- **Objective 2: Increase teacher understanding of software development processes of requirements analysis, design, implementation, and validation, through work on STEM app projects, with an emphasis on agile software engineering methodology.**
- **Objective 3: Increase teacher understanding of project-specific domain knowledge.**

AMP Goals for Students and Teachers

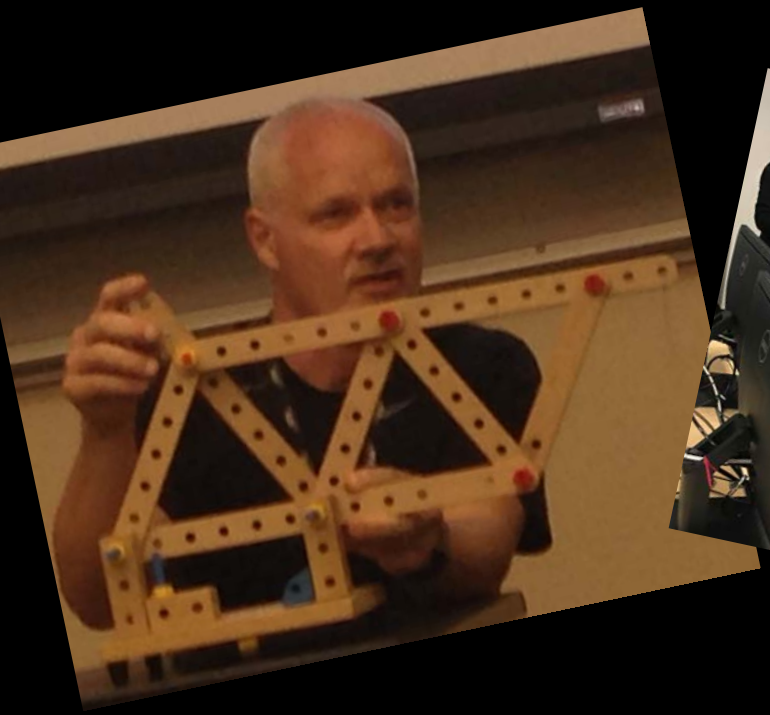
Goal: Successfully plan and offer software design and app development programs for after-school or in-school programs.

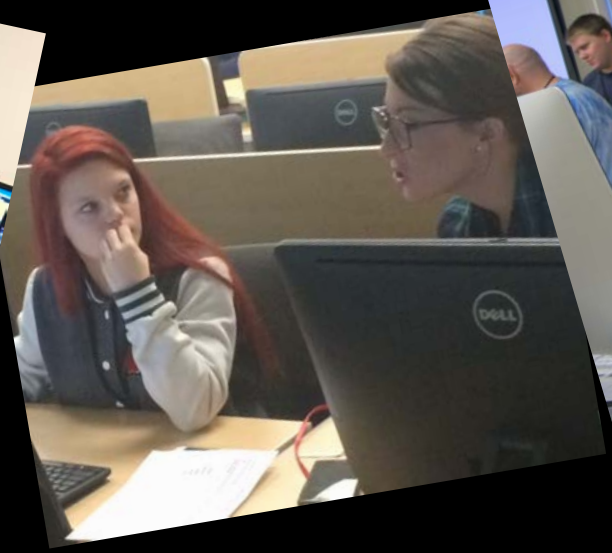
- **Objective: Successfully implement software design and app development programs for students, other teachers, and the community.**

Design Villages

Co-Led by Experts from ASU and Industry

- Domain Expert
- Software Development/Computer Science Expert





3 Cohorts of Design Villages

Cohort 1

Health Tech

Power Track

Cohort 2

Super Structures

Photo Focus

Cohort 3

Music Lab

Optical Illusions

Sustainable World

5 Sessions/Cohort

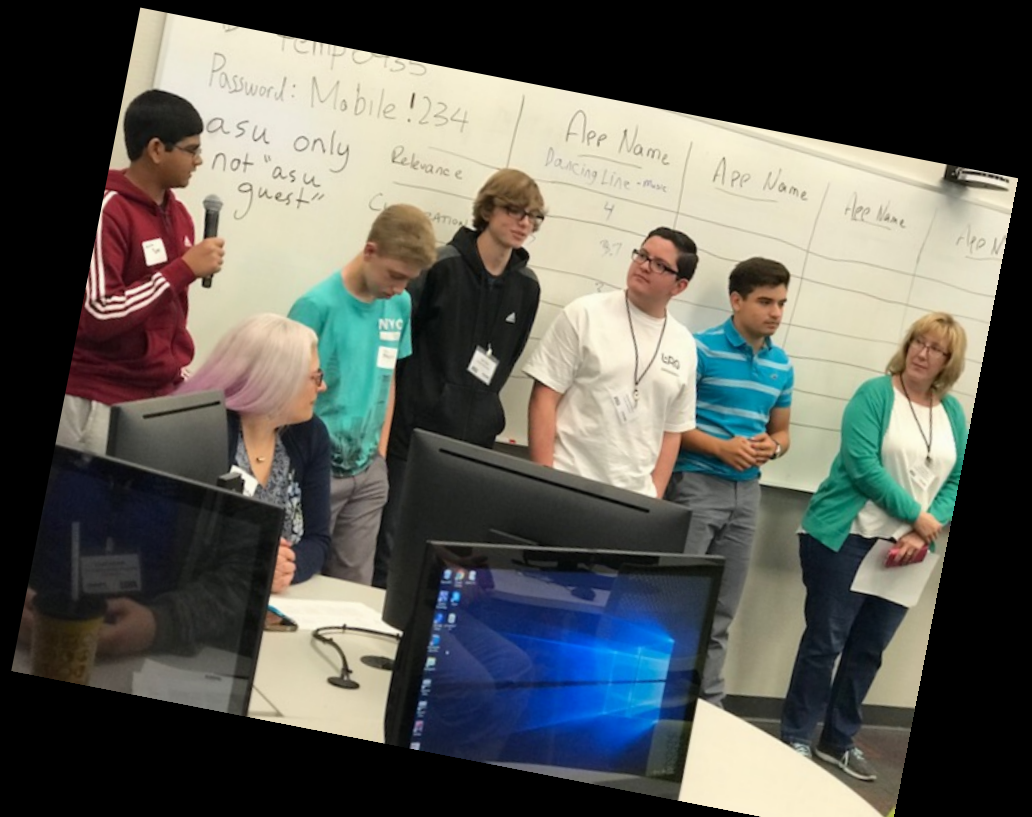
A session is a semester (6 Saturdays, 3 hours/meeting) or summer (10 days 4 hours/meeting)

Sessions 1 – 3: App Analyses (existing apps in the domain) and App Design

Session 4: Analyses and Refinement of Newly Designed Apps

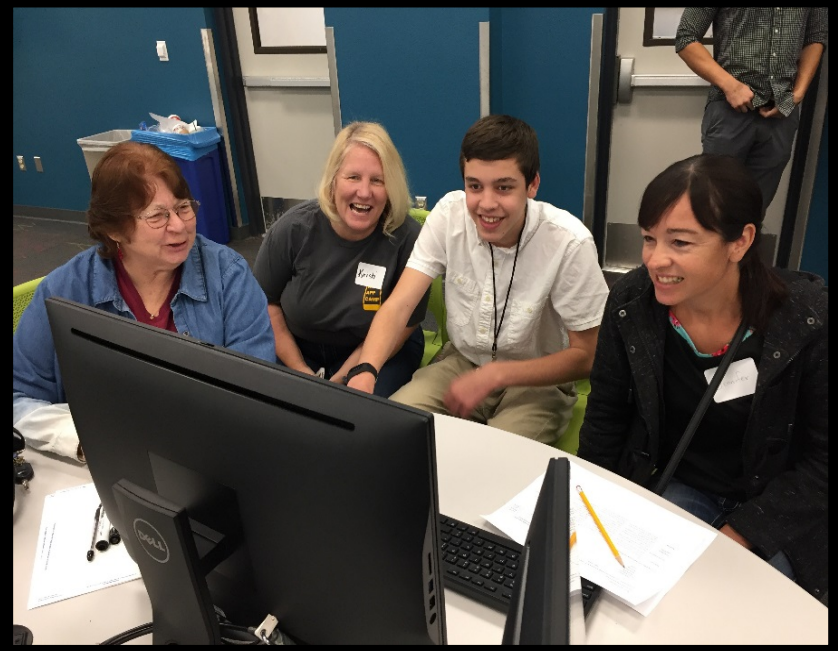
Showcase Open House
Held During The Last Meeting of Sessions 1 – 4

Participants take the stage and microphone to present accomplishments and difficulties to families, friends, and other community members



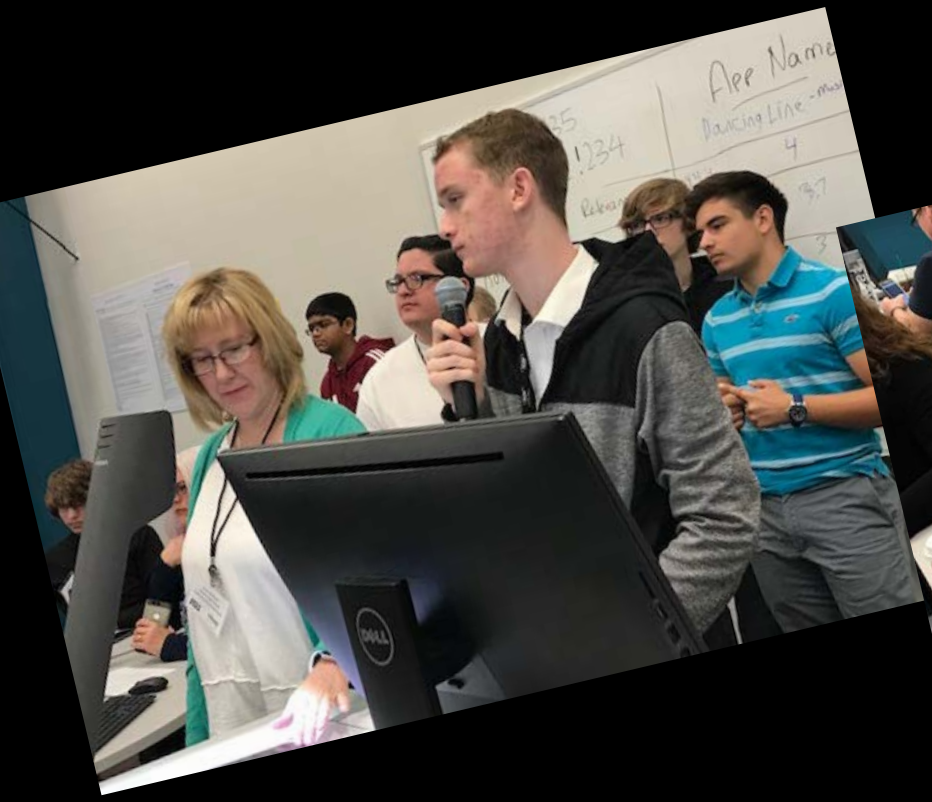
Session 5: Community Outreach Preparation and Conduct

- AMP Participants design a 4-5 hour AMP program for the community
- AMP Participants conduct the program for community members (peers, families, and others)
  - Describe the AMP Program
  - Engage community members in the evaluation of apps, both commercial and newly created, in the domain field
  - Teach community members basic programming



Spring 2018 Community Outreach

76 attended, ranging in age from 7 to 79 years



AMP in Morning and Evening Fox10 News
Optical Illusions & Sustainable World

May 22, 2017

Since the beginning of AMP, Showcase Open Houses & Community Outreach Programs have shown:

- Increases in number of families and community members in attendance
- Increases in number of attendee questions and comments
- Increases in number of parents with tech talent offering to help AMP leaders and participants

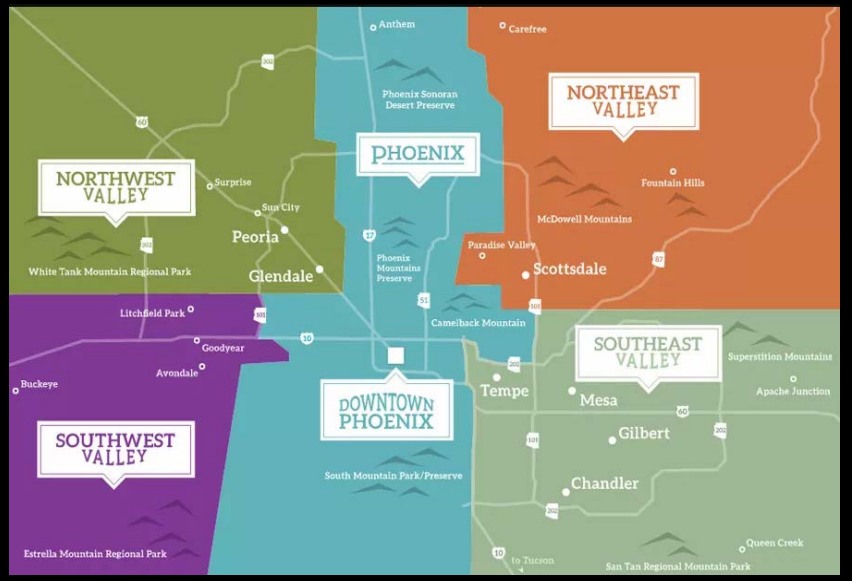
AMP Student Participants have shown improvement in:

- Organization of ideas for presentation to audiences, considering that audience members may have limited knowledge of the domain field or technology
- Knowledge of the domain areas and technology (significant improvement)
- Oral communication skills

AMP Advisory Board
Involving the Community

School Districts:

Superintendents: Chandler, Higley, Phoenix
STEM Integration Specialist: Phoenix
Director of Curriculum & Instruction: Phoenix



Industries:

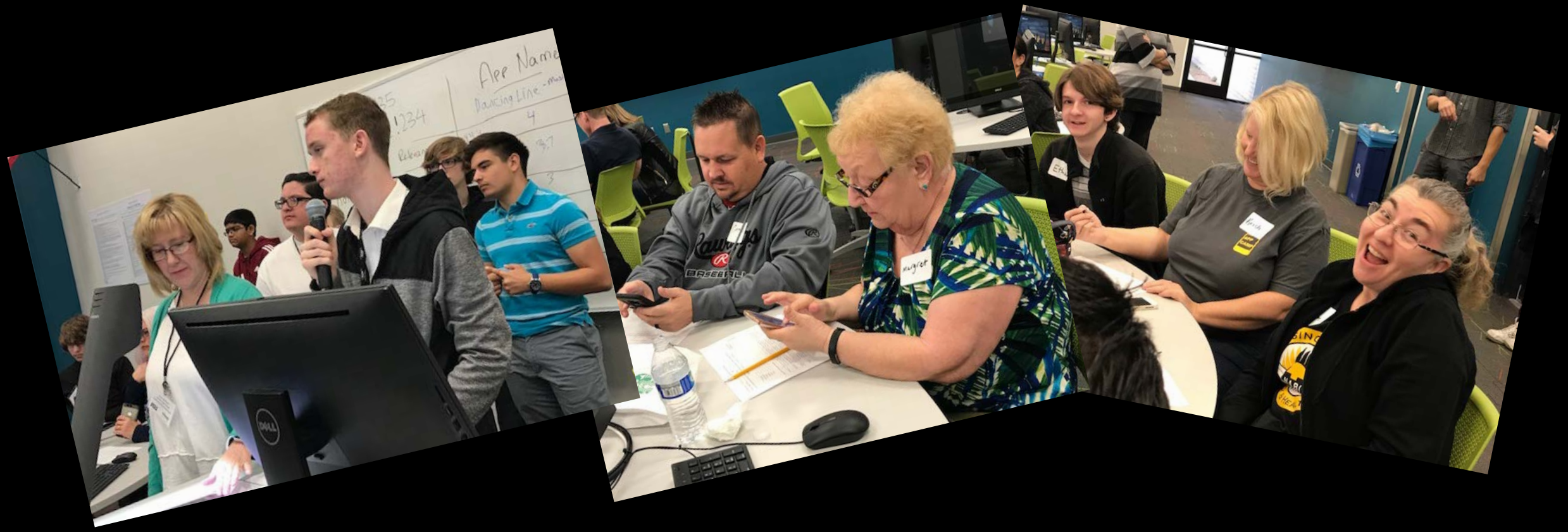
Embry-Riddle Aeronautical University,
Intel Corp, Mayo Clinic,
Spottedhorse Infosystems, Unicon Corp

ASU:

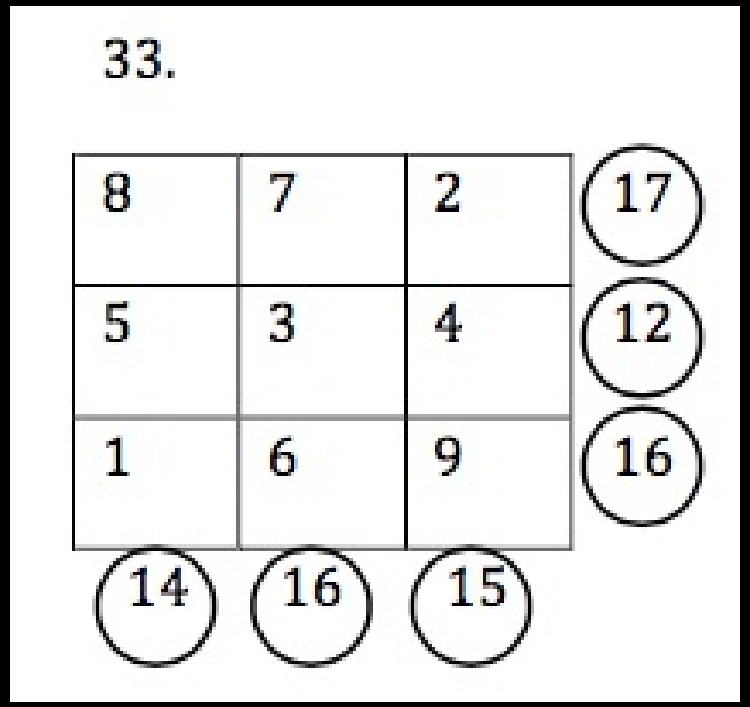
AMP PI, co-PIs, PD, PM, & Evaluator
Sr. Associate Dean, Academic Programs, W.P. Carey School of Business
Assoc. Director, American Indian Studies Student Support Services & AMP Parent
Sr. Research Analyst, American Indian Policy Institute

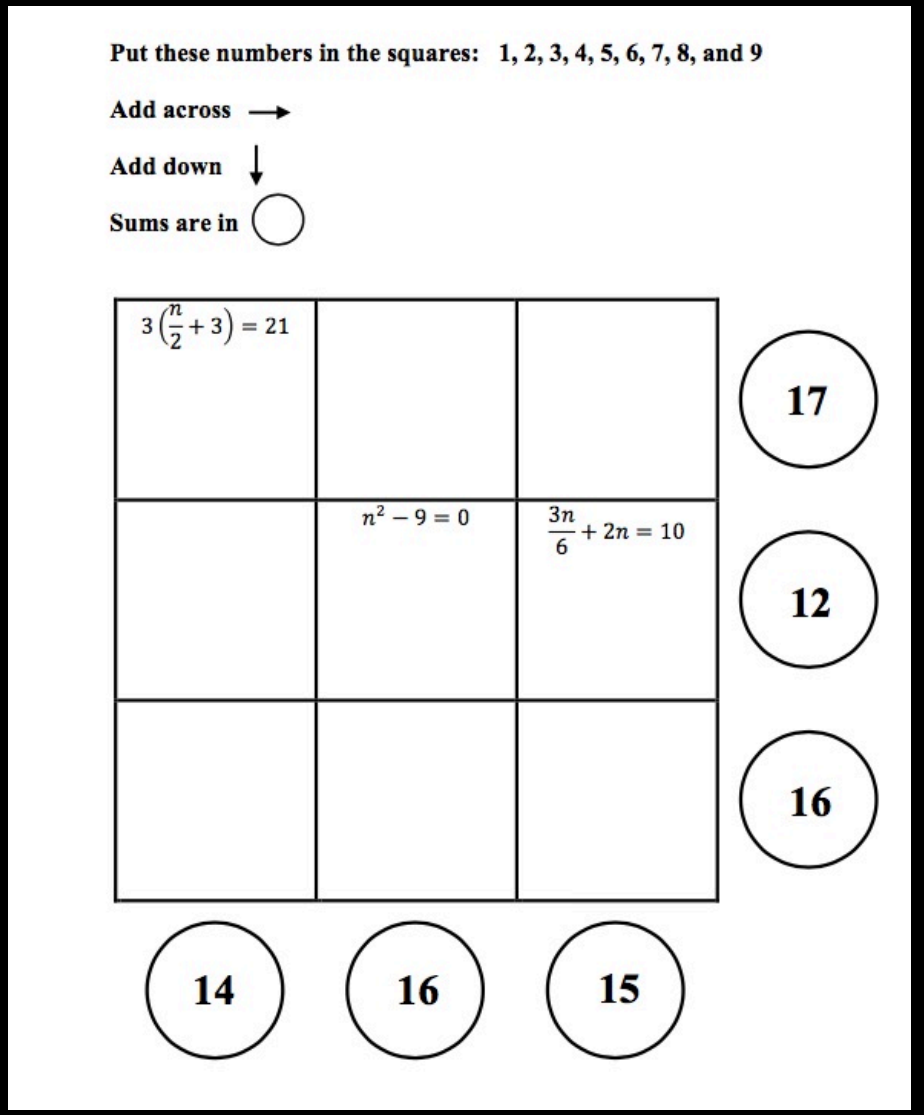
MATHadazzles Puzzle Book Writing Project

Saturday afternoons (after AMP) 1 – 4 pm

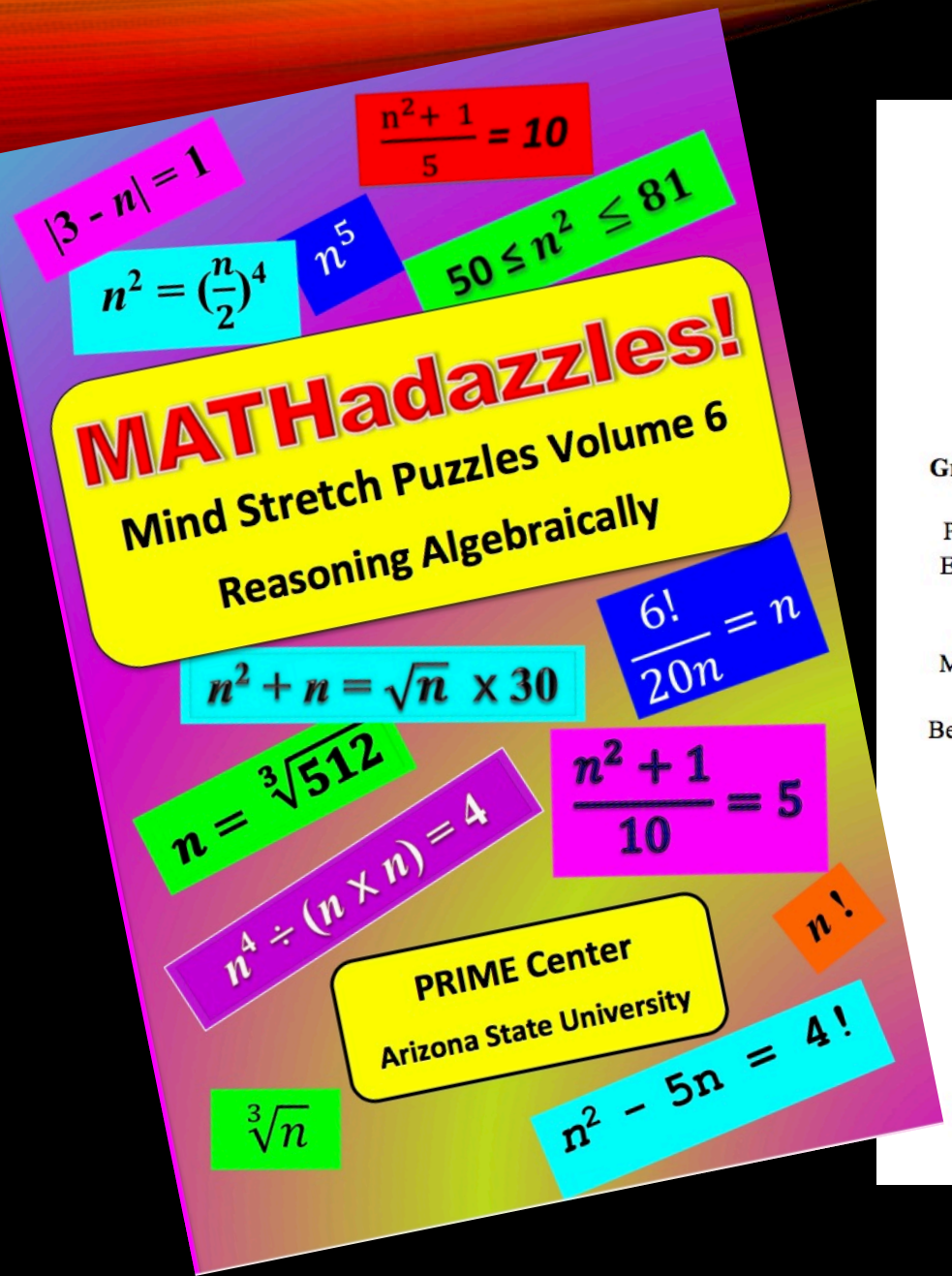


What is a MATHadazzle?
Volume 7





Volume 6



MATHadazzles

Mind Stretch Puzzles Volume 6

Reasoning Algebraically

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Carole Greenes, Ed.D.

Mary Cavanagh, Ph.D.

Grades 9-12 contributors participated in the National Science Foundation's App Maker Pro (AMP) Project

Porter Aller, Eduardo Amastal, Jadd Bazzi, Khristian Beninati, Elijah Bigelow, Subin Chang, Kameron Dawson, Jessica Dirks, Griffin Eberlein, Connor Harney, Bradley Kaufman, Griffin Kimball, Braum Kimball, Robin Kuo, Julie Larsen, Michael Leung, Riley Macias, Nickoli McKenzie, Nathan Rios, Esteban Salas, Ishan Amit Shah, Shuchi Sharma, Benjamin Stokman, NaShawn Lee Tadytin, Laasya Vallabhaneni, Edward Wong, Rebecca Yacoub

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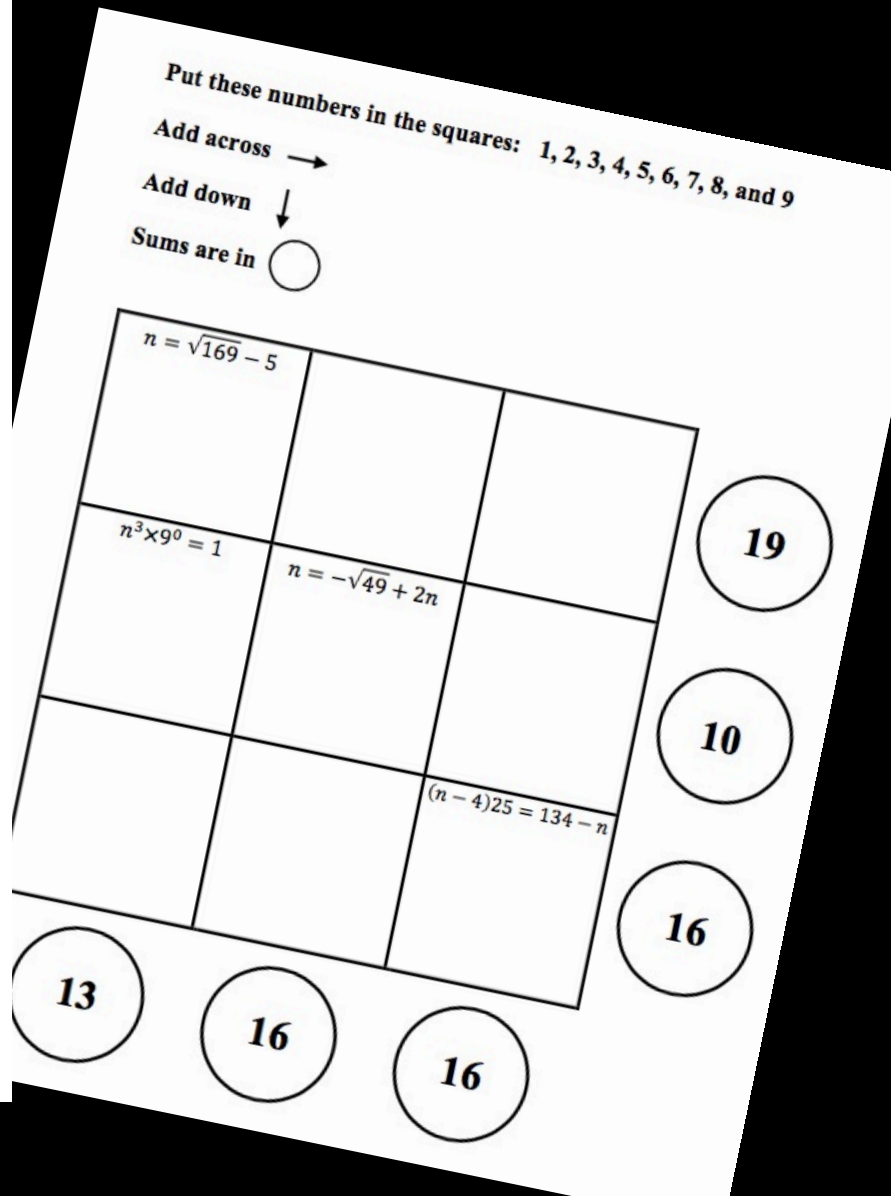
James Kim, Jason Luc, Yifan Tian, Tanner Wolfram

Project Assistant

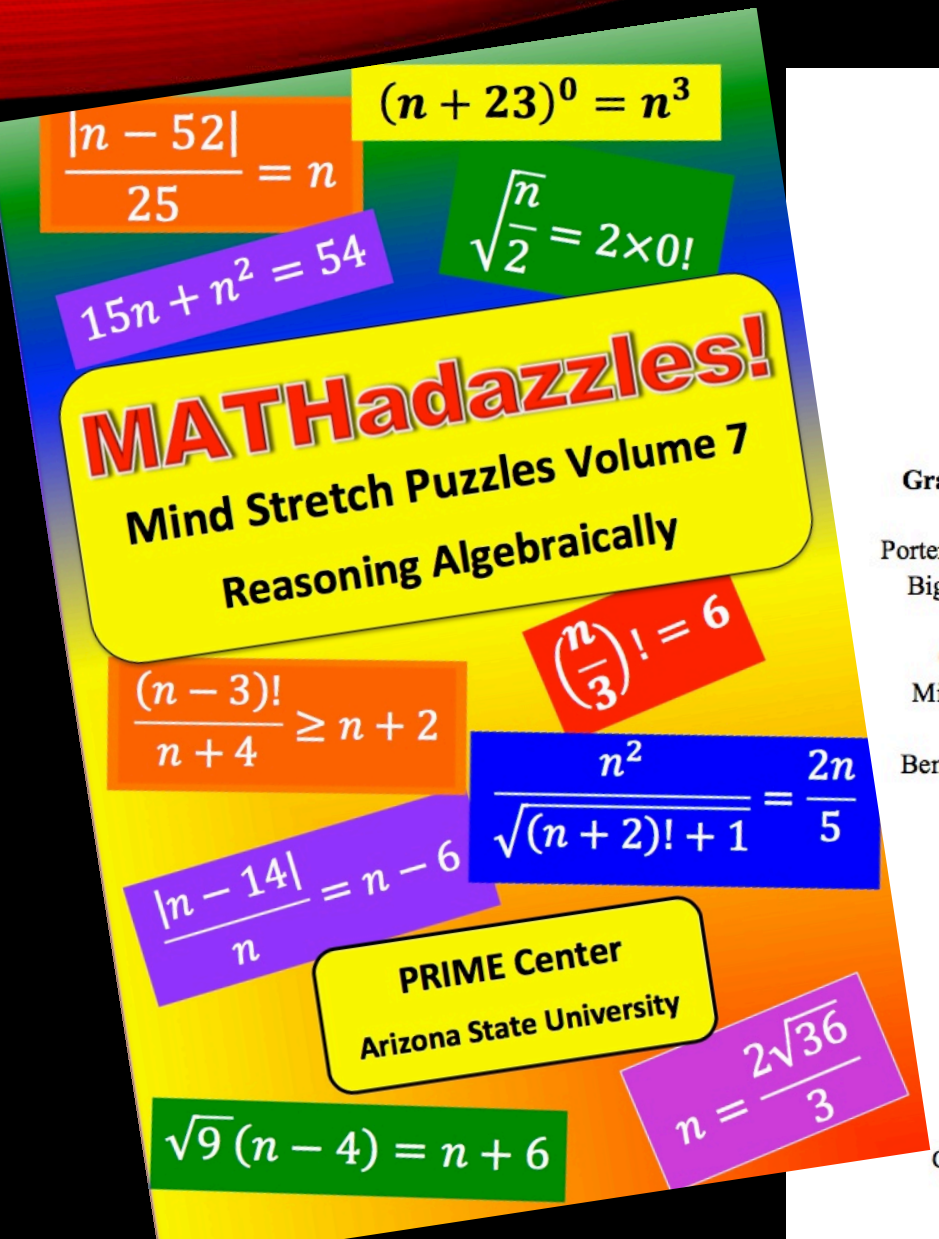
Daniel Lee

Cover Design

Mary Cavanagh



Volume 7



MATHadazzles

***Mind Stretch Puzzles* Volume 7**

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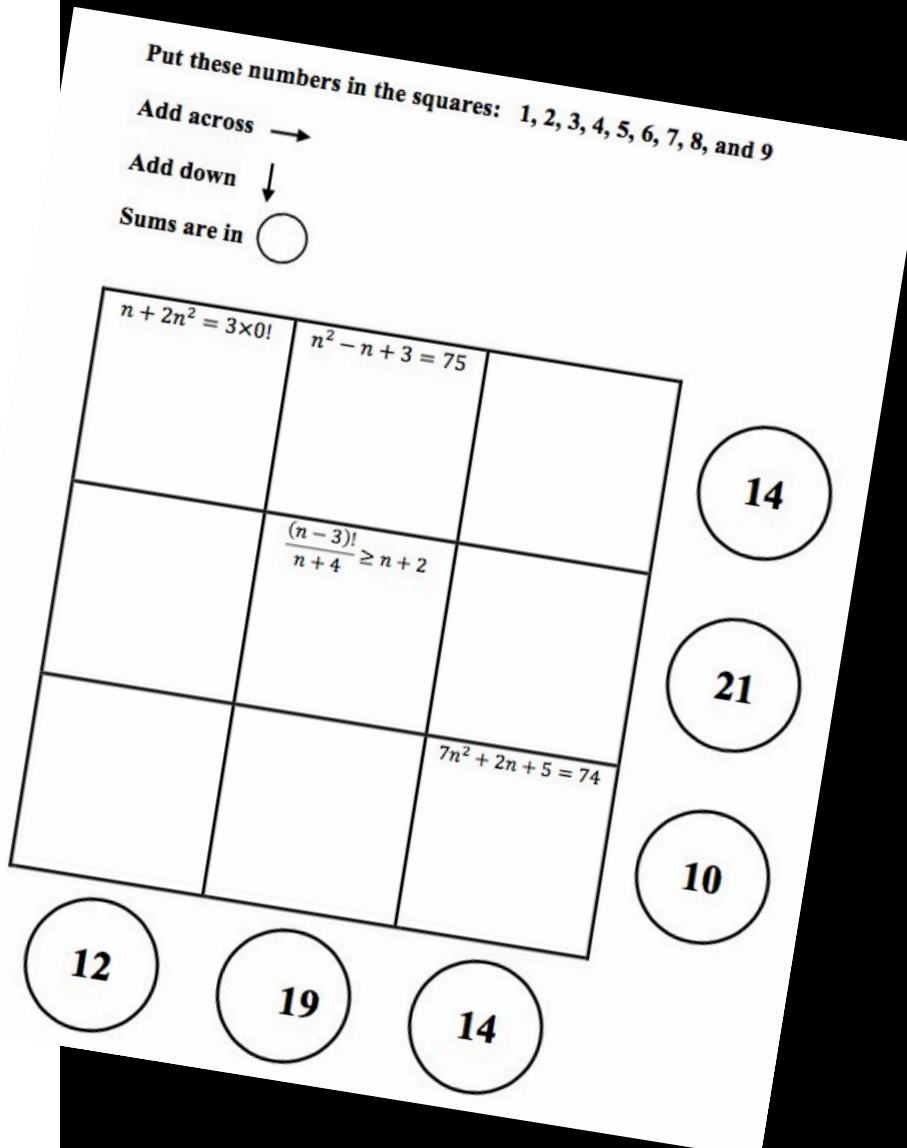
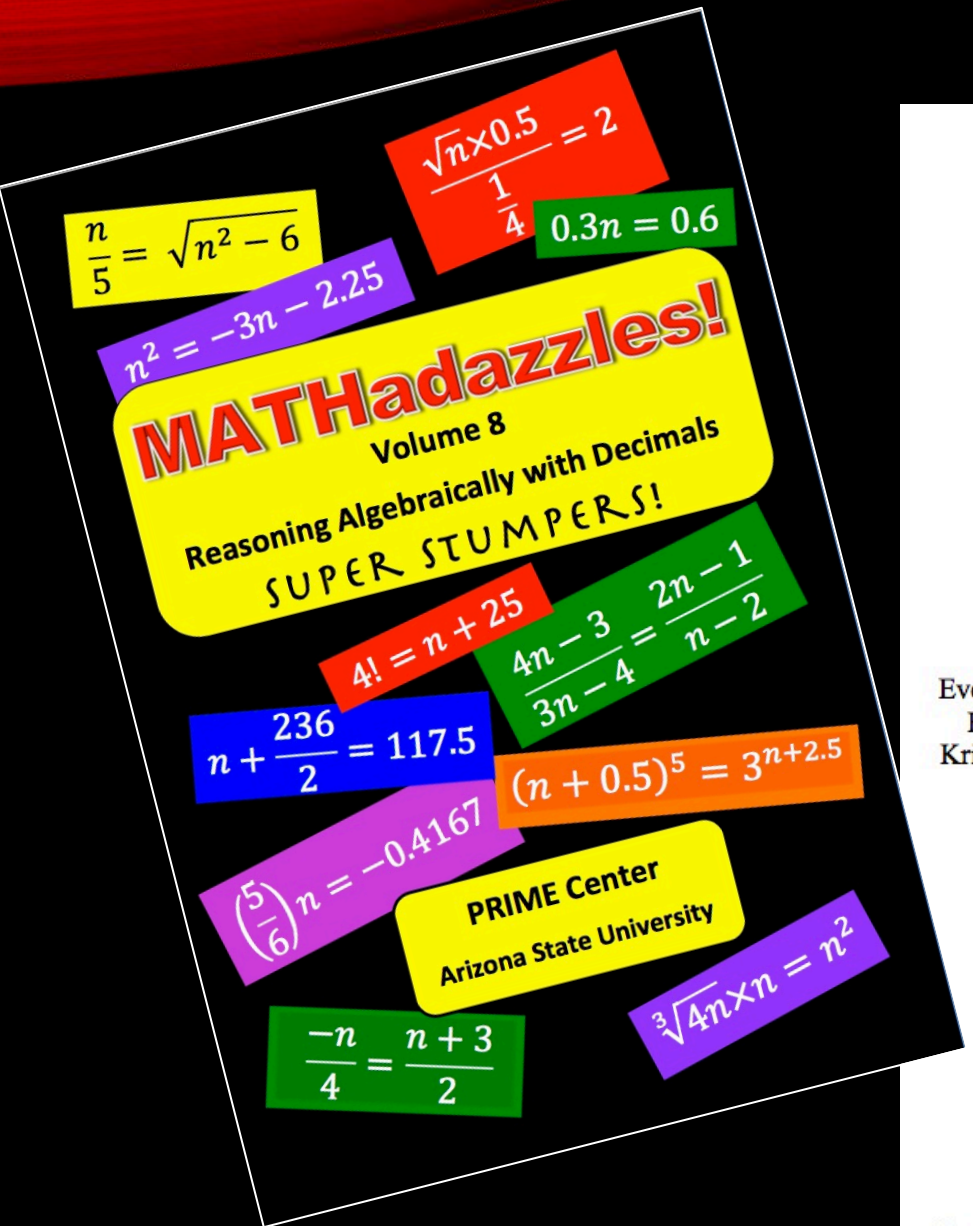


Volume 8



MATHadazzles

Volume 8

Reasoning Algebraically with Decimals

SUPER STUMPERS!

Authors

Carole Greenes

Mary Cavanagh

Contributors: Grades 9-11 Students

Eve Armstrong, Max Gao, Johnny Guerra, Connor Harney, Bradley Kaufman, Christiana Luna, Nikoli McKenzie, Krish Patel, Nathan Rios, Sanjana Sarkar, Maximus Smith, Nashawn Tadytin, Rebecca Yacoub

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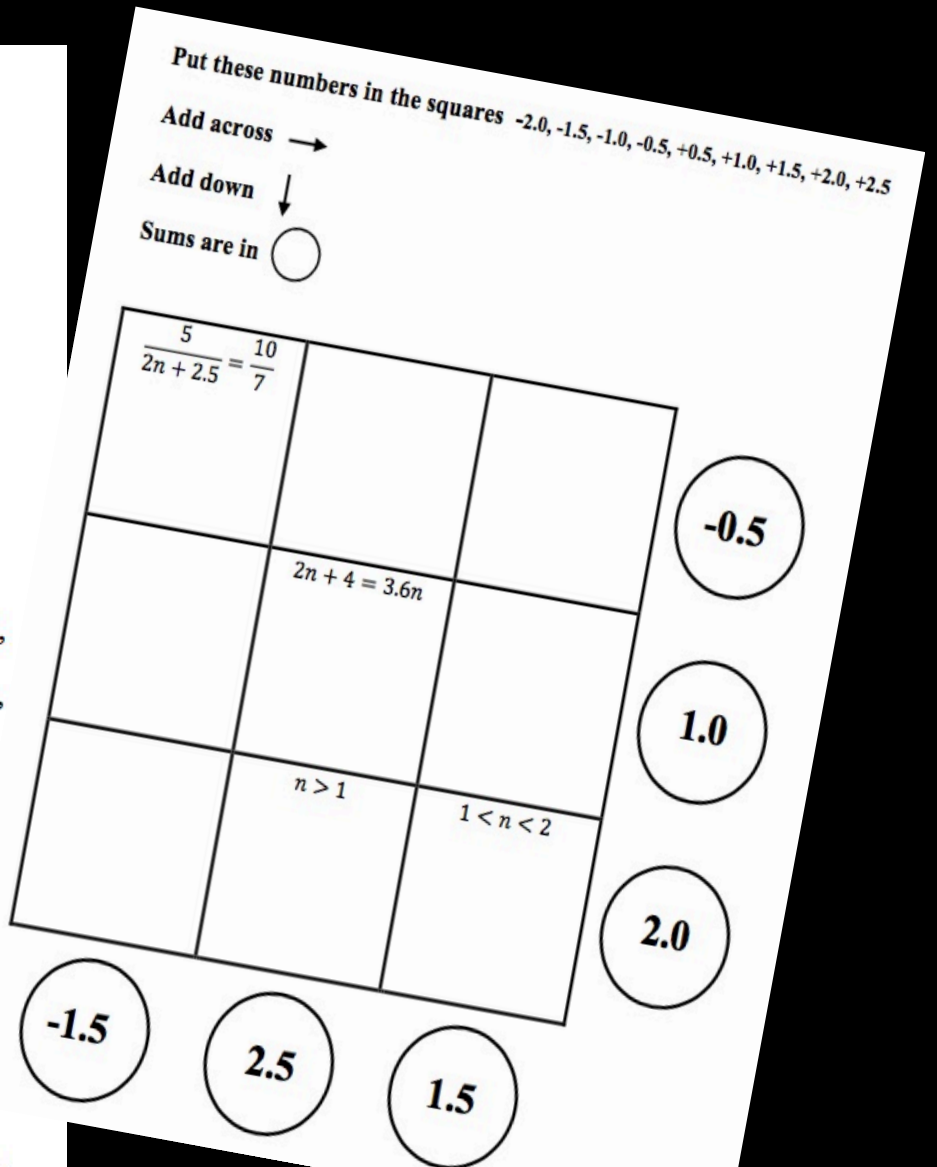
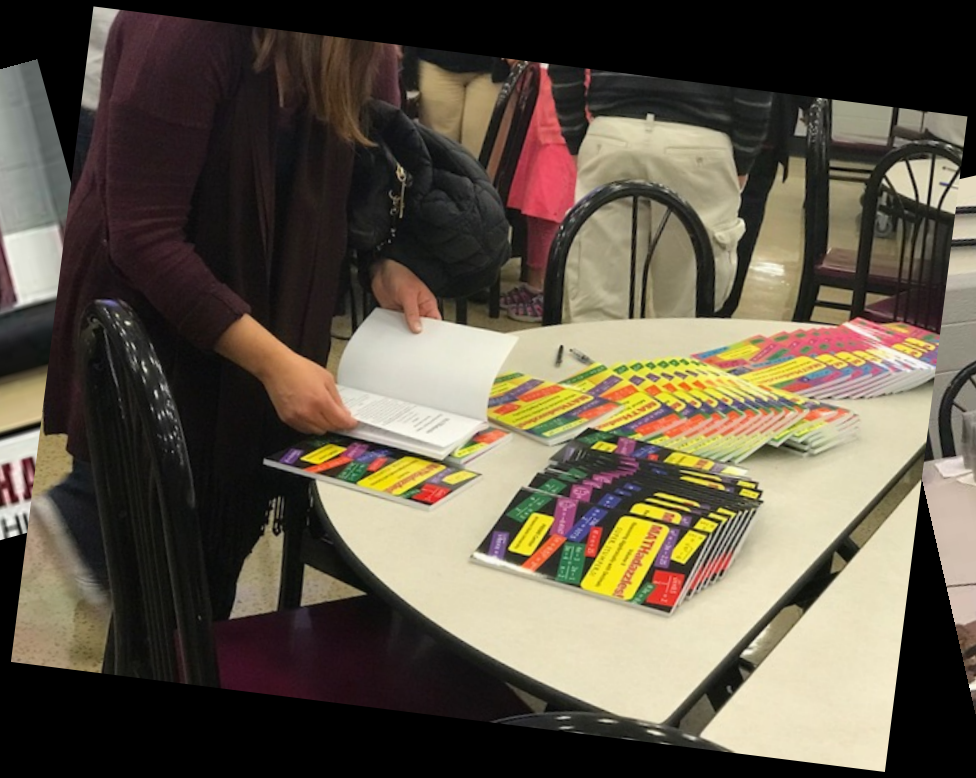


MATHadazzles Book-Signing Party

Each student takes the stage and microphone , introduces self, and describes the book writing experience, in particular, the mathematics and problem-solving methods



Adapting and Implementing a Geospatial High School Course in Career and Technical Education Clusters in Urban Settings

David Uttal

Northwestern University

Steve McGee

The Learning Partnership

Bob Kolvoord

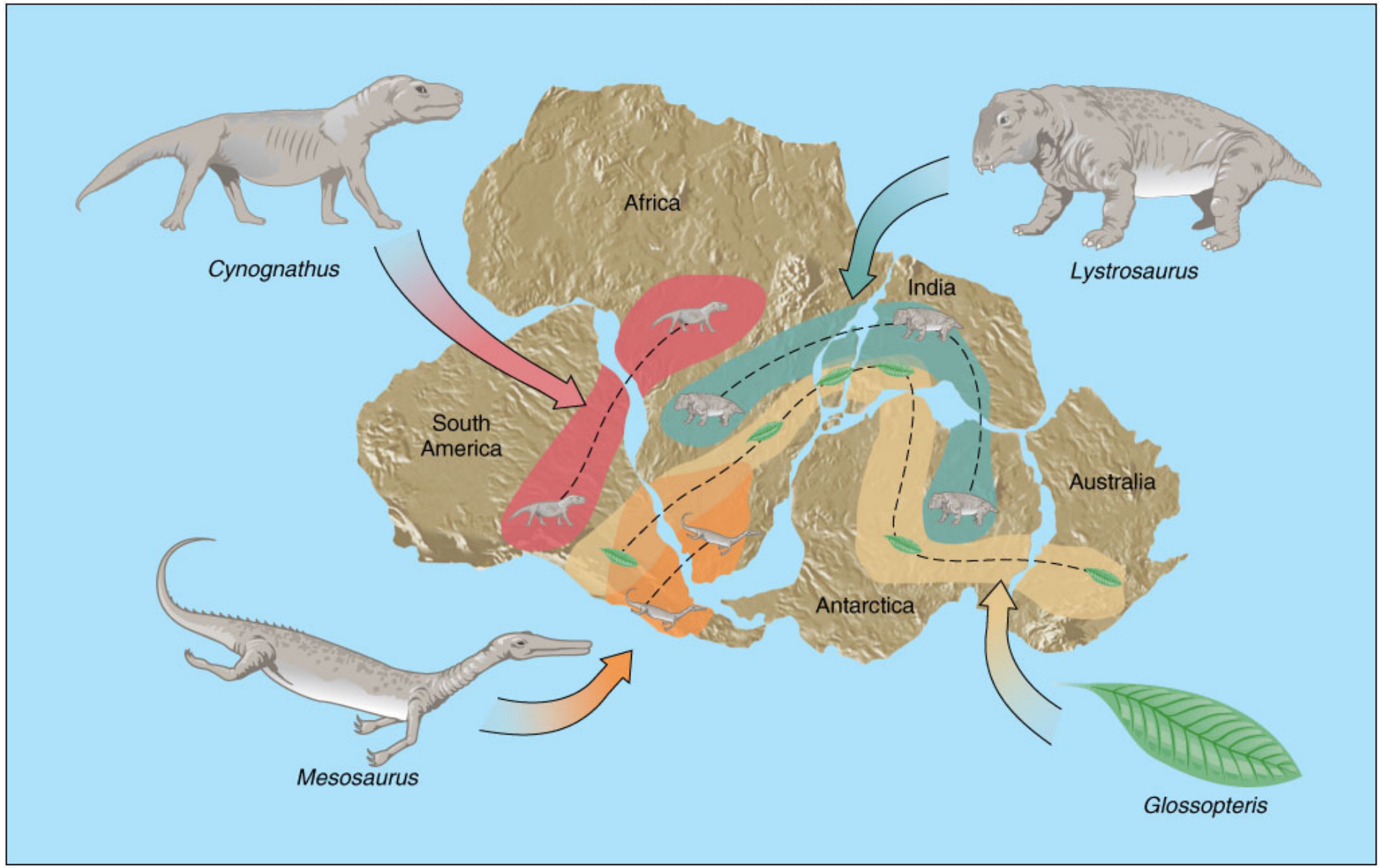
James Madison University

Carolyn Jourdan

Chicago Public Schools

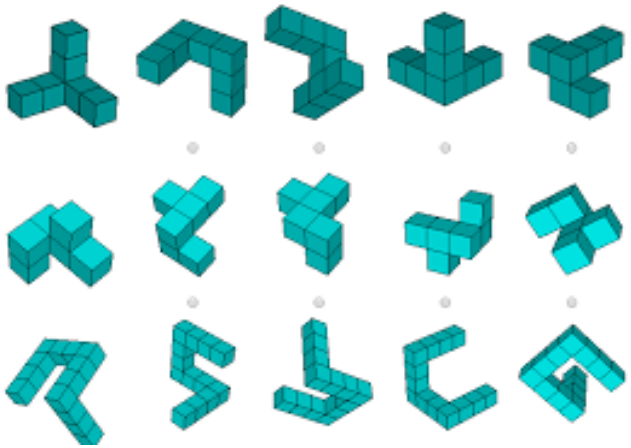
Overview

- Spatial Thinking and STEM Education
- Spatial Thinking and Career and Technical Education (CTE)
- Our approach to instruction and research



What do we mean by *spatial thinking*?

- Reasoning, mental representation, and transformation of information about
  - Locations in space
  - *Relations among those locations*

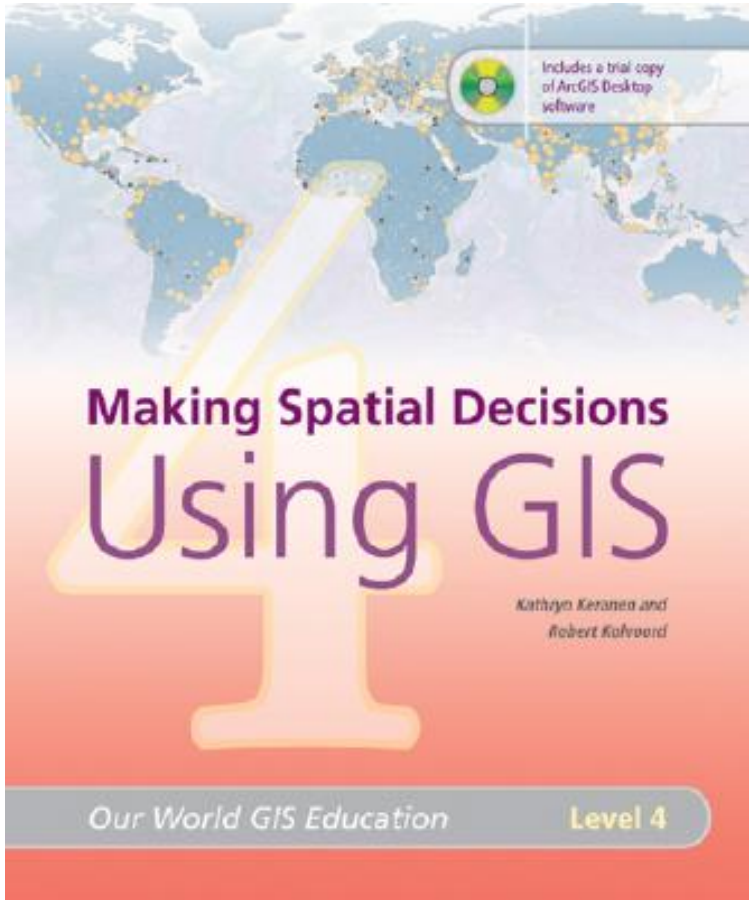


Our Focus: Spatial Thinking in CTE

- Chicago Public Schools
- Six areas
  - pre-engineering
  - entrepreneurship
  - agricultural sciences
  - health science
  - architecture
  - public safety
- An integrated approach that emphasizes spatial thinking

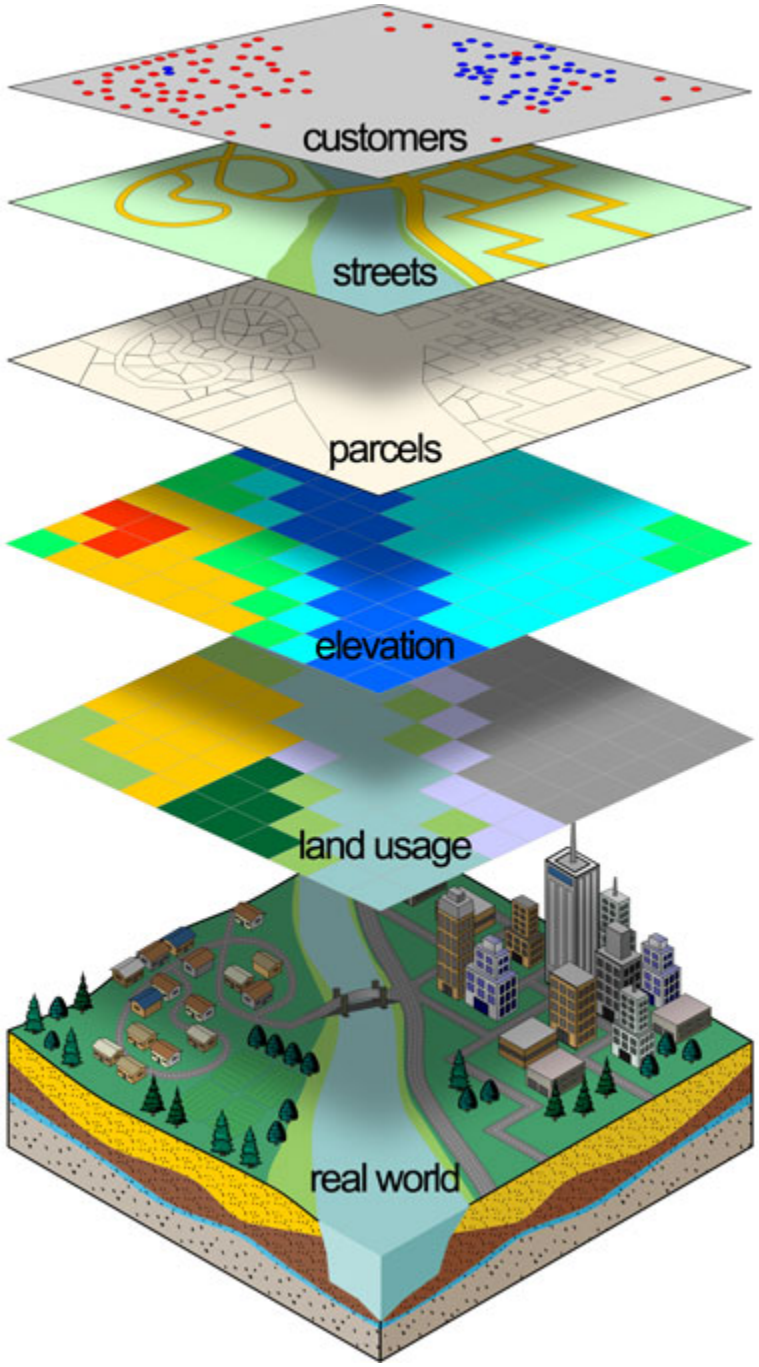
Promoting Spatial Problem Solving in Science Education

- The Geospatial Semester
- Robert Kolvoord,
  James Madison University



Geographic Information Systems (GIS):

- Layering
- Spatial analysis



You are an engineer and are trying to determine the best location(s) for a windmill farm off the east of the United States

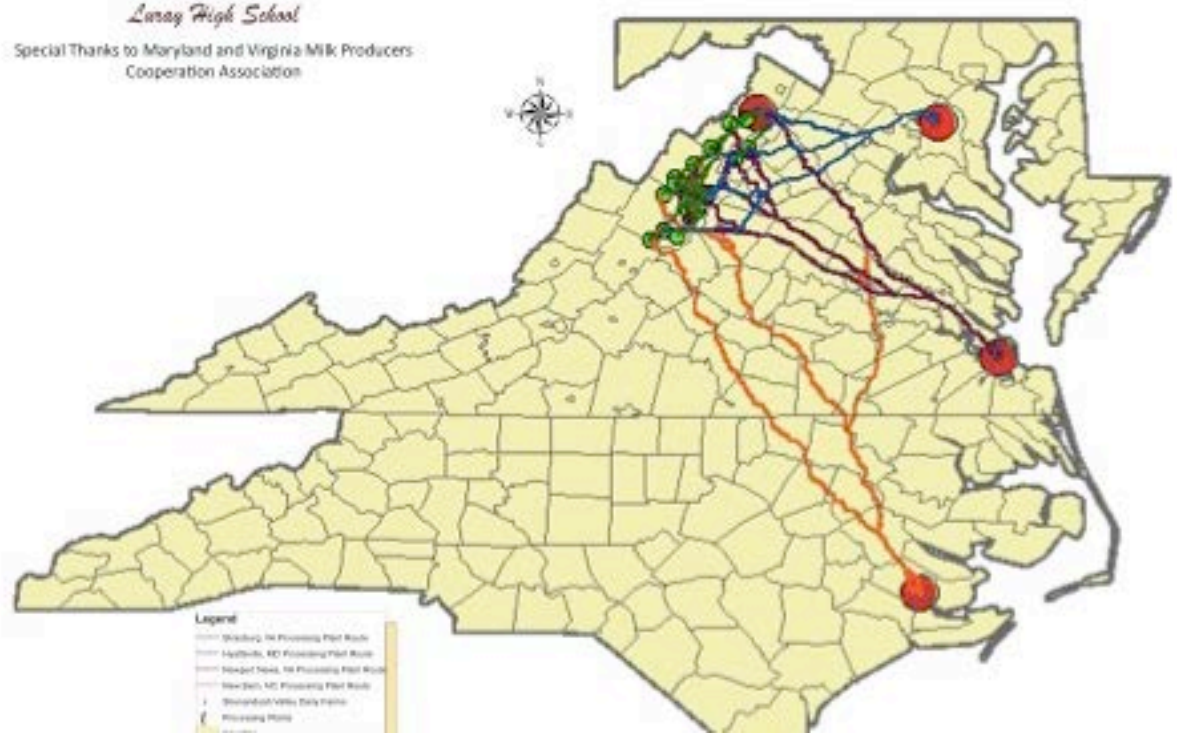
GOT LOCAL MILK?

Maryland & Virginia Milk Producers Cooperative Association, Inc.

By: Hannah Yancey and Ryan Good

Luray High School

Special Thanks to Maryland and Virginia Milk Producers Cooperation Association



Research Plan

- Integrate Geospatial Semester approach into Chicago CPS CTE
  - Partnership with Chicago City Colleges
- Experts (from James Madison University) train initial teachers
- Scale up over time
- Assess measures of spatial thinking, problem-solving, course choice, etc.

INTEGRATING THE COMPUTER SCIENCE FOR ALL

Matthew Militello & Martin Reardon
Ronnie Smith & Bobbie Hoggard
East Carolina University

***

Friday Institute, NC State

JONES COUNTY PUBLIC SCHOOLS

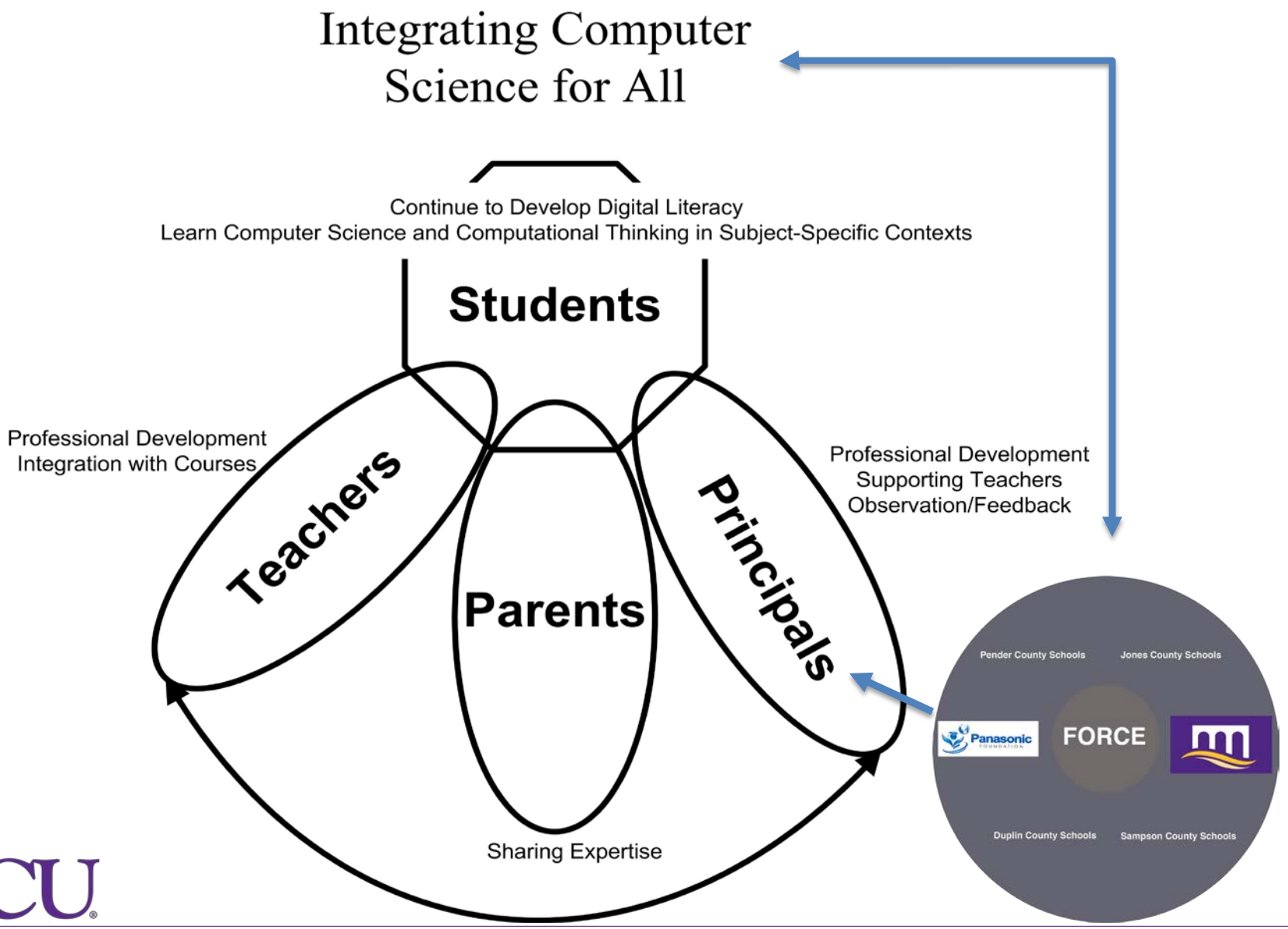
DUPLIN COUNTY SCHOOLS
Excellence without excuses
"A unified approach to academic excellence"

The focus of **iCS4All** is enabling middle school students to benefit from the integration of computational skills into their **music** and **visual arts** classes.

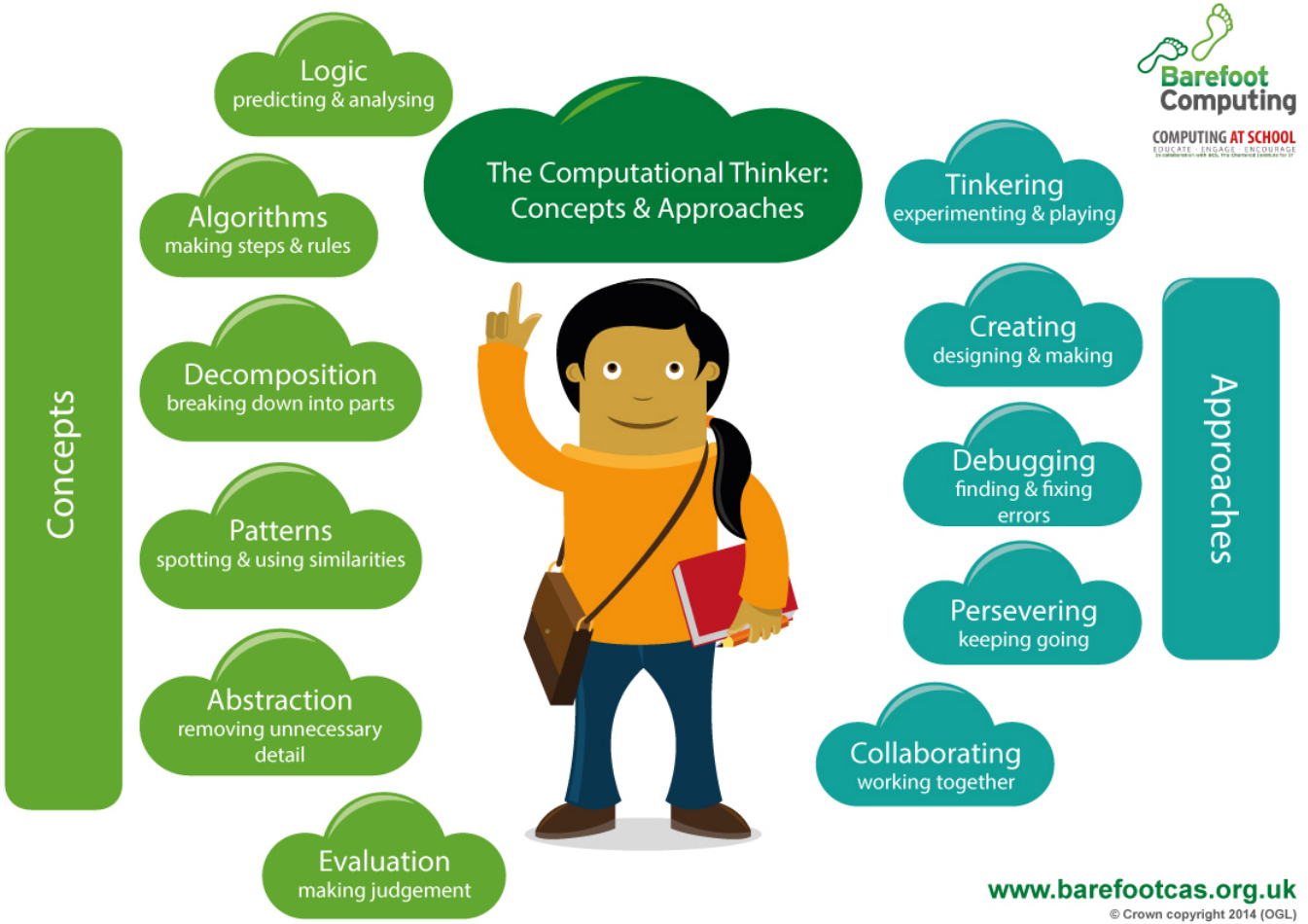
ECU

iCS4All

Concept


Integrating Computer Science for All
Continue to Develop Digital Literacy
Learn Computer Science and Computational Thinking in Subject-Specific Contexts
Students
Professional Development
Integration with Courses
Teachers
Parents
Principals
Professional Development
Supporting Teachers
Observation/Feedback
Sharing Expertise
Pender County Schools
Jones County Schools
Panasonic
FORCE
Duplin County Schools
Sampson County Schools

Computational Thinking



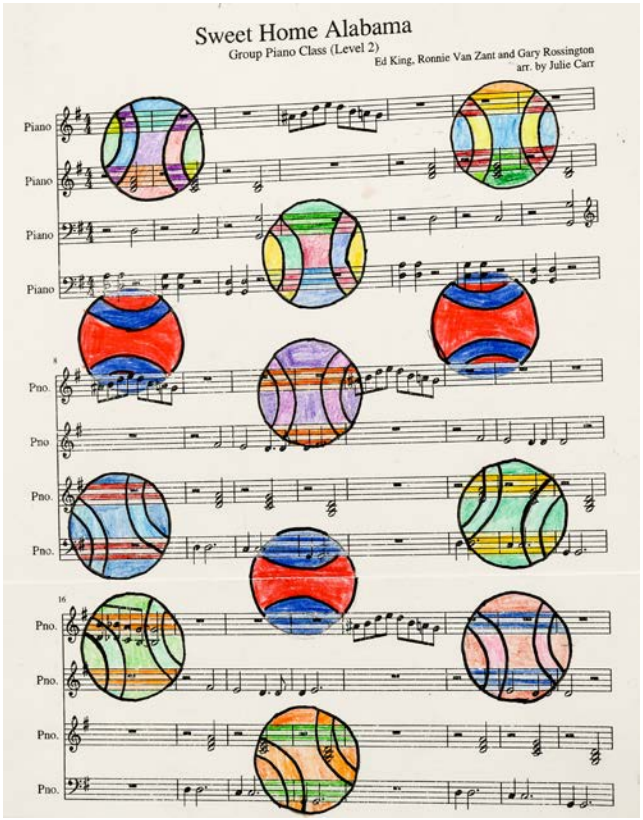
Barefoot would like to acknowledge the work of Julia Briggs and the eLIM team at Somerset County Council for their contribution to this poster.

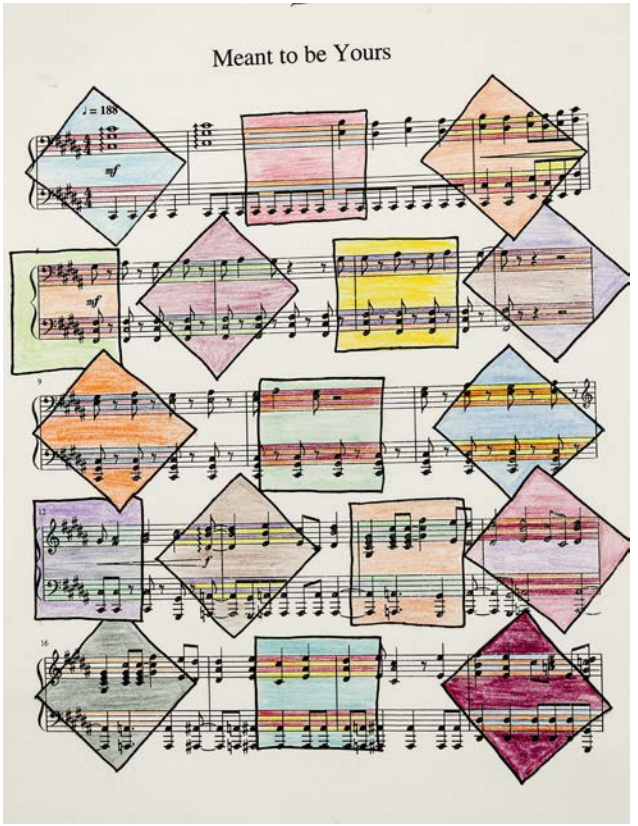
ECU

The iCS4All Teachers

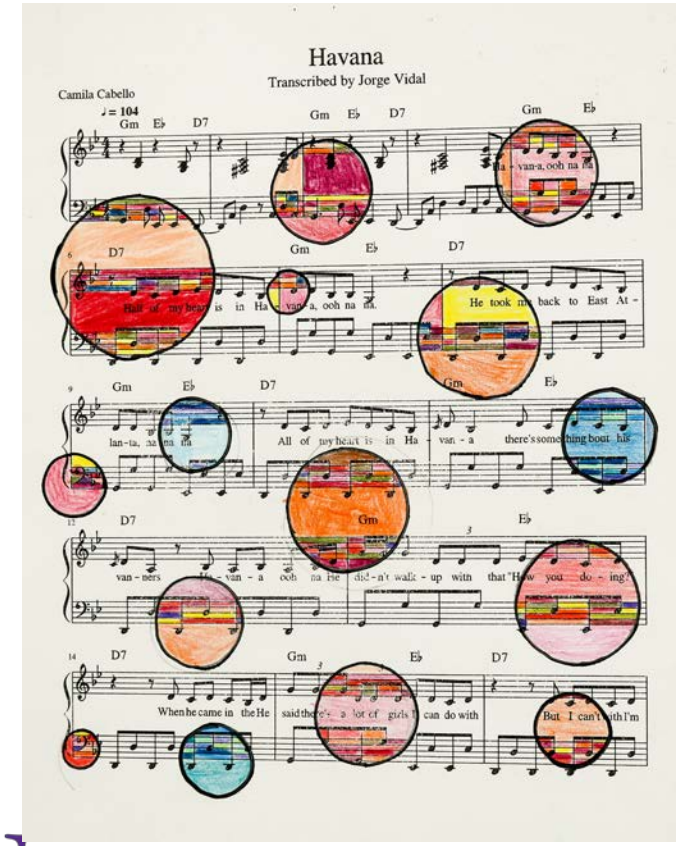
Anne Haugh (Duplin County Schools, Visual Arts), **Craig Sparrow** (Jones County Schools, Visual Arts), & **Rue-Lee Holmes** (Sampson County Schools, Music)

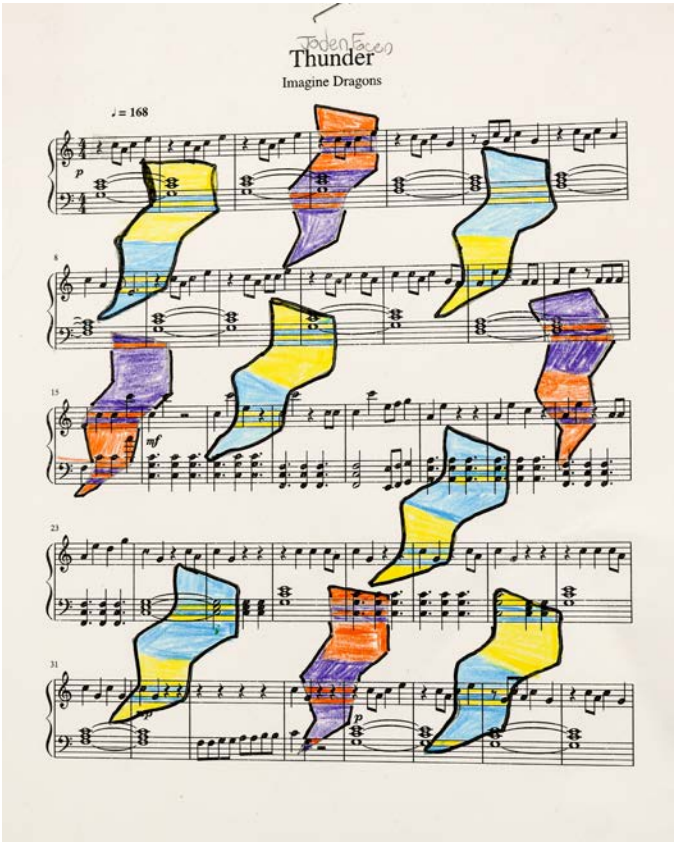
The *Music Score Redesigned* used musical scores as a tool for **creating** designs that incorporated the elements of art and principles of organization.



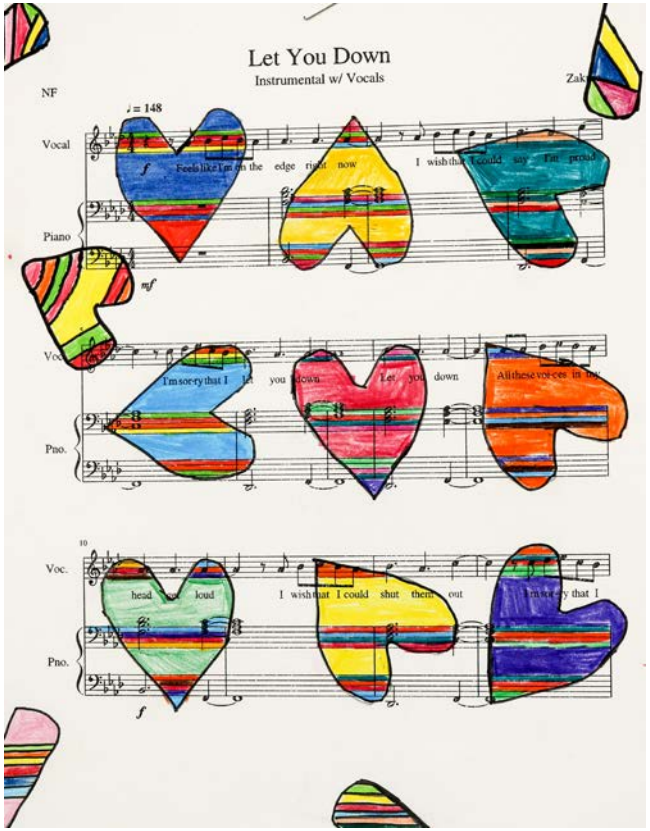


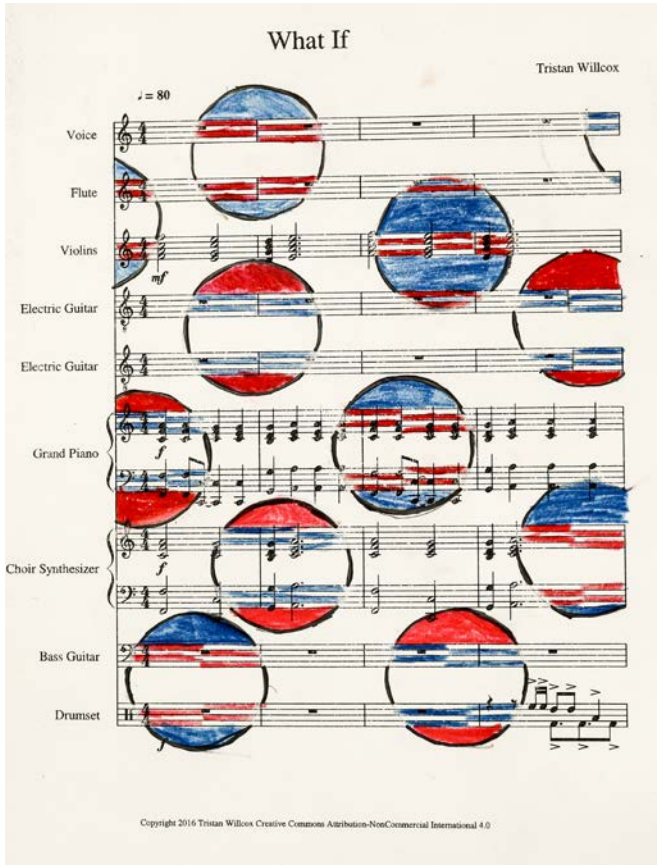
There was a certain order (**algorithm**) that the students had to follow in order to create these designs, starting with choosing their music, to preliminary sketches, to the development of their final piece.



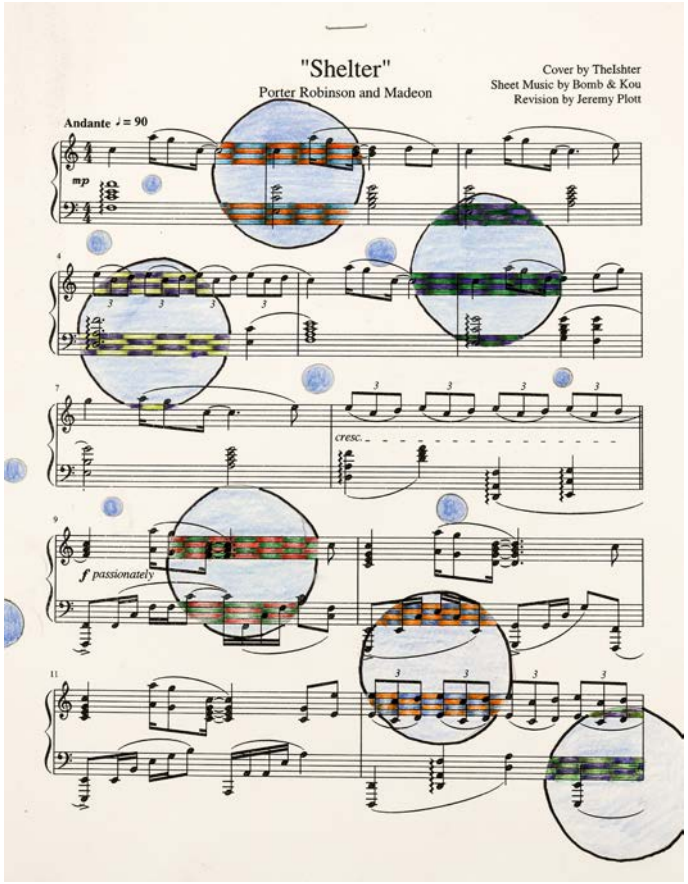


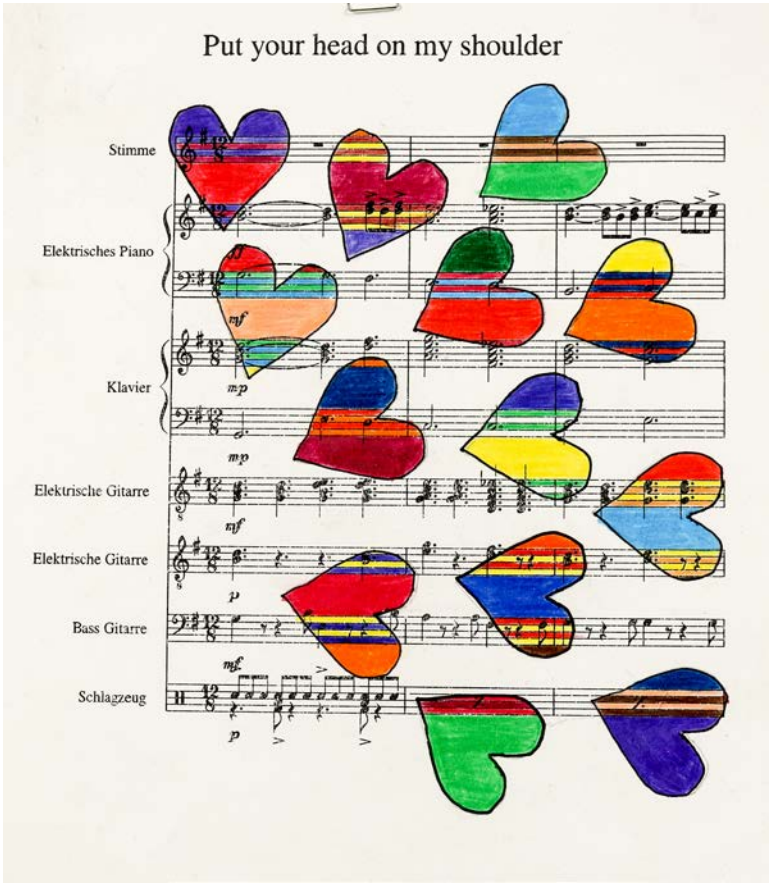
As students worked on their designs, they had to **analyze** and use **logic** to make sure their designs were balanced, as well as exhibited variety and unity.



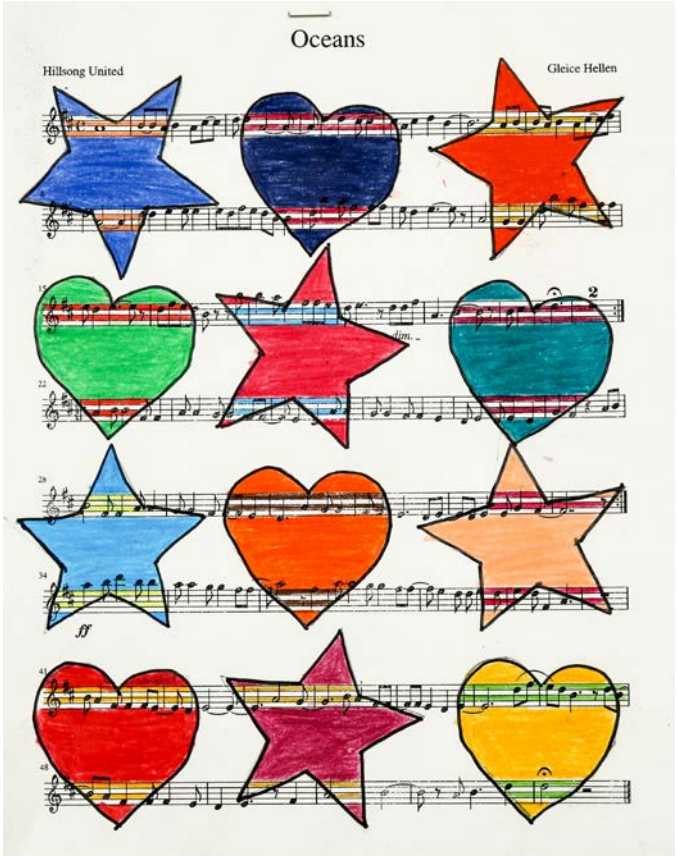


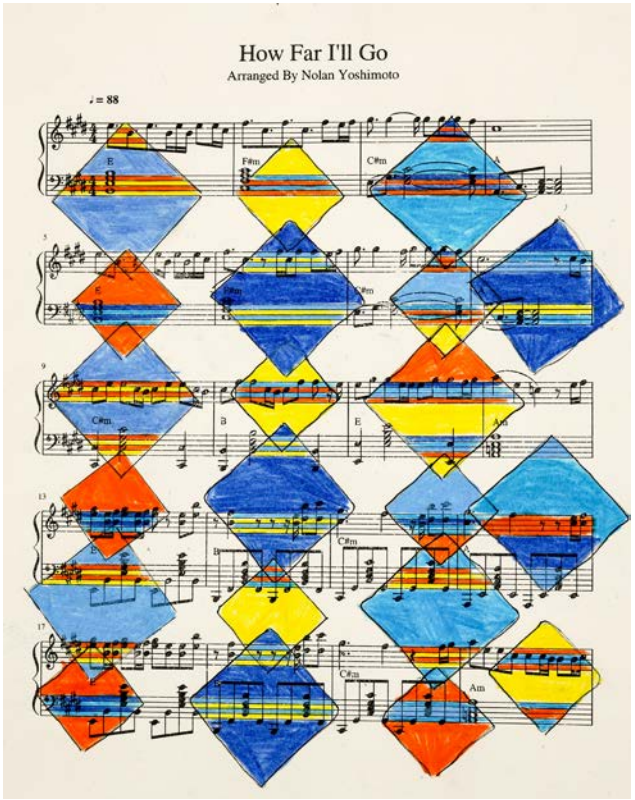
They were working with very **abstract** ideas, just utilizing shape and color to create a design.



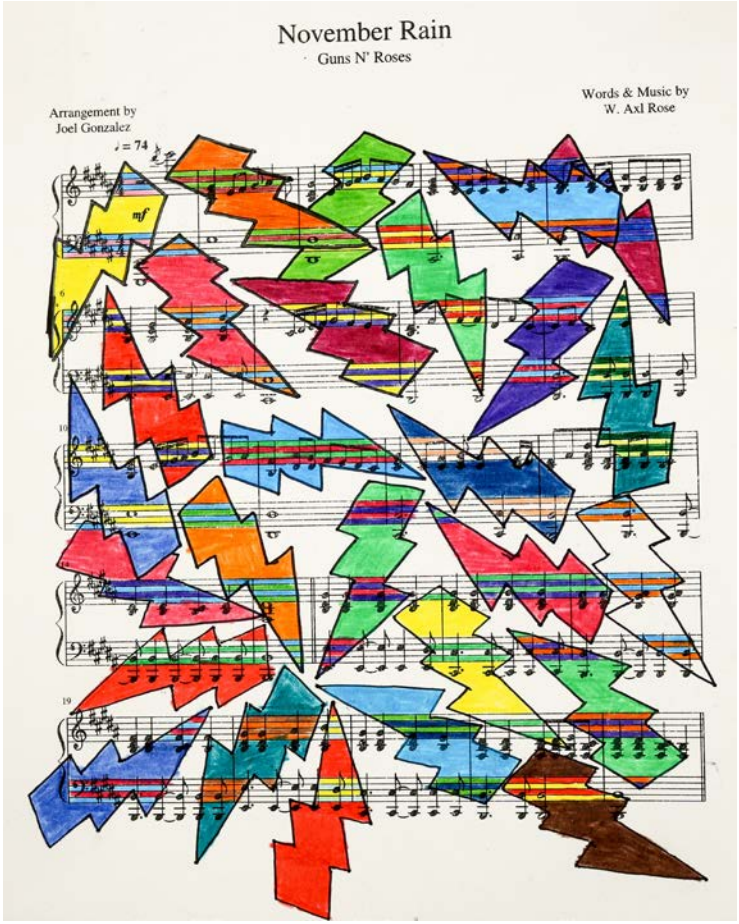


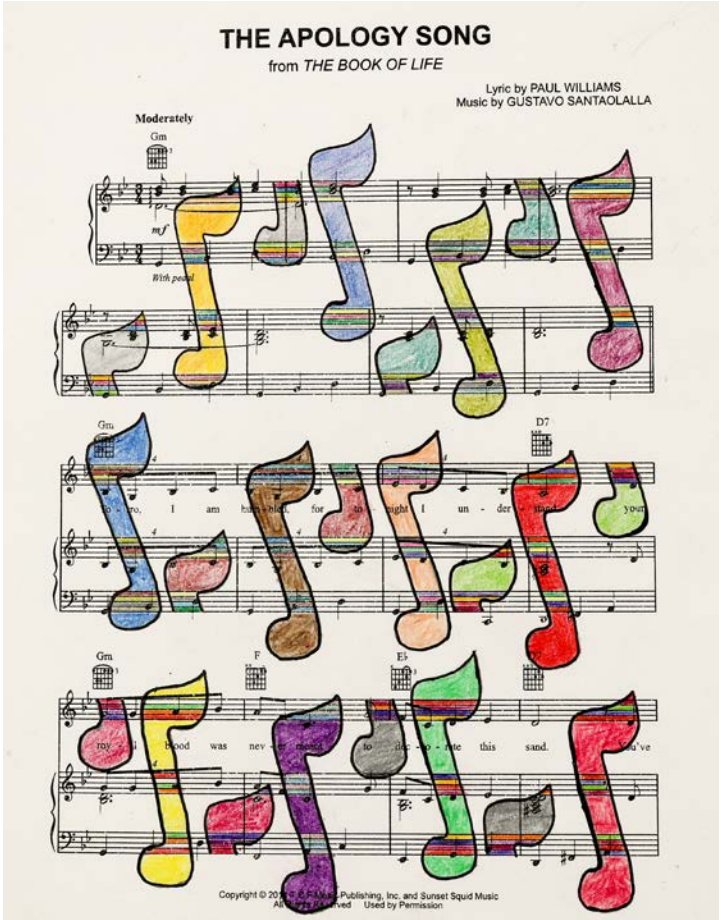
At first there was a lot of **tinkering** and preliminary drawing on music sheets, trying out different shapes and ideas, before advancing to the final image.



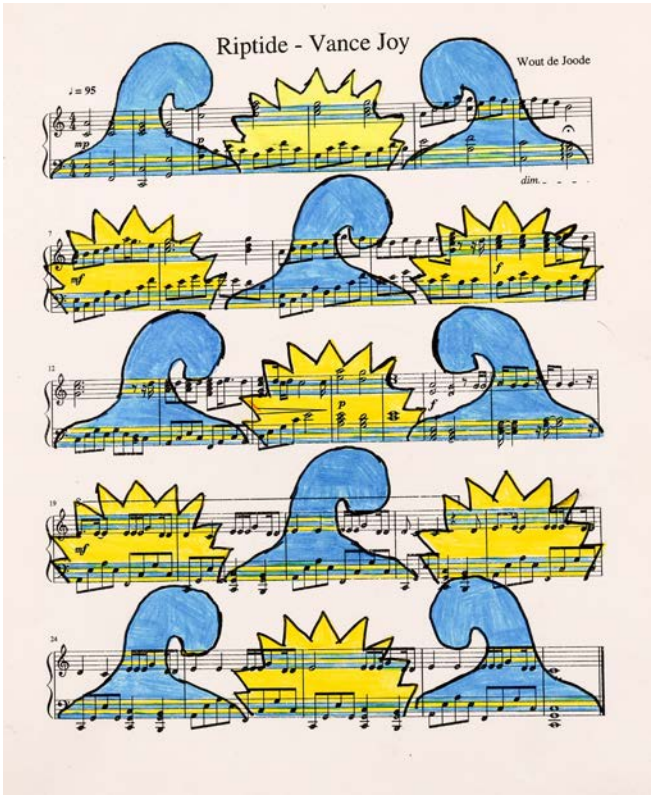


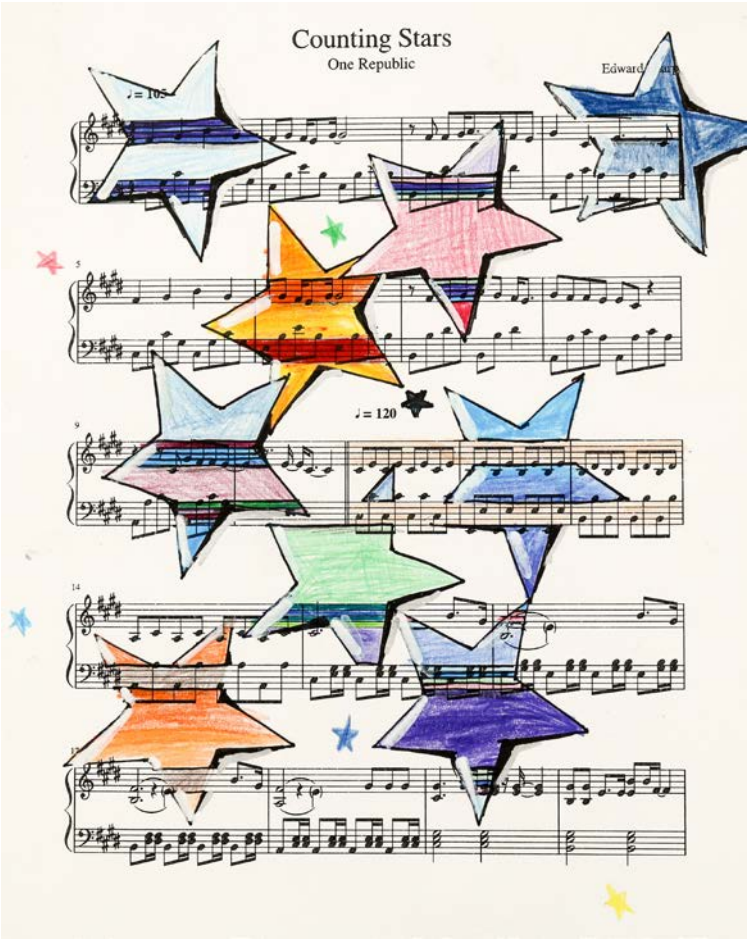
As they started to color their designs, **patterns** emerged that were then used repeatedly throughout the design.





They **collaborated** with fellow students throughout the process**, evaluating** and getting feedback on their work. This project required a lot of **perseverance** and patience in the coloring of their design as I stressed the importance of their final presentation.





Hobbton Middle School, *PTO Meeting*, May 7, 2018

HOBBTON MIDDLE SCHOOL
PTO/Progress Reports
May 7, 2018

Welcome	Jeff Bradshaw, principal
PTO	Jill Usher, president Amanda Bradshaw, vice president Maria Contreras, secretary Jana McLamb, treasurer
Athletic Booster Club	Amanda Bradshaw, president Lynette Britt, vice president Maria Contreras, secretary Amy Grimes, treasurer
Music Education Presentation	Dr. Rue Lee-Holmes

Student EOG Goals
EOG Pep Rally on May 22nd, 2:15 PM
EOG Celebration on June 6th, 1:30-2:55 PM

Awards Assemblies
6th/7th Grades on June 6th at 8:45 AM
8th Grade on June 7th at 8:45 AM

8th Grade Cookout
June 6th, 11:00-12:30

Summer School
8th Grade Science (June 11-12)
6th – 8th Grade Math (June 11-14)
6th – 8th Grade ELA (June 18-21)

Testing Proctors Needed

Dismissal

Please report to your child's grade level hallway after the meeting to pick up progress reports.

Make sure you have signed in at the front table.

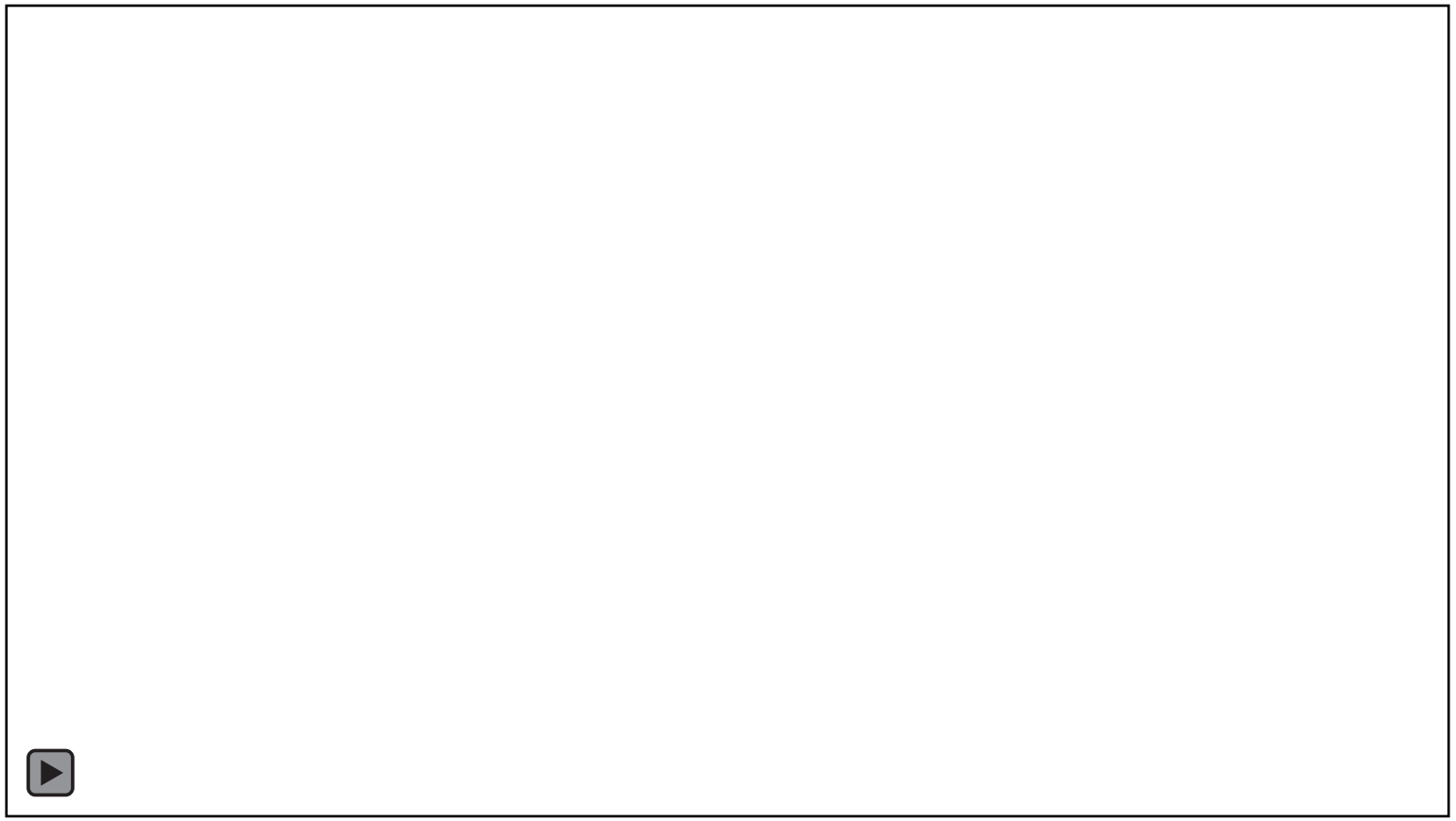
Thank you for attending our PTO meeting!

ECU

Hobbton Middle School, *PTO Meeting*, May 7, 2018

ECU

Hobbton Middle School, *PTO Meeting*, May 7, 2018



What's to come?

- build on our ***thematic*** approach,
- implement "***sneaky evaluation***" activities,
- incorporate a multi-literacy approach in a theme with a working title of "***the shape of light and sound***," and
- explore a theme with a working title of "***the texture of fabric.***"

Innovative Science, Technology, Engineering and Mathematics Strategy Project: Encouraging STEM Careers through Innovation (iSTEM)

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Funded through the National Science Foundation ITEST grant (DRL-1512957)

Overview

iSTEM at Morehouse College is an academic program designed for grades eighth through tenth to increase their exposure to innovation and creativity in the STEM disciplines. iSTEM addresses the need to increase underrepresented minority students in the STEM workforce by inspiring, encouraging, supporting, and creating student interest in STEM at the secondary level.

This program also incorporates a strong entrepreneurial component and will develop students into future STEM business leaders who will not only participate in the STEM workforce, but also contribute to the expansion of a STEM based economy.

Goals

1. Increase student awareness of STEM educational opportunities and careers
2. Increase student knowledge and skills in STEM
3. Increase participation of underrepresented minorities in STEM

Working Teams

- Morehouse faculty from STEM departments
- Center for Teacher Preparation
- Morehouse College Entrepreneur Center
- Academic Advisor Specialist
- 6-12th grade STEM faculty

Near-Peer Tutors/Mentors: Morehouse College and Spelman College Pre-service STEM educators

Participants: 2015- 42, 6-8 grade underrepresented minority students from metropolitan Atlanta, 2016- 51, 7-9 grade underrepresented minority students from metropolitan Atlanta, 2017 – 46, 8-10 underrepresented minority students from metropolitan Atlanta

Program Components

- Students begin in grades 6-8 and are supported for a long-term (3 year) STEM technology program

Saturday Academy : Theme Yr. 1-- Colonization of Earth's Moon

- Transportation to the Moon
- Academic focus – Math, Physics, English/Communication, and Innovation
- Project focus – creative ideas related to travel from earth to the moon
- Summer Academy Year 1 continued the Theme of Transportation

Saturday Academy : Theme Yr. 2 -- Infrastructure and Sustainability

- Community Mapping, 3-D Modeling
- Academic focus – Math, Physics, English/Communication, and Innovation
- Project focus – Aquaponics, Water Reclamation, Soil, Infrastructure, Power
- Summer Academy Year 2 continued the Theme of Projects and Coding

Program Components, Cont.

Saturday Academy : Theme Yr. 3 – Careers in STEM

- "Speed Dating" format – interviewing during National Black Physicist Assoc. Mtg.
- Academic focus – Math, Physics, English/Communication, and Innovation
- Project focus – Building with the STE(A)M Truck, Components of writing a manuscript, Producing a video about STEM Innovation, Making a Kalimba (STEAM).

- **Parent Workshops**
- Computer Skills with Microsoft representatives
- Technical Evaluation/Review of "The Martian" and "Hidden Figures"
- College Preparation Workshop w/Panelist (Financial Aid, Admissions, Scholarships, Sports-NCAA requirements)
- Attending the USA Science and Engineering Festival in Washington, DC
- Summer Academy Preview

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ITEST grant (DRL-1512957)

Lead Institution: Morehouse College

Partners:

- Atlanta Public School System
- Fayette County School System
- Spelman College
- NSF Noyce Teacher Scholarship Program (DUE-1240037)
- NSF DRK12 Grant (DRL-1119512)

QUESTIONS

THANK YOU

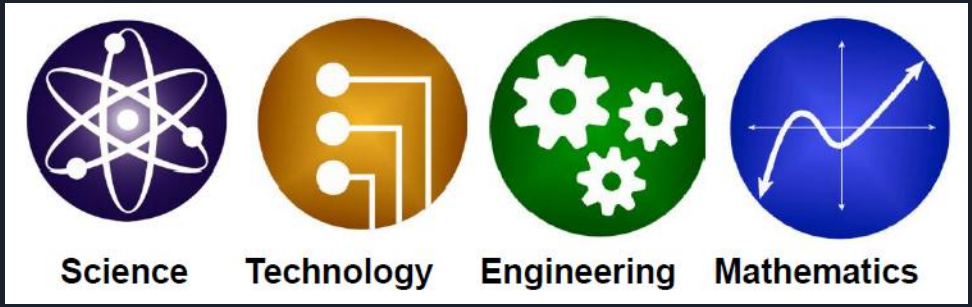
Beyond the STEM Classroom

Families and Parents as STEM Education Partners

CSOs Anthony, Mackenzie, Mayra, and Sebastian

How have your parent(s)/family been involved in your work as a Chief Science Officer?

- Parents become aware of what STEM is
- Parents become supportive when their kids begin to learn about what they are interested in



What have your parent(s)/family learned about STEM as a result of your involvement in CSO?

- Possible future careers for their children
- Parents also learn about the true interests of their children, and possibly their own interests as well

What recommendations would you make to researchers who want to involve parent(s)/family in a STEM program?

- Offer regular family nights, something that an entire family can become a member of
- Include interactive activities for parents that have to do with STEM, not just for their kids

How has parent(s)/family involvement enhanced your learning and interest in STEM?

- “Personally as a CSO, my parents have been pushing me to learn the most I possibly can about STEM and STEM careers”
- "Becoming a CSO has led me into many different opportunities that my parents find crucial as I go through my education”

Have you cultivated STEM interest among your siblings?

- “I have started talking to my brother about becoming a CSO, and teaching him about STEM and the stuff it deals with”
- Working together with a fellow CSO at all times can provide advantages no other partnership has