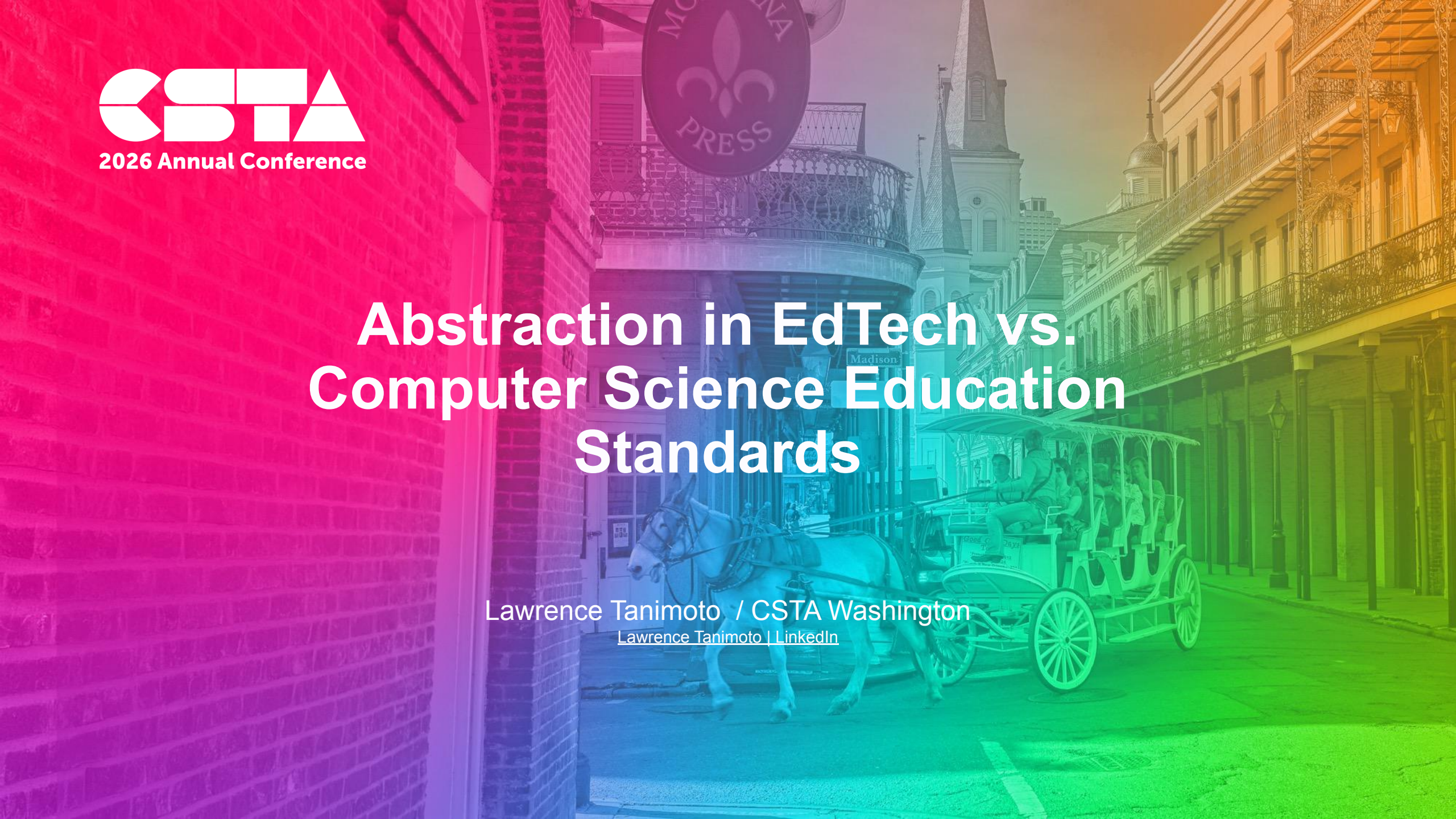


Abstraction in EdTech vs. Computer Science Education Standards

Lawrence Tanimoto / CSTA Washington
Lawrence Tanimoto | LinkedIn

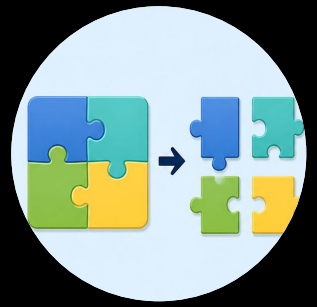
For the latest version of this presentation and related resources…

Visit the blog post on CSTAWA.org

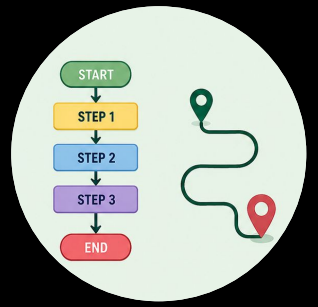
https://tinyurl.com/abstraction-edtech-vs-cs

Quick Audience Poll

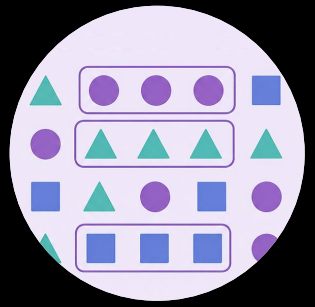
Of the four Computational Thinking concepts, which is the most difficult to teach?



Decomposition



Algorithms



Pattern Recognition

Abstraction

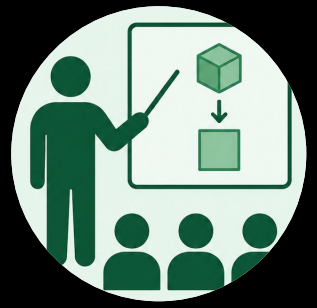
Elementary Teacher Survey Results

Number of teachers (n=20) self-reporting struggle with…

PATTERN RECOGNITION	DECOMPOSITION	ABSTRACTION	ALGORITHMS
0	1	**15**	1

Making Abstraction Concrete in the Elementary Classroom (SIGCSE 2024 Presentation (Hung, Vanderberg, Krause, Skuratowicz)

Quick Audience Poll



Do you feel that you teach abstraction in computer science well?

Do you feel that you understand abstraction in computer science well?

EDTECH VS. CS STANDARDS

CSTA K-12 CS Standards Progression Chart

Progression of Computer Science Teachers Association (CSTA) K-12 Computer Science Standards, Revised 2017

Concept	Subconcept	Level 1A (Ages 5-7) *By the end of Grade 2, students will be able to...*	Level 1B (Ages 8-11) *By the end of Grade 5, students will be able to...*	Level 2 (Ages 11-14) *By the end of Grade 8, students will be able to...*	Level 3A (Ages 14-16) *By the end of Grade 10, students will be able to...*
Computing Systems	Devices	**1A-CS-01** Select and operate appropriate software to perform a variety of tasks, and recognize that users have different needs and preferences for the technology they use. *(P1.1)*	**1B-CS-01** Describe how internal and external parts of computing devices function to form a system. *(P7.2)*	**2-CS-01** Recommend improvements to the design of computing devices, based on an analysis of how users interact with the devices. *(P3.3)*	**3A-CS-01** Explain how abstractions hide the underlying implementation details of computing systems embedded in everyday objects. *(P4.1)*
	Hardware & Software	**1A-CS-02** Use appropriate terminology in identifying and describing the function of common physical components of computing systems (hardware). *(P7.2)*	**1B-CS-02** Model how computer hardware and software work together as a system to accomplish tasks. *(P4.4)*	**2-CS-02** Design projects that combine hardware and software components to collect and exchange data. *(P5.1)*	**3A-CS-02** Compare levels of abstraction and interactions between application software, system software, and hardware layers. *(P4.1)*
	Troubleshooting	**1A-CS-03** Describe basic hardware and software problems using accurate terminology. *(P6.2, P7.2)*	**1B-CS-03** Determine potential solutions to solve simple hardware and software problems using common troubleshooting strategies. *(P6.2)*	**2-CS-03** Systematically identify and fix problems with computing devices and their components. *(P6.2)*	**3A-CS-03** Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors. *(P6.2)*
Networks & The Internet	Network Communication & Organization		**1B-NI-04** Model how information is broken down into smaller pieces, transmitted as packets through multiple devices over networks and the Internet, and reassembled at the destination. *(P4.4)*	**2-NI-04** Model the role of protocols in transmitting data across networks and the Internet. *(P4.4)*	**3A-NI-04** Evaluate the scalability and reliability of networks, by describing the relationship between routers, switches, servers, topology, and addressing. *(P4.1)*
	Cybersecurity	**1A-NI-04** Explain what passwords are and why we use them, and use strong passwords to protect devices and information from unauthorized access. *(P7.3)*	**1B-NI-05** Discuss real-world cybersecurity problems and how personal information can be protected. *(P3.1)*	**2-NI-05** Explain how physical and digital security measures protect electronic information. *(P7.2)*	**3A-NI-05** Give examples to illustrate how sensitive data can be affected by malware and other attacks. *(P7.2)*
				2-NI-06 Apply multiple methods of encryption to model the secure transmission of information. *(P4.4)*	**3A-NI-06** Recommend security measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts. *(P3.3)*
					3A-NI-07 Compare various security measures, considering tradeoffs between the usability and security of a computing system. *(P6.3)*
					3A-NI-08 Explain tradeoffs when selecting and implementing cybersecurity recommendations. *(P7.2)*
Data & Analysis	Storage	**1A-DA-05** Store, copy, search, retrieve, modify, and delete information using a computing device and define the information stored as data. *(P4.2)*	*Continuation of standard 1A-DA-05*	**2-DA-07** Represent data using multiple encoding schemes. *(P4.0)*	**3A-DA-09** Translate between different bit representations of real-world phenomena, such as characters, numbers, and images. *(P4.1)*
					3A-DA-10 Evaluate the tradeoffs in how data elements are organized and where data is stored. *(P3.3)*
	Collection, Visualization, & Transformation	**1A-DA-06** Collect and present the same data in various visual formats. *(P7.1, P4.4)*	**1B-DA-06** Organize and present collected data visually to highlight relationships and support a claim. *(P7.1)*	**2-DA-08** Collect data using computational tools and transform the data to make it more useful and reliable. *(P6.3)*	**3A-DA-11** Create interactive data visualizations using software tools to help others better understand real-world phenomena. *(P4.4)*
	Inference & Models	**1A-DA-07** Identify and describe patterns in data visualizations, such as charts or graphs, to make predictions. *(P4.1)*	**1B-DA-07** Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea. *(P7.1)*	**2-DA-09** Refine computational models based on the data they have generated. *(P5.3, P4.4)*	**3A-DA-12** Create computational models that represent the relationships among different elements of data collected from a phenomenon or process. *(P4.4)*
Algorithms & Programming	Algorithms	**1A-AP-08** Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks. *(P4.4)*	**1B-AP-08** Compare and refine multiple algorithms for the same task and determine which is the most appropriate. *(P6.3, P3.3)*	**2-AP-10** Use flowcharts and/or pseudocode to address complex problems as algorithms. *(P4.4, P4.1)*	**3A-AP-13** Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests. *(P5.2)*
	Variables	**1A-AP-09** Model the way programs store and manipulate data by using numbers or other symbols to represent information. *(P4.4)*	**1B-AP-09** Create programs that use variables to store and modify data. *(P5.2)*	**2-AP-11** Create clearly named variables that represent different data types and perform operations on their values. *(P5.1, P5.2)*	**3A-AP-14** Use lists to simplify solutions, generalizing computational problems instead of repeatedly using simple variables. *(P4.1)*
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Practices		*P1. Fostering an Inclusive Computing Culture* *P2. Collaborating Around Computing*	*P3. Recognizing and Defining Computational Problems* *P4. Developing and Using Abstractions*	*P5. Creating Computational Artifacts* *P6. Testing and Refining Computational Artifacts*	*P7. Communicating About Computing*

The above link is invalid (06/11/2026)

CS Standards Covered By EdTech Standards

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Excel Link | PDF Link

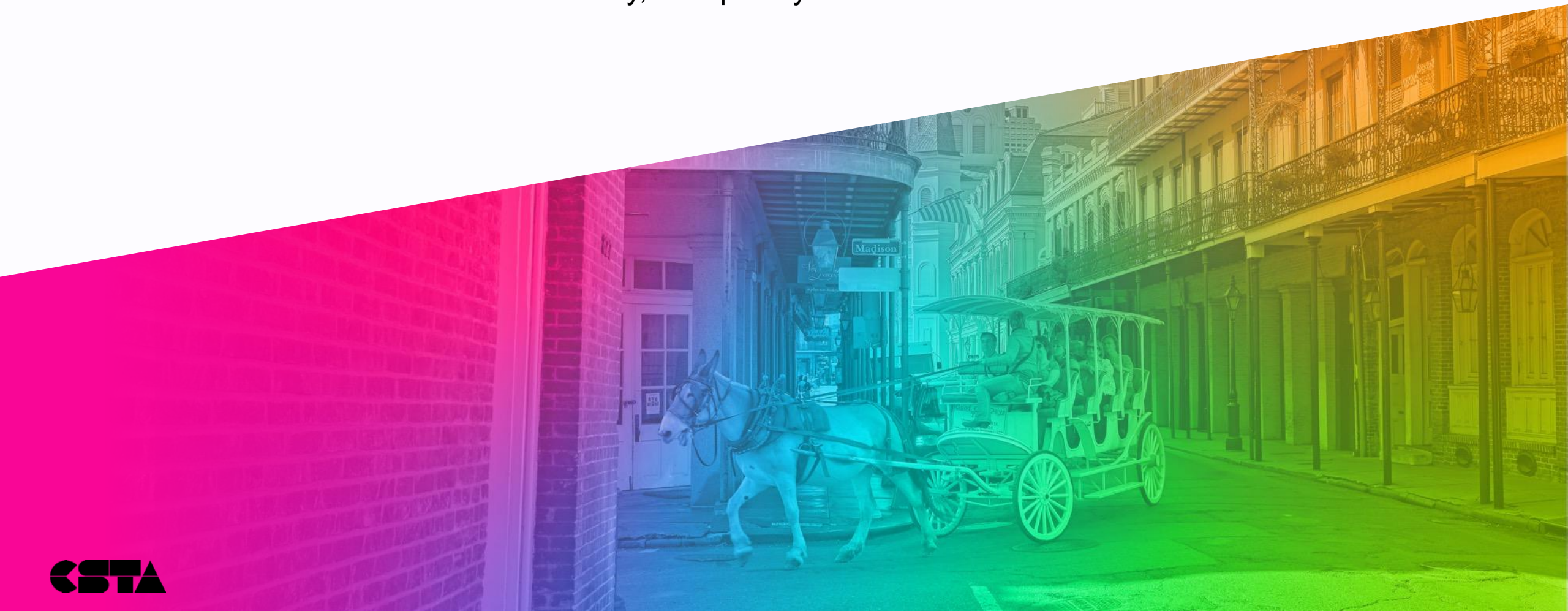
Missing Subconcepts

- **Variables (including Lists)**
- Storage
- Culture

Variables are a key Abstraction idea!

It’s All About Abstraction

Actually, multiple layers of abstraction



CSTA

Why Abstraction Matters

Every modern computing system runs on layers of abstraction

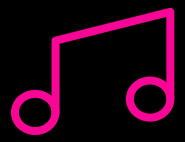
Without abstraction, modern software would be impossible

Each layer hides terrifying complexity below it

Without teaching abstraction, AI becomes magic

"Any sufficiently advanced technology is indistinguishable from magic."

– Arthur C. Clark



Abstraction is the key to turning **Magic** into **Knowledge**.

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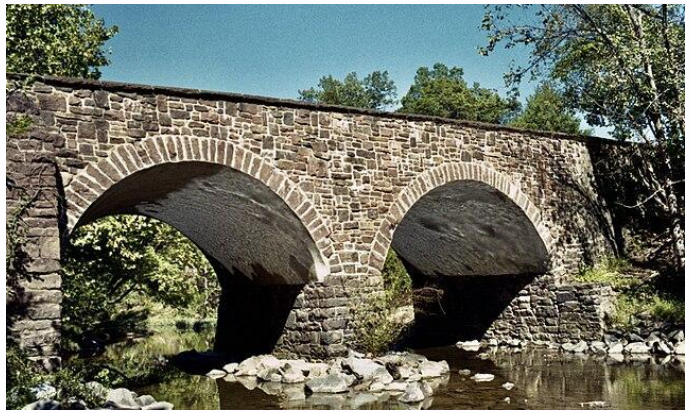
The Bridge of Abstraction



Abstraction helps explain

- why all students need to learn some computer science, but
- not everyone needs to major in it.

Abstraction in CS provides the literacy between

- math - precise but lacks context, and
- natural language - provides context but is imprecise

Abstraction provides the bridge language between

- humans - who often know what they want to do - even if they can't do it well, and
- computers - which don't know what they want to do but do it incredibly well if given the correct instructions.

EdTech Mostly Lives At The Top Layer of Abstraction

- Top layer: using apps
- Computer science asks HOW layers work.
- Each layer in itself is not that complicated, but building upon multiple layers of abstraction makes magic happen
- Students deserve both
- Digital literacy alone is not CS

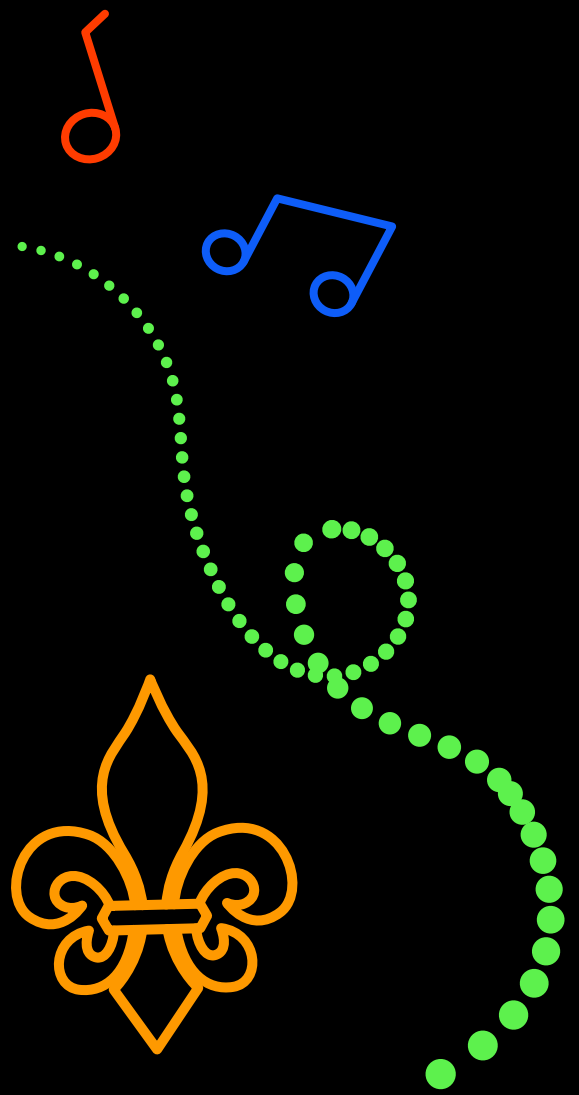
To better understand abstraction and how layers of abstraction make the computing world possible…

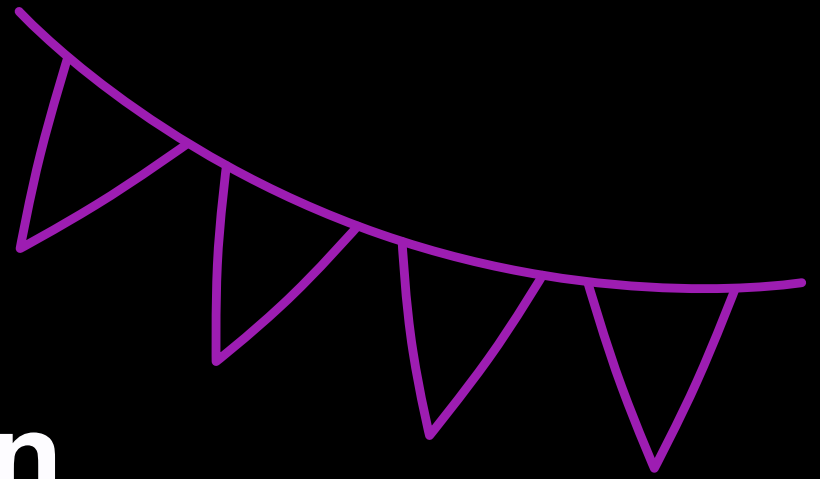
See the video on CSTAWA.org

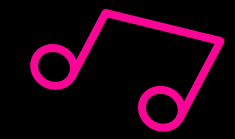
https://tinyurl.com/abstraction-edtech-vs-cs

Thank You!

This presentation was created for use at







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2026 Annual Conference