Coding as a Developmental Playground: Computational Thinking and Robotics

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What technologies in your life are playgrounds and which ones are playpens?
Many technologies for children are playpens
Our choice
Positive Technological Development (PTD)
Positive Technological Development (PTD) Framework

Assets

Caring
Connection
Contribution
Competence
Confidence
Character

Behaviors

Communication
Collaboration
Community Building
Content Creation
Creativity
Choices of Conduct

Classroom Practice

• Tech Circle
• Storytelling Projects
• Collaboration Web
• Whole-Class Projects
• Open House
• Community Experts
• Design Process
• Engineering Journals
• Final Projects
• See, Think, Wonder
• Expertise Badges
• Ethical Design Process

Personal development trajectory within a sociocultural context
Why coding?
Seymour Papert, MIT
LOGO turtle
1967
Sweden's government is about to introduce coding in schools – from first grade

Government launches digital strategy to get children coding

CODeLLA Aims to Teach Latina Girls Another Vital Language: Coding

Computer Coding Academy Launches In Center City

As Tech Booms, Workers
1,000,000 more jobs than students by 2020

$500 billion opportunity

1.4 million computing jobs

400,000 computer science students
• Coding as playground

• Coding as literacy
Coding is a new literacy

Literacy empowers people

- New ways of thinking
- New ways of expression
- New ways of communication
Tools

Java

ScratchJr
(in collaboration with Mitch Resnick, MIT Media Lab)

KIBO robot

Projects funded by the National Science Foundation
NSF DRL-1118897 & NSF DRL-1118664 and the Scratch Foundation
Jumping frog

Scratch

ScratchJr
ScratchJr User Analytics:  
Jan. 2016 – March 2019

Top 10 countries

1. United States (34%)
2. United Kingdom (12%)
3. Australia (8%)
4. Canada (6%)
5. Sweden (4%)
6. France (3%)
7. China (3%)
8. Spain (3%)
9. Netherlands (2%)
10. Japan (2%)

- Over 10.9 million users since 2014 launch
- 37 million projects created
- 49 million times projects are revised
- 473 registered languages

PBS KIDS ScratchJr over 600,000 downloads

Only country with no ScratchJr usage is North Korea
ScratchJr Maryland
Jan. 2016 – March 2019

53,547 total users

Top Five Cities:
- Baltimore: 4,996
- Bethesda: 3,367
- Salisbury: 3,258
- Silver Spring: 3,258
- Rockville: 2,933

Total sessions: 248,000
<table>
<thead>
<tr>
<th>Category</th>
<th>View in ScratchJr</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triggering Blocks</td>
<td><img src="image" alt="Image" /></td>
<td>Start a program</td>
</tr>
<tr>
<td>Motion Blocks</td>
<td><img src="image" alt="Image" /></td>
<td>Move characters</td>
</tr>
<tr>
<td>Looks Blocks</td>
<td><img src="image" alt="Image" /></td>
<td>Change characters’ appearance</td>
</tr>
<tr>
<td>Sound Blocks</td>
<td><img src="image" alt="Image" /></td>
<td>Play or record sound</td>
</tr>
<tr>
<td>Control Blocks</td>
<td><img src="image" alt="Image" /></td>
<td>Control parts of a program</td>
</tr>
<tr>
<td>End Blocks</td>
<td><img src="image" alt="Image" /></td>
<td>End a program</td>
</tr>
</tbody>
</table>
KIBO
Let's Play together!
THE VERY HUNGRY CATERPILLAR

by Eric Carle
GEOMETRY ART!

Program Kibo to draw shapes on our shapes mural! Try some of the following:

- Circle 〇
- Triangle △
- Lines —

Or create your own!
KIBO is in 54 countries
KIBO in Singapore
KIBO in Argentina

INTEC is putting KIBO in every kindergarten in the city of Buenos Aires

PENSAMIENTO COMPUTACIONAL... ¡CON ROBOTS!

ne que hacer. Cada bloque de madera contiene un código de barras que Kibo lee y ejecuta.
How?
Working on Hokey-Pokey sequence
Learning by designing

TEST & IMPROVE
CREATE
ASK
IMAGINE
SHARE
PLAN
Learning by designing

1. Plan
2. Draft
3. Plan
4. Prewrite
5. Edit
6. Improve
7. Share
8. Publish
9. Revise
10. Create
11. Ask
12. IMAG
What ?
Powerful ideas from computer science

1. Algorithms
2. Modularization
3. Control structures
4. Representation
5. Design process
6. Debugging
7. Hardware/software

...
Why young children?
Returns to a Unit Dollar Invested*

Coding as a literacy

I've always considered "programming" to be a neologism, and I'm not sure if I can still call it by it, lest I be an old guy."

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P.S. This is the first book I remember ever reading in my father's house in College. Madison, Ohio.

I purchased it, without the intention to buy, for you. Who had no money, and to which I

of the house. Made up, the face of it. I read the book within. First, but when Jackson was a candidate in 1803 for the Presidency, I offered him a vote for Adams. I joined with the rest of...
Coding as a literacy of the XXI century

• The ability to use a symbol system and a technological tool to comprehend and express ideas.
Coding promotes abstract, logical thinking and engages in problem solving

Computational Thinking
Useful for everyone
Coding as a literacy of the XXI century

- It changes our thinking and enables civic participation.
Facebook Is Changing. What Does That Mean for Your News Feed?

What Do Social Media Algorithms Mean For You?

AJ Agrawal, CONTRIBUTOR

Social media algorithms are what all social media platforms run on these days. They have led to a lot of changes to social media, and not always desired ones. If you are going to take advantage of social media, you understand:

Taking the threeTwitter, and Instagram, you what these:

Net Neutrality

Net Neutrality

How Net Neutrality Actually Ended Long Before This Week

The internet was supposed to operate outside communications monopolies. Now it is run by giants — and net neutrality didn’t stand a chance, our tech columnist says.

By FARRIAD MANOOC
June 30, 2016

Net Neutrality Has Officially Been Repealed. Here’s How That Could Affect You.

Net Neutrality rules that mandated internet service providers to
Coding as STEM

Coding as a language
Coding as Another Language (CAL) Curriculum

**KIBO CODING CURRICULUM**

**A KIBO Coding Curriculum for Emergent Readers**

Unit For Emergent Readers

12 lessons incorporating *There Was an Old Lady Who Swallowed a Fly* by Simms Taback.

Building on emerging literacy skills, this unit was created with emergent readers in mind.

**A KIBO Coding Curriculum for Readers**

Unit For Readers

12 lessons incorporating *Where the Wild Things Are* by Maurice Sendak.

Building on early literacy skills, this unit was created with early readers in mind.

**SCRATCHJR CODING CURRICULUM**

**A ScratchJr Coding Curriculum for Emergent Readers**

Unit For Emergent Readers

12 lessons incorporating *Knuffle Bunny* by Mo Willems.

Building on emerging literacy skills, this unit was created with emergent readers in mind.

**A ScratchJr Coding Curriculum for Readers**

Unit For Readers

12 lessons incorporating *Giraffes Can’t Dance* by Giles Andreae and Guy Parker-Rees.

Building on early literacy skills, this unit was created with early readers in mind.
Coding as Literacy (CAL)

What are the relationships between learning to read and write and learning to code?

What are the fundamental shared cognitive mechanisms?

How can our pedagogical approaches to literacy impact our teaching of computational thinking and coding and vice versa?
Brain imaging studies
What happens in the brain when kids program?

If coding is a literacy, would the language brain regions activate while programming?
The cognitive and neural mechanisms of computer programming in young children: storytelling or solving puzzles?

PI Marina Bers (Tufts); co-Pi Ev Fedorenko (MIT/MGH)
Classroom studies
What is the impact of CAL on coding, developing computational thinking, and improving literacy?

If coding is a new literacy, would literacy scores improve?
CAL @ Norfolk, Virginia

- Virginia is the first state to mandate the teaching of CS.
- Pilot with 8 schools
- 65% teachers have 10+ years teaching experience
The CAL KIBO curriculum @ Norfolk

- CAL integrates literacy and coding
- 12 one hour lessons
- Lessons align with Common Core Literacy standards and K-12 CS frameworks
Which of these programs will make KIBO shake after it hears a clap?

Which is the correct order to scan program blocks?

What comes next?

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SOLVE-ITS

CROSS SECTIONAL CODING ABILITY ASSESSMENT

TACTIC

SUMMATIVE CODING AND CT ABILITY ASSESSMENT

TECH CHECK

LONGITUDINAL CT AND PROBLEM SOLVING ASSESSMENT

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pals™

PHONOLOGICAL AWARENESS LITERACY SCREENING

DRA2™

Design Journal

Lesson 4: Pokey Pokey Reflections

Use the KIBO stickers to write your Pokey Pokey program here. Make sure the blocks are in the right order!
Looking for sites as research partners
PROFESSIONAL DEVELOPMENT

July 9th – July 12
9am – 3pm

Open to educators and practitioners working with young children pre-K through second grade. The PD is divided in content (option to sign up per day or all days).

- **July 9**: Hands-on introduction to ScratchJr
- **July 10**: Curriculum and integration ScratchJr
- **July 11**: Hands-on introduction to KIBO
- **July 12**: Curriculum and integration of KIBO

For more information and to register: http://bit.ly/devtechPD
Early Childhood Technology (ECT) Graduate Certificate Program

Online & in-person graduate courses & certification for educators and practitioners working with young children in pre-kindergarten through second grade

Virtual Open House: December 8th at 4:00PM EST

with Associate Director Dr. Amanda Sullivan

Questions?

http://www.tufts.edu/~mbers01/

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