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How Much Digital Literacy Do Students Need?

Expert Presenters:

Bennett Brown, director of instruction for computer science, Project Lead The Way

Paul Barnwell, English and digital media teacher, Fern Creek Traditional High School, Louisville, Ky.
An on-demand archive of this webinar will be available at www.edweek.org/go/webinar in less than 24 hrs.
Digital Literacy
What Content, When, and Why?
CSTA Standards

Strands

- Computational Thinking
- Collaboration
- Computing Practice & Programming
- Computers and Communications Devices
- Community Global, and Ethical Impacts

Grade bands
K-3 / 3-6 / 6-9 / 9-12

Computer Science Teachers Association (CSTA)
Association for Computing Machinery (ACM)
ISTE Standards for Students

Strands
1. Creativity and innovation
2. Communication and collaboration
3. Research and information fluency
4. Critical thinking, problem solving, and decision making
5. Technology operations and concepts
6. Digital citizenship
# CSE Framework, Course-wide

## Understandings

<table>
<thead>
<tr>
<th>Creativity</th>
<th>Abstraction</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1.01 - Computing fosters creative expression, sometimes resulting in artif...</td>
<td>U2.01 - Binary sequences represent digital data</td>
<td>U3.01 - Data can be structured to facilitate use</td>
</tr>
<tr>
<td>U1.02 - Computational artifacts can be evaluated</td>
<td>U2.02 - Computing relies on layers of abstraction in software</td>
<td>U3.02 - Our capabilities to collect, store, and process data are changing at a...</td>
</tr>
<tr>
<td>U1.03 - Programming is a creative endeavor</td>
<td>U2.03 - Computing relies on abstractions of hardware represented with software</td>
<td>U3.03 - Analysis of data can be automated</td>
</tr>
<tr>
<td></td>
<td>U2.04 - Abstraction allows for simple utilization of other people's code</td>
<td>U3.04 - Data visualizations are important tools for discovering and communicating...</td>
</tr>
<tr>
<td></td>
<td>U2.05 - Solutions to complex problems can be encapsulated in reusable code</td>
<td>U3.05 - The human brain and today's computers have complementary strengths</td>
</tr>
<tr>
<td></td>
<td>U2.06 - The solution to one problem can be applied to another seemingly unrelated problem by finding and reusing a pattern</td>
<td>U3.06 - The size of a data set affects how the data can be used</td>
</tr>
<tr>
<td></td>
<td>U2.07 - Simulation and modeling can help us understand, communicate about, and predict phenomena</td>
<td>U3.07 - Collecting and managing data raises technical issues regarding storage, privacy, and security</td>
</tr>
<tr>
<td></td>
<td>U2.08 - Physical systems, like sound or biological molecules, have both digital and analog elements</td>
<td>U3.08 - Informed ethical and civic participation is essential for the responsible use of technology</td>
</tr>
<tr>
<td></td>
<td>U2.09 - Intelligent behavior emerges from networked collections of simple artificial behavior</td>
<td>U3.09 - Data can be used to make predictions about the future and to inform society's decisions</td>
</tr>
</tbody>
</table>

## Skills

## Knowledge

PLTW Computer Science
What Content?

Computational Thinking = Critical Thinking + Computation
Student teams create solutions to problems

- Creative expression
- Safe and effective use of Internet
- Collect, visualize, analyze, communicate data
- Model and simulate
- Create and adapt software
Why CS in All Grades?

Labor shortage
Members of technological society
Conceptual groundwork
Equity
Need K-12 CS to Fill Labor Pipeline

Openings vs. Graduates

1.4 million

Number of computer specialist job openings expected in U.S. by 2018

29%

Percentage of these that could possibly be filled by U.S. computing graduates

Source: NCWIT (2009). Women and Information Technology By the Numbers
Need K-12 CS to Fill Labor Pipeline
Need K-12 CS to Fill Labor Pipeline

Imagine:
- No K-8 life science
- No universal 9-12 life science
- Only one life science elective at HS

How many kids would be interested in biology, medicine?
Need K-12 CS to Fill Labor Pipeline

Percent of 2012 ACT-Tested High School Graduates with Career Interests and Projected 2020 Annual Job Openings by Career Field

Need K-12 CS to Fill Labor Pipeline

Data from research.collegeboard.com
Need K-12 CS for Societal Participation

Troubleshooting
Safety
Use
Understanding artifacts
Need K-12 CS for Concept Building

Engaging fundamentals at early, developmentally appropriate ages allows rich content in high school.

What if high school mathematics had to begin with lessons on place value and arithmetic?

Most coders began before high school.
Unplugged Concept Building
Need K-12 CS for Equity

• Students identify interests early
• Elective approach unacceptable
Why CS in All Grades?

Labor shortage
Members of technological society
Conceptual groundwork
Equity
About Learning.com

4.9 MILLION STUDENTS
50 states
16 countries
2,700 districts

15 YEARS
Founded in 1999
Headquartered in Portland, Oregon

25 AWARDS
Nationally recognized for excellence.
Today’s students love technology.
But to prepare for tomorrow’s success, they need to be able to use technology to develop 21st century skills.
Defining 21st Century Skills

**Creativity and Innovation**
- brainstorm; develop new ideas; demonstrate creative thinking

**Communication and Collaboration**
- listen effectively; articulate thoughts and ideas; work with others

**Research and Information Fluency**
- gather, evaluate, and use information; select the right information for the task

**Critical Thinking and Problem Solving**
- plan and conduct research; solve problems; make informed decisions

**Digital Citizenship**
- practice safe and ethical online behavior; understand cultural and societal issues related to technology

**Technology Operations and Concepts**
- understand how to use technology systems safely, effectively, and productively

http://www.iste.org/docs/pdfs/20-14_ISTE_Standards-S_PDF.pdf
We provide digital learning solutions.

Our curriculum and assessments make it easy to integrate 21st century skills into the everyday classroom.
A Local Case: Digital Literacy Implementation

Mr. Paul Barnwell
Fern Creek High School
Louisville, KY
“Don't be afraid to expand what classrooms are and can be.”

Paul Barnwell
Jefferson County Public Schools, KY
Catalysts for Course Creation

• Graduate school experiences—"Emerging New Literacies" and other courses
• Review of Common Core State Standards
• Howard Rheingold’s *Net Smart: How to Thrive Online*
• Leisure/Distraction paradigm.
We Will Be Replacing the Material Index & Simplifying Content

In an effort to make it easier for users to create and organize content and simplifying the process for content creation. Update your course now.

Update Course Learn More

DSM Spring 2014: Section 1
Fern Creek Traditional High School

This course was archived on Aug 18, 2014. It will be deleted in 30 days.

Materials

Add Materials Options

Attention and Mindfulness

Digital Footprint/Who am I online?

Digital Curation

Crap Detection

Access Code
56FVJ-3SBFM

Reset
1. Real World Application

The gap between what students do with their phones/devices and what they *could do* is striking in schools, and the gap will only grow unless we fully embrace the ubiquity of digital connectivity in all of our lives.
2. Digital Footprints/Personas

If a Google Search can bolster a modern resume, then why not teach students to the skills to help manage and create a positive online footprint?
About 571 results (0.59 seconds)

Courtney Ellis | Navajo Kentuckians
navajokentuckians.com/tag/courtney-ellis/
Mar 22, 2013 - Posts about Courtney Ellis written by foodlit209. ... The relationship between the Navajo Nation and Fern Creek High School ...

Day 2- Part Two- Lunch at Window Rock High School ...
navajokentuckians.com/.../day-2-part-two-lunch-at-window-rock-high-sch...
Mar 22, 2013 - Many Fern Creek students were... ... The relationship between the Navajo Nation and Fern Creek High ... Photos courtesy of Courtney Ellis ...

Courtney Ellis Photography
courtneyellisphotography.com/ ▼
Apr 6, 2014 - Louisville wedding photographer Courtney Ellis. Share this: Share this page via Email Share this page via Stumble Upon Share this page via ...

Courtney Ellis' (Louisville, KY) High School Timeline ...
www.maxpreps.com/athlete/courtney-ellis/7z8Sc.../default.htm ▼
Courtney Ellis' high school sports timeline. MaxPreps has events and updates about Courtney Ellis while she was playing soccer at Fern Creek High School ...
3. Multitasking/Mindfulness

With evidence mounting against the efficacy of multitasking—and anecdotal evidence swamping we educators, it’s foolish to avoid deliberately challenging the students to resist multitasking. If we desire for students to thrive the digital world, they must be taught and practice mindfulness and sustained attention.
4. Information Literacy

One of the most empowering elements of social and digital media is the opportunity to learn anything, anytime, anywhere.
Vox @voxdotcom · 2h
Slow-moving lava is threatening to engulf a town in Hawaii: vox.com/e/6842842?utm_

Thomas Sauer retweeted
VisitLEX KY @BigLexKY · 3h
"Kentucky is the Real America," by Lain Campbell @DailyMirror bit.ly/1yFRwOv
#ShareTheLex

Erica Peterson @ericampeterson · 2h
More testing needed at homes near Lees Lane Landfill, after chemicals found in crawl spaces wfpl.org/post/8-homes-n_

TeachThought @TeachThought · 2h
A Neurologist Makes the Case for the Video Game Model as a Learning Tool: edut.to/1snt4AH via @edutopia & @judywillis
Challenges

• Without a foundation in traditional literacy skills, students struggle mightily with productive digital lit. usage.

• Skill and implementation gap between at-risk students and more affluent students.

• Teacher expertise and willingness in implementation.

• Accountability pressure.
Questions:

• Should Digital and Social Media Literacy be a required, stand-alone course? Or should skills be integrated into other content areas? Or both?

• What are “essential” skills with regards to digital literacy in ever-changing technology landscape?
PLTW Approach to Digital Literacy

Student teams create solutions to problems

- Creative expression
- Safe and effective use of Internet
- Collect, visualize, analyze, communicate data
- Model and simulate
- Create and adapt software
Discuss Broad Meaning

- Computational Thinking
- Computer Science
- Coding
- Information Technology
- Digital Literacy
- Technology Enhanced Learning
Equity Strategies
PLTW CS Pathway

- Launch (K-6)
- Gateway (6-8)
- Introduction to Computer Science (9)
- Computer Science & Software Engineering
- Computer Science Applications
  - Simulation & Modeling
  - Cybersecurity
  - Artificial Intelligence
- Capstone
Some Tools for K-8 CS
CSE Curriculum Framework

Computing…

- Enables **creativity**
- Relies on **abstraction**
- Enables **data** collection and analysis
- Relies on **algorithms**
- Relies on **programming**
- Enables the **Internet**
- **Impacts** society
- Enables and requires **collaboration**
- Is needed in all **careers**
Teacher-ready materials

Day-by-Day Plans

Time: 8 days

Activity 2.3.1 - The Vulnerable User (2 days)
(U7.02, U7.07, U9.03, U6.04, U6.05, U6.06, U6.07) (K6.1 S6.11, S2.06, S6.06, S6.07, S6.04)

Activity 2.3.2 - Security by Encryption (1 day)
(U4.02, U4.01, U4.04, U5.04, U6.07) (K3.04, K3.03, K6.1 (S2.06)

Activity 2.3.3 - World Security, World Democracy (2 days)
(U7.07, U7.04, U7.01, U3.08, U3.07, U6.03, U6.06) (K6.0 (S7.02, S6.08, S6.07)

Project 2.3.4 - The Heist (3 days)
(U4.01, U5.04, U5.01, U5.03, U8.02, U6.07) (K9.01, K9.0, K6.12)

Day 3:
- Present 2.3.2 Complexity.pptx. An additional practice activity is provided for students who are interested in further activities.
- Circulate as students work on Activity 2.3.3. Ask how you will handle the optional Safety and Security video.  Steps 20-25 and conclusion questions can be used as desired. Steps 21, 23, and 25 can be done in class.

Day 4:
- Review and discuss student work from Step 12 in which they compared and contrasted how students understand the relationships among the concepts.
- Introduce Activity 2.3.3 World Security. Begin a class discussion to collect all group responses.
Student-ready materials

Activity 2.3.2 Security by Encryption

Introduction
Data and processing power should only be available to people who are authorized to access them. But how does a computer know who someone is? A user proves her identity with a password, but an eavesdropper can capture a password en route.

Ultimately, cybersecurity depends on encryption, and encryption depends on mathematics—on one-way mathematical functions. One-way functions are functions that are faster to do than to undo—so much faster that it is impractical to undo them. Cybersecurity comes down to speed. Systems are secure because it would take a malicious hacker "forever" to break in.

Why can’t we depend on secret passwords? Why is time the anchor of cybersecurity?

Materials
- Computer with Canopy distribution of Python®
- 2.3.2 Source files

Procedure
1. Form pairs as directed by your teacher. Meet or greet each other to practice professional skills. Review the class expectations for Engineering notebooks or electronic documents for written work.

19. Repeat Steps 13-16, but use the following data as inputs. Record the following steps.

<table>
<thead>
<tr>
<th>Input data</th>
<th># Input digits</th>
<th>Time t (10,000 digits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>n</td>
<td>Algorithm A</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>317</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3167</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>33769</td>
<td>5</td>
<td>(too slow)</td>
</tr>
<tr>
<td>321983</td>
<td>6</td>
<td>(too slow)</td>
</tr>
<tr>
<td>3221983</td>
<td>6</td>
<td>(too slow)</td>
</tr>
<tr>
<td>33149399</td>
<td></td>
<td>(too slow)</td>
</tr>
</tbody>
</table>

a. (Like Step 15) Execute efficiency_with_mins.py to have the computer to determine whether the numbers in the column from the table above are prime. Record the time it takes for each algorithm.

b. (Like Step 16) According to what pattern does the runtime of Algorithm A increase with the number of input characters?
<table>
<thead>
<tr>
<th></th>
<th>Creativity</th>
<th>Abstraction</th>
<th>Data</th>
<th>Algorithms</th>
<th>Programming</th>
<th>Internet</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1.1 Algorithms and Agile Development</td>
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<td>L1.2 Mobile App Design</td>
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<td>L1.3 Images and Object-Oriented Libraries</td>
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<td>L1.4 GUIs in Python</td>
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<tr>
<td>L2.1 The Internet and the Web</td>
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<tr>
<td>L2.2 Shopping and Social on the Web</td>
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<tr>
<td>L2.3 Security and Cryptography</td>
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<tr>
<td>L3.1 Visualizing Data</td>
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<tr>
<td>L3.2 Discovering Knowledge in Data</td>
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<tr>
<td>L4.1 Intelligent Machines</td>
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<tr>
<td>L4.2 Interpreting Simulations</td>
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</table>
Activity 2.3.3 Security and Liberty

Introduction

Balancing security with liberty has been a challenge for thousands of years. People want to be safe and be assured that other people follow the laws of the land. But people also want to be free to do as they wish and to be unafraid of being attacked for having their own opinions and personality. The Internet and the global nature of computing offer opportunities for both security and liberty.

In what ways can computing improve the safety of our society? In what ways can computing increase our liberty and our ability to preserve democracy? Will both security and liberty increase because of computing, or will one overtake the other? Can computing help us balance these two principles?

13. In each Unit of this course, you will investigate particular aspects of the impact of computing on society. In each Unit, you will have the option of completing a short essay or a longer research performance task. You should complete the longer research performance task in at least one of the four units.

Find one or more articles referenced in the ACM TechNews archive, http://technews.acm.org/archives.cfm, about the impact of a computing innovation on law enforcement, privacy, or democracy. Read the summaries from the ACM TechNews as well as the original articles referenced. Complete one of the following two options, as directed by your teacher. Use APA-style citations to correctly reference the articles.

a. Short Essay. Write a short essay that expresses each of the following:

   - Your understanding of the computing innovation.
   - The impact on people of the computing innovation.
   - The potential for beneficial and harmful effects of the computing innovation.

b. Research Performance Task.

   i. Create an artifact (music, an image, a video, informative artwork, a web page, a program, a presentation, etc.) that expresses each of the following:

      - Your understanding of the computing innovation.
      - The impact on people of the computing innovation.
      - The potential for beneficial and harmful effects of the computing innovation.

   ii. Write an essay to accompany your artifact that answers the following questions.

      - How does the computing innovation impact people, including both benefit and harm?
      - How does your artifact express this impact?
Computational Thinking

• Formulating problems so that computation can help solve them
• Logically organizing and analyzing data
• Generalizing solutions to problems and patterns in data
• Automating solutions with an algorithm
• Analyzing solutions for efficiency
• Understand, predict, and communicate with a model/simulation
CSE Lesson 1.1: Algorithms in Scratch

Press, tap, or hold the space bar!

Welcome to PLTW's CSE Pilot! See inside for more directions...

mit.scratch.edu from MIT Media Lab's Lifelong Kindergarten Group
CSE Lesson 1.2: Algorithms with Android
CSE Lesson 1.3: Algorithms in Python

<table>
<thead>
<tr>
<th>Partner's Action</th>
<th>Your Action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Collude</td>
</tr>
<tr>
<td>Betray</td>
<td>Released 0 pts</td>
</tr>
<tr>
<td>Collude</td>
<td>Severe Punishment -500 pts</td>
</tr>
</tbody>
</table>
CSE Unit 2: The Internet and the Web

Your Results:

Search the art database using the fields below.

First Name

Last Name
Standards Mapping Example: Grade 2 Data and Information

- **CCSS.Math.Content.2.MD.D.10**
  Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.

- **CSTA.CT-1A.3 Algorithms**: Understand how to arrange information into useful order, such as sorting students by birthdate without a computer.
Launch CS: Next Gen Science Standards Examples

• **K-2-ETS1-1**
  Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

• **K-2-ETS1-3**
  Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

**NGSS 8 Practices of Science and Engineering:**

• 1. Asking questions (for science) and **defining problems** (for engineering)
• 2. Developing and using **models**
• 3. Planning and carrying out investigations
• 4. Analyzing and interpreting **data**
• 5. **Using mathematics and computational thinking**
• 6. Constructing explanations (for science) and **designing solutions** (for engineering)
• 7. Engaging in argument from evidence
• 8. Obtaining, evaluating, and communicating **information**
Standards Mapping Example: Grade 5

Launch CS Grade 5 project:
Build a simulation by programming the rules and constraints of a real-world system. Students develop understanding that the computer can run the simulation many times, much faster and more efficiently than a human could.

- **CSTA.CT-1B.4 Modeling and Simulation**: Describe how a simulation can be used to solve a problem.
  - Molecules moving across a membrane
  - Predator and Prey
  - Coin Toss Probability
Example of detailed standards for Computational Thinking

**Level 1:6**
- 1:6-1. Understand and use the basic steps in algorithmic problem solving.
- 1:6-2. Develop a simple understanding of an algorithm using computer-free exercises.
- 1:6-3. Demonstrate how a string of bits can be used to represent alphanumerical information.

**Level 1:3**
- 1:3-1. Use technology resources (e.g., puzzles, logical thinking programs) to solve age-appropriate problems.
- 1:3-2. Use writing tools, digital cameras, and drawing tools to illustrate thoughts, ideas, and stories in a step by step manner.
- 1:3-3. Understand how to arrange information into useful order, such as sorting students by birthdate, without a computer.
- 1:3-4. Recognize that software is created to control computer operations.
- 1:3-5. Demonstrate how 0s and 1s can be used to represent information.

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Problem solving  
Algorithm  
Data representation
CSTA Standards Excerpt

Level 2

2-1. Exhibit legal and ethical behaviors when using information and technology and discuss the consequences of misuse.
2-2. Demonstrate knowledge of changes in information technologies over time and the effects those changes may have on education, the workplace, and society.
2-3. Analyze the positive and negative impacts of computing on human culture.
2-4. Evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources concerning real-world problems.

Level 1:6

1:6-1. Discuss basic issues related to responsible use of technology and information, and the consequences of inappropriate use.
1:6-2. Identify the impact of technology (e.g., social networking, cyberbullying, mobile and web technologies, cybersecurity, and virtualization) on personal life and society.
1:6-3. Evaluate the accuracy, relevance, appropriateness, comprehensiveness, and biases that occur in electronic information sources.

Level 1:3

1:3-1. Practice responsible digital citizenship in the use of technology systems and software.

Responsible use

Impacts of technology

Information accuracy

PLTW Computer Science
Enrolled Students vs. AP CS Test Takers

National School Enrollment and APCS Exam Participation by Race and Gender

- Enrollment
- APCS Exams

85%

- 1.3% 0.5%
- 5%
- 23%
- 17%
- 19%
- 6%
- 57%
- 67%
- 49%
- 15%
- 51%

American Indian
Asian
Black
Latino
White
Female
Male

https://csta.acm.org/Advocacy_Outreach/sub/PresentationFiles/NGCPConPres.pdf
Challenges We Help Address
Today’s Districts Face Unique Challenges

• Preparing for PARCC and Smarter Balanced
• Teaching digital literacy skills
• Moving to project-based learning
• Organizing and managing digital content
• Implementing BYOD/1:1 programs
Our Solutions
EasyTech

A K-8 digital literacy curriculum that provides self-paced, interactive lessons to help students develop core technology skills, including keyboarding and online safety.
Inquiry

A 21st century skills curriculum for grades K-8 that takes a project-based approach to integrating technology into core instruction.
Digital Citizenship App

Provides middle and high school students with instruction on online safety, ethical use of digital resources, and cyberbullying.
21st Century Skills Assessment

Measures student mastery of 21st century skills. It provides insight to help pinpoint skill gaps and identify teaching strategies.
WayFind

Uses performance-based and multiple-choice questions to measure teachers’ 21st century instructional skills.
• Single searchable content repository

• Tools to help districts build and share custom curriculum

• Ability to assign curriculum to students

• Single sign-on functionality
Educator Services

Implementation and Training
Professional Development
Customer Support
Thank You!
An on-demand archive of this webinar will be available at www.edweek.org/go/webinar in less than 24 hrs.
How Much Digital Literacy Do Students Need?

Required Reading from *Education Week*:

**Spotlight on Digital Literacy in the Common-Core Era**
As states and districts plan for the Common Core State Standards, educators are left to wonder how digital literacy fits into the standards. This Spotlight focuses on how to incorporate digital literacy, explores public-private efforts to close the digital-skills gap, and looks at competency-based and technology-driven programs attempting to give students a head start on common-core assessments.