

What does computational thinking have to do with Appalachian ingenuity?

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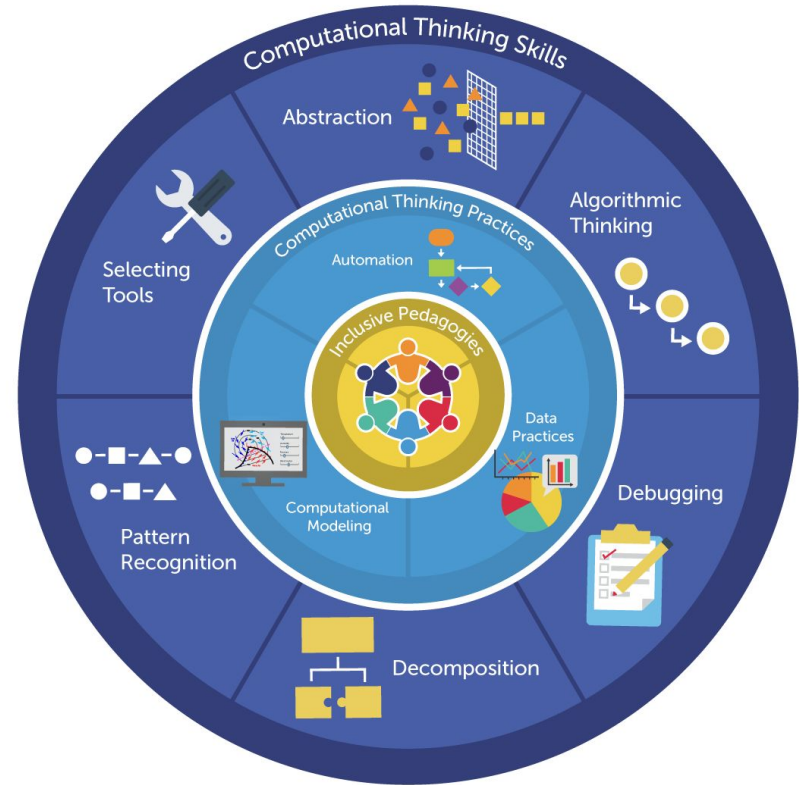


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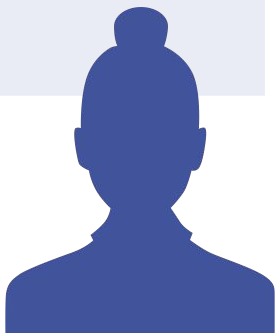
What is “Computational Thinking” (CT)?

Computational thinking is an interrelated set of skills and practices for solving complex problems, a way to learn topics in many disciplines, and a necessity for fully participating in a computational world.



What is computational thinking? - Teachers explain

*“Computational thinking is not a new theory—this is just a new name of a **problem solving approach that involves using innovative technology to assist** in the process.”*



*“Computational thinking is **being able to analyze, build and create steps in a process in order to generate new understandings**. This can entail collecting data, problem solving while building our understanding of various competencies.”*



*“Computational thinking is **problem solving steps that teach students perseverance through exploring and analyzing algorithms** to find solutions”*



Computational Thinking Pathways

Computational Thinking Pathways (CT Pathways) are system-wide, K-12 pathways supporting equitable participation in computational thinking that is consistent across classrooms, cumulative from year to year, and competency-based.



Computational Thinking Pathways



Consistent



Cumulative



**Competency-
Based**

Our Setting: Eastern KY



Kentucky Appalachia

- Eastern Kentucky (yellow)
- “Mountain people” (kinship, strong love of place, egalitarianism, independence, religious worldview, etc; Keefe 2005)
- Coal industry → computer science & entrepreneurship?
- Education leaders invited Digital Promise researchers to help design a K-8 Computational Thinking pathway
- Two NSF CSforAll Research Practice Partnerships (RPPs)



District visions (2020)

Our CSforALL *Vision*

We believe in CS because ALL students should possess competencies and skills to become citizens who recognize problems and create innovative solutions.

We believe in CS because All students have the opportunity to be competitive in today's global economy, demonstrate leadership and success, inspire innovative solutions, and grow and expand our region's workforce.

Our current “Why” - Connecting computing education with Appalachian Ingenuity

“Who are the community makers? Who are the creators? Even the historians? ... [T]he conversation about imparting that Appalachian ingenuity and how we capture and perpetuate that, for me is the biggest driver that has come out of what we’ve done in the past 3 years. It takes [computer science] from novelty to actual change, and it ties it directly to the people on the ground.”

Neil Arnett (Pikeville Independent School District)
reflecting on possible research questions for Drawing
on Kinship



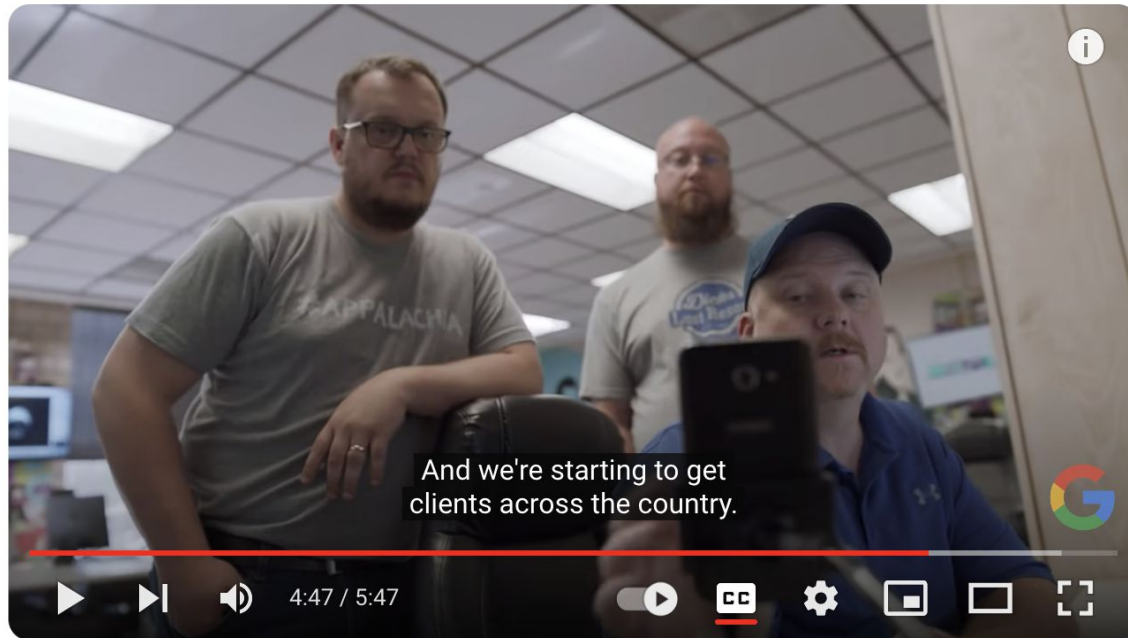
Why stories?

“The stories we tell ourselves about **ourselves** are equally as important as these other efforts. And so it's really important, ...that you're teaching **not the victim narrative** that we all hear – the put-upon narrative – **but [to teach] the possibility narrative.**”

(R. Justice, personal communication to Eastern KY teachers, Summer 2021)



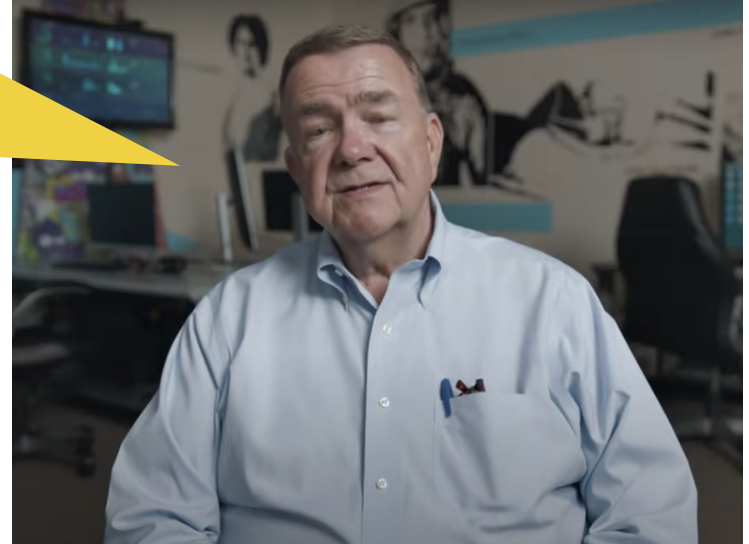
Iconic possibility narrative in E KY (2018)



Bit Source: Appalachian ingenuity

Lynn Parish - Co-Founder of Bit Source (software development company in Eastern Kentucky)

All the naysayers kept saying, “you can’t train coal miners to be able to code.” But hey, these guys have been working around tech their whole lives. And they’re **tough as nails**. We can do this.



Opportunities to learn stories of Appalachian Ingenuity

WHAT IS APPALACHIAN RETELLING?



- Digital**
Hosted on a website and including media such as videos, photos, essays, audio recordings, etc.
- Collaborative**
Includes media made by many different people. No need to be a professional storyteller to participate!
- Documentary**
Sharing true stories from your own life, or the lives of your family or community



Inspire talks from local innovators
(Summer 2021, 2022, 2023)



Civic Imagination workshop (Feb 2023)

Field trips to innovative companies
(Summer 2022, 2023)



Seeing students engage with innovators
and innovation (Summer 2023)

Purpose: What does computational thinking have to do with Appalachian ingenuity?

Research question

How, if at all, are computational thinking skills and practices present within stories of Appalachian Ingenuity, that are casually conveyed by teachers and innovators?

Methods

Brief Ingenuity Stories

- ☐ 18 teachers, 2 district leaders from Eastern Kentucky
- ☐ Physical object representing the history of Appalachian Ingenuity
- ☐ 1 - 10 minutes per story

Extended Ingenuity Stories

- ☐ 2-hour visit to local entrepreneur
- ☐ Interview conducted by two local educators

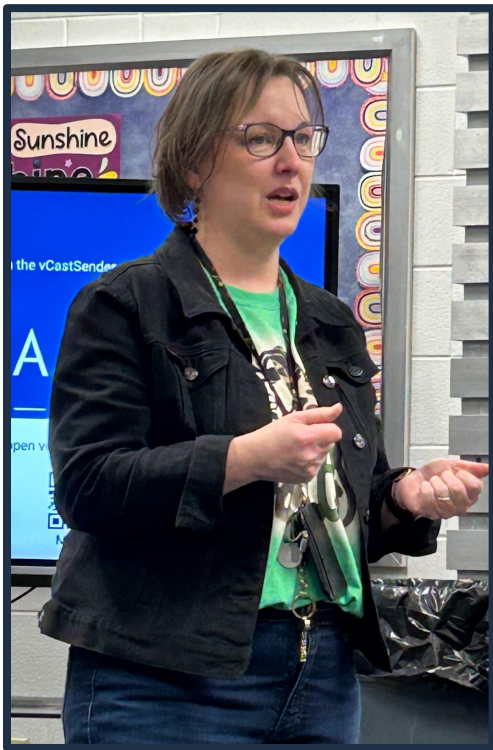
Methods

CT Skills	CT Practices	Appalachian Ingenuity
Abstraction	Automation	Perseverance
Algorithmic Thinking	Computational Modeling	Selflessness
Debugging	Data Practices	Collaboration
Decomposition		Resourcefulness
Pattern Recognition		Agency
Selecting Tools		



Elissa Settles

Elissa's father was an Eagle Scout and a Baptists Preacher. Elissa tells the story of her father using brown duct tape to recover his bible when it was falling apart and how her father created lanterns from candles and soft drink cans when they stayed out hiking too late in the woods.



Click on the icon to listen to the story!



Appalachian Ingenuity Themes in Brief Ingenuity Stories

Perseverance (1)

- ☐ [indirect] Relative had a “hard life,” working in coal mines since age 8, and built items out of necessity

Selflessness/Family (8)

- ☐ Quilting and sewing money often went to purchase necessities for the family
- ☐ Father created a make-shift lantern to protect children from snakes

Resourcefulness (6)

- ☐ Father made a cup holder from a paint can to mimic newer mowers
- ☐ Grandmother could make a 12 course meal out of nothing

Agency (1)

- ☐ [Indirect] When parents needed/wanted something, they took action to create it.

Slope Master



Appalachian Ingenuity Themes in Extended Ingenuity Stories

Perseverance (7)

- ☐ Developing a system to keep the tracks on, even on steep slopes.

Collaboration (2)

- ☐ Getting inspiration to build portable sawmills from a friend's idea.

Resourcefulness (4)

- ☐ Mower brings together existing electronics in a unique way.

Agency (1)

- ☐ Built a cart at age nine because he “want[ed] to go for it.”

Computational Thinking Themes in Extended Ingenuity Stories

Algorithmic Thinking (1)

- ☐ Creating a system between the different transmissions and the electronics to control the mower.

Debugging (6)

- ☐ Continuously improving the mower to make it stronger, wider, more usable and affordable.

Selecting Tools (1)

- ☐ Selecting the plasma table to cut metal plates for the mower.

Automation (2)

- ☐ Cutting grass by machine rather than by hand.
- ☐ Developing controls for multiple transmissions that are blended together to control direction.

What we learned

- CT concepts can connect to Appalachian Ingenuity, but the connections will not be obvious from brief and everyday ways stories are told.
- More work is needed to crosswalk and develop community-grounded terminology or definitions.
- It seems helpful to ask more questions about the process of ingenuity rather than just the artifact, because CT is a process.

Three next steps we've taken

1. “Appalachian Ingenuity Story 2-pagers” for students with CT connections (right)
2. Interview protocol for students to ask their elders about ingenuity and CT
3. Five reasons local ingenuity stories are important for K-8 education” (next page)

Lend A Hand

What is Lend A Hand?
Lend A Hand is an app that allows students to share safety information anonymously and administrators to share information with students. Students can report bullying, tobacco or drug use, or weapons concerns. Administrators get notices based on the level of threat.

What problem does Lend A Hand solve?
Bullying has a negative impact on students and school culture. Students often witness bullying but are worried about telling adults. The Lend A Hand app allows students to share what they know anonymously and aims to improve school culture and safety.

Why is Lend A Hand important for the community?
In addition to reporting issues of school safety, the app has evolved to also be a place where schools can share information with students. It is a great tool for students to have access about events happening in their community as well as a tool that helps keep them safe.

How is Lend A Hand an example of how people in Appalachia have solved important challenges?
This app was developed in collaboration with students in Pikeville schools and computer programmers at Bit Source, a local company that drives innovation within Eastern Kentucky. This is an example of local talented skilled professionals listening to the needs of local school students and staff.

What challenges in the community do you think students could help address?
Based on student feedback and use, the app added the school announcement feature to normalize use of the app. What other features do you think would encourage students to use the app? How could Bit Source encourage other schools to use the app? How would you spread the word?

Computational Thinking Connections

Automation
It was important to design the app to quickly send the student report to the correct school staff. Based on an algorithm, Lend A Hand automatically sends weapons reports to school security and administration or mental health concerns to school counselors.

Decomposition
The developers decomposed the app into smaller parts: the login process, the home screen, the reporting system, & the announcement system. By first focusing on these smaller parts it was then easier to solve the larger problem by putting the small parts together.

Pattern Recognition
When talking to students and staff, Mr. Adams and the developers identified trends in what types of threats would need to be reported (bullying, weapons, tobacco use, mental health). They used pattern recognition to identify the most common themes needed for the app.

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bit source

Digital Promise

Why Local Ingenuity Stories are Important for K-8 Education

- We want **examples of local problem-solving and innovation** that middle school students in Eastern KY might find interesting. These examples can inspire students to solve problems in their own lives and their communities.
- We're looking for **real-world challenges that are close-to-home** for middle school students in Eastern KY. We believe that these students have creativity and resourcefulness to help find solutions to these challenges.
- We are **curious about whether anything similar to (what we today call) computational thinking skills have been used in the community and its history**. Exploring this connection could provide helpful examples for students as they learn these skills themselves.
- We aim to **create a collection of resources that students and teachers** can easily access and use during project-based learning. These resources will provide guidance and support throughout their projects.
- We want to **develop storytelling models and methods for educators and students**. These models may encourage them to connect with their families and communities. They may also enhance student learning through community involvement, and inform community members about the interests and skills of today's students.

Thank you!

For more bit.ly/TANrefs



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