Creating a Culture for STE(A)M

Georgia Department of Education

Federal Programs/Curriculum & Instruction

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Objective(s)

- Share the "Why" of STEM / STEAM and share examples of engaging learning experiences created by implementation.
- Share ways that Title IV A funds can support your goals to create or expand STEM / STEAM opportunities for your teachers and students.

System of Continuous Improvement

Why STEM and STEAM?

What are you here to learn more about?

Why STEM and STEAM?

- STEM careers will grow by 77,000 new jobs between now and 2026.
- Biggest areas of growth: software developers, nurses, computer customer support, emergency medical technicians.
- More than half of the job growth in GA between now and 2026 will be in the healthcare and film industry.
- GA Long Term Workforce Trends Report

Why STEM and STEAM?

- **Not just about STEM / STEAM jobs, but the STEM and STEAM in the jobs.**
  - Collaboration
  - Problem-solving
  - Innovation / Risk Taking
  - Independent Work / Thinking
- **Example:** Less data processing & more decision making with data (Great Forbes article!)

Fine Arts and the Georgia Economy

- The Creative industries in Georgia represent a combined $37 billion in revenue, including 200,000 employed with $12.1 billion in earnings, and $62.5 billion in total economic impact.
- The creative industries represent 5% of all employment and 4% of all business revenue in the state.
- The Creative Industries are surpassing Agriculture as a CASH CROP of Georgia.

How are we building learning opportunities that support STEM / STEAM thinking with our content standards?

How are we creating professional learning opportunities that support this type of planning and thinking for our teachers and leaders?

Title IV A and STEM / STEAM?

(C) programming and activities to improve instruction and student engagement in science, technology, engineering, and mathematics, including computer science, (referred to in this section as "STEM subjects") such as—

(i) increasing access for students through grade 12 who are members of groups underrepresented in such subject fields, such as female students, minority students, English learners, children with disabilities, and economically disadvantaged students, to high-quality courses;

(ii) supporting the participation of low-income students in nonprofit competitions related to STEM subjects (such as robotics, science research, invention, mathematics, computer science, and technology competitions);

Title IV A and STEM / STEAM?

(iii) providing hands-on learning and exposure to science, technology, engineering, and mathematics and supporting the use of field-based or service learning to enhance the students' understanding of the STEM subjects;

(iv) supporting the creation and enhancement of STEM-focused specialty schools;

(v) facilitating collaboration among school, afterschool program, and informal program personnel to improve the integration of programming and instruction in the identified subjects; and

(vi) integrating other academic subjects, including the arts, into STEM subject programs to increase participation in STEM subjects, improve attainment of skills related to STEM subjects, and promote well-rounded education;

Characteristics of STEM Education

Characteristics of STE(A)M Education: Pedagogy not Product

PROJECT AND PROBLEM-BASED LEARNING

Students must be able to apply content from multiple disciplines to answer complex questions and develop solutions to real world problems. Teacher takes on the role of facilitator in the classroom.

INTEGRATED MATH, SCIENCE, CTAE, AND FOR STEAM, FINE ARTS INSTRUCTION

Students are able to analyze and articulate interdisciplinary connections that exist within math, science, CTAE, and fine arts content.

STRONG BUSINESS, COLLEGE, COMMUNITY PARTNERS

Partners are involved in development of curriculum and assist with making connections between classroom teaching and learning and business and industry applications.

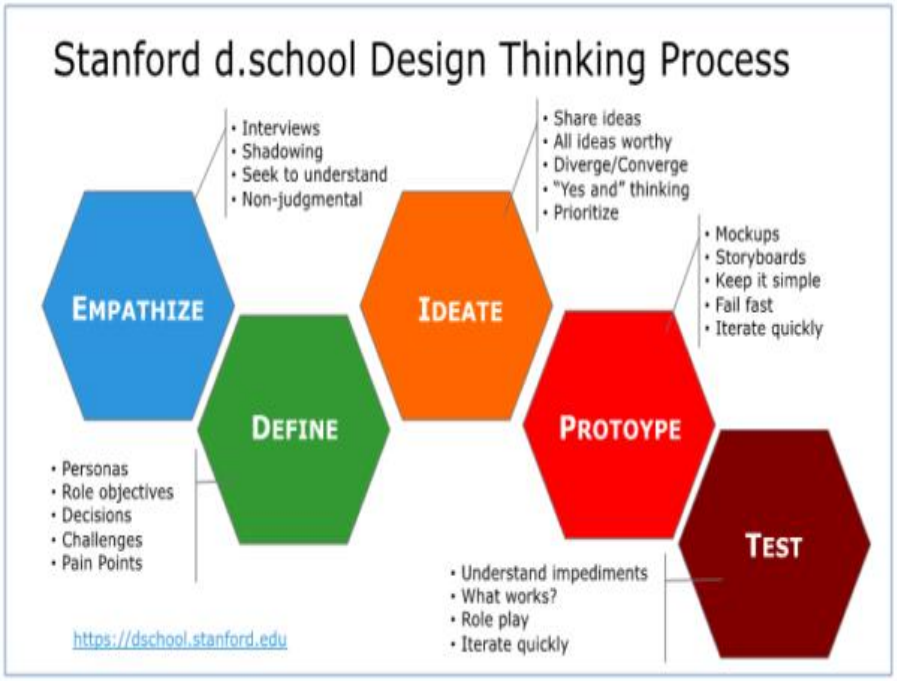
STUDENTS CONDUCT INVESTIGATIVE RESEARCH

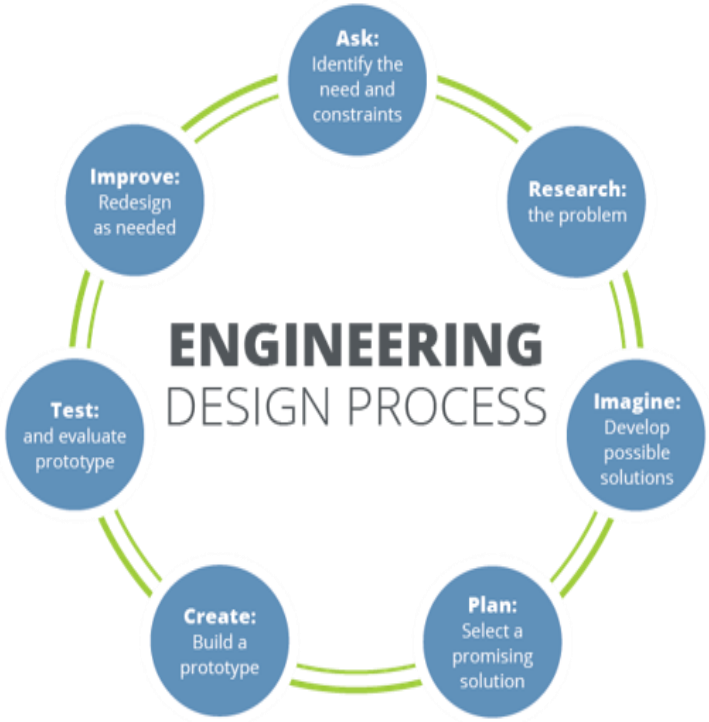
Students identify and support claims related to a complex question or real-world problem by supplying relevant data as evidence.

COLLABORATIVE PLANNING TIME

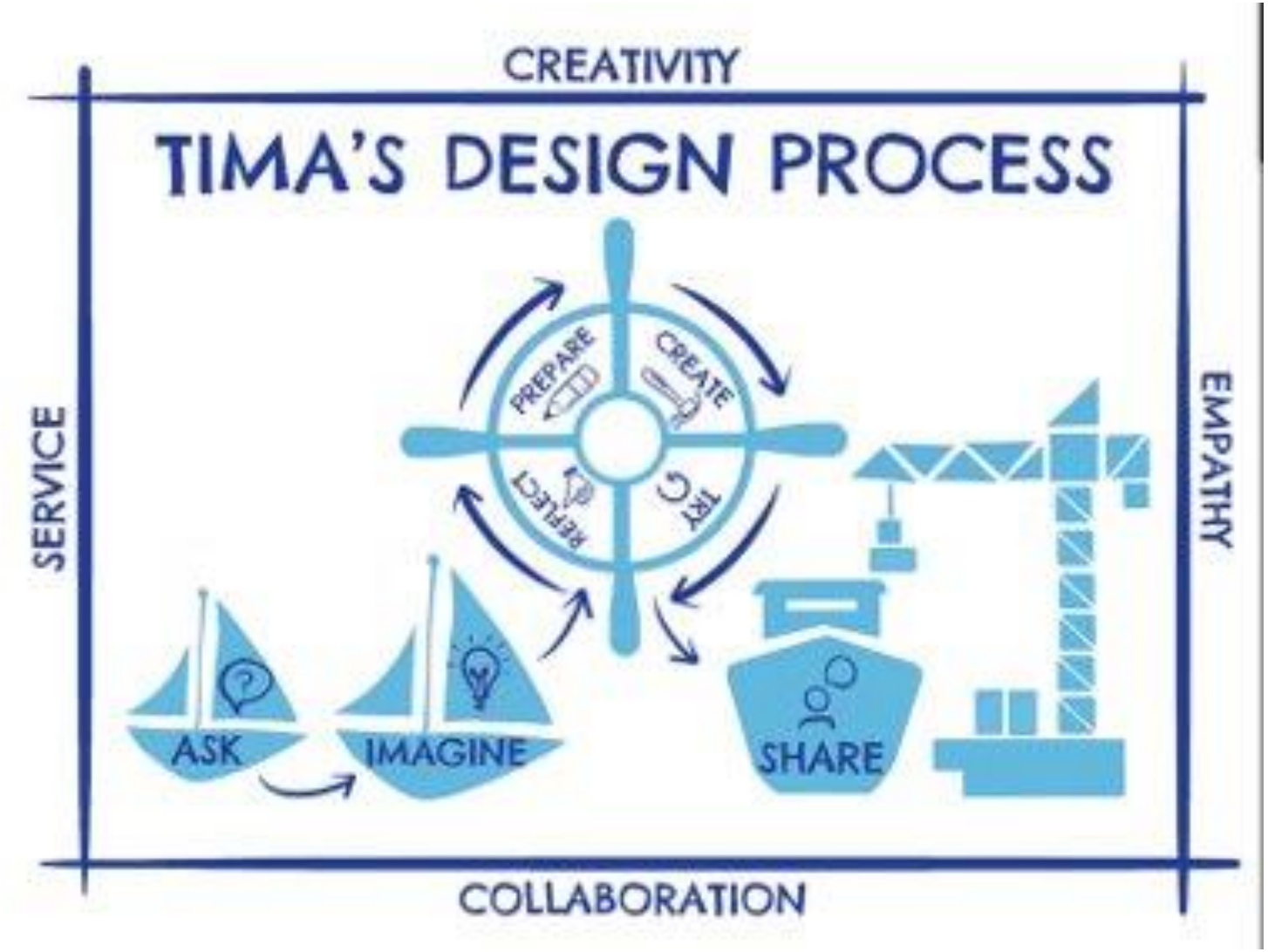
Time must be allocated for teachers to work collaboratively to plan purposeful, meaningful, and intentional interdisciplinary lessons.

Thinking and Planning is Rooted in a Process





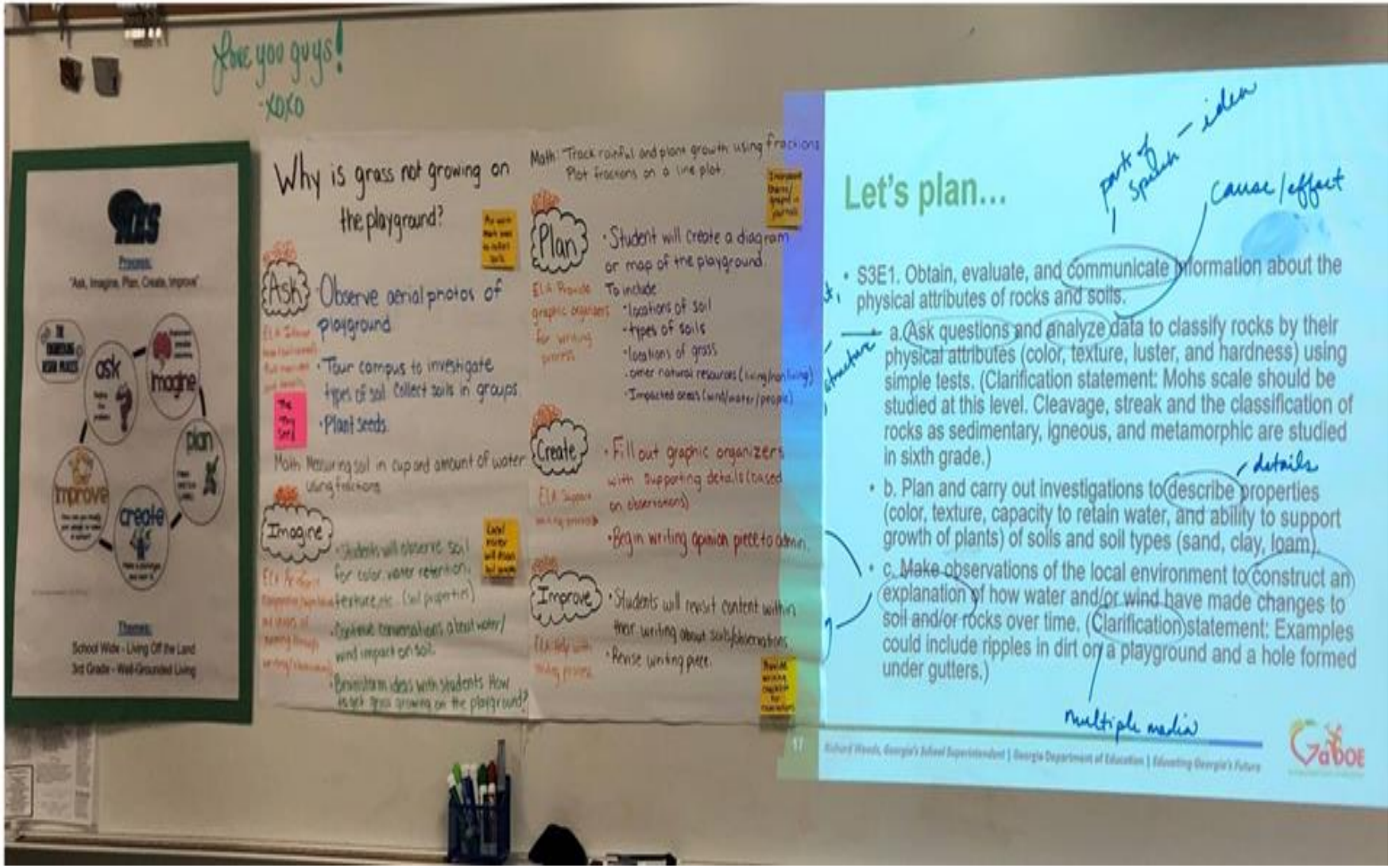

STEM
ASK
Find out more about the problem.
IMAGINE
Think of possible solutions.
IMPROVE
Look at the model. Make it better.
PLAN
Think ahead about the steps.
CREATE
Follow your plan.


CREATIVITY
TIMA'S DESIGN PROCESS
SERVICE
EMPATHY
PREPARE
CREATE
REFLECT
ITERATE
ASK
IMAGINE
SHARE
COLLABORATION


IDENTIFY
IMPACT
INVESTIGATE
INVENT
IMPROVE
INFORM


COLLINS HILL
Engineering Design Process
8 steps to make any design project a success
1
ASK QUESTIONS
WHO?
WHAT?
WHY?
HOW?
doodle
investigate
creativity
research
write
spark
flow
inspiration
2
BRAINSTORM
ideas
mindmap
fresh
think


3
DESIGN CONCEPT
4
FEEDBACK
5
REVISIONS
6
REPEAT
STEPS 1 TO 5 UNTIL LAUNCH
7
LAUNCH
Take the final design to completion
ASSESS &
COMMUNICATE
Think about what you learned & apply it to the next project!
8


Love you guys!
-xoxo
Why is grass not growing on the playground?
Ask
Observe aerial photos of playground
Tour campus to investigate types of soil. Collect soils in groups
Plant seeds
Imagine
Plan
Student will create a diagram or map of the playground
To include
Create
Fill out graphic organizers
Improve
Let's plan...
S3E1. Obtain, evaluate, and communicate information about the physical attributes of rocks and soils.
a. Ask questions and analyze data to classify rocks by their physical attributes (color, texture, luster, and hardness) using simple tests. (Clarification statement: Mohs scale should be studied at this level. Cleavage, streak and the classification of rocks as sedimentary, igneous, and metamorphic are studied in sixth grade.)
b. Plan and carry out investigations to describe properties (color, texture, capacity to retain water, and ability to support growth of plants) of soils and soil types (sand, clay, loam).
c. Make observations of the local environment to construct an explanation of how water and/or wind have made changes to soil and/or rocks over time. (Clarification statement: Examples could include ripples in dirt on a playground and a hole formed under gutters.)
Richard Woods, Georgia's School Superintendent | Georgia Department of Education | Educating Georgia's Future

What do STE(A)M Learning Experiences look like?

- Projects / problems are rooted in standards-based education
  - Not all standards will fit with your overarching project
  - Teach with inquiry perspective
- Community creates authentic learning experiences
- Built upon relevance / interest

Project-Based Learning

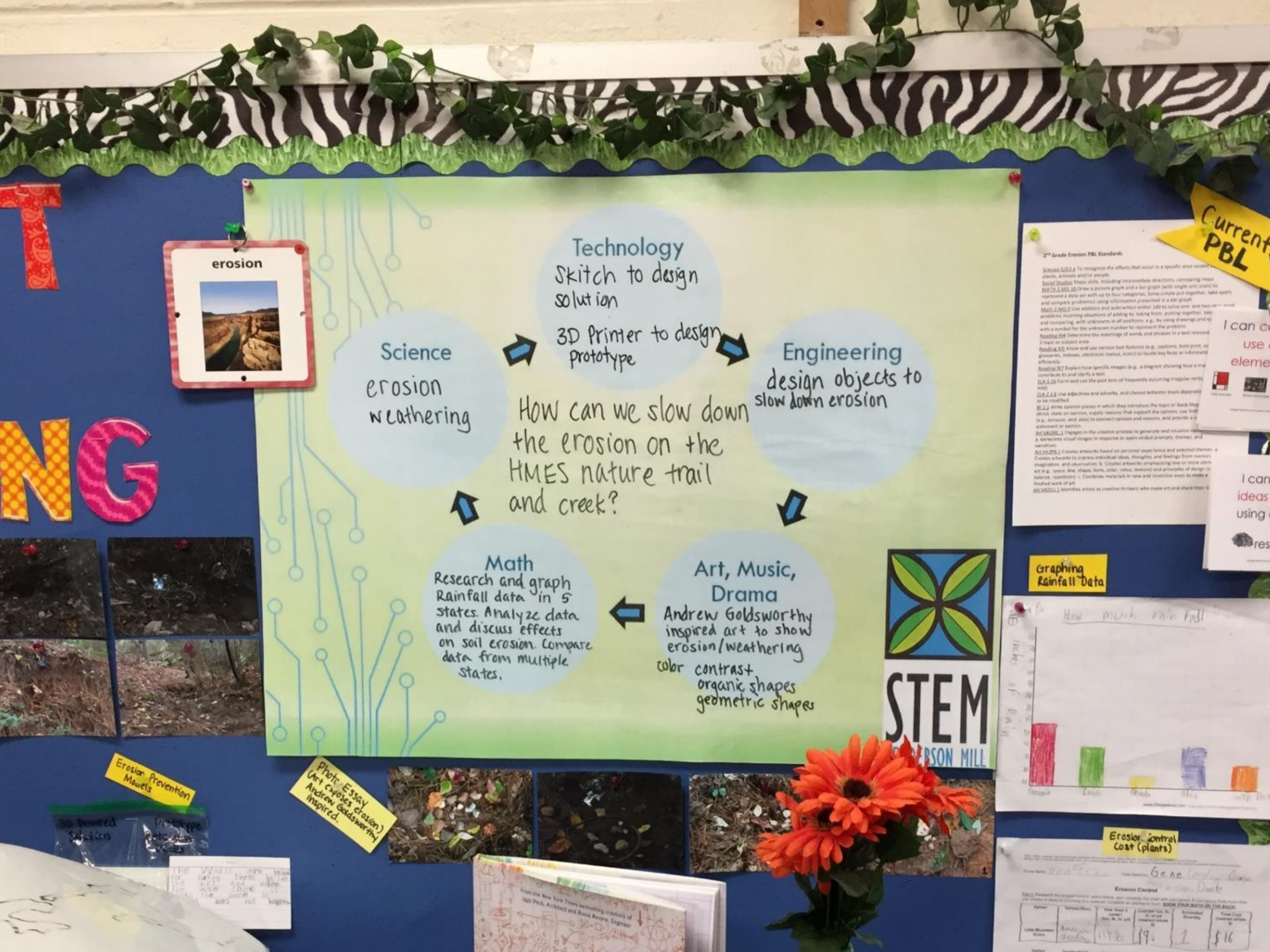
Overarching grade-level or schoolwide focus

Students solve a real-world problem

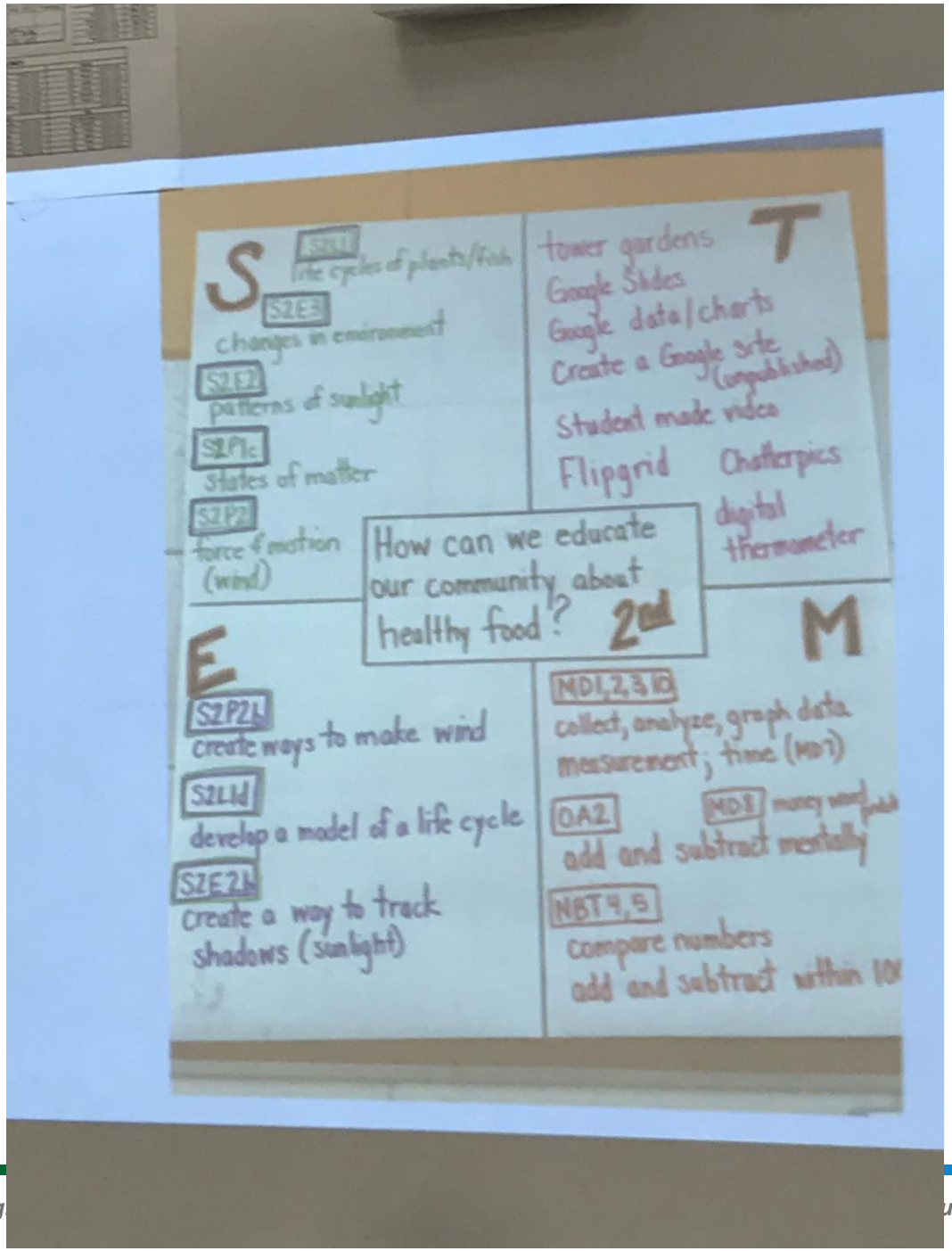
Day-to-Day Interdisciplinary Instruction

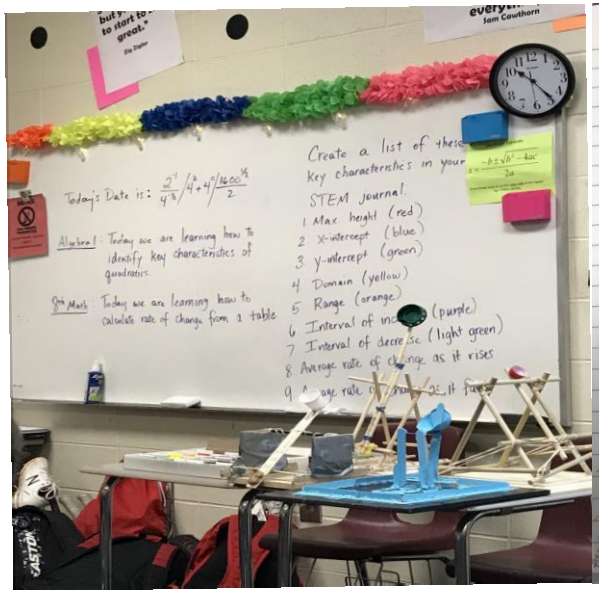
Typical instruction integrates, at the minimum, science and math- for STEAM, arts as well

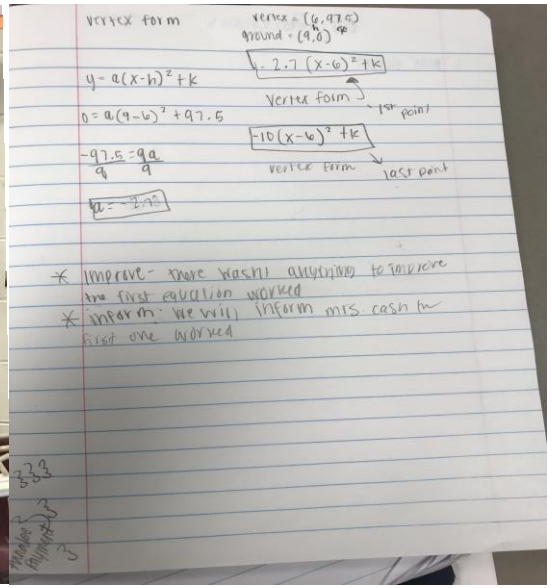
- Driven by grade-level Georgia Standards of Excellence
- Learning targets are identified
- Documented in STEM or STEAM Journal
- Students document data collection
- Students use school/program identified thinking process

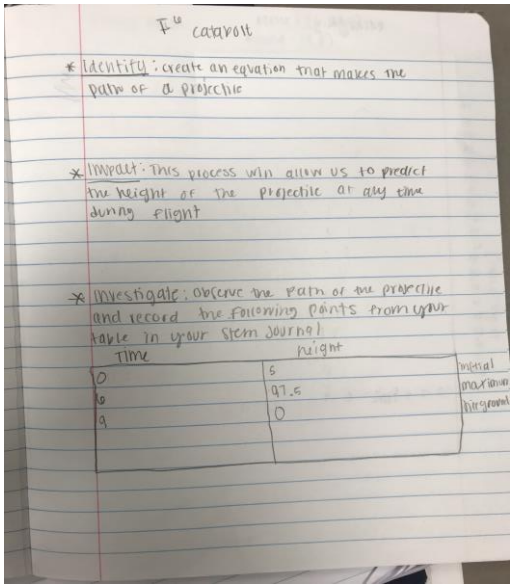


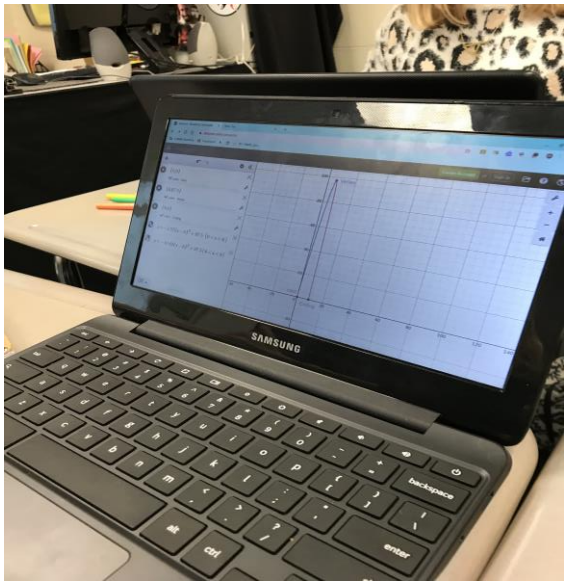
Technology
Skitch to design solution
3D Printer to design prototype
Science
erosion
weathering
Engineering
design objects to slow down erosion
How can we slow down the erosion on the HMES nature trail and creek?
Math
Research and graph Rainfall data in 5 states. Analyze data and discuss effects on soil erosion. Compare data from multiple states.
Art, Music, Drama
Andrew Goldsworthy inspired art to show erosion/weathering
color contrast
organic shapes
geometric shapes
STEM
erosion
Current PBL
Graphing Rainfall Data
Erosion Prevention Models
Photo Essay (Art exposes erosion) Andrew Goldsworthy inspired.
Erosion Control Cost (plants)

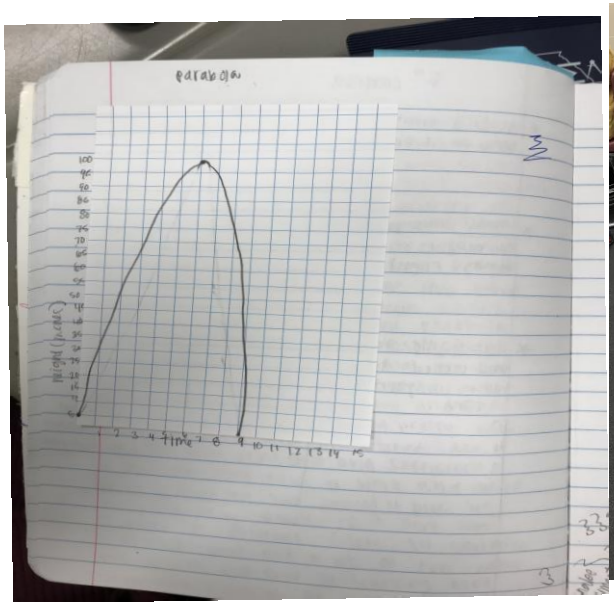

S
S2L1
life cycles of plants/fish
S2E3
changes in environment
S2E1
patterns of sunlight
S2P1c
States of matter
S2P2
force & motion (wind)
T
tower gardens
Google Slides
Google data/charts
Create a Google site (unpublished)
Student made video
Flipgrid
Chatterpics
digital thermometer
How can we educate our community about healthy food? 2nd
E
S2P2b
create ways to make wind
S2L1d
develop a model of a life cycle
S2E2b
create a way to track shadows (sunlight)
M
MD1,2,3 K
collect, analyze, graph data measurement; time (MD1)
OA2
add and subtract mentally
MD1
NBT4,5
compare numbers
add and subtract within 10

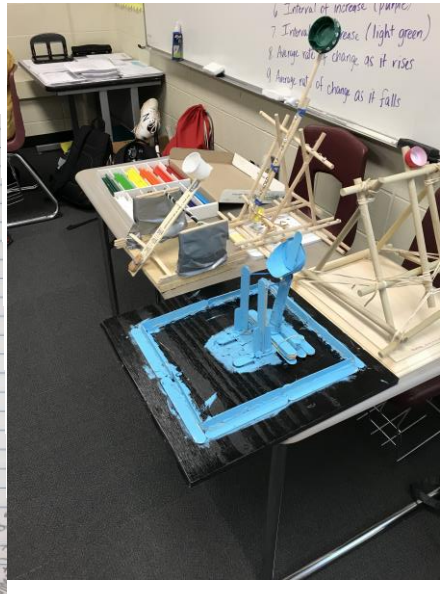

Create a list of these
Key characteristics in your
STEM journal.
1. Max height (red)
2. x-intercept (blue)
3. y-intercept (green)
4. Domain (yellow)
5. Range (orange)
6. Interval of increase (purple)
7. Interval of decrease (light green)
8. Average rate of change as it rises
9. Average rate of change as it falls
Today's Date is:
Algebra I - Today we are learning how to identify key characteristics of quadratics.
9th Math - Today we are learning how to calculate rate of change from a table


vertex form
vertex = (6, 97.5)
ground = (9, 0)
$y = a(x-h)^2 + k$
$-2.7(x-6)^2 + k$
vertex form
1st point
$0 = a(9-6)^2 + 97.5$
$-10(x-6)^2 + k$
vertex form
last point
$-97.5 = 9a$
$a = -2.7$
* Improve - there wasn't anything to improve the first equation worked
* Inform: We will inform mrs cash the first one worked


F.6 catapult
* Identify: create an equation that makes the path of a projectile
* Impact: This process will allow us to predict the height of the projectile at any time during flight
* Investigate: Observe the path of the projectile and record the following points from your table in your stem journal
Time
Height
0
6
9
5
97.5
0
Initial
maximum
ground


SAMSUNG


parabola
Height (feet)
Time (seconds)


8 Average rate of change as it rises
9 Average rate of change as it falls

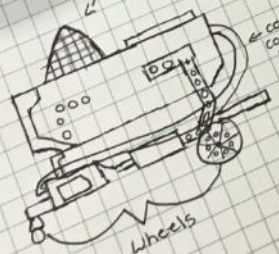
STE(A)M Journal: The House for Student Thinking

- "Journal of Messy"
- Process-Based Thinking
- Interdisciplinary Connections
- Reflection
- Investigative Research and Data

Design and create a Martian Rover that can successfully navigate Mar's Terrain.

Day 1

Day 2



TITLE
From Page No.
No.
Witnessed & Understood by me.
Date
TL11
Project No.
Book No.
Brandon H.

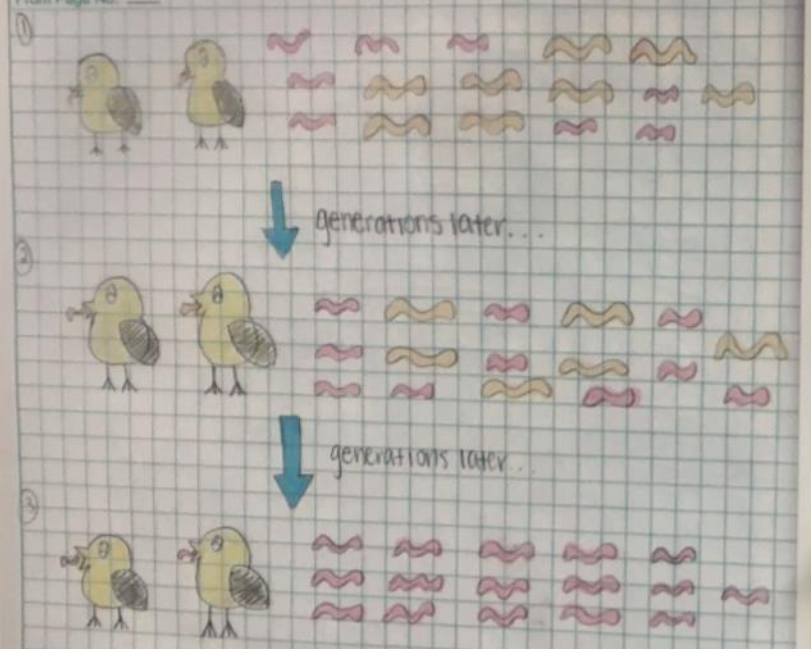

How do you think rocks and min
agriculture?

22

Project No. _____

Book No. _____ TITLE _____

From Page No. ____



1. The 0 worm species started with about the same population. The birds preferred the large orange worms over the small pink worms.
2. They continued to eat the large orange worms and the small pink worms began to breed with each other.
3. The birds ate the last of the large orange worms and small pink worms becoming outbored.

The birds selected the large orange worms and the small pink worms and the small pink worms have flourished due to adapting in their environment and becoming purebred with each other.

Witnessed & Understood by me. Date 4-2-18 Invented by: Recorded by: Date To Page No. ____

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Book No. _____

TITLE _____

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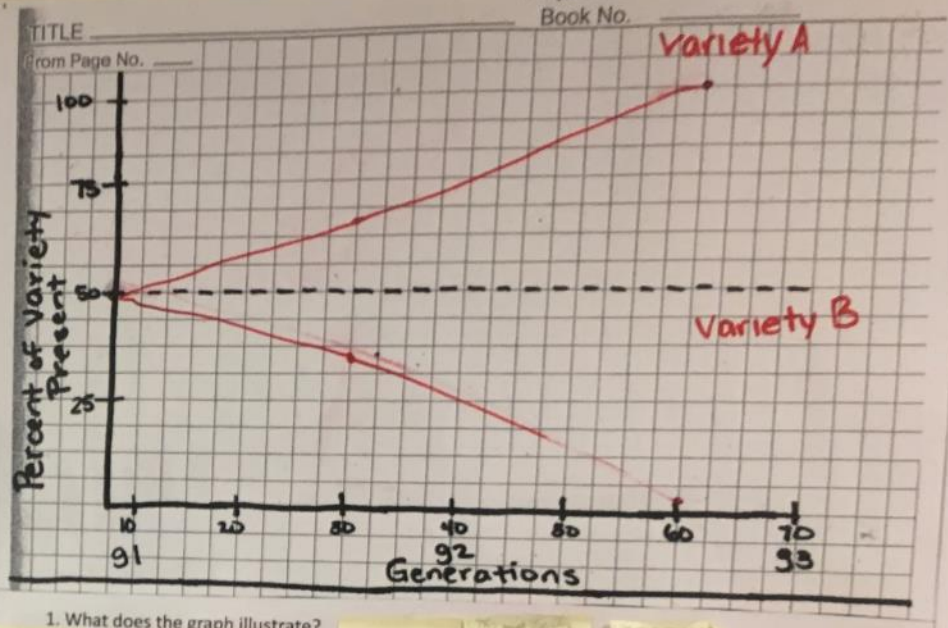


1. What does the graph illustrate?

2. Which variety will contribute significantly to the future of the species gene pool?

3. What does the line for variety A represent? B?

4. In what generations does the graph reach its highest point for variety A and B?

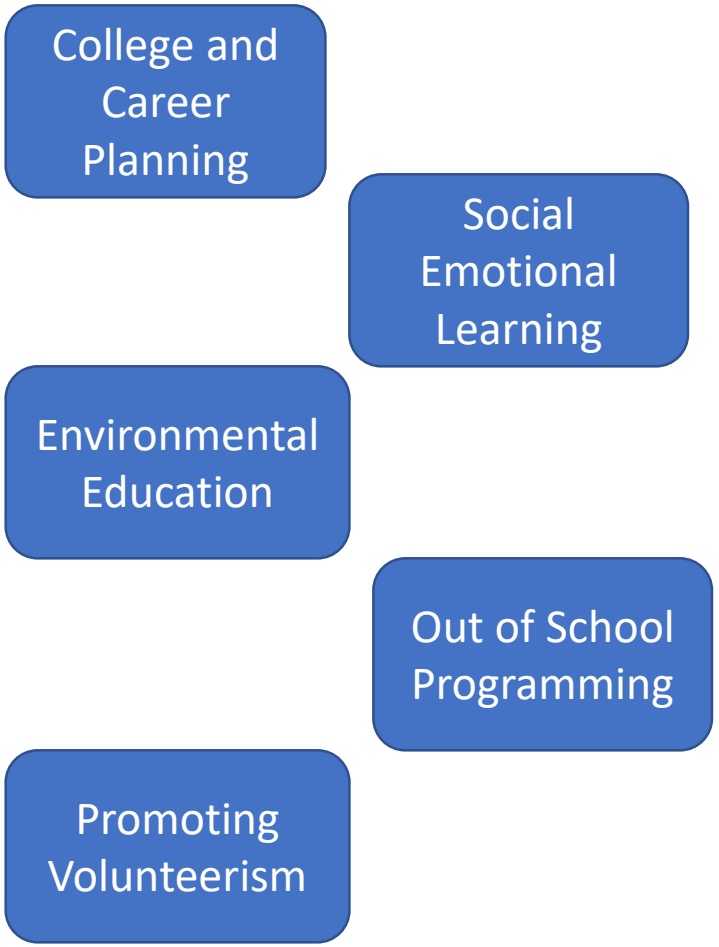
...w many species were fitted and survived for the environment in third generation for

How can Title IV A help you create these learning experiences?

The Student Support & Academic Enrichment (SSAE) program provides LEAs the flexibility to tailor investments **based on the needs** of their **unique student populations** for a variety of activities with the intent and purpose of improving student outcomes and/or addressing the opportunities gaps identified through the needs assessment.

Well-rounded Education

- Enriched curriculum and education experiences.
- Exploration and connection between students and subjects, curiosities and skills.
- Promote a diverse set of learning experiences across a variety of courses.



Effective Use of Technology

Supporting professional learning STEM/STEAM.

Provide funding for teachers to participate in virtual, blended, or face-to-face courses and workshops.

Intended to increase educator's capacity to offer high-quality STEM courses, such as computer science, engineering, game design and/or other STEM-related courses.

Opportunities to learn how to embed STEM elements, such as engineering design principles, computational thinking, and app design within other learning experiences can also be included.

Allowable Activities: Is this in your CLIP?

- ✓Is the proposed activities part of the locally developed plan based on results of the **need** assessment?
- ✓Is the proposed activity consistent with the purposes of one of the **three focus areas**?
- ✓Is the proposed activity **reasonable and necessary** for the performance of the grant?
- ✓Is the proposed activity **supplemental**?

Examples (Needs-based and Supplemental)

- Salaries
- **Substitutes**
- Stipends
- **Professional Training/Development**
- **Conferences**
- **Travel**
- **Contracted services**
- Resource materials
- Software
- Instructional/STE(A)M Coaches
- Field trips
- Transportation
- Supplies
- Train the trainer
- **Guest speakers**
- Duel Enrollment Activities
- AP testing for low income students
- **Direct serve professional services**

Using Title IV A for STE(A)M Professional Development

- School Visits
- Teacher Academies
- State of Georgia STEM/STEAM Leadership Cohort
- STEM/STEAM Georgia Forum held in Athens, GA (October)
- Registration coming soon: http://www.stemgeorgia.org/professional-development/

GaDOE Title IV A Experts

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Stay connected to STE(A)M

- **To join our listserv to receive email notices and updates from the GADOE STEM/STEAM program, please send an email with no message to the email address listed below.**

join-STEM-Georgia@list.doe.k12.ga.us

Stay connected to STE(A)M

- **STEM Georgia Online: http://stemgeorgia.org**

Enables users to find STEM resources, materials, links to STEM schools, grants, competitions, lesson plans, and more.

- **Follow us on Twitter: http://twitter.com/stemgeorgia**

@stemgeorgia enables users to receive tweets about STEM updates, grants, scholarships, workshops, information, articles, resources, and more.

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each and every child

in our state.

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