Session 6L:

Lightning Talks Session 1

1:45 – 3:00 p.m.

Please hold your applause and questions until all the talks are done.

Vote for your favorite talk – use Whova!

Exploring a student-centered approach to innovating computer science education, **Madeleine Lorås**

Interactive, language-neutral flowcharts and pseudocode for teaching core CS0/1 programming concepts, **Alex Edgcomb**, Frank Vahid

Designing active mediated learning tasks: Can small failures enhance student learning?, **Cruz Izu**, Olga Sanchez Castro

Interest-driven coding projects, **Jared O'Leary**

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We Should Give Messy Problems and Make Students Reflect on What They Learn, **Paul Dickson**

Teaching Students a Systematic Approach to Debugging, **Roman Lysecky**, Frank Vahid

Improving Course Content and Providing Intelligent Support Simultaneously, **Toby Dragon**

Recruiting Experts: Toward a Concept Inventory for Computer Science 2, **Lea Wittie**, Anastasia Kurdia, Meriel Huggard

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SIGCSE 2018 Lightening Talk

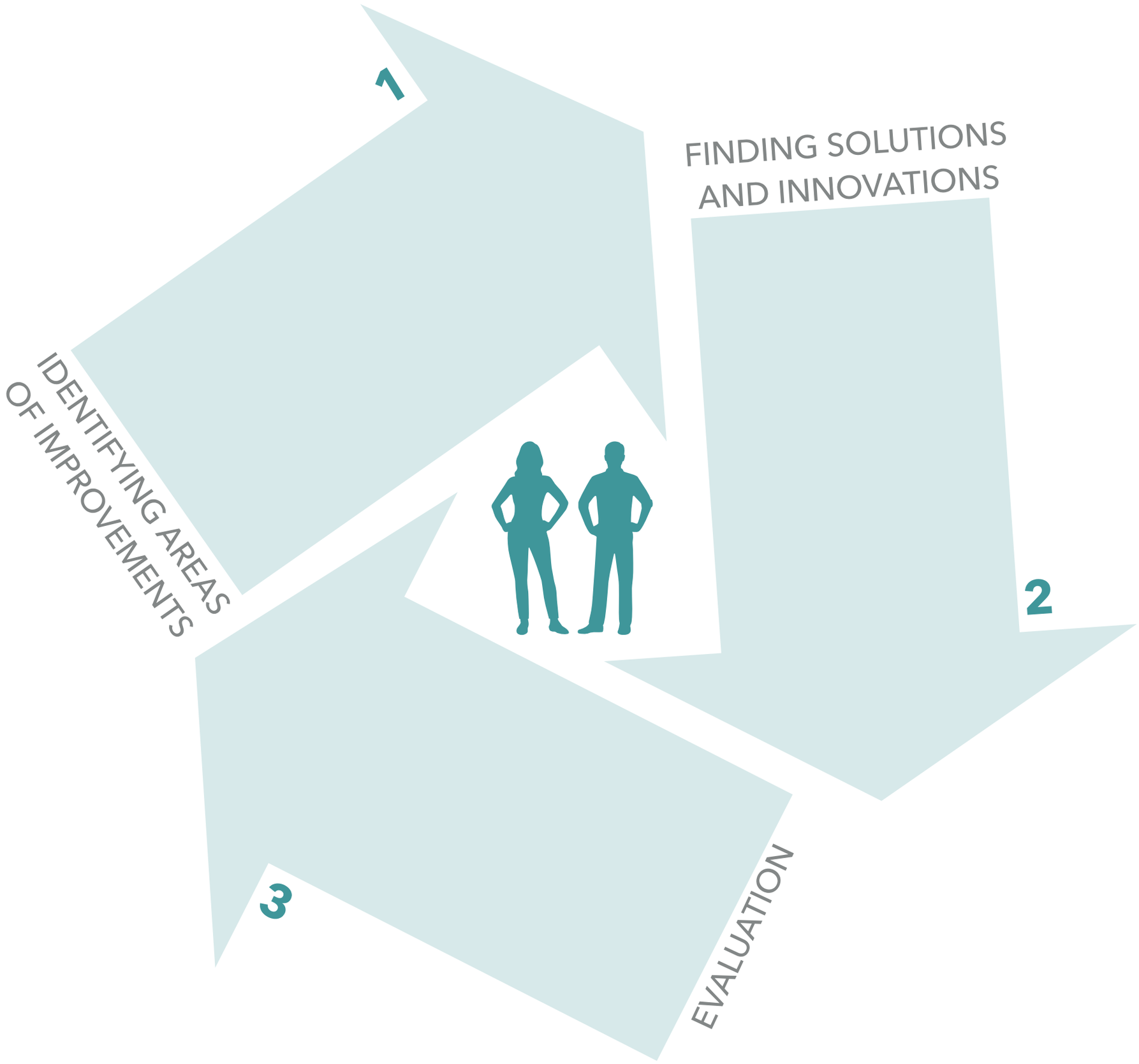
EXPLORING A STUDENT-CENTERED APPROACH TO INNOVATING COMPUTER SCIENCE EDUCATION

Madeleine Lorås, PhD candidate

Department of Computer Science,
Norwegian University of Science and Technology

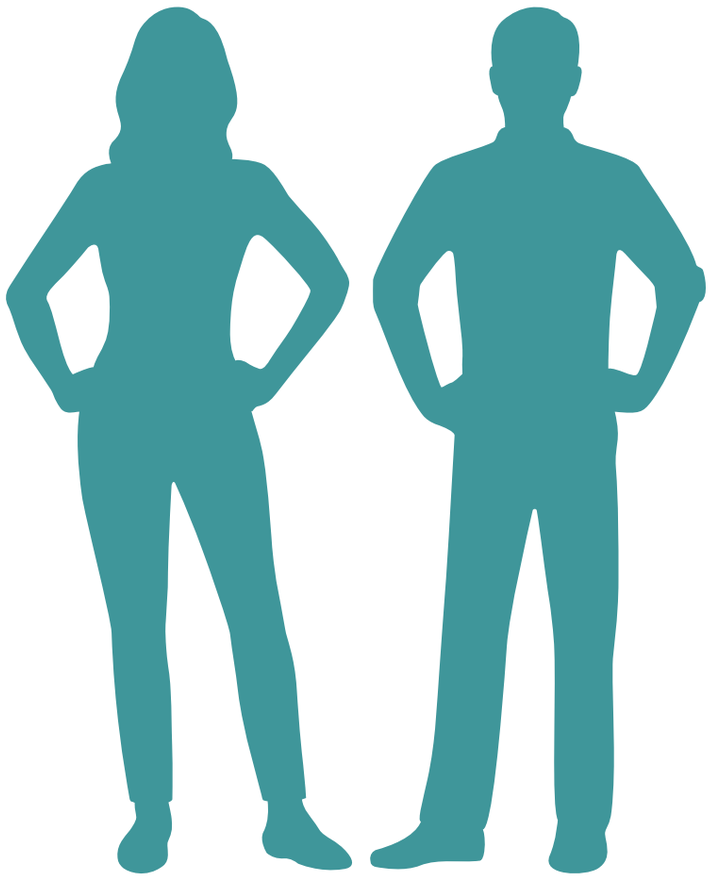
Excited
Centre for Excellent IT Education

STUDENT-CENTERED APPROACH

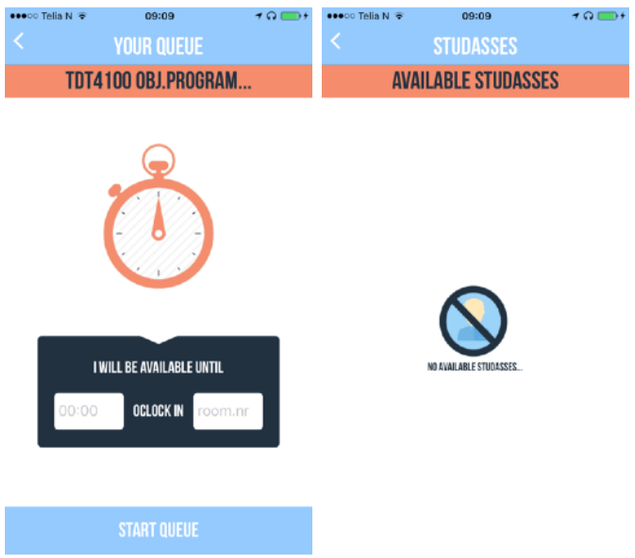


Students taking a course

Older students who have taken the course

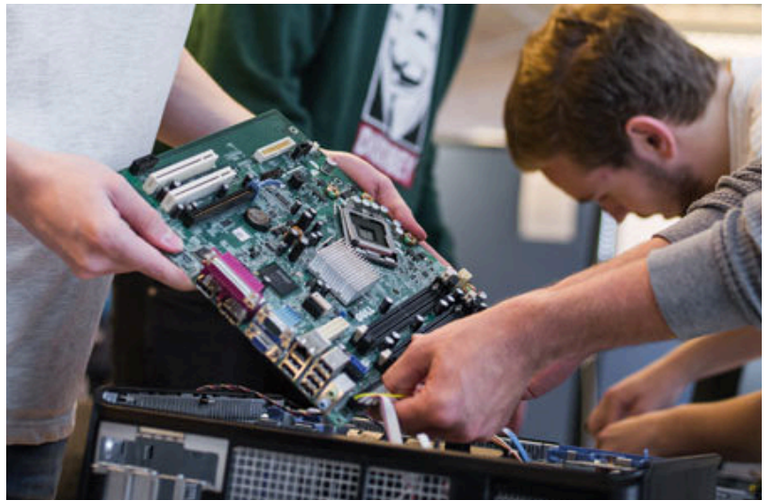


Older students hired as teaching assistants (peer educators)



CURRENT ISSUES

Increasing number of computer science students



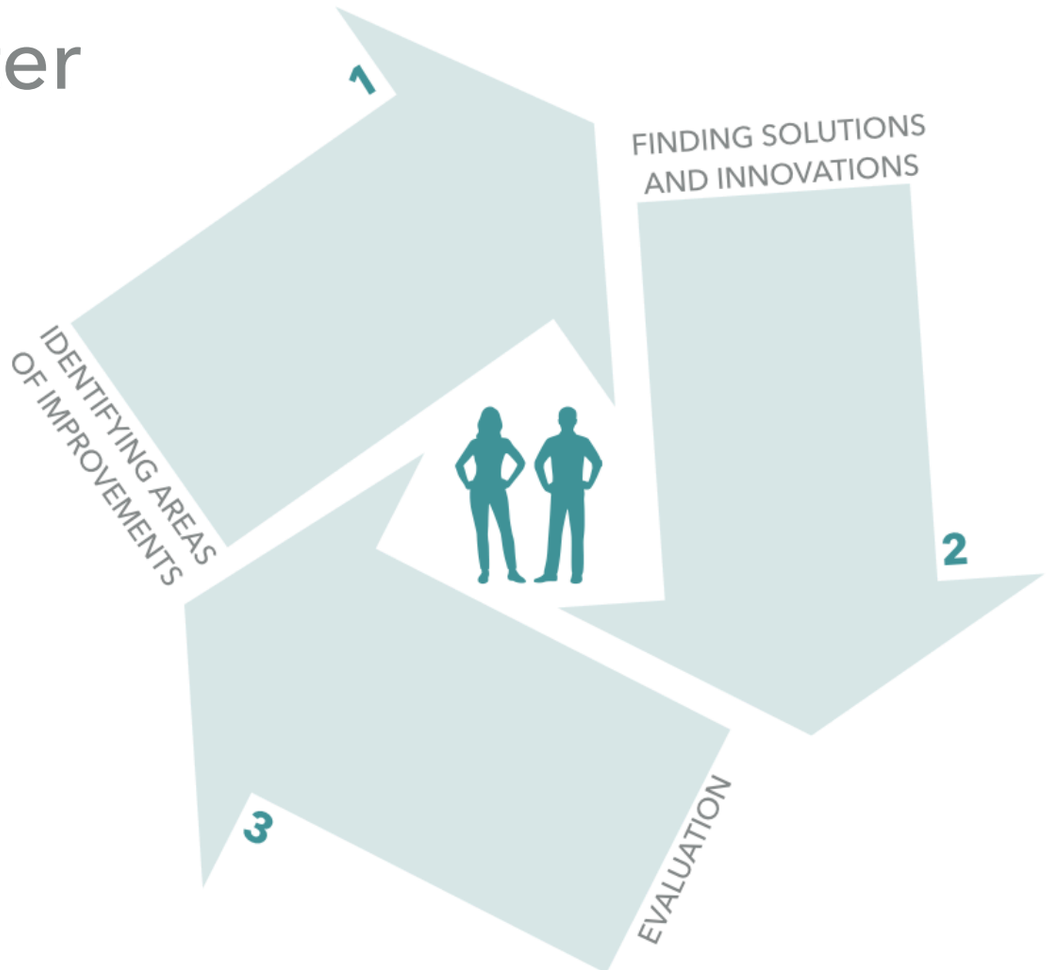
Computer science majors and non-majors

Difference in prerequisites

Retention - throughput - diversity

STUDENT-CENTERED APPROACH

Interviews and surveys
During and after



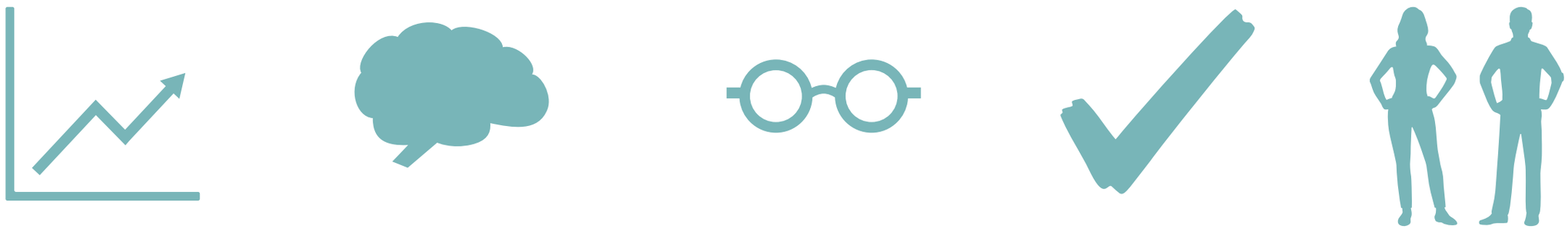
Student apps
Organizational improvements

Challenge

EVALUATION – HOW TO MEASURE INNOVATION?

What is an educational improvement?

Who defines what is better?



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Thanks for Listening!

Questions and comments are welcome.

Madeleine Lorås, PhD candidate
Department of Computer Science,
Norwegian University of Science and Technology

@madelelo madeleine.loras@ntnu.no www.ntnu.edu/excited

Pictures: Faculty of Information technology and electrical engineering, NTNU

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Interactive language-neutral flowcharts and code for teaching core programming concepts

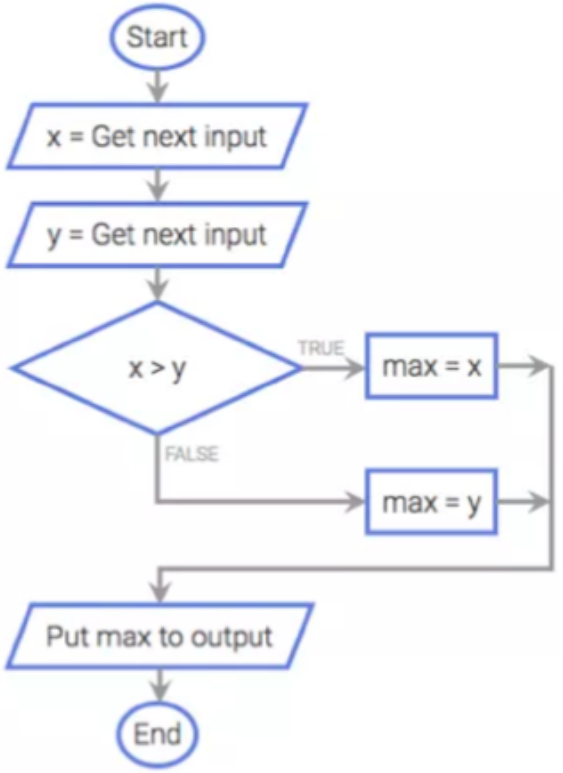
ALEX EDGCOMB[1,2], FRANK VAHID[2,1], ROMAN LYSECKY[3,1]

[1]ZYBOOKS, LOS GATOS, CALIFORNIA

[2]COMPUTER SCIENCE AND ENGINEERING, UNIVERSITY OF CALIFORNIA, RIVERSIDE

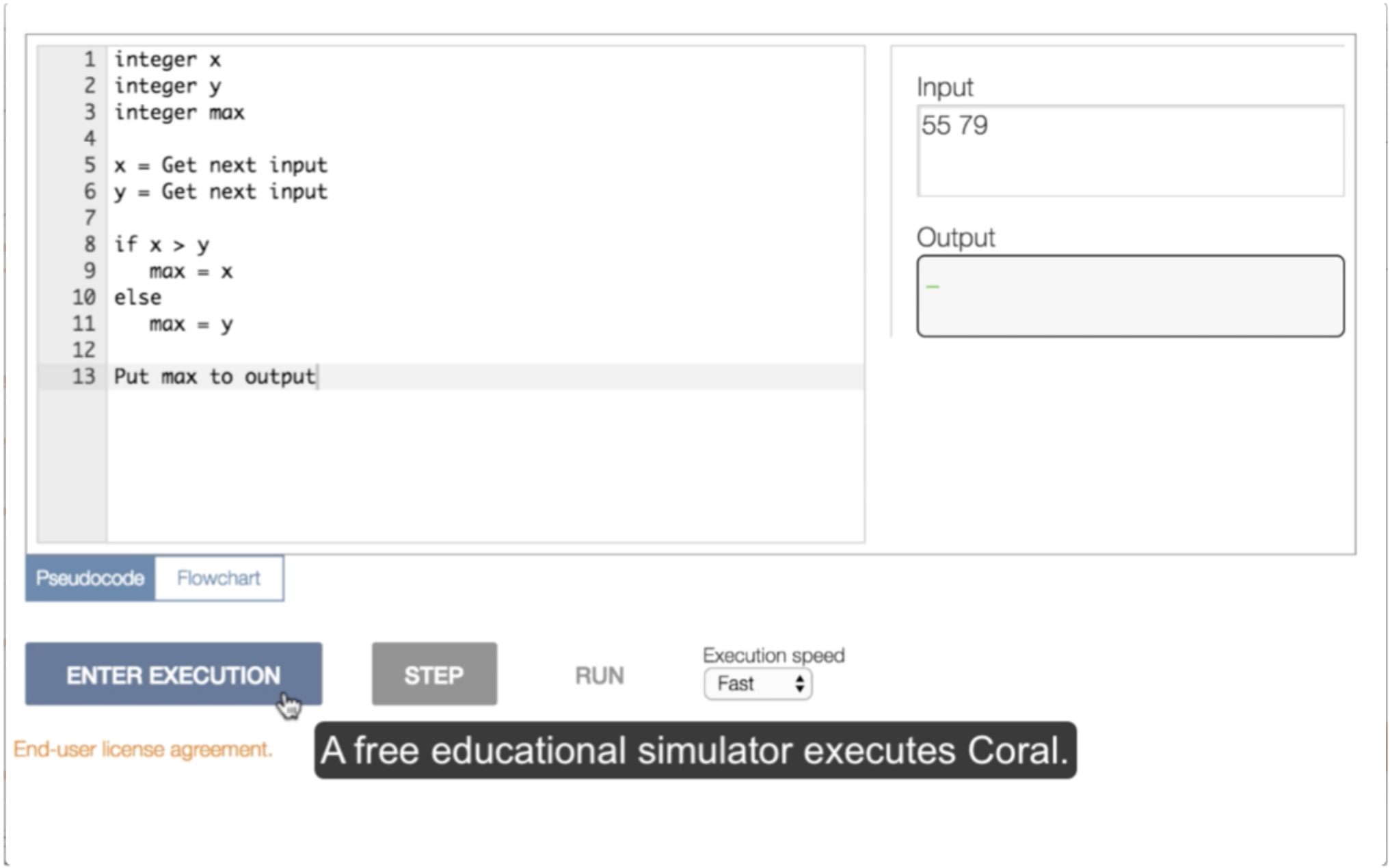
[3]ELECTRICAL AND COMPUTER ENGINEERING, UNIVERSITY OF ARIZONA

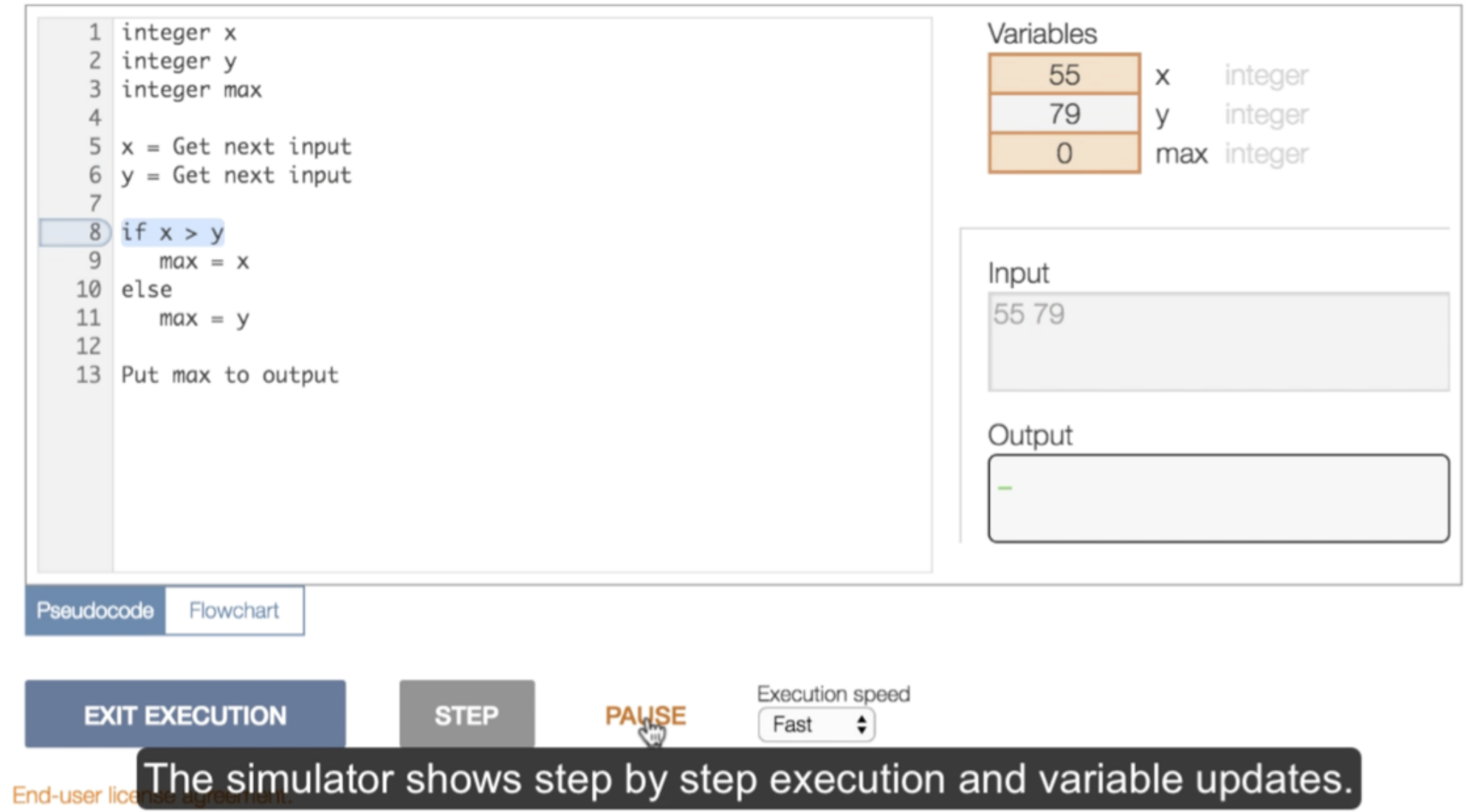
```
integer x
integer y
integer max

x = Get next input
y = Get next input

if x > y
   max = x
else
   max = y

Put max to output
```

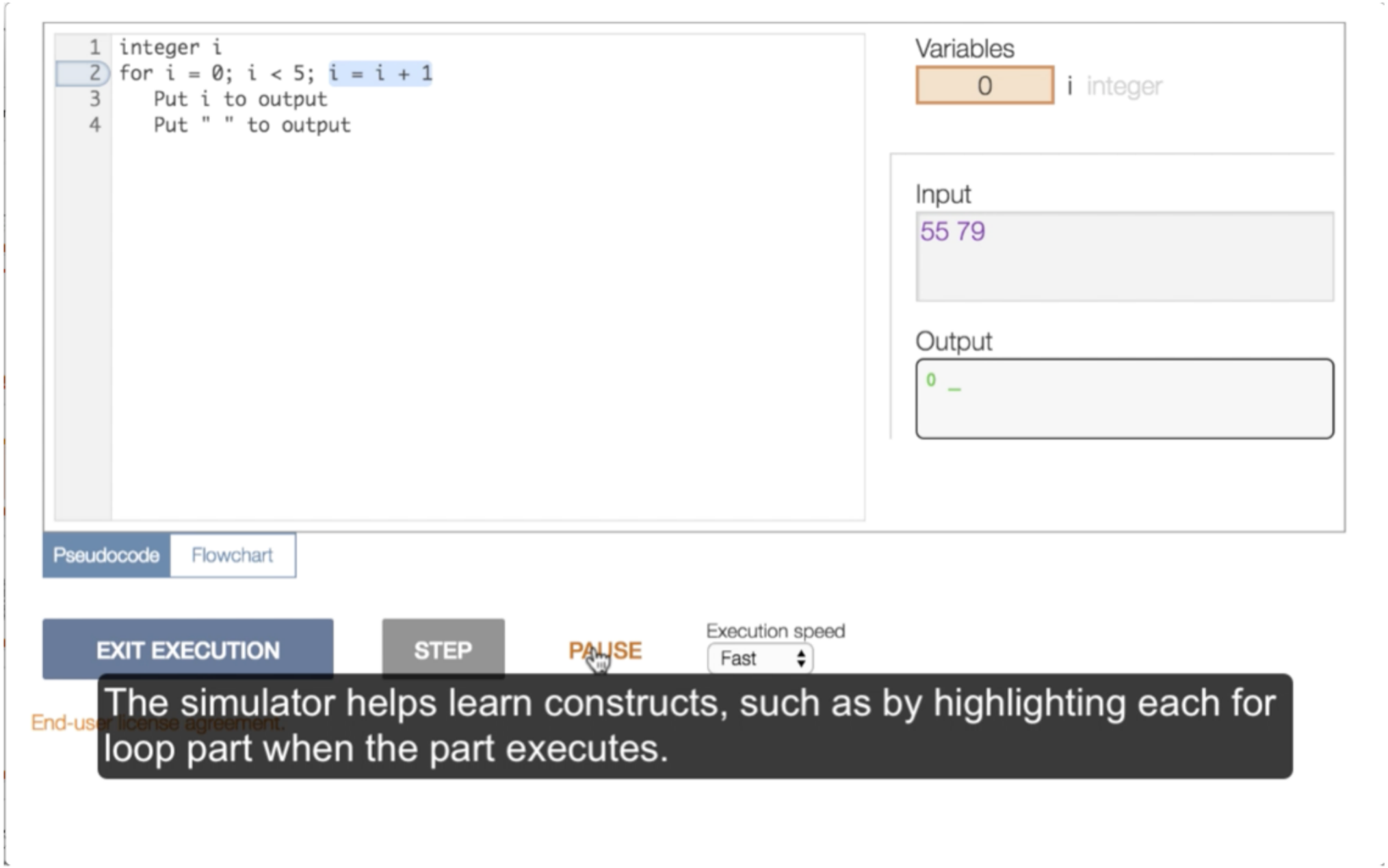


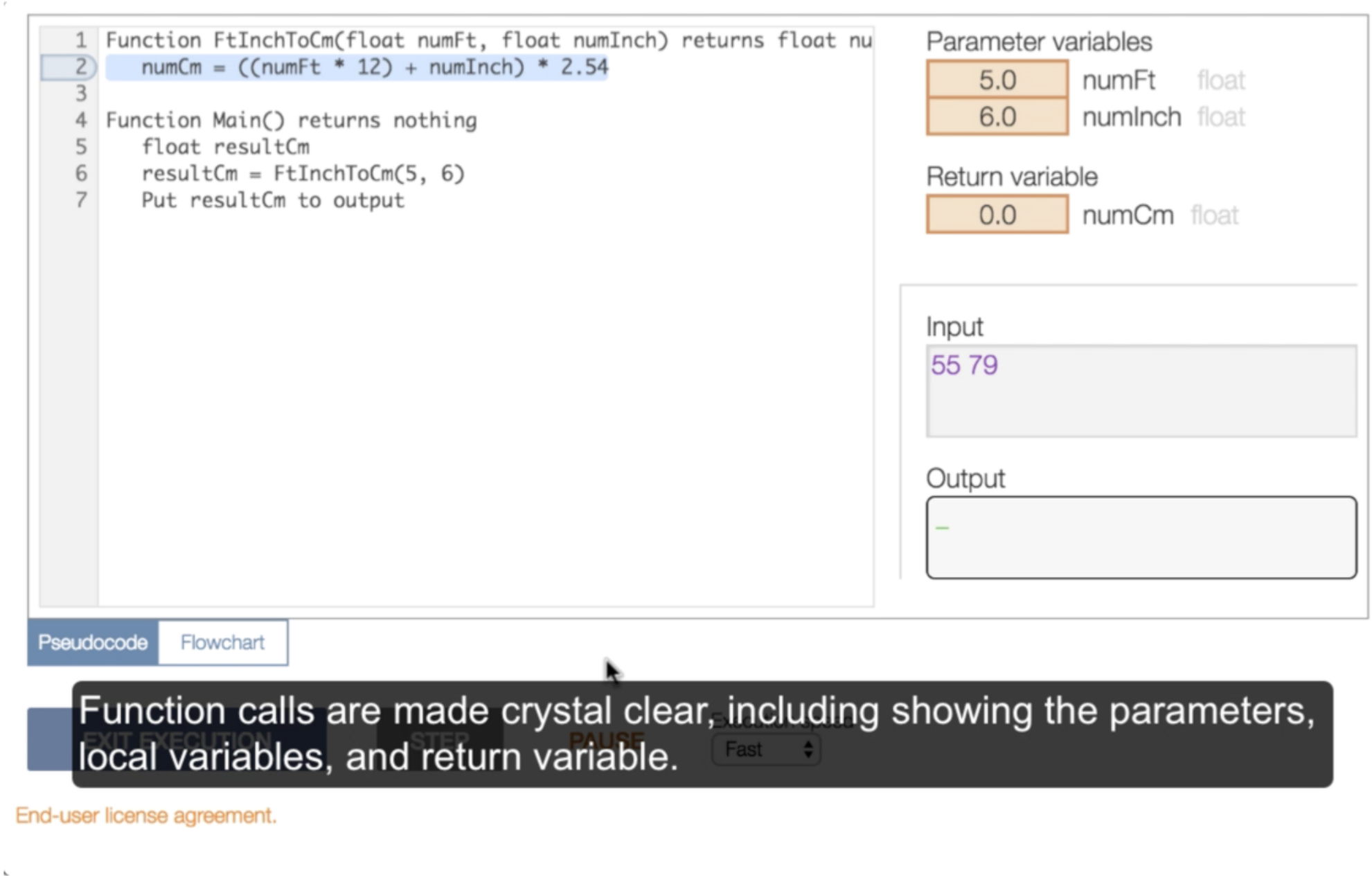
```
integer x
integer y
integer max

x = Get next input
y = Get next input

if x > y
    max = x
else
    max = y

Put max to output
```

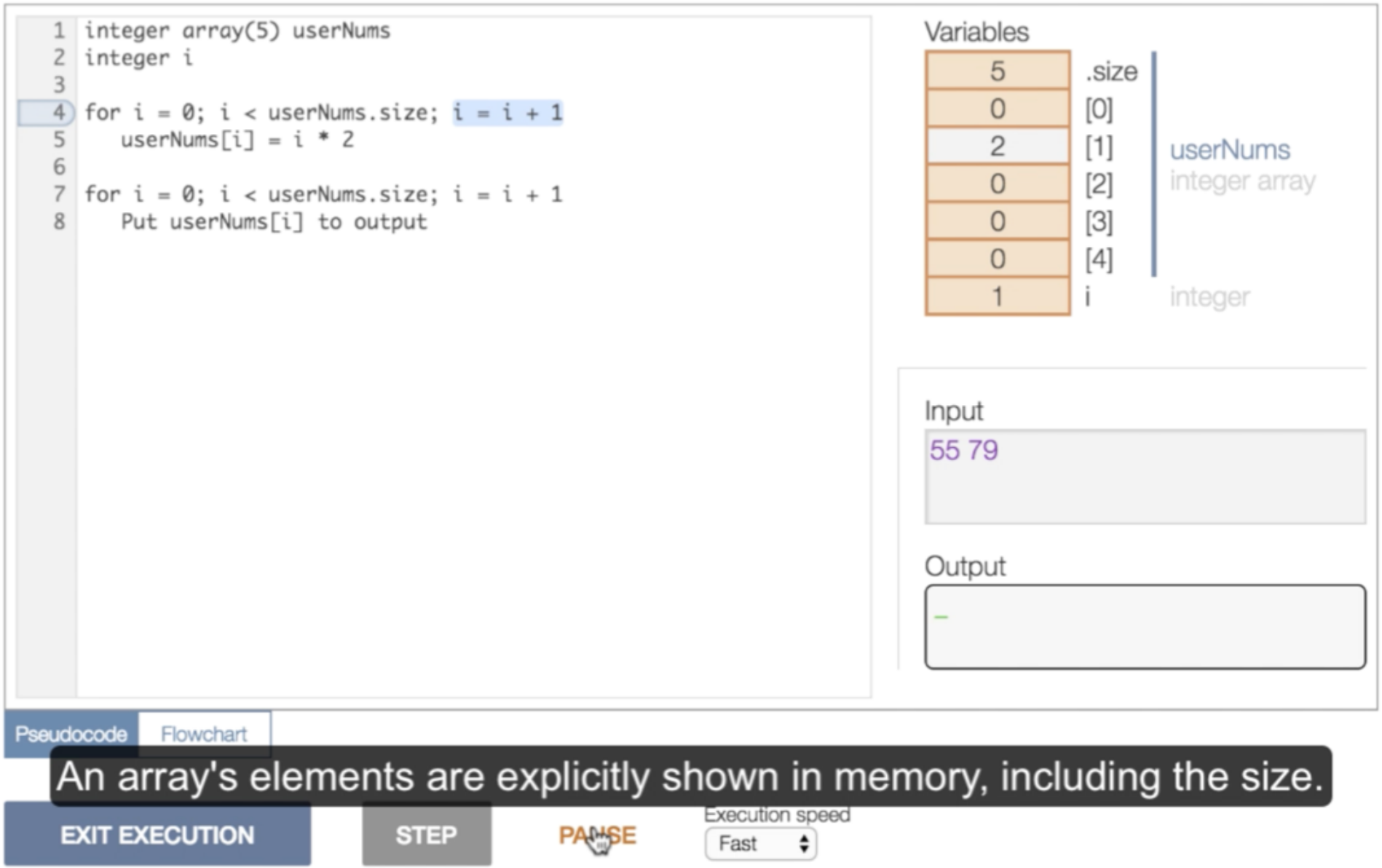
Coral is an ultra-simple language for learning to program.

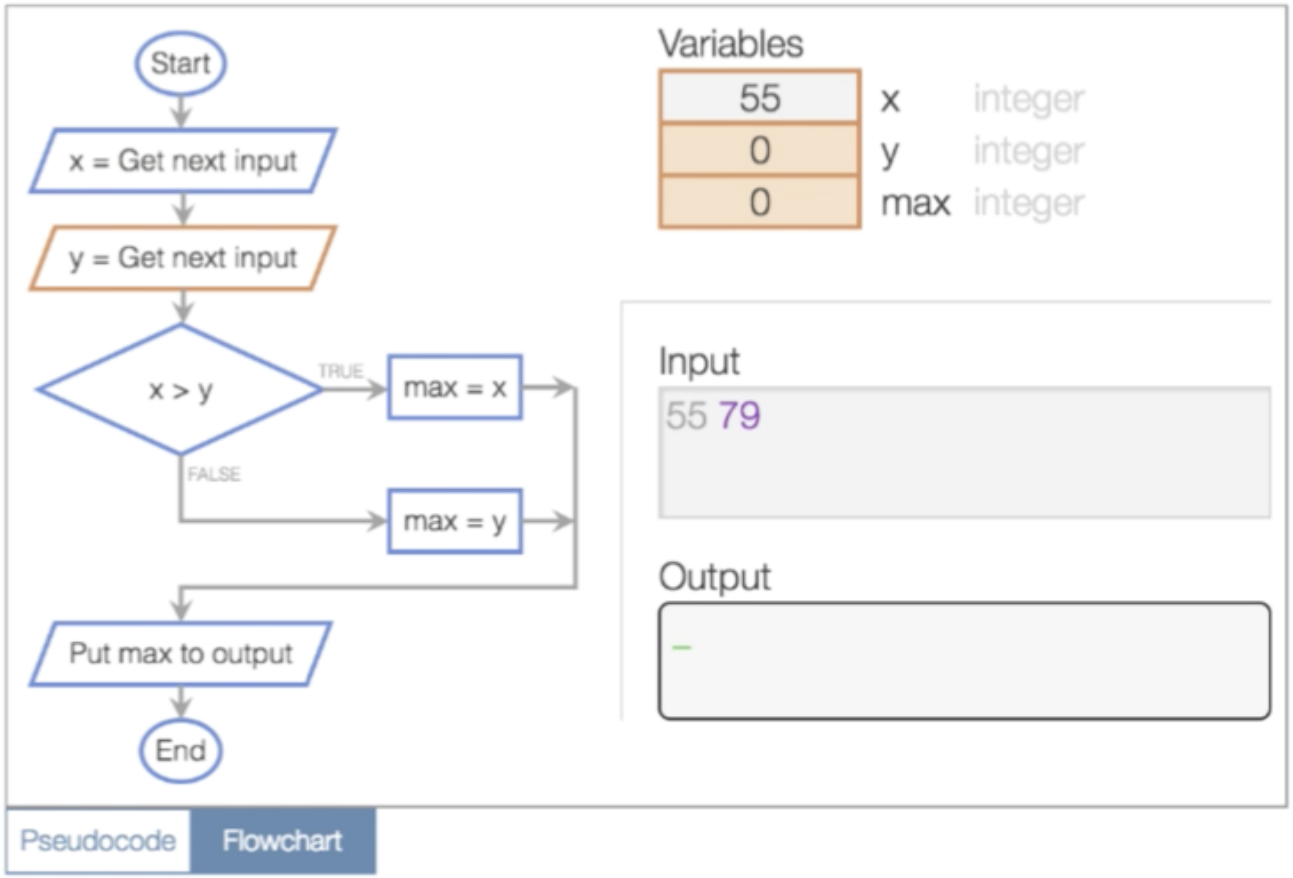




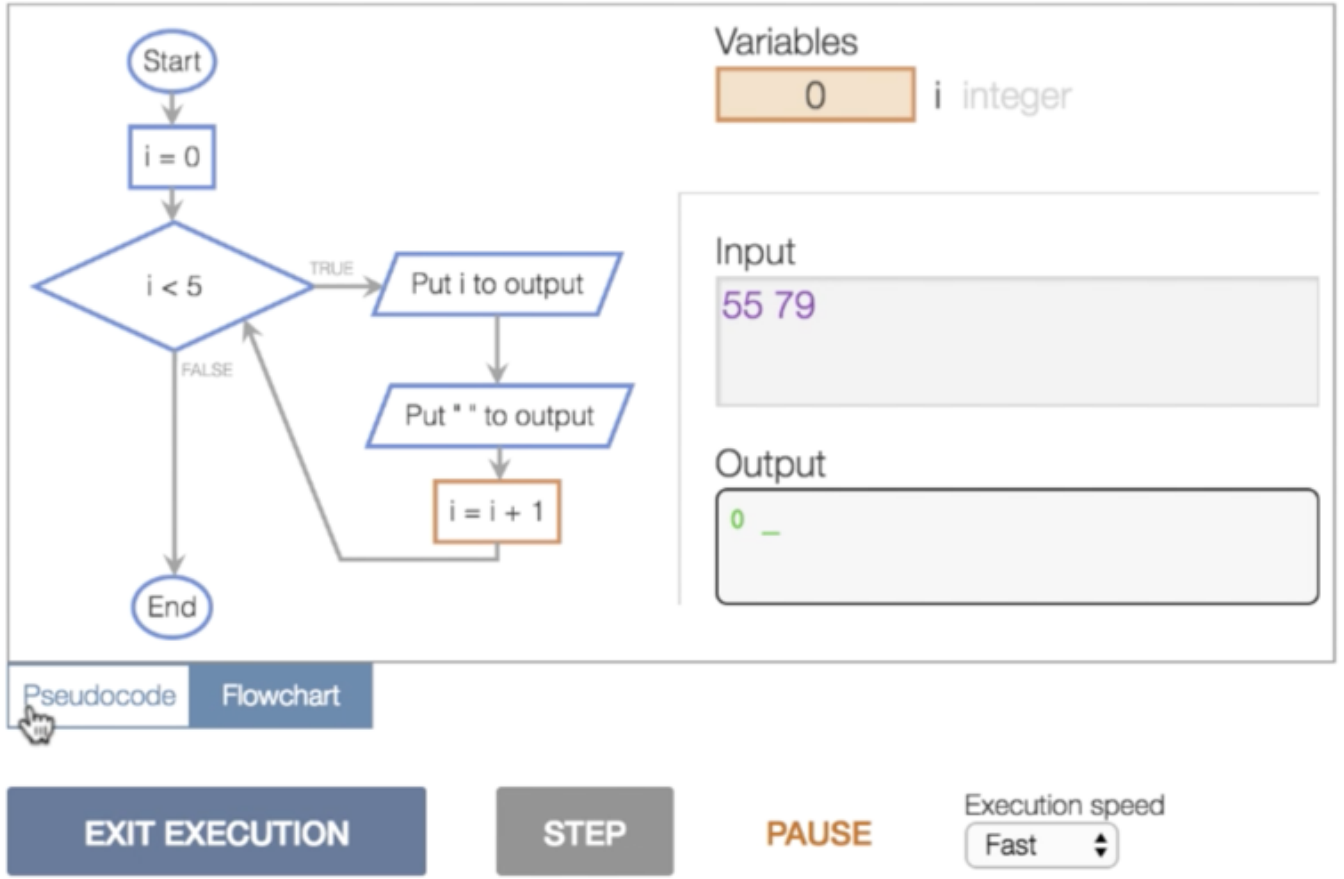






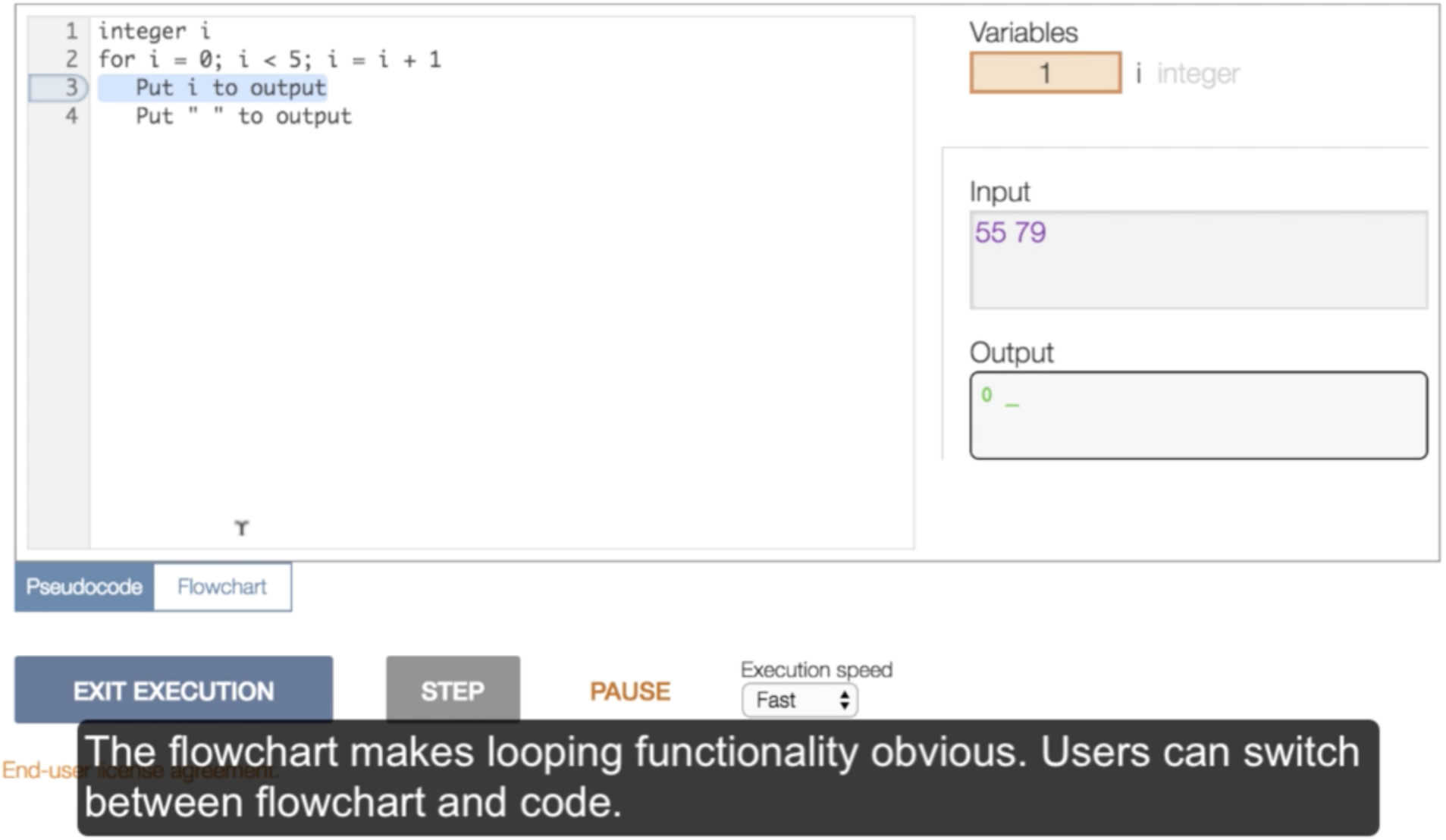


The simulator auto-generates a flowchart for given code (mimicking the code layout) and executes the flowchart graphically.



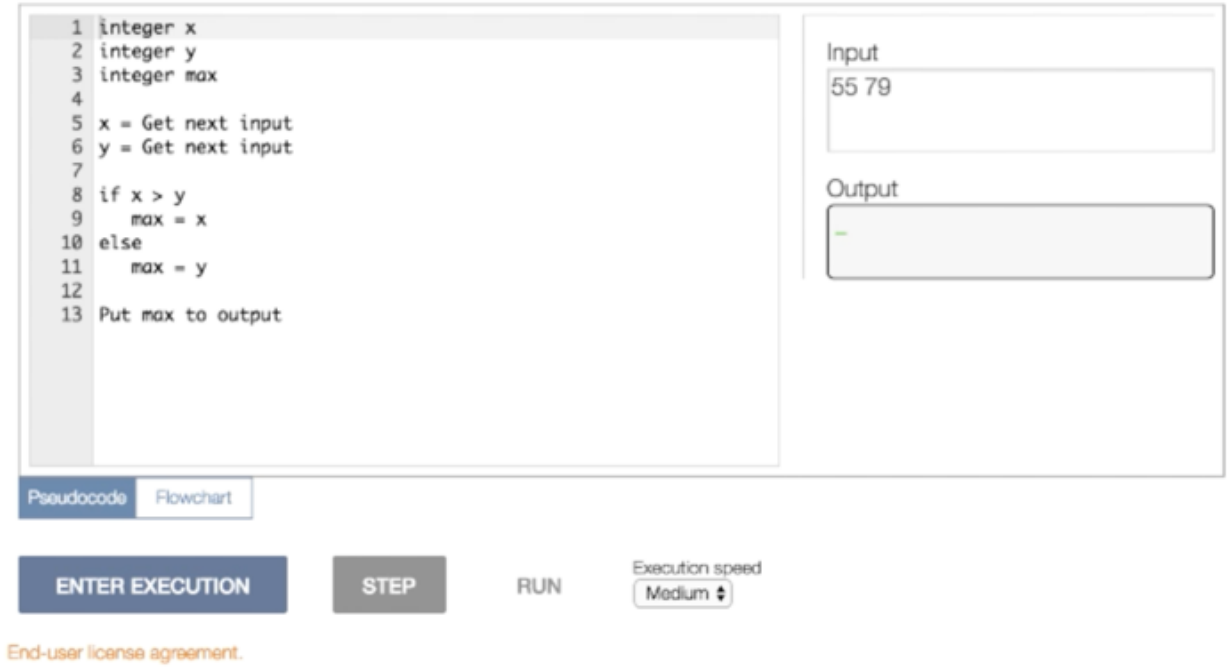
End-user license agreement.

The flowchart makes looping functionality obvious. Users can switch between flowchart and code.



CoralLanguage.org

Simulator

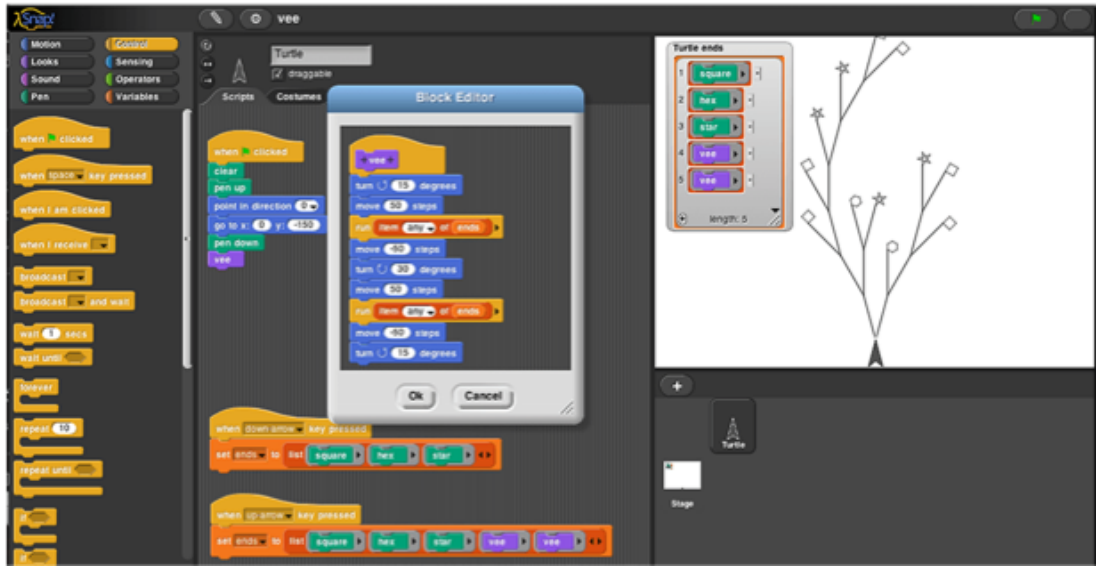


The simulator is web-based and free to students and instructors, and comes with a free tutorial.

- Click "Enter execution", then "Step" to execute one statement, or "Run" to execute entire program. You can view the code or flowchart executing

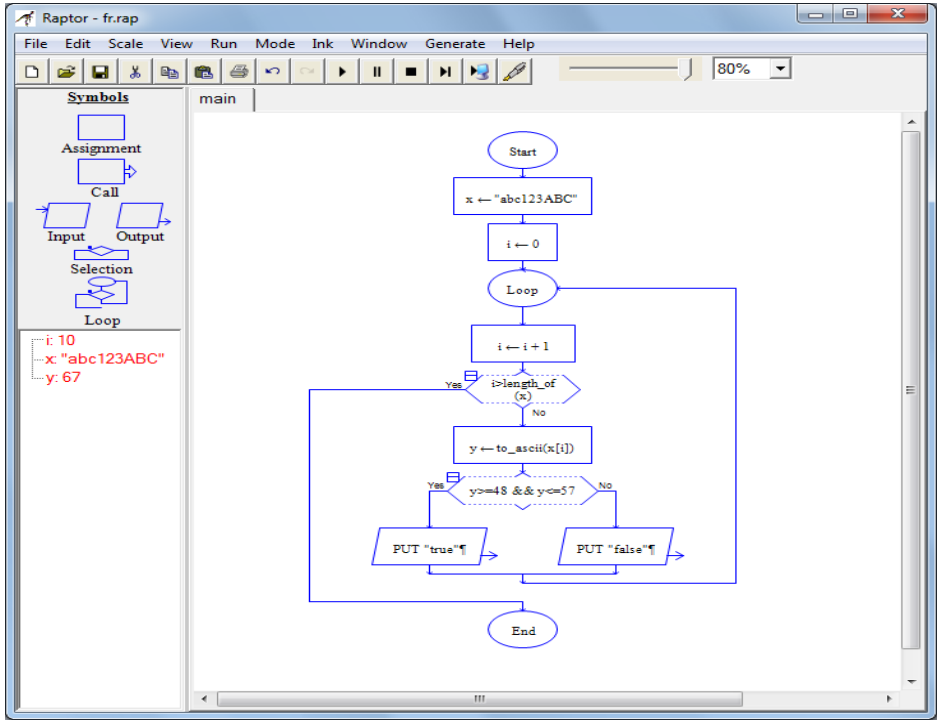
Snap (and Scratch)

Image from http://snap.berkeley.edu/



Raptor

Image from https://stackoverflow.com/a/23299479



Python

Visit: CoralLanguage.org

Suggested uses:

- CS1: Visualize branches, loop, & variable updates
- Gentle programming class: Use Coral, end with Python/Java/C++
- Brief coding intro: AP CS Principles, Intro to Computing Tech, etc.

Thoughts: alex.edgcomb@zybooks.com, vahid@cs.ucr.edu, rlysecky@ece.arizona.edu

Support: support@zybooks.com

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DESIGNING ACTIVE LEARNING TASKS: CAN SMALL FAILURES ENHANCE STUDENT LEARNING?

Cruz Izu, *The University of Adelaide*

Olga Sanchez Castro, *Flinders University*

ARE FAILURES ALWAYS BAD?

"Failure is simply the opportunity to begin again, this time more intelligently."

Henry Ford

"Failures are finger posts on the road to achievement."

C.S. Lewis

"Science, my lad, is made up of mistakes, but they are mistakes which it is useful to make, because they lead little by little to the truth"

Jules Verne

"*It's fine to celebrate success but it is more important to heed the lessons of failure."*

Bill Gates

WHAT SoLT SAYS ABOUT IT

Avoid failure through scaffolding

ZDP (Lev Vygotsky)

Embrace failure as preparation for learning

Productive failure (M. Kapur)

Prob. Solving –Instruction (K. Loibl et al)

We *deliberately* <u>design for controlled failure</u> and then bootstrap that failure into something that's productive.

WHY PS-I WORKS?

- Problem solving phase (with failure)
- Mechanism 1: activation of prior knowledge
- Mechanism 2: Awareness of knowledge gaps
- Mechanism 3: Recognition of key features
- Instruction phase
- Outcome: well connected and organized knowledge

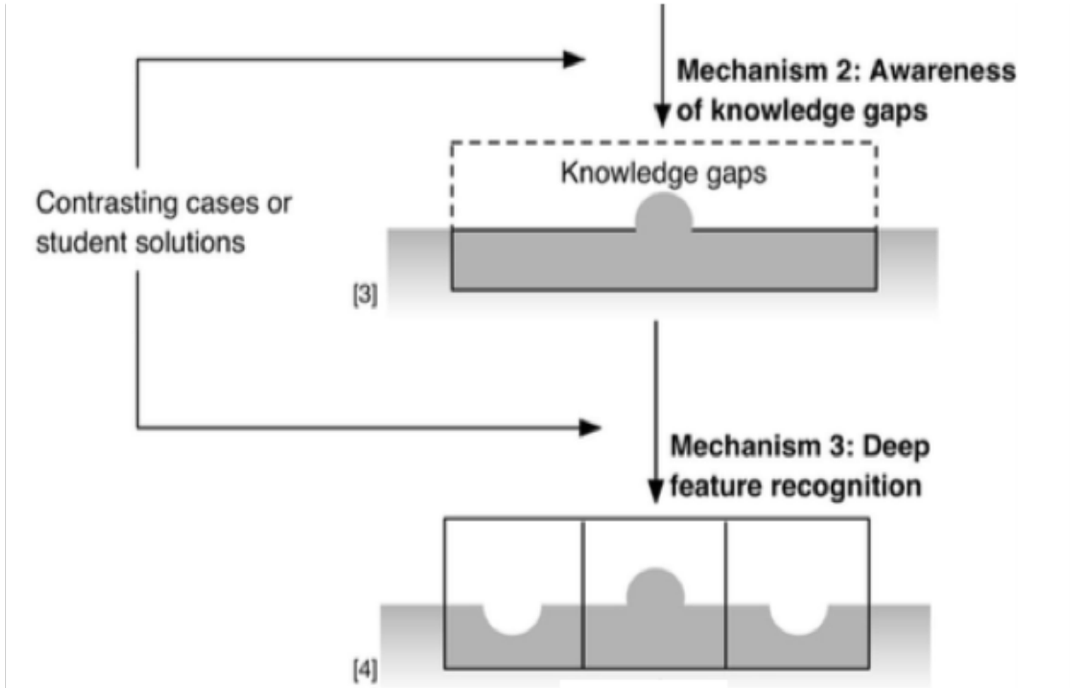

Figure extracted from (Loibl, Roll and Rummel 2016) *Towards a theory of when and how problem solving followed by instruction supports learning*.
Educ Psychol Rev 1–23

CALL FOR INTERESTED PARTNERS

- Looking for **interdisciplinary** and/or **multi-institutional** partners

Stage 1 Review of the literature on Productive Failure (PF)

Stage 2 Define a PF intervention for CS1 course(s)

- Apply PS-I on a course module
- Compare with control

Stage 3 Further explore PF in higher education

- Other CS courses/concepts
- SLA (second language acquisition)
- Other areas

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IRT In 5 Minutes: Assessing Questions

Michael Ball

February 25, 2018

http://bjc.link/sigcse-irt-lightning

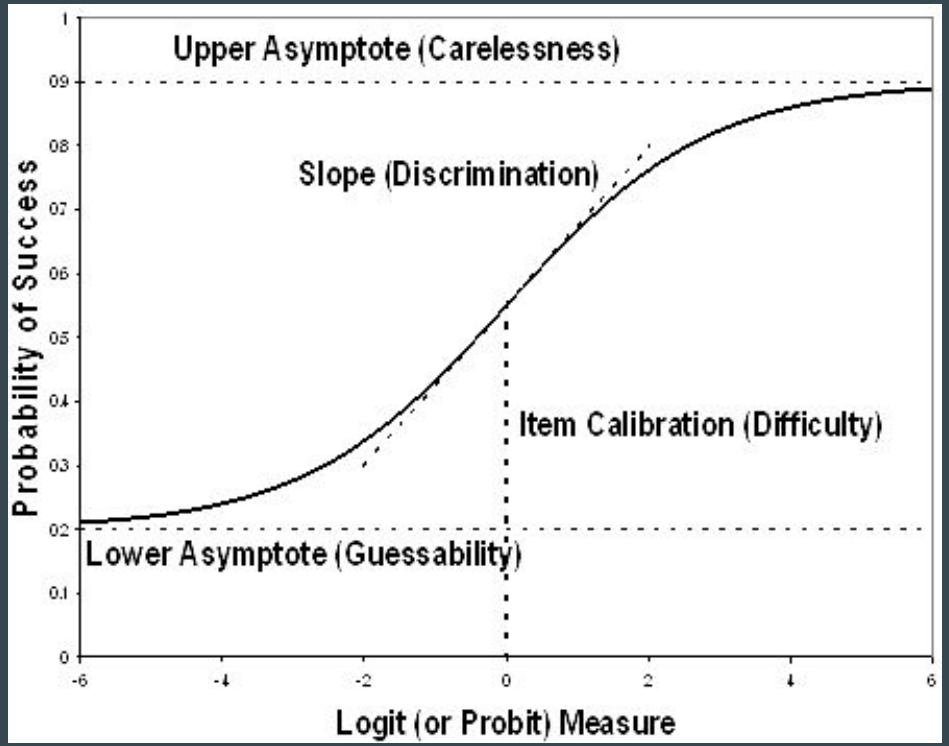
What Is Item Response Theory?

Developed by psychometricians, IRT provides a way to understand how effective a question is at predicting behavior.

Can be applied to Multiple Choice Questions, but much trickier to apply to open-ended work.

https://www.rasch.org/rmt/rmt181b.htm

Item Response Function



I *really* can’t do IRT in 5 minutes.

...so we'll do something easy!

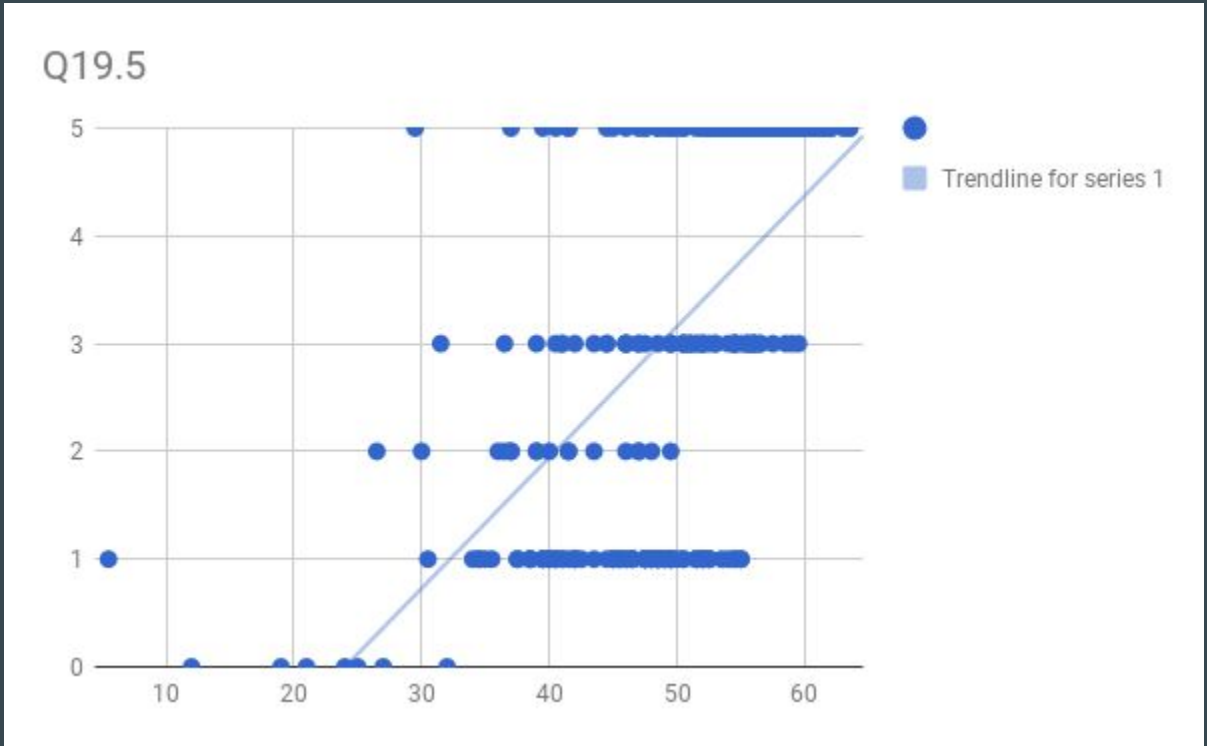
Simple Goal:
Understand whether questions on an exam are predictive of a student's score

CORREL(question_score, exam_score)

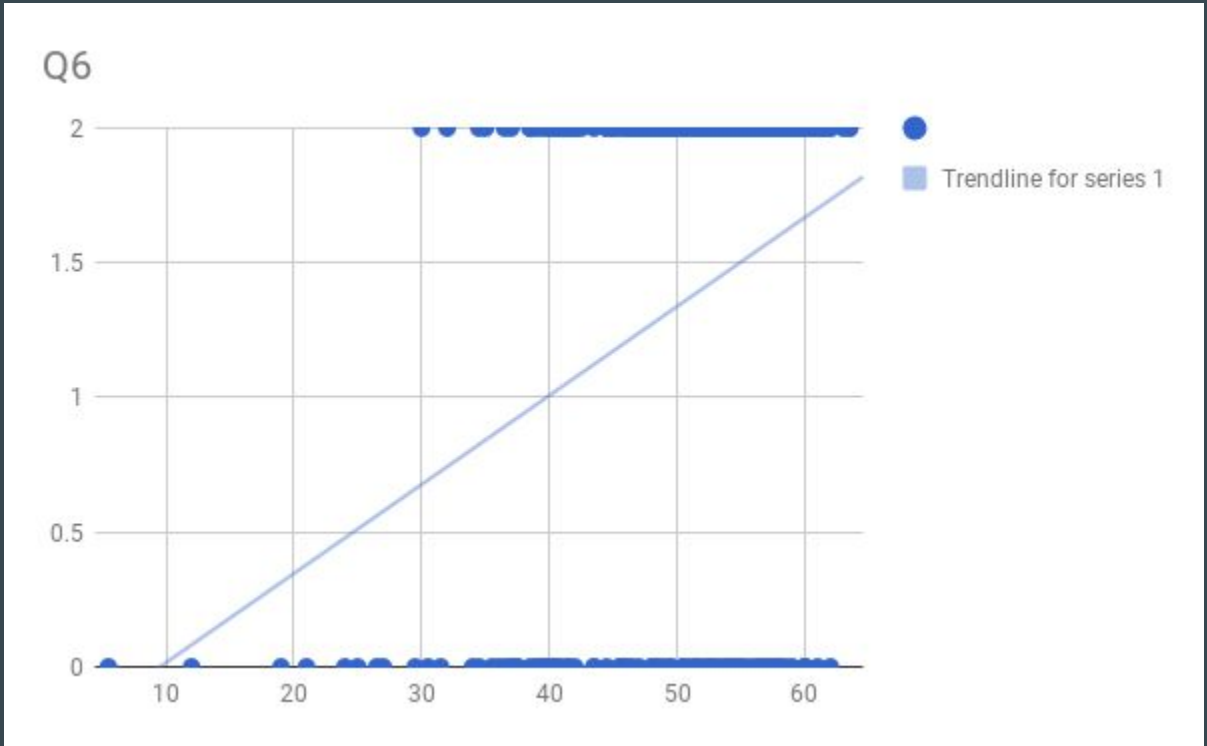
What can we learn?

- Overall, we want questions to be predictive of exam scores. That means students who got the question right will do well on the exam
- Negative correlations indicate a question is “broken” in some way.

Scatter Plot: Good Question



Scatter Plot: Poor Question



Data + Examples

Google Sheets Example Workbook

https://docs.google.com/spreadsheets/d/1pJAj_vK5M4yqdZGsygtS7YnobmDxa_t-nWT4DM5fEzI/edit?usp=sharing

Thank You

Questions, Feedback: ball@berkeley.edu

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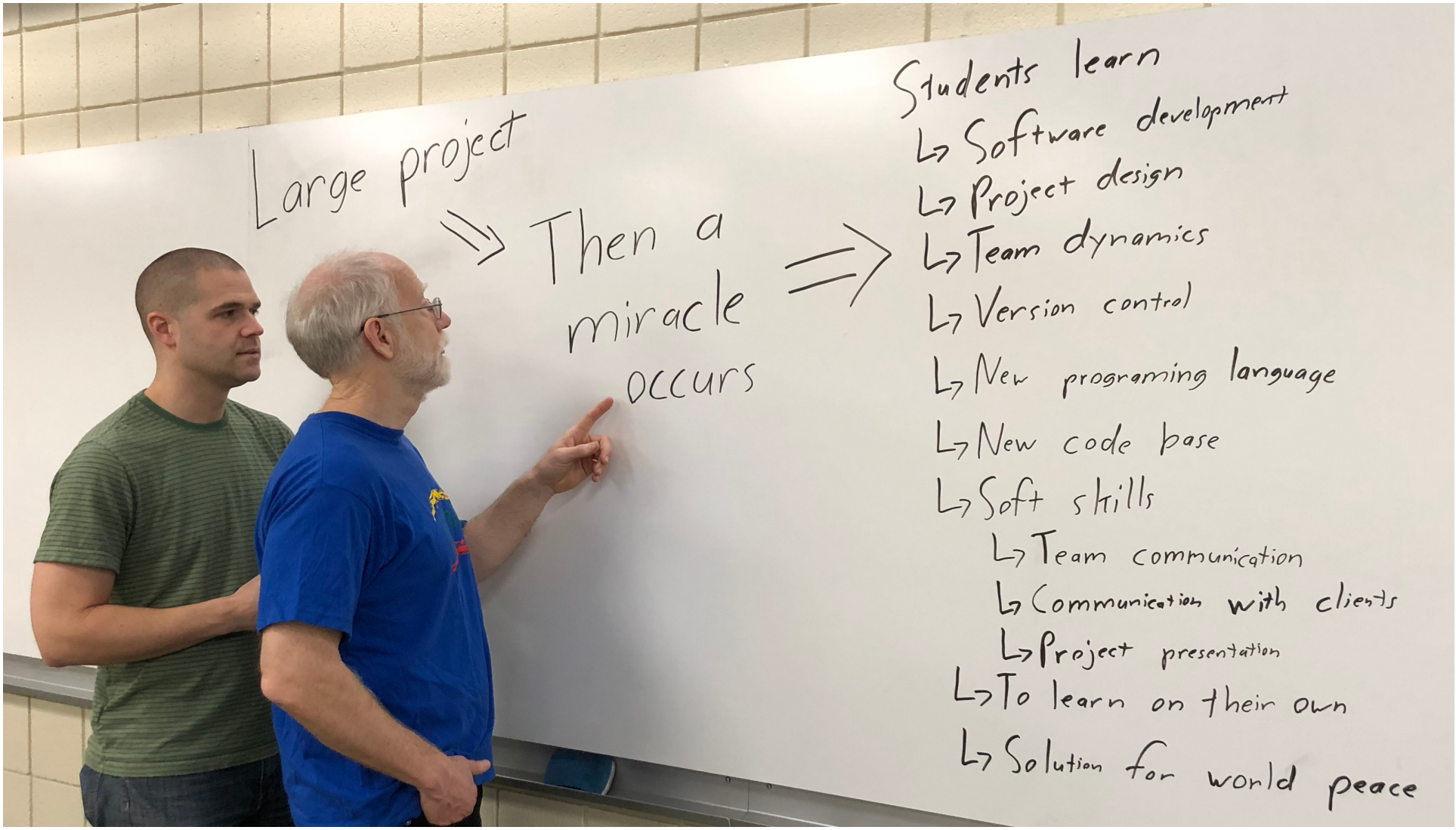
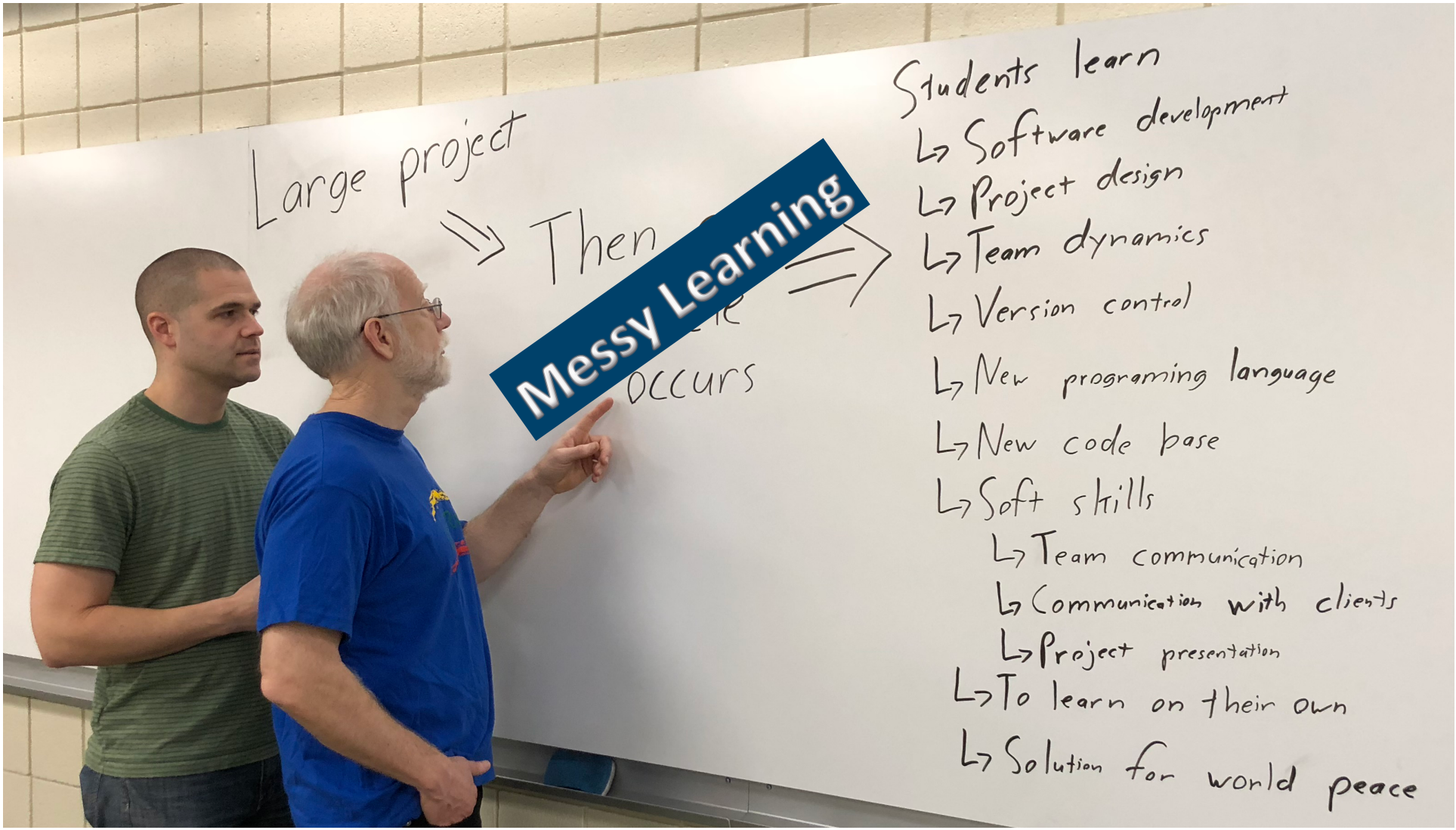


"Paul, I think you should be more explicit here in step two."

Based on the comic by Sidney Harris



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Teaching Students a Systematic Approach to Debugging

Roman Lysecky[1,3], Frank Vahid[2,3]

[1] University of Arizona, rlysecky@ece.arizona.edu
[2] University of California, Riverside, vahid@cs.ucr.edu
[3] zyBooks

Many students have weak debugging skills

```
 1  integer x
 2  integer i
 3  integer total
 4
 5  x = Get next input
 6  total = x
 7  i = 0
 8  while (i < x)
 9     total = total * x
10     i = i + 1
11  Put "Total: " to output
12  Put total to output
```

Program should compute x^x.
ERROR: x = 2. Expected 4. Got 8.

Input

2

Output

```
Total: 8_
```

Common behavior: Make random change & hope things improve

```
 1  integer x
 2  integer i
 3  integer total
 4
 5  x = Get next input
 6  total = x
 7  i = 0
 8  while (i <= x)
 9     total = total * x
10     i = i + 1
11  Put "Total: " to output
12  Put total to output
```

Error remains, and things got worse

Input

2

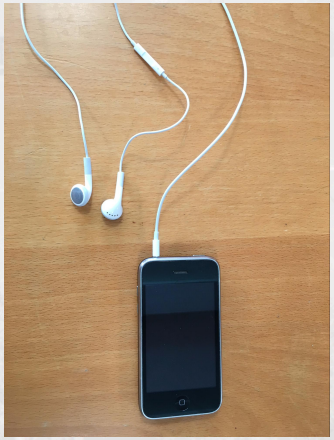
Output

```
Total: 16_
```

Issue *not* just about debugging, but how people approach troubleshooting in general

First teach systematic troubleshooting process

- Troubleshooting process
  - Create a hypothesis. A hypothesis states a possible cause of a problem
  - Run a test. A test is a procedure whose result validates or invalidates a hypothesis
- Use everyday systems



PARTICIPATION ACTIVITY | 1.2.2: For each hypothesis, a test is used to validate or invalidate the hypothesis.

Start ☐ 2x speed

Hypothesis	Test	Result
Lamp wire is unplugged	View wire. Plugged in?	N Validated Y Invalidated
Bulb is broken	Insert bulb into working lamp. Lights?	N Validated Y Invalidated
Outlet is dead	Plug working lamp into outlet. Lights?	N Validated Y Invalidated

Then teach program debugging

- Debugging process
  - Create a hypothesis. A hypothesis states a possible cause of a problem
  - Run a test. A test is a procedure whose result validates or invalidates a hypothesis

PARTICIPATION ACTIVITY 2.1.3: Inserting debug output statements can help test each statement during debugging.

Start 2x speed

```
 1: celsiusValue = GetUserInput("Enter Celsius temperature")
1a: Output("DEBUG: celsiusValue is: ", celsiusValue)

 2: tempValue = celsiusValue * (9 * 5)
2a: Output("DEBUG: tempValue is: ", tempValue)

 3: fahrenheitValue = tempValue + 32
3a: Output("DEBUG: fahrenheitValue is: ", fahrenheitValue)

 4: Output("Fahrenheit temperature is: ", fahrenheitValue)
```

```
Enter Celsius temperature 100
DEBUG: celsiusValue is: 100
DEBUG: tempValue is: 4000
```

Hypothesis	Test	Result
Statement 1 has a bug	Inspect output	OK
Statement 2 has a bug	Inspect output	Bad
Statement 3 has a bug	Visually inspect	Bug found
Statement 4 has a bug		

IT'S FREE!!

- Free two-chapter zyBook (with sign in)
  - Targeted at roughly the fifth week of a CS1 course
    - When students are beginning to face harder debugging challenges
  - Also beneficial for any programming class beyond CS1
    - Ex: Could be used in the first few weeks of CS2
  - Uses dozens of animations and learning question sets

- http://www.zybooks.com/catalog/troubleshooting-basics/

Comments and feedback always welcome

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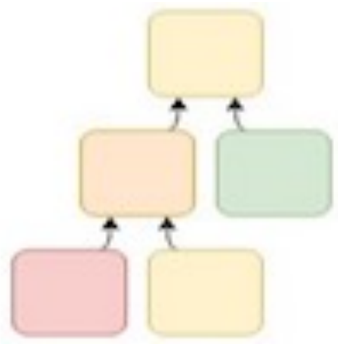
Improving Course Content and Providing Intelligent Support Simultaneously



Toby Dragon

The Challenge

- Wide array of teaching materials
  (Instructional Design challenge)

- Need for domain models to provide individualized support
  (Artificial Intelligence in Education challenge)

The Goal

- Support Students:
  - Offer high-level assessment
  - Suggest of materials / practice

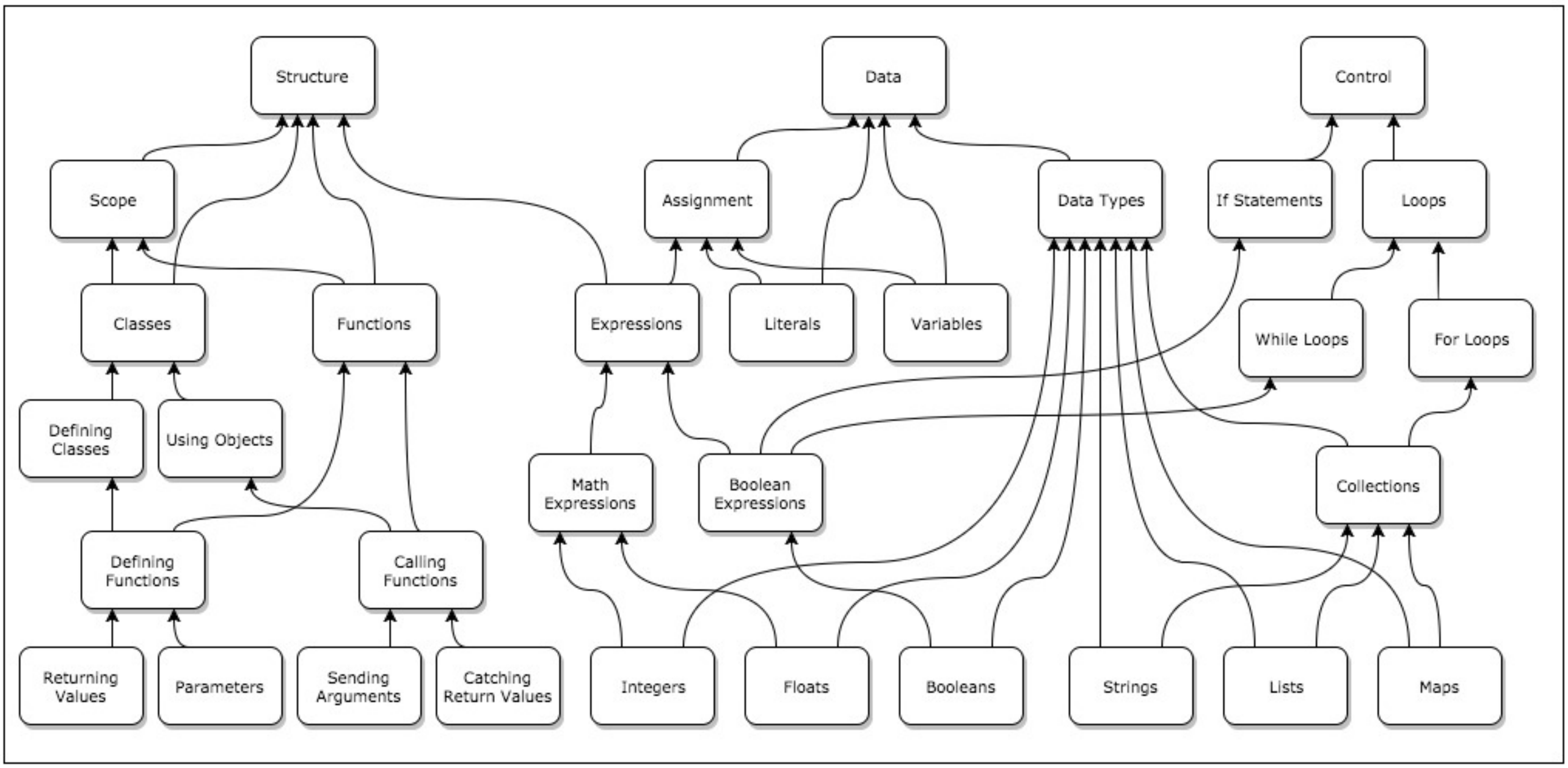
  (use Artificial Intelligence in Education)

- Support instructors:
  - Relate various online / offline materials
  - Offer high-level student/class assessment

  (use Instructional Design)

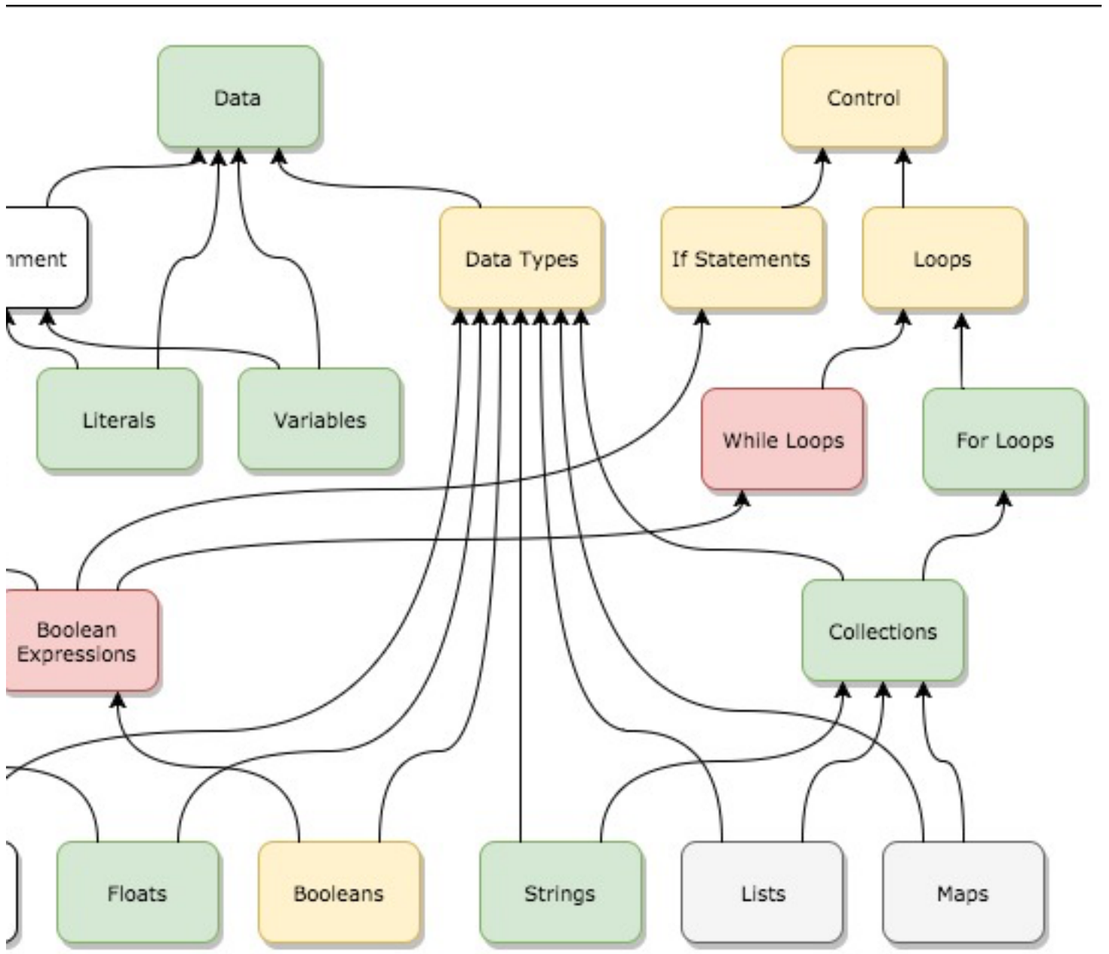
The Approach

Concept Maps to represent course content



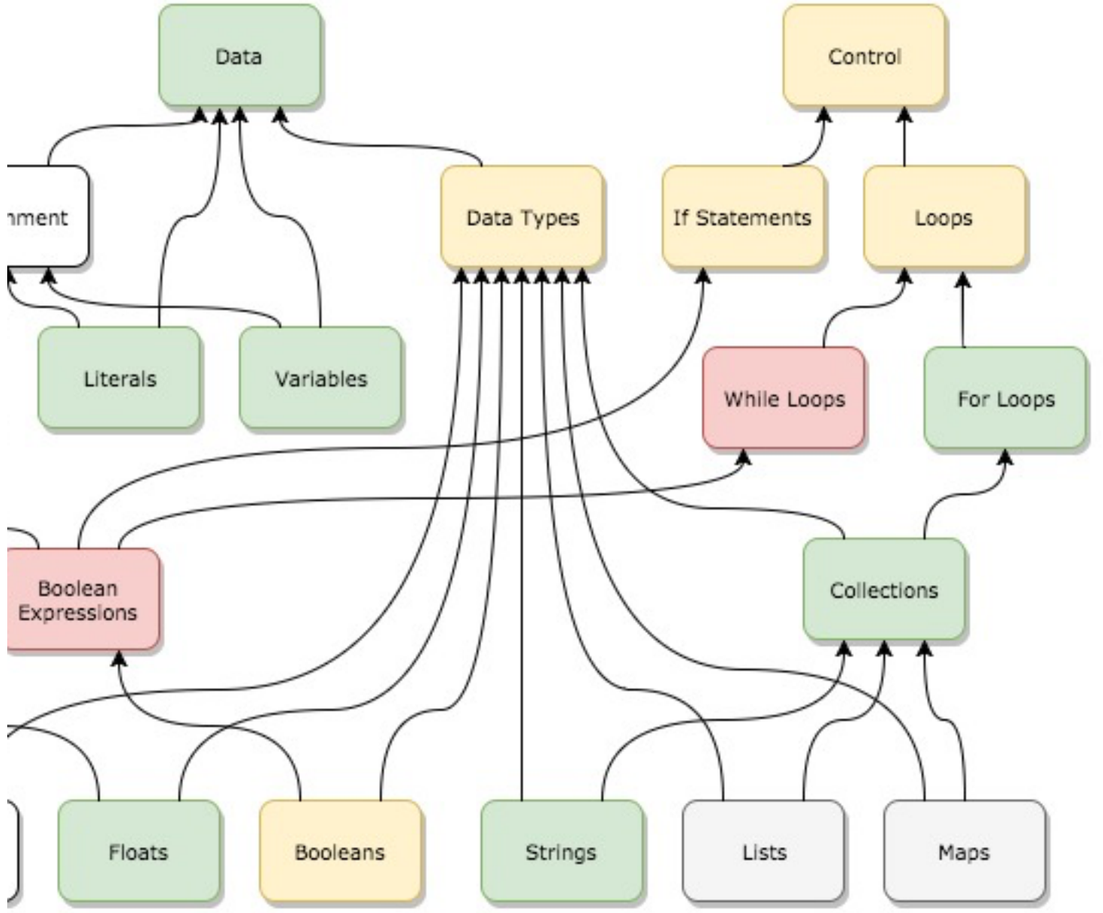
Using the Graph – Students

- Visualization of Instructor's Content Plan
- Quick Visualization of Assessment based on Concepts
- Automated Intelligent Suggestions



Using the Graph – Instructors

- Quick Visualization of Student Performance
- Automated Intelligent Suggestions
- Course Content Improvement



Thank you.

Improving Course Content and Providing Intelligent Support Simultaneously

Toby Dragon
tdragon@ithaca.edu

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Meriel Huggard, Trinity College Dublin

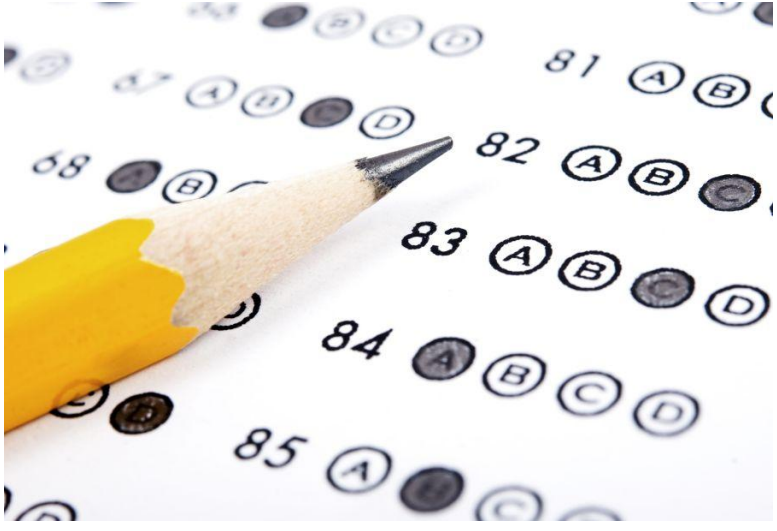
SIGCSE 2018

Concept Inventory

A multiple choice test

Has **important** and **difficult**

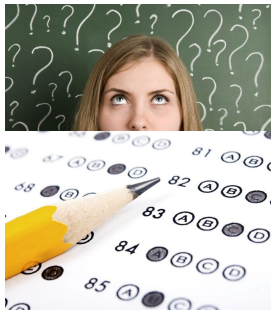
topics from a course.



Each question has **1 correct answer** and

a bunch of **misconception answers**

What to do with a Concept Inventory



How much did the course actually add?

What do I still not understand?

Do those teaching technique changes actually improve learning?

year

after

year

We are creating a concept inventory for **Computer Science 2**

We want CS2 educators and researchers (experts) to do a Delphi consensus building process.

Communicate:

Anonymous
(except to the authors)

- Send us some quick envelope info
- List the important, difficult CS2 topics
- Rank whole set for difficulty, importance
- Given stats, re-rank the set and justify when you deviate
- Given justifications, re-re-rank the set

Sign up at SIGCSE 2018 or email us at info@cs2ci.org

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OpenCSF: Computer Systems Fundamentals

`http://opencsf.org/`

Part 1: Sequential Systems

- Intro to C
- Pointers and Memory
- Binary Representation
- Assembly Language: Data
- Assembly Language: Control
- Memory Hierarchy and Cache
- Interrupts and I/O

Part 2: Concurrent Systems

- Processes and OS Basics
- State & Timing Models
- Concurrency with IPC
- Networking Basics
- Multithreading
- Synchronization Primitives
- Synchronization Problems
- Parallel Decomposition

OpenCSF: Computer Systems Fundamentals

`http://opencsf.org/`

Goals:

- Open, online, interactive textbook
- ACM Computing Curriculum 2013 alignment
- Early feedback, active learning support

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Goals:

- Open, online, interactive textbook
- ACM Computing Curriculum 2013 alignment
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Future directions & needs:

- Web-based visualization & animation
- Integrated coding exercises (PythonTutor/C)
- Collaborators/readers/co-writers

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Developing Computer Forensics Minor - Challenges and Opportunities

Adam Fischbach, Yana Kortsarts, Suk-Chung Yoon

Widener University, Chester, PA

History

Semester	Activity
Fall 2006	CSCI 130 Intro Computer Forensics
Fall 2013	Computer Forensics Lab
Fall 2014	CSCI 393 Advanced Computer Forensics
Fall 2014	Design of Computer Forensics Minor
Spring 2015	Minor Application Submitted to Committee
Fall 2016	Computer Forensics Minor Approved

Curriculum 30/31 Credits

Core Courses	
CJ 105	Introduction to Criminal Justice
CJ 268	Cybercrime
CSCI 391	Practical Cryptology
CSCI 392	Network and Computer Security
CSCI 393	Computer Forensics

Curriculum 30/31 Credits

One Math/Logic Course	
MATH 151	Discrete Math
PHIL 120	Symbolic Logic
PHIL 105	Introduction to Logic

One Programming Course	
CSCI 151	Intro Programming (CS Majors)
CSCI 131	Intro Programming (Non-CS Majors)

Curriculum 30/31 Credits

Two Criminal Justice Courses	
CJ 210	Criminal Courts
CJ 225	Principals of Criminal Investigation
CJ 305	Criminal Evidence
CJ 320	White Collar Crime

One Ethics Course	
PHIL 352	Business Ethics
PHIL 350	Ethics
CJ 405	Ethics in Criminal Justice

Lab Facilities

FRED **F**orensic **R**ecovery
of **E**vidence **D**evice
Digital Intelligence
12 workstations

Software: Access Data FTK
Academic Program Subscription

Challenges

- Administrative Issues
  - Hosting Division: Science/Social Science
  - College of Arts and Sciences
- Curriculum Issues
  - Finding Interdisciplinary Balance
  - Staffing for Required Courses
- Cost Issues
  - Software/Hardware Cost
- Student Recruitment/Advising

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Bitcoins, Blockchains and Cybersecurity

Teaching Emerging Topics in the Classroom

Debasis Bhattacharya, JD, DBA

URL: http://maui.Hawaii.edu/cybersecurity

University of Hawaii Maui College

SIGCSE 2018 - Lightning Talk

$8K Again? Bitcoin Is Up Nearly $2K from Today's Low - CoinDesk

https://www.coindesk.com › News

8 hours ago - **NEWS**. **Bitcoin** jumped almost $2,000 from its intraday low Tuesday, making up some of the losses it sustained from 2018's January correction. As of press time, **bitcoin** was trading around $7,900, after hitting a low of $5,947 a little over 12 hours ago. The world's largest cryptocurrency by market cap opened ...

Bitcoin News: News

https://news.bitcoin.com/

news.**Bitcoin**.com is the world's premier 24/7 **news** feed covering everything **bitcoin**-related.

Is Bitcoin's Risk On Trade Back In Play? - Forbes

https://www.forbes.com/sites/chuckjones/2018/.../is-bitcoins-risk-on-trade-back-in-pla...

3 hours ago - **Bitcoin** and other cryptocurrency prices moved higher on Tuesday. They were coming off lows and mirroring the Risk On trade seen in the equity markets.

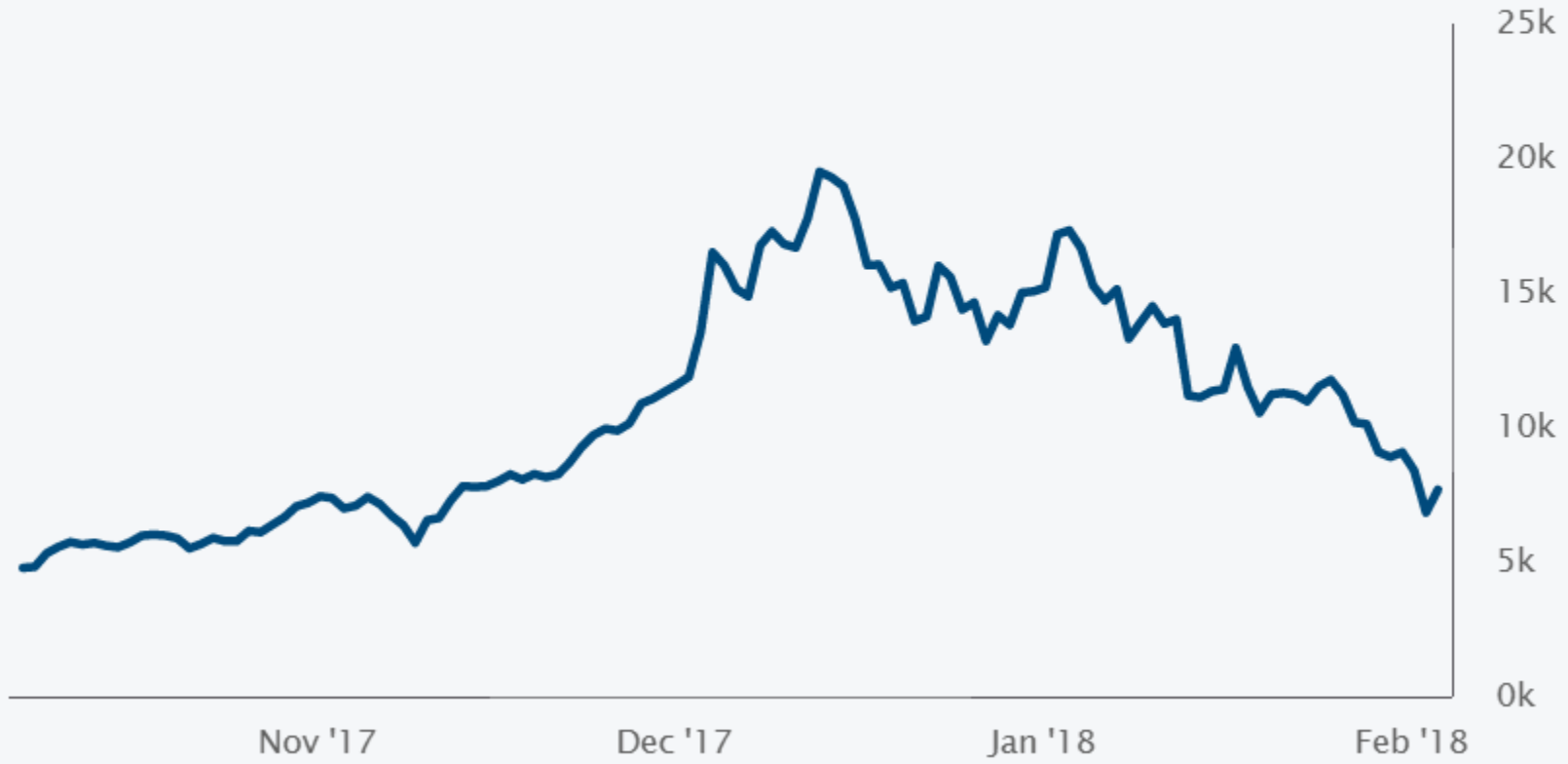
Bitcoin price warning: Cryptocurrency to reach $100,000 if it keeps ...

https://www.express.co.uk › Finance › City & Business

13 hours ago - **BITCOIN's** prices fell dramatically amid a frenzied sell-off following **news** the Chinese Government and Lloyd's bank would ban buying BTC with credit cards. But independent crypto trend analyst Ronnie Moas said **bitcoin's** value could reach $100000 if it maintains its current market share.

1 BTC = $7,353.16

Interactive Chart →



TRANSACTIONS PER DAY

The number of bitcoin transactions in the last 24 hours.

Transactions since Mon Feb 05 2018 7:46:28 PM.

MARKET CAP: $115,222,434,845.00

HASH RATE: 23,938,939.78 TH/s

City & Business News

Bitcoin ‘SKYROCKETS’ Cryptocurrency soars 25 per cent in 24 hours as 'investors celebrate'

A BITCOIN resurgence could be underway as the cryptocurrency soared over 24.5 per cent in the last 24 hours that has surely given investors an excuse to celebrate, it has been revealed.

By JOSEPH CAREY

PUBLISHED: 05:40, Wed, Feb 7, 2018 | UPDATED: 05:41, Wed, Feb 7, 2018

CEO of Major UK-Based Cryptocurrency Exchange Kidnapped in Ukraine

Wednesday, December 27, 2017 Mohit Kumar

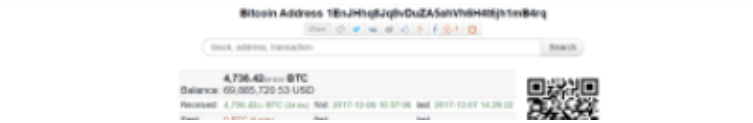
Share 6.06k Share 652 Tweet Share

Pavel Lerner, a prominent Russian blockchain expert and known managing director of one of the major crypto-exchanges EXMO, has allegedly been kidnapped by "unknown" criminals in the Ukranian capital [...]

Largest Crypto-Mining Exchange Hacked; Over $70 Million in Bitcoin Stolen

Wednesday, December 06, 2017 Mohit Kumar

Share 8.3k Share 2.1k Tweet Share



Bitcoin is breaking every record—after gaining 20% jump last week, Bitcoin price just crossed the $14,800 mark in less than 24 hours—

Separating the hype from the technology

- Crypto currencies are becoming popular with banks, consumers and various industries.
- There is a need for consumers and students to understand the basic underlying technology behind these crypto currencies and the underlying value, security risks and concerns.

Core Topics

- Cryptocurrencies
  - Bitcoin (BTC, started in January 2009 after paper by “Satoshi Nakamoto”
  - Altcoins - Ethereum, Ripple, Bitcoin Cash, Cardano, Litecoin, NEM, Stellar, NEO, IOTA, Dash, Monero, TRON
- Blockchain (invented by Satoshi Nakamoto in 2008, as public transaction network for Bitcoin)
- Mining
- Proof of Work
- Wallet
- Exchange
- Initial Coin Offering (ICO)
- Regulations
- Cybersecurity

Embed within Traditional Programs/Courses

- Accounting
- Finance
- Business
- Computer Science
- Information Technology
- Cybersecurity
- Administration of Justice
- Law
- Etc…

Examples from CompSci and Business

- Computer Science
  - Proof of Work Protocol
  - Economic measure to deter DDOS or Spam
  - Extend understanding to create transaction block in a chain
  - Mining computers, hash rate
  - Electricity consumption
- Business: Accounting, Finance, Supply Chain, Security
  - Tax and government regulations
  - Distributed ledger for private/public supply chain
  - Cryptocurrencies for payments
  - Initial Coin Offering (ICO) for startups
  - Security of Wallets and Exchanges

Session 8L:
Lightning Talks Session 2

3:45 – 5:00 p.m.