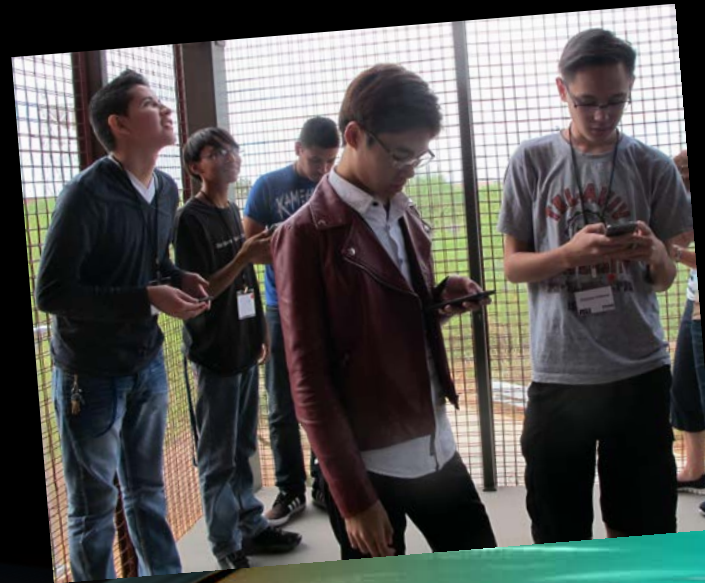


App Maker Pro (AMP) Motivating STEM Study Through App Development

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

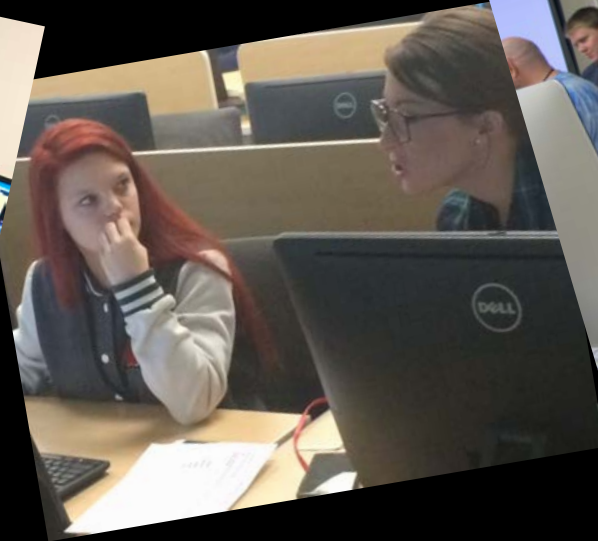
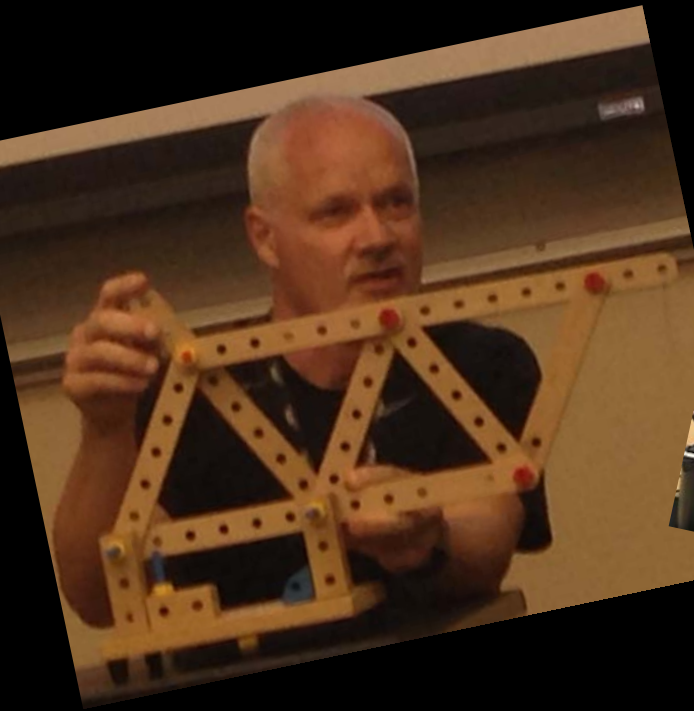
Goal: Successfully plan and offer software design and app development programs for after-school or in-school programs.

- **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)

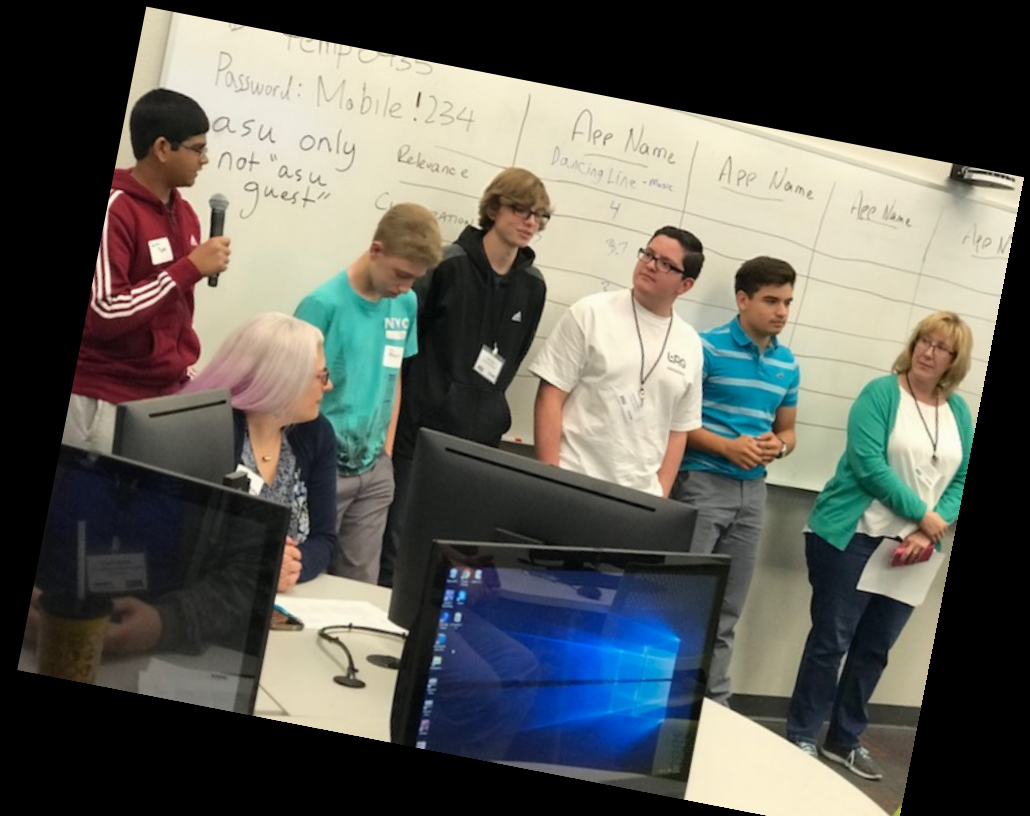
Sessions 1 – 3: App Analyses (existing apps in the domain) and App Design

Session 4: Analyses and Refinement of Newly Designed Apps



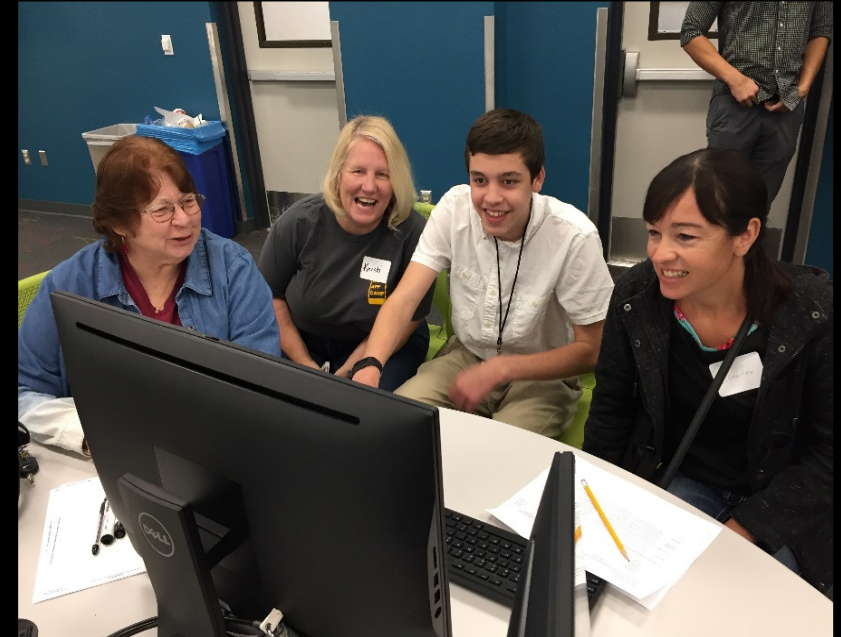
Showcase Open House Held During The Last Meeting of Sessions 1 – 4

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



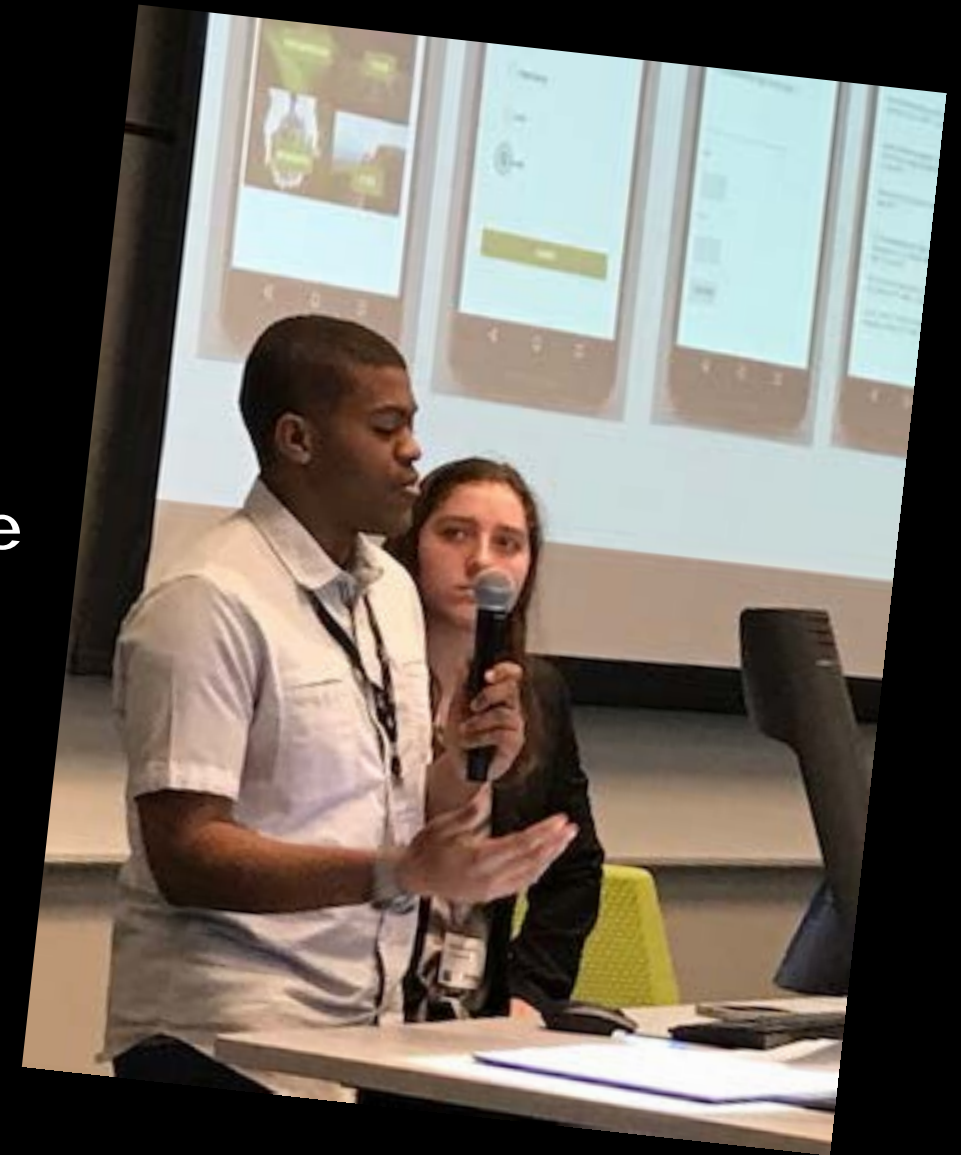
Since the beginning of AMP, Showcase Open Houses & Community Outreach Programs have shown:

- 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:

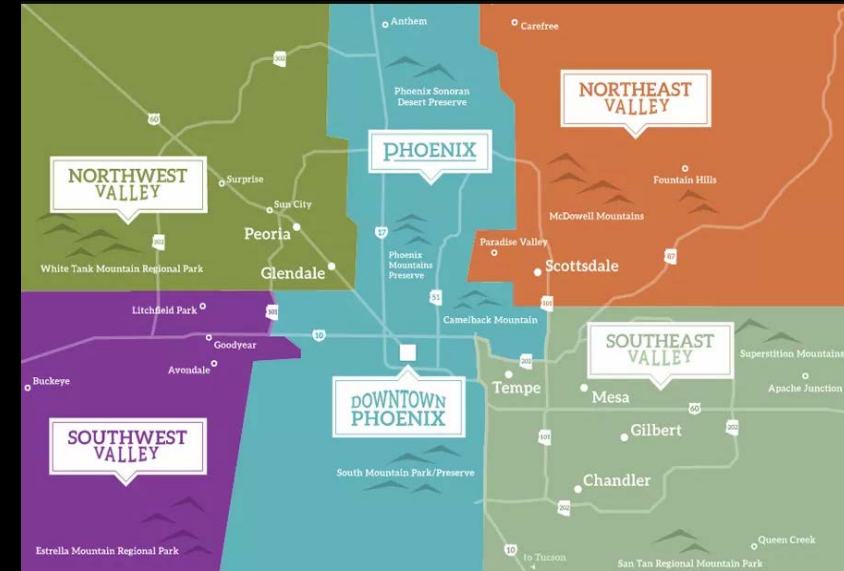
Superintendents: Chandler, Higley, Phoenix
STEM Integration Specialist: Phoenix
Director of Curriculum & Instruction: Phoenix

Industries:

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

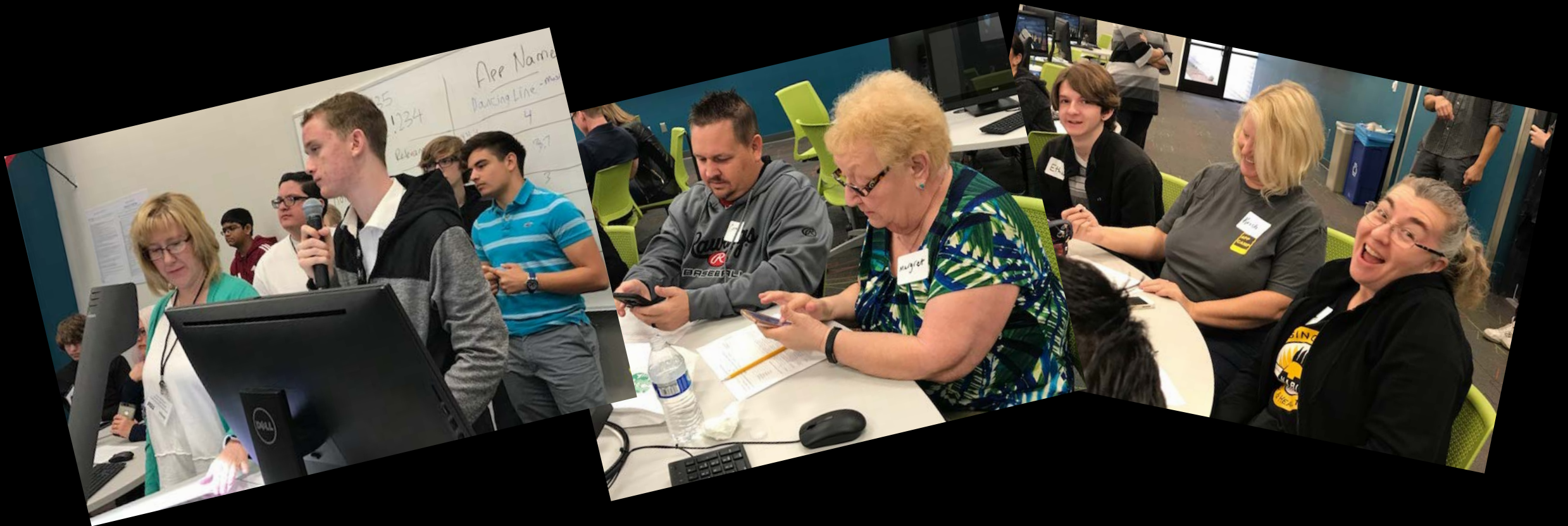
ASU:

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

33.

8	7	2	17
5	3	4	12
1	6	9	16

14 16 15

Put these numbers in the squares: 1, 2, 3, 4, 5, 6, 7, 8, and 9

Add across →

Add down ↓

Sums are in ○

$3\left(\frac{n}{2} + 3\right) = 21$			17
	$n^2 - 9 = 0$	$\frac{3n}{6} + 2n = 10$	12
			16

14 16 15

Volume 6

MATHadazzles

Mind Stretch Puzzles Volume 6

Reasoning Algebraically

Authors

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

Editors

Ping Chuan (Larry) Yong, Senior Editor

James Kim, Jason Luc, Yifan Tian, Tanner Wolfram

Project Assistant

Daniel Lee

Cover Design

Mary Cavanagh

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Put these numbers in the squares: 1, 2, 3, 4, 5, 6, 7, 8, and 9

Add across →

Add down ↓

Sums are in ○

$n = \sqrt{169} - 5$		
$n^3 \times 9^0 = 1$	$n = -\sqrt{49} + 2n$	
		$(n-4)25 = 134 - n$

19

10

16

13

16

16

$|3 - n| = 1$

$\frac{n^2 + 1}{5} = 10$

$n^2 = \left(\frac{n}{2}\right)^4$

n^5

$50 \leq n^2 \leq 81$

MATHadazzles!

Mind Stretch Puzzles Volume 6

Reasoning Algebraically

$n^2 + n = \sqrt{n} \times 30$

$\frac{6!}{20n} = n$

$n = \sqrt[3]{512}$

$\frac{n^2 + 1}{10} = 5$

$n^4 \div (n \times n) = 4$

$n!$

PRIME Center
Arizona State University

$\sqrt[3]{n}$

$n^2 - 5n = 4!$

Volume 7

$$\frac{|n - 52|}{25} = n$$

$$(n + 23)^0 = n^3$$

$$\sqrt{\frac{n}{2}} = 2 \times 0!$$

$$15n + n^2 = 54$$

MATHadazzles!

Mind Stretch Puzzles Volume 7

Reasoning Algebraically

$$\frac{(n - 3)!}{n + 4} \geq n + 2$$

$$\left(\frac{n}{3}\right)! = 6$$

$$\frac{n^2}{\sqrt{(n + 2)! + 1}} = \frac{2n}{5}$$

$$\frac{|n - 14|}{n} = n - 6$$

PRIME Center
Arizona State University

$$\sqrt{9}(n - 4) = n + 6$$

$$n = \frac{2\sqrt{36}}{3}$$

MATHadazzles

Mind Stretch Puzzles Volume 7

Reasoning Algebraically

Authors

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Mary Cavanagh, Ph.D.

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Arizona State University (ASU)

Put these numbers in the squares: 1, 2, 3, 4, 5, 6, 7, 8, and 9

Add across →

Add down ↓

Sums are in ○

$n + 2n^2 = 3 \times 0!$	$n^2 - n + 3 = 75$	
	$\frac{(n-3)!}{n+4} \geq n+2$	
		$7n^2 + 2n + 5 = 74$

○ 14

○ 21

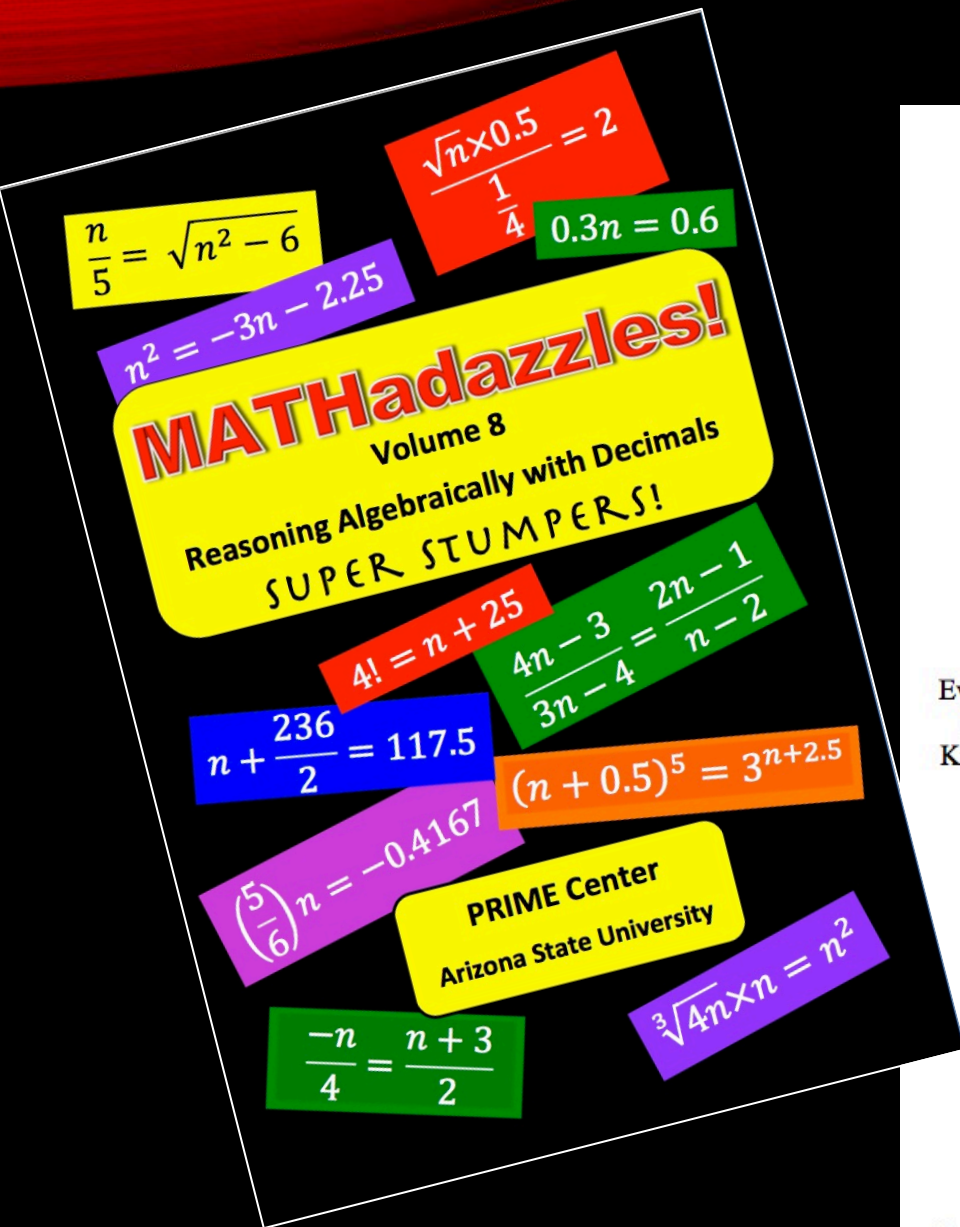
○ 10

○ 12

○ 19

○ 14

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

Editors

Tanner Wolfram, Senior Editor
Daniel Lee, Assistant Senior Editor
Jason Luc
Yifan Tian
Ping Chuan (Larry) Yong

Cover Design
Mary Cavanagh

Put these numbers in the squares -2.0, -1.5, -1.0, -0.5, +0.5, +1.0, +1.5, +2.0, +2.5

Add across →

Add down ↓

Sums are in ○

$\frac{5}{2n+2.5} = \frac{10}{7}$		
	$2n+4 = 3.6n$	
	$n > 1$	$1 < n < 2$

○ -0.5

○ 1.0

○ 2.0

○ -1.5

○ 2.5

○ 1.5

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

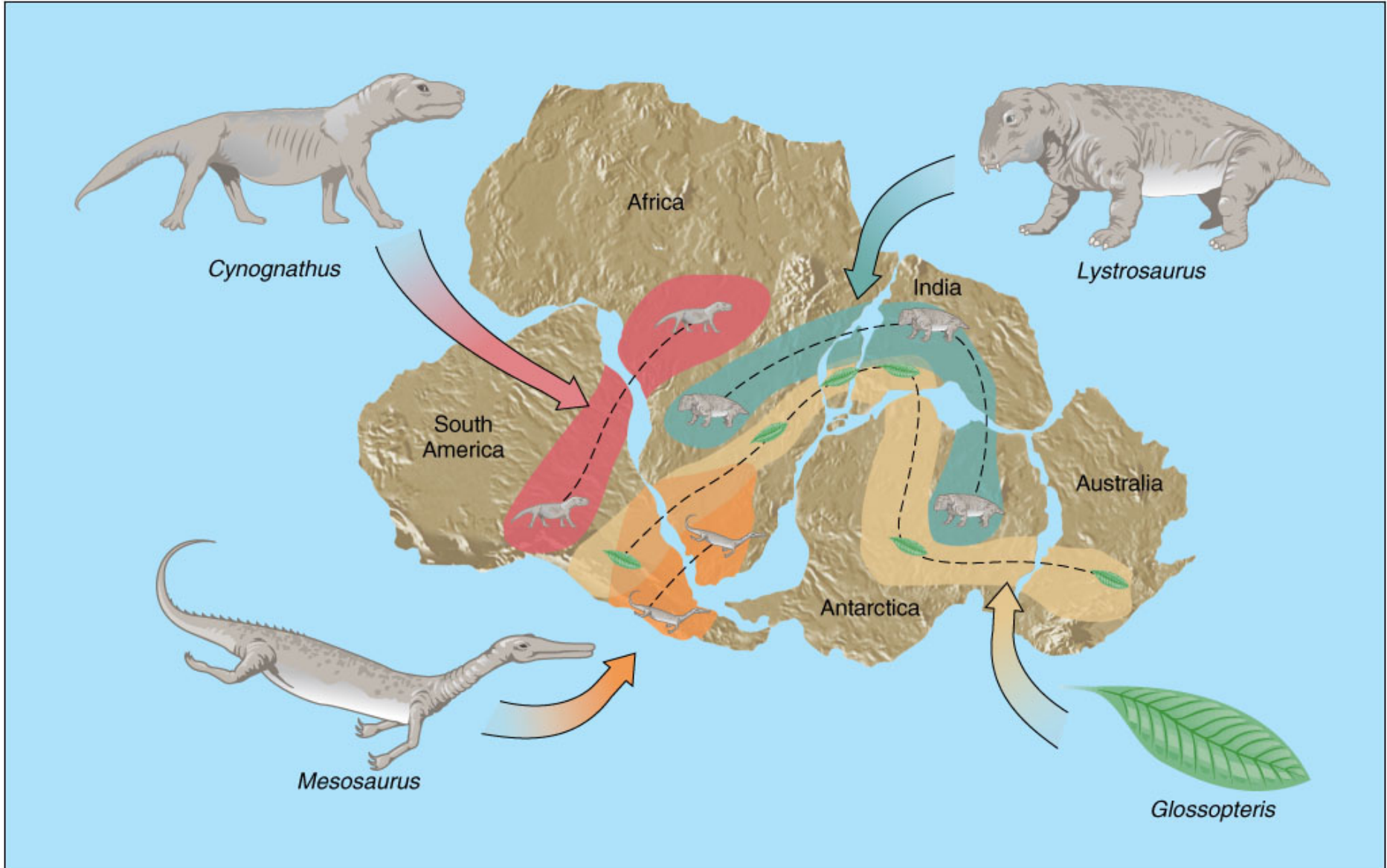
James Madison University

Carolyn Jourdan

Chicago Public Schools

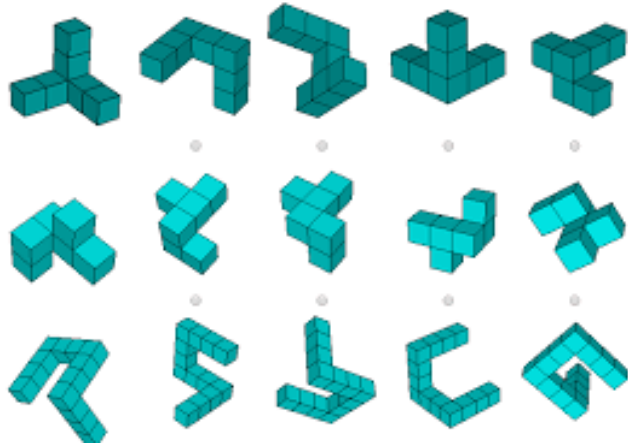
Overview

- 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*



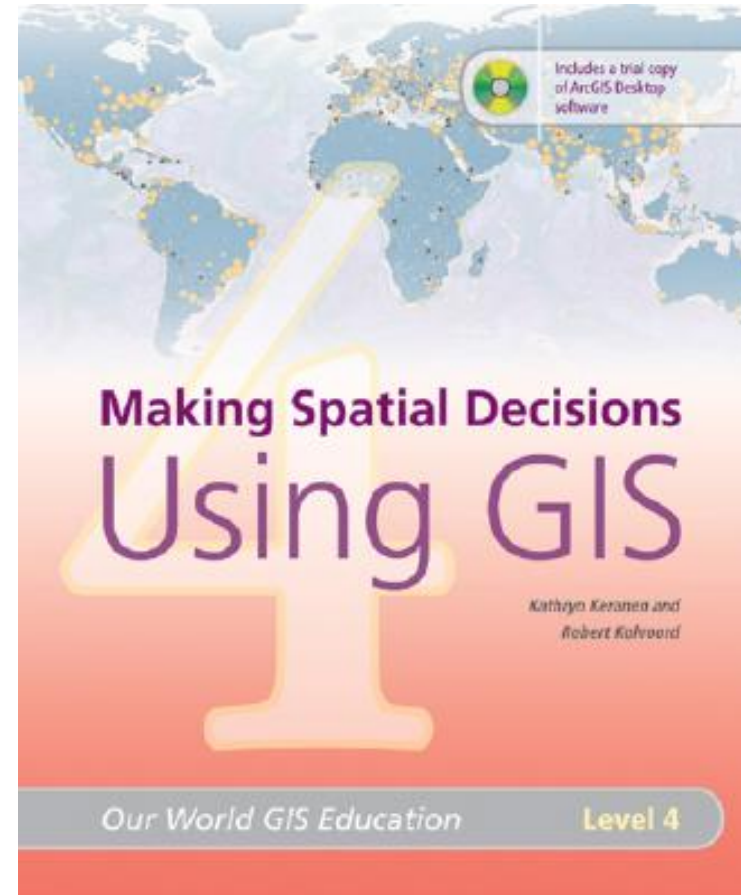
Our Focus: Spatial Thinking in CTE

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



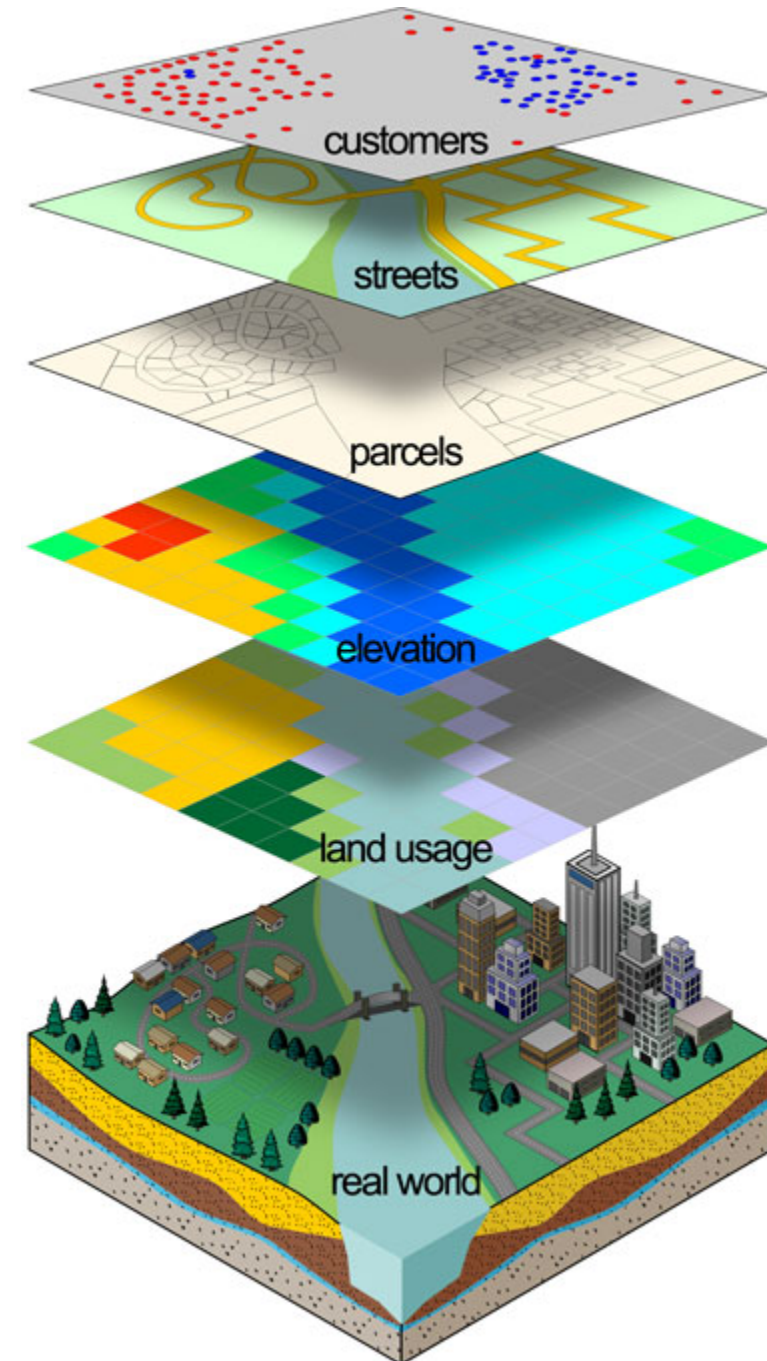
Promoting Spatial Problem Solving in Science Education

- 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?



View: View of Dairy Farm



View: View of Dairy Farm

Dr. Hannah Parsley and Ryan Good
Loray High School

Special Thanks to Maryland and Virginia Milk Producers
Cooperation Association

Introduction

Milk used to be produced in the local area of agricultural fields and was sold to the local market. However, most of the milk produced in Virginia today is transported over 100 miles away, which is why we are able to buy local milk. The project was created to help the community understand the local milk production process and the challenges of local milk production. The project was created to help the community understand the local milk production process and the challenges of local milk production.

Discussion

Finding information for this project was very difficult. Local Milk Producers and Virginia Milk Producers are associated with each other and we were able to get the information we needed. We needed to understand the local milk production process and the challenges of local milk production. We needed to understand the local milk production process and the challenges of local milk production.

Analysis

We used ArcGIS to analyze the local milk production process. We found that the local milk production process is very complex and involves many different steps. We found that the local milk production process is very complex and involves many different steps. We found that the local milk production process is very complex and involves many different steps.

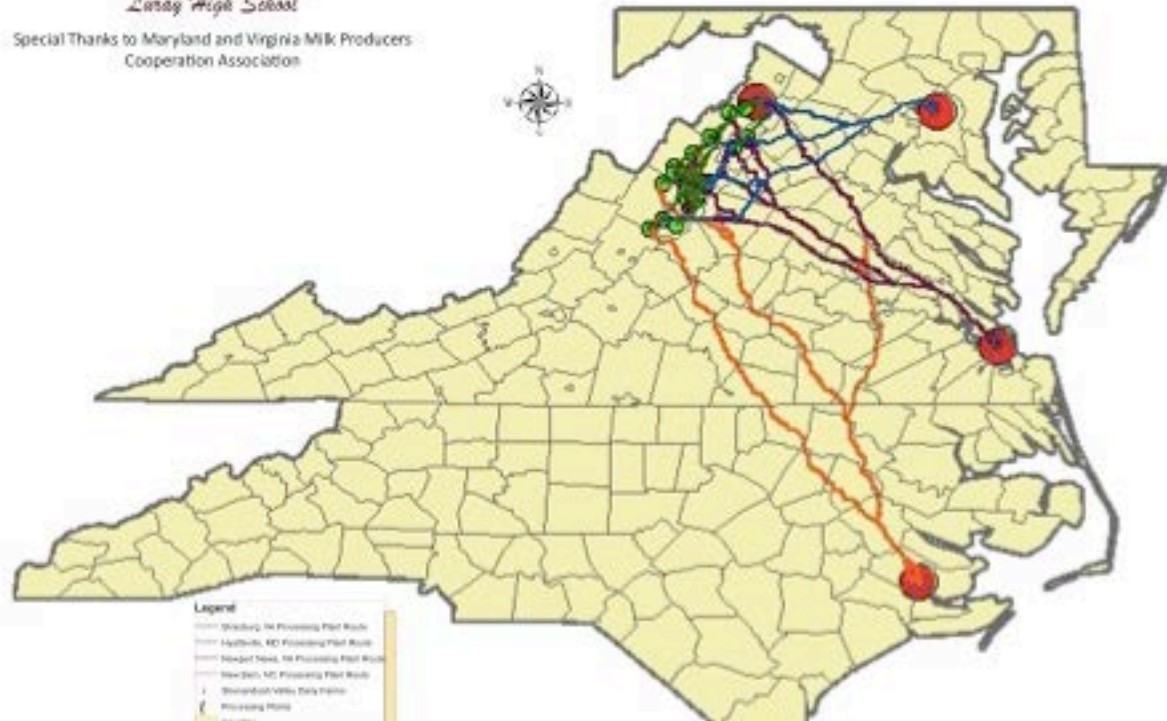
Conclusion

We are excited to see the local milk production process. We found that the local milk production process is very complex and involves many different steps. We found that the local milk production process is very complex and involves many different steps. We found that the local milk production process is very complex and involves many different steps.



The Milk at Home

Milk is a very important part of our diet. It is a source of protein and calcium. It is also a source of energy. Milk is a very important part of our diet. It is a source of protein and calcium. It is also a source of energy.



Legend

- Spotsylvania, VA Processing Plant
- Stafford, VA Processing Plant
- Loudoun, VA Processing Plant
- New Kent, VA Processing Plant
- Processing Plants

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



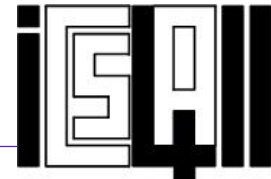
ECU®



JONES COUNTY PUBLIC SCHOOLS



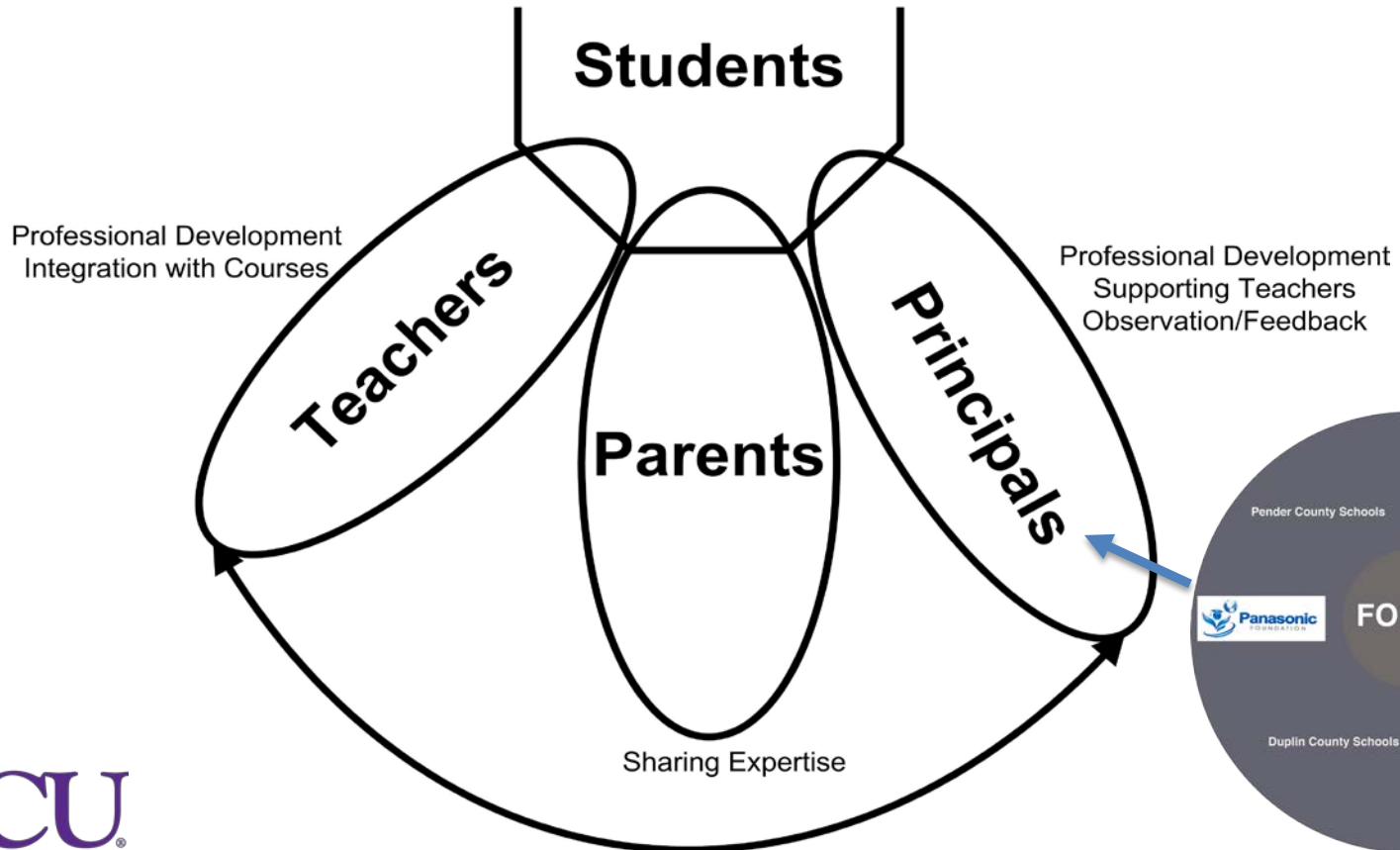
The focus of **iCS4All** is enabling middle school students to benefit from the integration of computational skills into their **music** and **visual arts** classes.



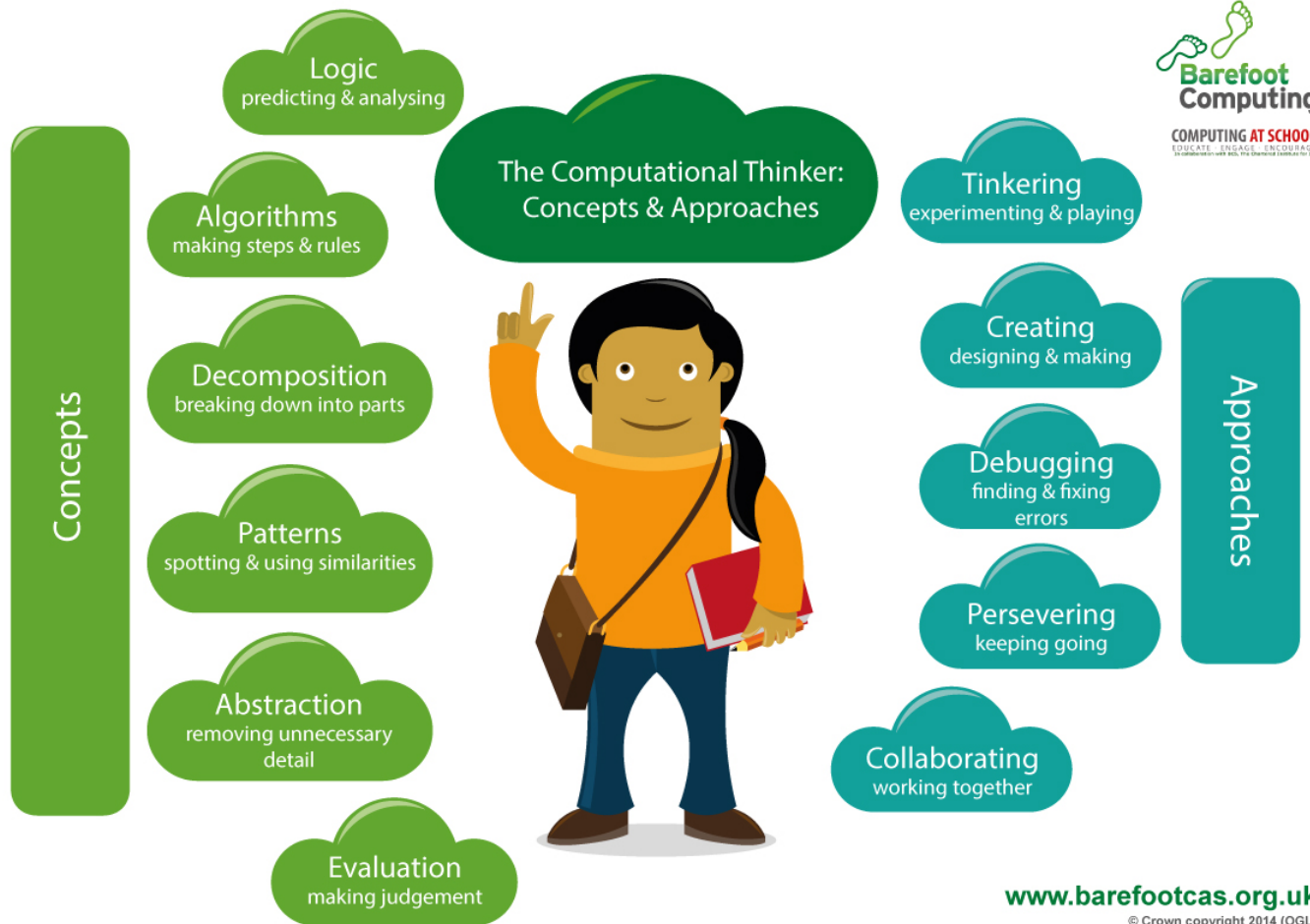
Concept

Integrating Computer Science for All

Continue to Develop Digital Literacy
Learn Computer Science and Computational Thinking in Subject-Specific Contexts



Computational Thinking



www.barefootcas.org.uk

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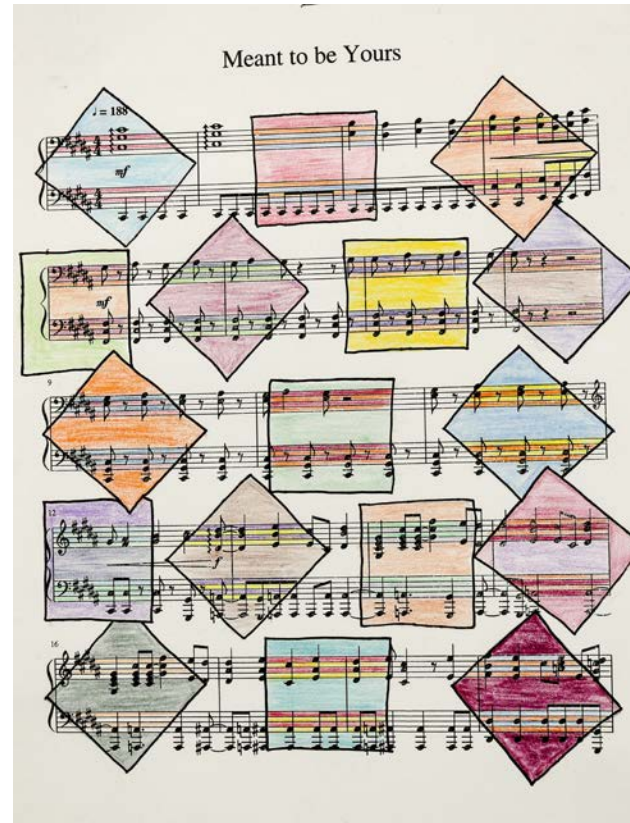
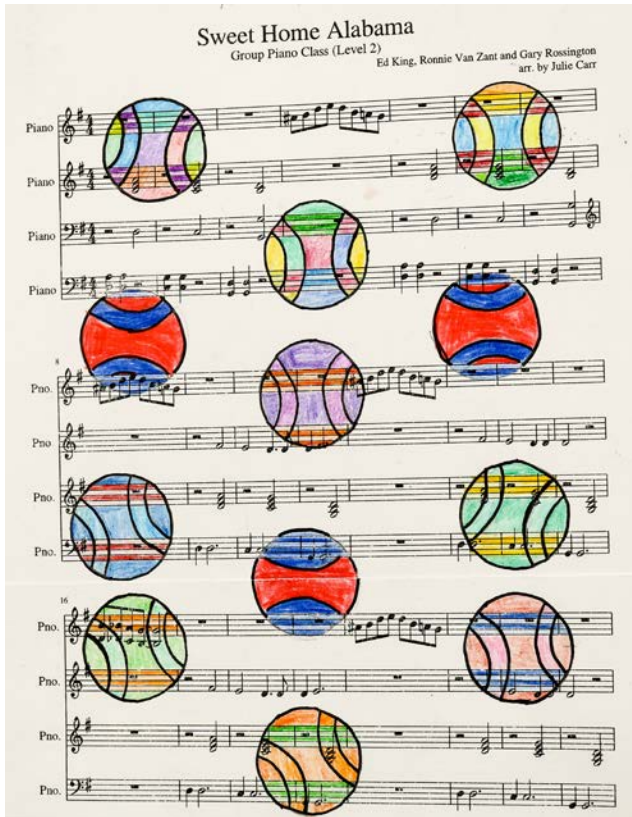
Barefoot would like to acknowledge the work of Julia Briggs and the eLIM team at Somerset County Council for their contribution to this poster.

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.



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.

Let You Down
Instrumental w/ Vocals
Zak

NF

$\text{♩} = 148$

Vocal *f* Feel like I'm on the edge right now I wish that I could say I'm proud

Piano *mf*

Voc. I'm sorry that I let you down Let you down All these voices in my

Pno.

10 Voc. head loud I wish that I could shut them out I'm sorry that I

Pno. *f*

This musical score for 'Let You Down' features hand-drawn, colorful heart-shaped annotations over the vocal and piano parts. The hearts are filled with various colors and patterns, such as stripes and gradients. The score includes a tempo marking of $\text{♩} = 148$ and dynamic markings like *f*, *mf*, and *f*. The lyrics are written across the vocal staves.

What If
Tristan Willcox

$\text{♩} = 80$

Voice

Flute

Violins

Electric Guitar

Electric Guitar

Grand Piano

Choir Synthesizer

Bass Guitar

Drumset

This musical score for 'What If' features hand-drawn, colorful circular annotations over the vocal and instrumental parts. The circles are filled with various colors and patterns, such as stripes and gradients. The score includes a tempo marking of $\text{♩} = 80$ and dynamic markings like *f* and *mf*. The instruments listed are Voice, Flute, Violins, Electric Guitar, Grand Piano, Choir Synthesizer, Bass Guitar, and Drumset.

Copyright 2016 Tristan Willcox Creative Commons Attribution-NonCommercial International 4.0

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

"Shelter"
Porter Robinson and Madeon

Cover by TheIshter
Sheet Music by Bomb & Kou
Revision by Jeremy Platt

Andante $\text{♩} = 90$

The sheet music for "Shelter" is presented in a standard staff format with treble and bass clefs. The tempo is marked "Andante" with a quarter note equal to 90 beats per minute. The music is written in 4/4 time. The score includes various dynamics such as *mp*, *cresc.*, and *f passionately*. The most striking feature is the use of large, hand-drawn circles and ovals in various colors (blue, orange, green, purple) that are superimposed over the musical notes and stems, creating a visual design that complements the abstract theme mentioned in the text.

Put your head on my shoulder

Stimme

Elektrisches Piano

Klavier

Elektrische Gitarre

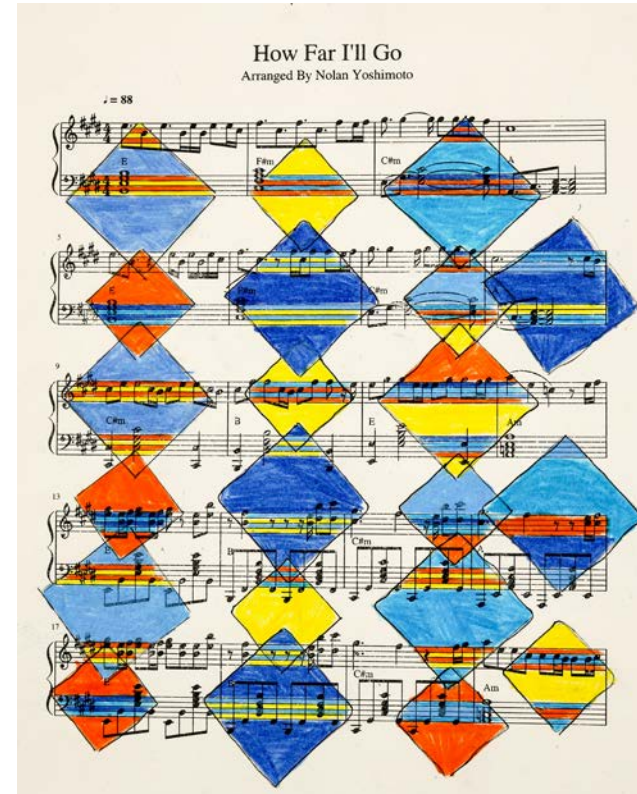
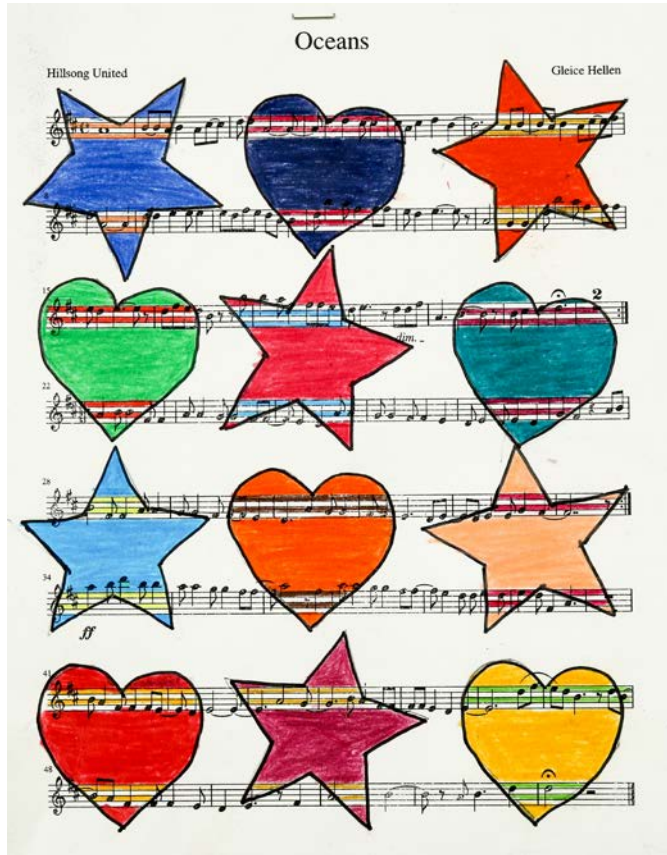
Elektrische Gitarre

Bass Gitarre

Schlagzeug

The sheet music for "Put your head on my shoulder" is arranged for a full band including voice, electric piano, piano, electric guitar, bass guitar, and drums. The score is written in 12/8 time. The music is characterized by a heavy, syncopated groove. The most prominent visual element is the use of large, hand-drawn hearts in various colors (red, purple, green, yellow, blue) that are superimposed over the musical notes and stems, creating a vibrant and abstract 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.

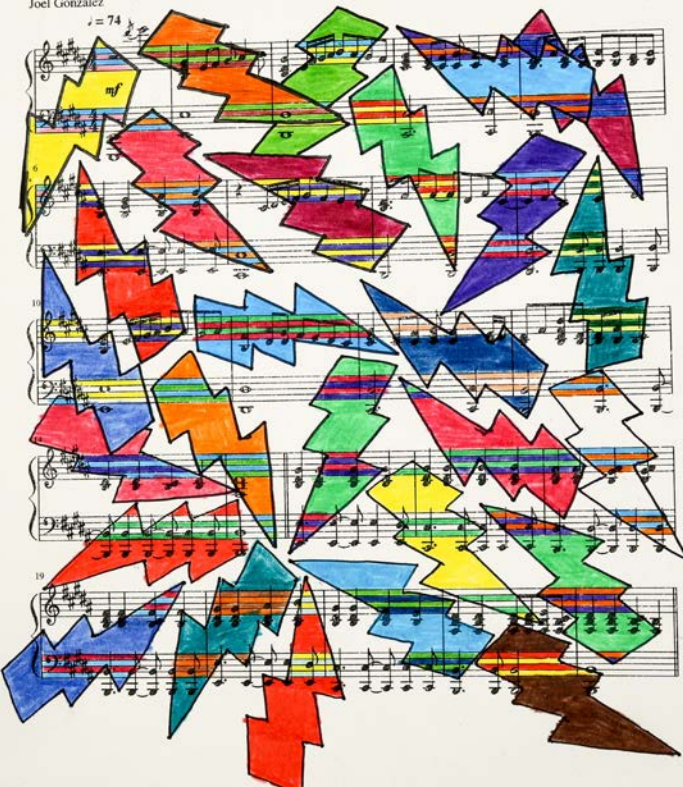


As they started to color their designs, **patterns** emerged that were then used repeatedly throughout the design.

November Rain
Guns N' Roses

Arrangement by
Joel Gonzalez

Words & Music by
W. Axl Rose



The image shows a musical score for the song "November Rain" by Guns N' Roses. The score is arranged by Joel Gonzalez and features a tempo of quarter note = 74. The music is written in G major and 4/4 time. The score is heavily decorated with large, colorful lightning bolt patterns in various colors (red, orange, yellow, green, blue, purple, brown) that are overlaid on the musical notation. The patterns are repeated throughout the score, creating a visual rhythm that mirrors the musical one.

THE APOLOGY SONG
from THE BOOK OF LIFE

Lyric by PAUL WILLIAMS
Music by GUSTAVO SANTAOLALLA

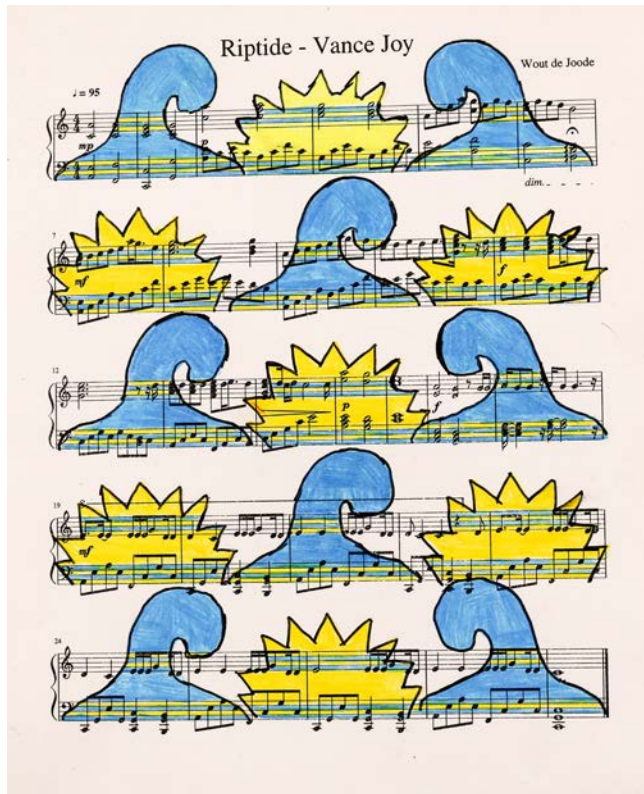
Moderately



The image shows a musical score for the song "The Apology Song" from the movie "The Book of Life". The score is arranged by Gustavo Santaolalla and features a tempo of Moderately. The music is written in G major and 3/4 time. The score is heavily decorated with large, colorful musical notes in various colors (yellow, blue, green, red, purple, brown) that are overlaid on the musical notation. The notes are repeated throughout the score, creating a visual rhythm that mirrors the musical one.

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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.



Hobbtown Middle School, PTO Meeting, May 7, 2018

HOBBTOWN MIDDLE SCHOOL
PTO/Progress Reports
May 7, 2018

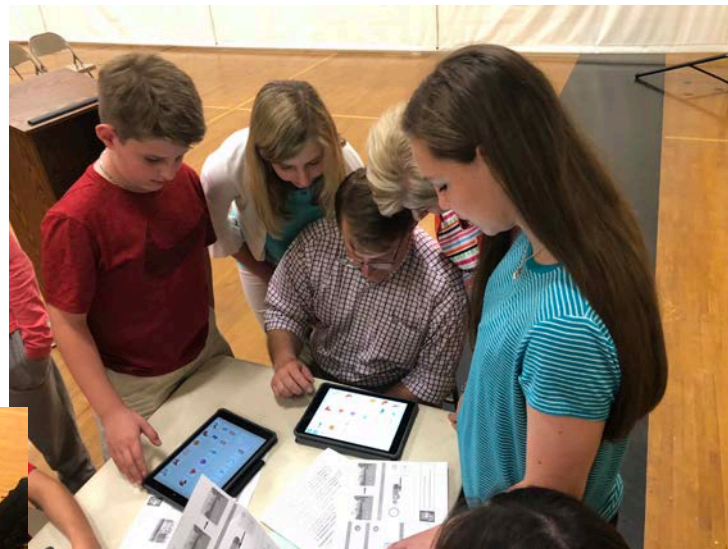
Welcome	Jeff Bradshaw, principal
PTO	Jill Usher, president Amanda Bradshaw, vice president Maria Contreras, secretary Jana McLamb, treasurer
Athletic Booster Club	Amanda Bradshaw, president Lynette Britt, vice president Maria Contreras, secretary Amy Grimes, treasurer
Music Education Presentation	Dr. Rue Lee-Holmes
Student EOG Goals	EOG Pep Rally on May 22 nd , 2:15 PM EOG Celebration on June 6 th , 1:30-2:55 PM
Awards Assemblies	6 th /7 th Grades on June 6 th at 8:45 AM 8 th Grade on June 7 th at 8:45 AM
8 th Grade Cookout	June 6 th , 11:00-12:30
Summer School	8 th Grade Science (June 11-12) 6 th – 8 th Grade Math (June 11-14) 6 th – 8 th 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.

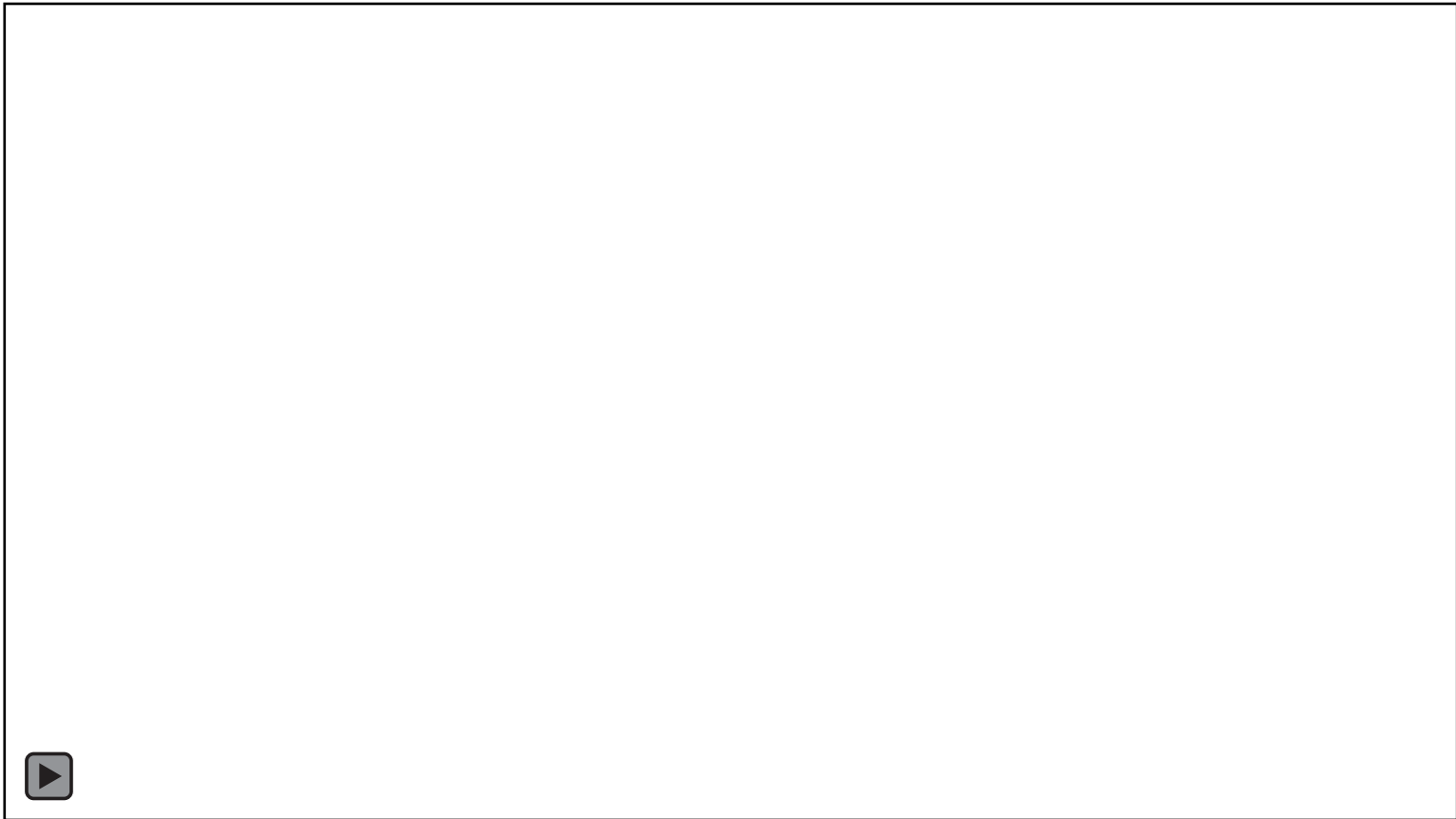
Make sure you have signed in at the front table.
Thank you for attending our PTO meeting!



Hobbs Middle School, PTO Meeting, May 7, 2018



Hobpton 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*.”



MOREHOUSE
COLLEGE



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

Cynthia E. Trawick, Ed.D. Principal Investigator,

Willie S. Rockward, Ph.D. & Tiffany R. Bussey, D.B.A. Co-Directors

Jamie P. Clayton, MEd, Program Manager

Melissa K. Demetrikopoulos, Ph.D. External Evaluator, Institute for Biomedical Philosophy
Morehouse College, Atlanta, GA

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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- ▶ Fayette County School System
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QUESTIONS



THANK YOU



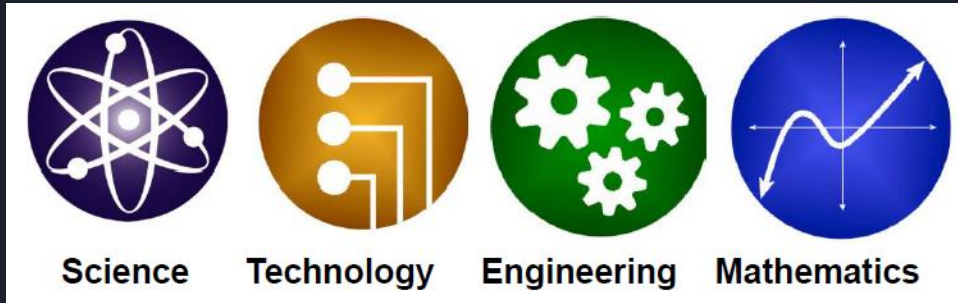
Beyond the STEM Classroom

*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

