# Computational Thinking Overview

CIRCL Webinar Series

Webinar 1

January 30, 2018

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# CL• A Network to Amplify Impact of Technology-
# hanced Learning

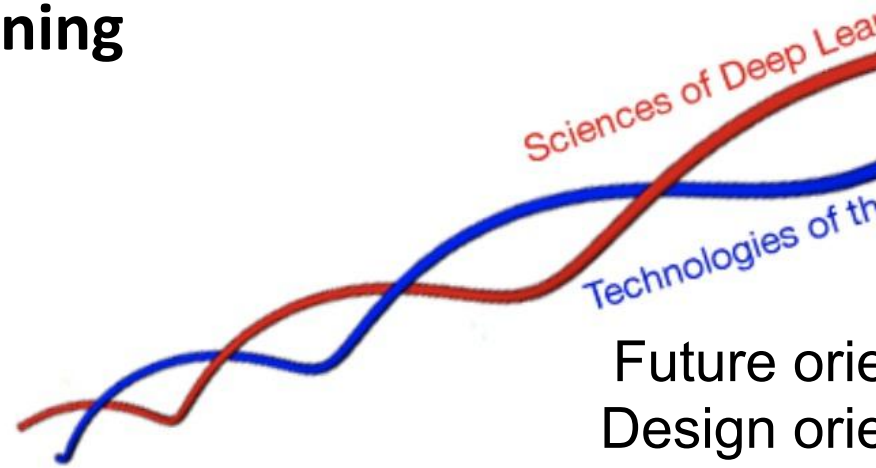
**Center for Innovative Research in Cyberlearning**

s to amplify research-based voices by:

dressing common needs and new directions

ding relationships & nurturing communities

ating broader impact together




Future orie
Design orie
Equity orie
Community orie

CIRCL is a partnership between:

Digital Promise
Accelerating Innovation in Education

SRI Education

Learning

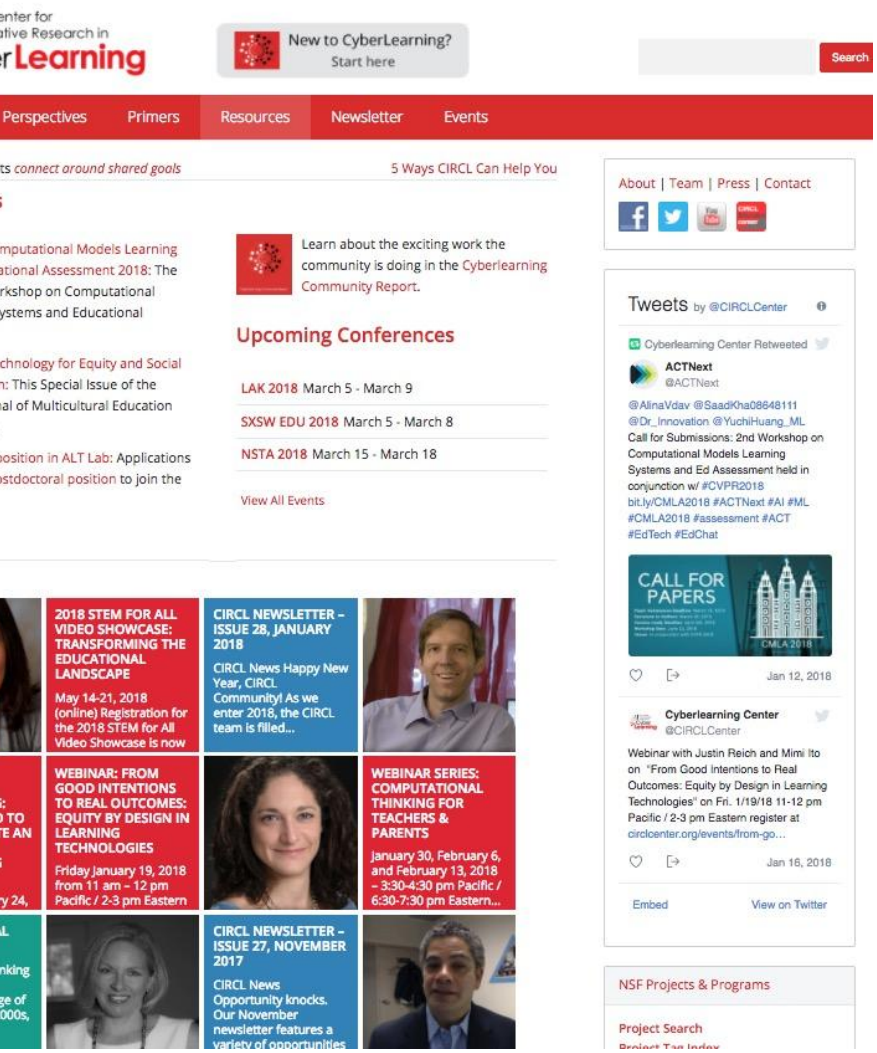
EDC Learning transforms lives.

NORC at the UNIVERSITY of CHICAGO

NSF

Funded by grants
IIS-1441631,

# CL• Connect, Collaborate, Create




Learning

## Meet Tammy Clegg

Back to Pers

*CIRCL perspectives offer a window into the different worlds of various stakeholders in the cyberlearning co*
*— what drives their work, what they need to be successful, and what they think the community should be*
*Share your perspective.*

Tammy Clegg is a Learning Scientist and an Assistant Professor
College of Education and the iSchool at the University of Maryla
receiving her PhD at Georgia Tech working with Janet Kolodner,
conducted a post-doc at the University of Maryland in Participa
Design with Allison Druin, and is now a faculty member at the s
University. Her interests are in developing technology to suppo
relevant learning environments, participatory design with childr

*(Read*
*interview, which took place January 27, 2015*

CyberLearning The Educators' Corner

### Computational Thinking Webinar

1/4/2018

0 COMMENTS

**By Pati Ruiz, Sarah Hampton, Riley Leary, Judi Fusco, and Patti Schank**

For the last few months, we've been reading, thinking, and talking about computational thinking (CT) in preparation for three Webinars for Teachers and Parents on the topic. The webinars are on January 30, February 6, and February 13. Go to the link above to sign up for the webinar and get all the details.

CIRCL Educators' corner

circleducators.org

# CL• Primers, Projects, Designs Themes

S

s are brief summaries of key topics in the field of cyberlearning. They are used to build capacity
nd to give people a sense of cyberlearning's main themes. Primers are developed by small teams
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to write or contribute to a primer? Learn how.

| | | | |
|---|---|---|---|
| IONAL<br>nal thinking that a surge of the 2000s, | **SPEECH TECHNOLOGIES AND LEARNING**<br>The classroom learning environment is filled with speech in all forms —classroom discourse has notably been called... | **DATA SCIENCE EDUCATION**<br>Data Science is an interdisciplinary field that seeks to derive insights and knowledge from the analysis... | **PERSISTENCE IN EDUCATION**<br>Perseverance has become part of the everyday language of education. The misconception that intellectual power alone... |
| ENCE<br>ce is the ublic and n in earch or loration... | **REMOTE LABS**<br>Labs are widely considered to be essential to learning science and engineering. Remote labs can overcome... | **LOOKING AHEAD: TRENDS THAT WILL SHAPE CYBERLEARNING**<br>This primer organizes two dozen current trends that we feel are most relevant into five categories:... | **SMART AND CONNECTED COMMUNITIES FOR LEARNING**<br>Smart and connected communities for learning (SCCL) leverage networks and technology to foster |
| CENTERED<br>ntered CD for the art of nd turns it | **UNDERSTANDING UNIVERSAL DESIGN FOR LEARNING**<br>UDL is a research-based framework intended to guide the design of learning technologies that are accessible... | **THE CUTTING EDGE OF INFORMAL LEARNING: MAKERS, MOBILE, AND MORE!**<br>Cyberlearning spans in-school and out-of-school learning -- and these days, a lot of meaningful learning is... | **GAMES AND VIRTUAL WORLDS**<br>Computer-based games and virtual worlds provide opportunities for players to think about choices, take action, and... |
| G FOR CREASING | **TECHNOLOGY ENABLED FORMATIVE** | **COLLABORATIVE LEARNING** | **EDUCATIONAL DATA MINING AND** |

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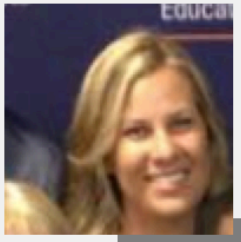
# Computational Thinking Series Overview

- Overview: computational thinking (CT)?
- CT Terms
- Why is CT important?



## Episode 2

- Teacher Episode
- Interpreting relationships in data using graphs

## Episode 3

- Parent Episode
- What activities can parents do support CT development at home?

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# AGENDA

I. What is Computational Thinking?
II. Background
III. CT Skills
IV. Why these are important skills and dispositions to develop to be good citizens?
V. What to expect in the rest of the series.

# Computational Thinking

There are some variations on the definition of CT, but we will focus on this one:

> Computational thinking (CT) is the range of processes that help people learn by engaging the power of computing to set up and solve problems and automate a broad range of processes.


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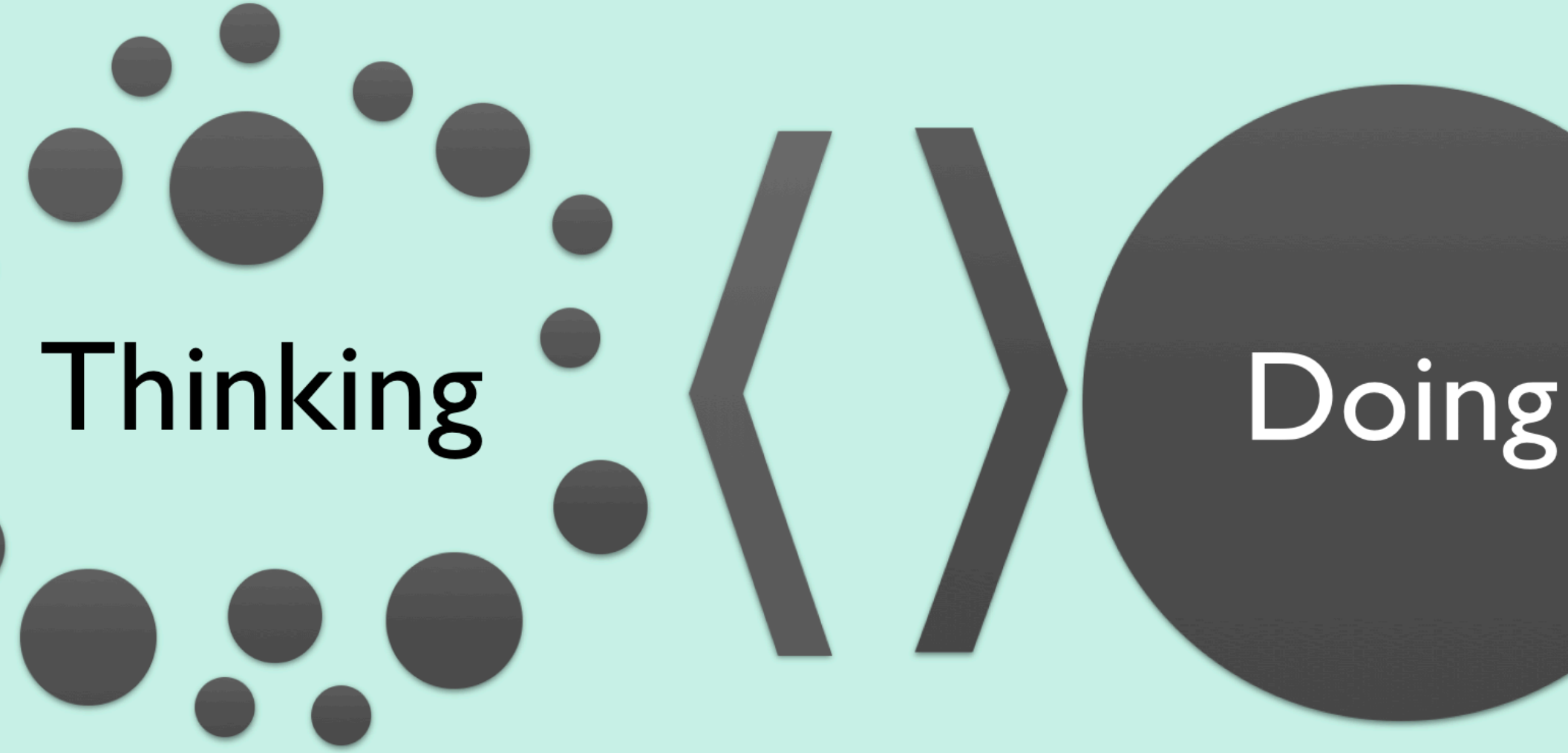
# Computational Thinking - CT

- 1980 - Seymour Papert
- 2006 – Jeannette Wing
- 2010 – Jan Cuny, Larry Snyder, and Jeannette M. Wing

"Computational thinking is the thought processes involved in formulating problems and their solutions so that the solutions are represented in a form that can be effectively carried out by an information-processing agent."

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# A Bit of History

1953 – The Human Computers of NASA

# 1955 – Computing Group

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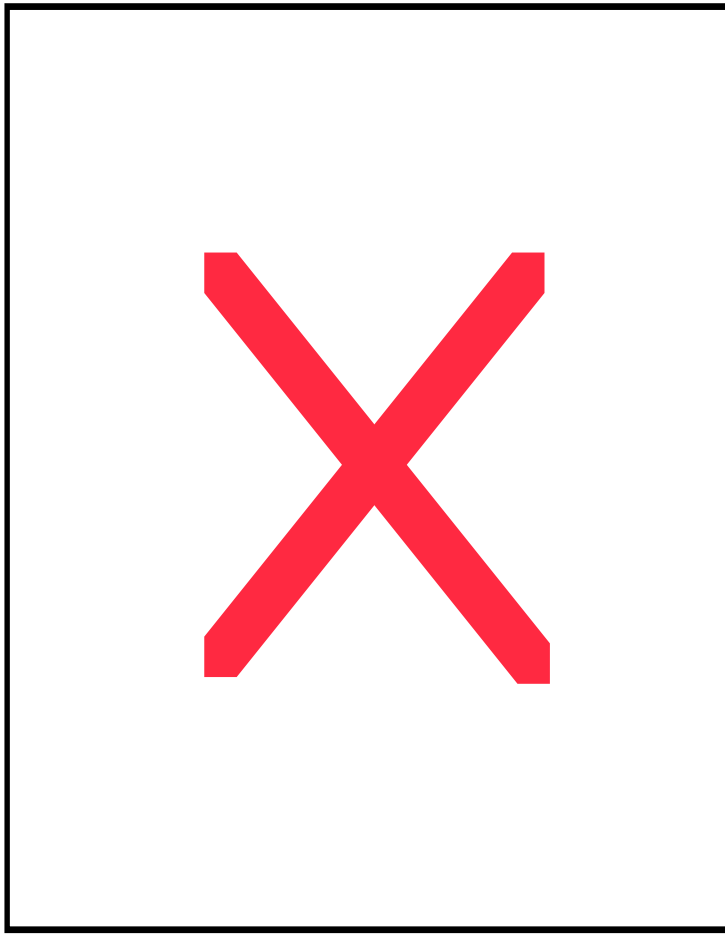
# 1952 - Grace Hoppe



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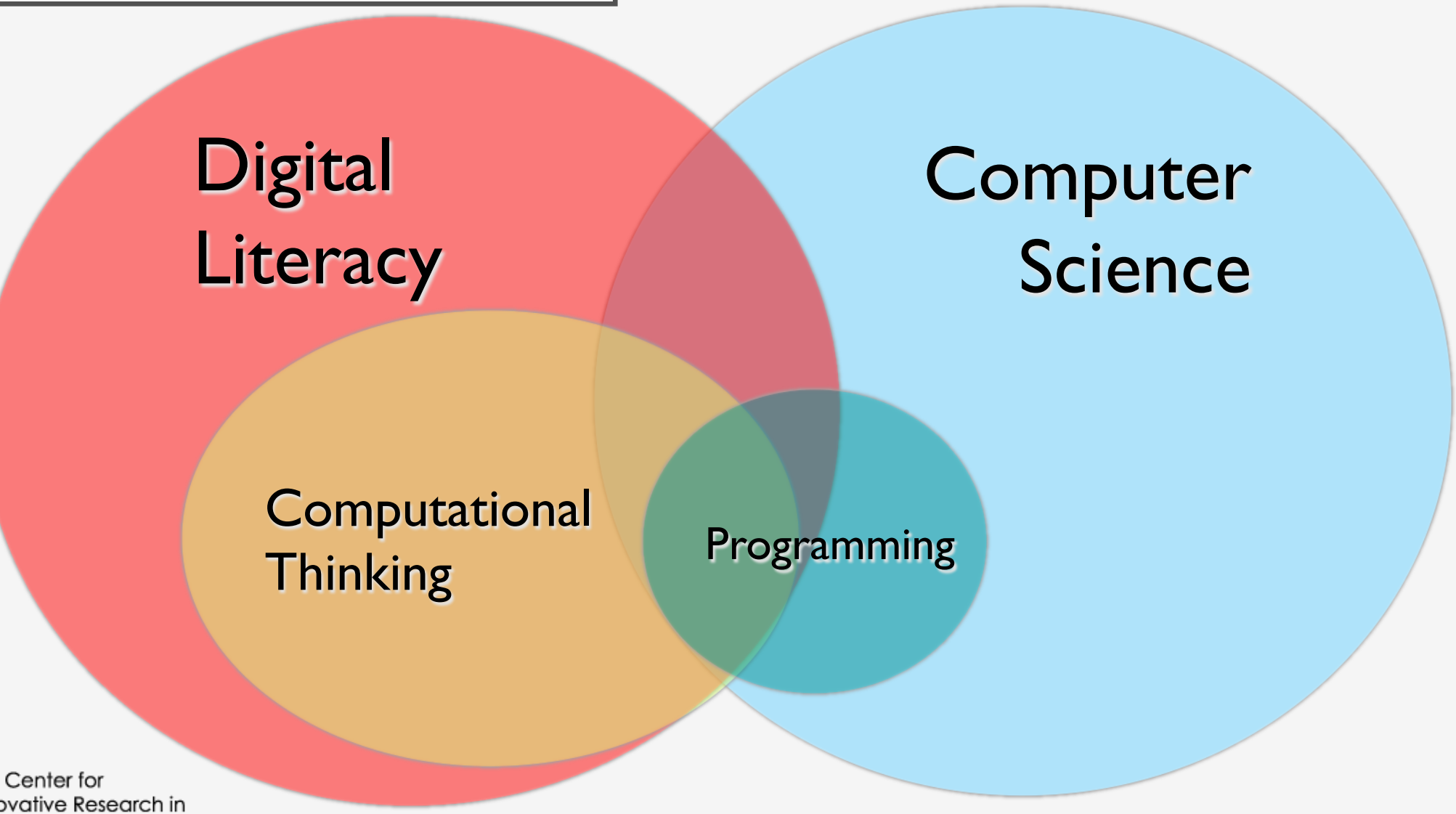
COMPUTING THE FUTURE

# here does computational thinking fit in?

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# Computational Thinking

Computational thinking (CT) is the range of processes that help people learn by engaging the power of computing to set up and solve problems and automate a broad range of processes.

# Computational Thinking

- Programming is one way to practice computational thinking skills but it is not the only way do develop these skills.
- Computers and other technologies support the development of CT skills, but are not always essential.

# Computational Thinking Skills

Problem Decomposition

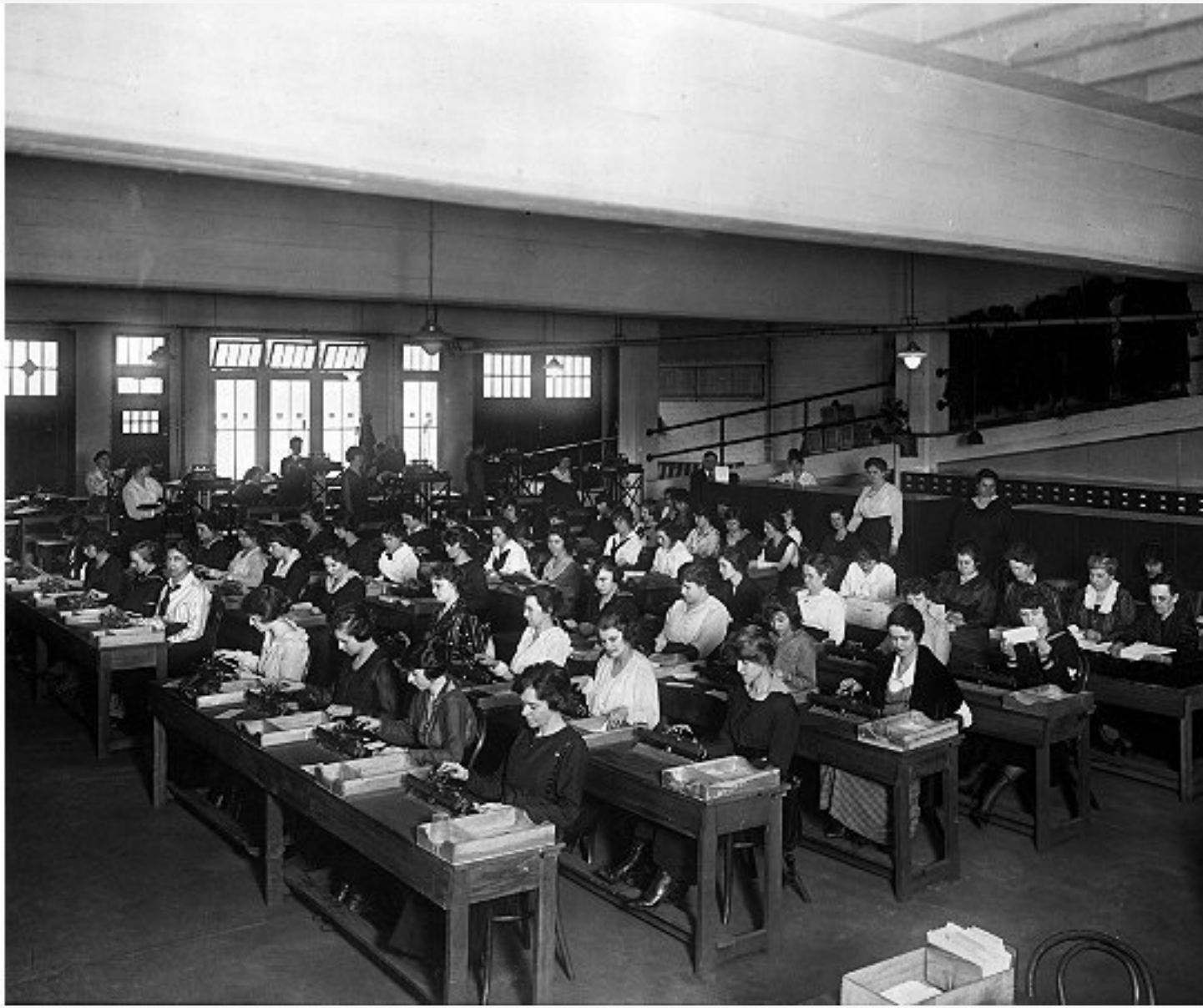
Abstraction

Pattern Recognition

Algorithm

# Problem
# ecomposition

omposing large
plex tasks into
manageable
dular subtasks.



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## Abstraction

efining multiple
ers of a problem
understanding the
onship among the
layers.

Yo camino a la escue
Ella camina a la escue
Nosotros caminamos a la escue

## Abstraction

efining multiple
ers of a problem
understanding the
onship among the
layers.

Nosotros caminamos a la escue

Ellos caminan

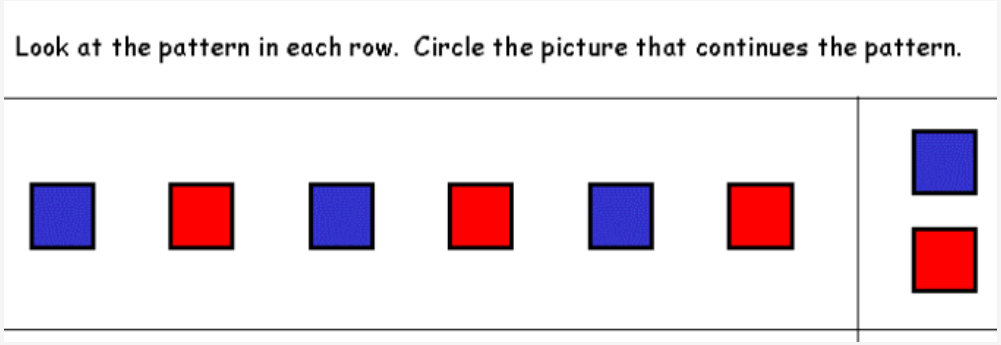
Yo caminé

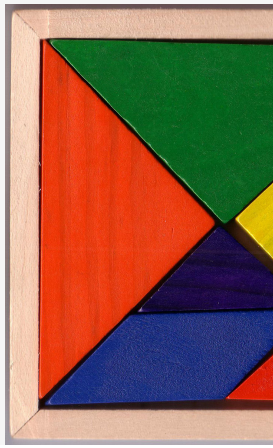
Tú caminas

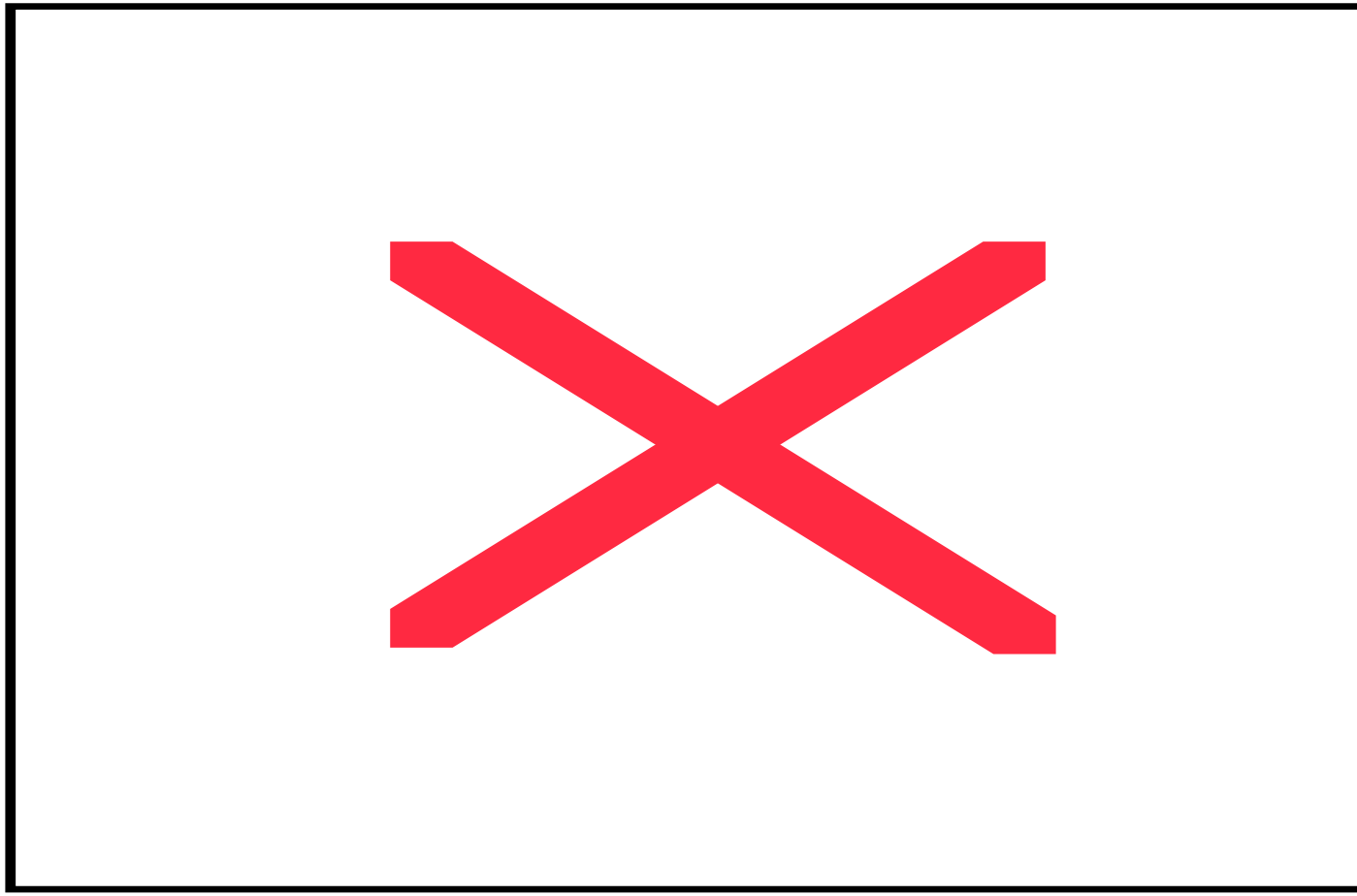
_____ _____ a la escuel

ern Recognition

tively developing
solutions and
ystematically
detecting and
rrecting errors.





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# Algorithms

nulating problems
at their solutions
be represented as
putational steps.

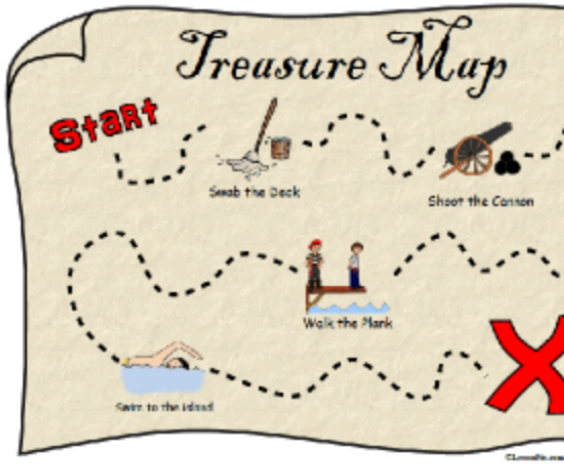
## Treasure Map

Treasure Map can be used to create a map of a sequence to follow. This materials allows 2 to 4 pictures to sequence. You can choose a parchment paper style or plain background (to save ink).

The Treasure Map is a materials that can be used in many ways and for many different types of lessons. Here are a few examples:

- Create a Map to follow to find a special treasure
- Create a Map to follow a character's path within a story.
  - Map the 3 Pigs Homes for the Wolf to follow.


  - Map the items Goldilocks used: Bowls, Chairs, and Beds
  - Map the travels of the Gingerbread Man
- Follow the map of specific tasks to earn a reward.

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# Computational Thinking Skills

Problem Decomposition

Abstraction

Pattern Recognition

Algorithm

# Computational Thinking Dispositions

- Confidence in dealing with complexity
- Persistence in working with difficult problems
- Tolerance for ambiguity
- The ability to deal with open-ended problems
- The ability to communicate and work with others to achieve a common goal or solution

# CT is…

Formulating problems in a way that enables us to use a computer and other tools to help solve them

Logically organizing and analyzing data

Representing data through abstractions such as models and simulations

Automating solutions through algorithmic thinking (a series of ordered steps)

Identifying, analyzing, and implementing possible solutions with the goal of achieving the most efficient and effective combination of steps and resources

Generalizing and transferring this problem-solving process to a wide variety of problems

# Computational Thinking

Computational thinking (CT) is the range of processes that help people learn by engaging the power of computing to set up and solve problems and automate a broad range of processes.

# What's Next

- How do you begin to put this in your classroom?
- How can you do this with your children?

# Thank You!

# Questions