SNAP! - One Week Workshop for K-12 Teachers

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Outline

- Introduction
- Related Work
- Workshop Overview (Sessions)
- Curriculum Developed
- Assessment, Feedback, Suggestions
- Conclusions
Introduction

- K-12 Teachers
  - Prepare students for college and workforce
  - Inspire students in Computer Science
  - Teaching tools appropriate for audience

- One week workshop
  - Utilizing SNAP! software
  - Creation of interactive programs or games
  - Ability to edit code in modular fashion
SNAP!

- Released in 2011 by Jens Mönig
  - Browser based (written in Javascript)
    - Usable on most OS platforms (iOS, OSX, Win, Linux, etc.)
    - Online persistence
    - No admin privileges required
- Can be coded with many programming languages
- Drag-and-Drop for simple development
- Advanced concepts (lists, methods, etc.)
SNAP! Workshop 2014

- Week long SNAP! Summer Workshop (K-12 Teachers)
  - Introduce fundamental CS principals to students
  - Designed for all subjects and levels of expertise
  - Develop their own classroom curriculum utilizing SNAP! Features and workshop knowledge
    - Students may then both learn their respective subjects and create their own SNAP! projects

- Evaluated by external source for potential future improvements
Related Work

K-12 Teacher Outreach programs have proven effective to make CS accessible to them

- Survey done by Queen Mary University in 2013 [1]
- Lamar University - Stencyl (2013) [2]
  - Targeted K-12 teachers
- Marquette University - Computational Thinking for the Sciences (2010)
  - 3-day workshop for high school math and science teachers [3]
- Duke University (2008)
  - Three-week Alice course [4]
- Saint Joseph's University
  - Teacher Enrollment in Computer Science [5]
- Georgia Institute of Technology (2006)
  - Workshops to influence CS teaching style [6]
Workshop Overview

- Five-day workshop
  - Morning and afternoon sessions
  - Pre- and Post-tests given to assess absorbed knowledge

- Morning sessions
  - Fundamental concepts
  - Pre-Test
  - Example projects
  - Class assignments
  - Post-Test

- Afternoon sessions
  - Develop own personal curriculum
  - Tutor assistance available constantly
## Workshop Overview

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00AM-9:30AM</td>
<td>Registration &amp; Opening Session</td>
<td>SA-2 Input</td>
<td>SA-4 Variable</td>
<td>SA-6 Methods</td>
<td>Curriculum Development Presentations</td>
</tr>
<tr>
<td>9:30AM-10:30AM</td>
<td>SA-0 SNAP! Overview</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10:30AM-12:00PM</td>
<td>SA-1 SNAP! Introduction</td>
<td>SA-3 Conditional Branching &amp; Boolean</td>
<td>SA-5 Loops</td>
<td>SA-7 Lists</td>
<td>Closing Session</td>
</tr>
<tr>
<td>1:00PM-3:00PM</td>
<td>Participant Introduction &amp; Curriculum</td>
<td>Curriculum Development</td>
<td>Curriculum Development</td>
<td>Curriculum Development Presentations</td>
<td></td>
</tr>
</tbody>
</table>
Session-0: SNAP! Overview

- SNAP! Website
  - Programming style
  - Free to use
  - Cloud Storage

- Launch SNAP!
  - Basic layout
  - Selling points of the program
Session-1: SNAP! Introduction

Main features of the program
- Create simple app from start to finish
  - Character Sprite
  - Blocks Editor
  - Movement

Focused completely on learning SNAP!
- No example or assignment to work

Each session explained fundamental computing concepts
- Sample program used to present relevant concept
- Assignment given to develop with help from tutors
Session-0 and 1:
SNAP! Overview and Introduction
Session-2:
Input and Output

- **Input**
  - Single/multiple character
  - Mouse actions

- **Output**
  - String (Persistent / Temporary)
  - Numeric
  - Triggering actions

- **Example**
  - Character sprite asks name when clicked
  - Display input name on-screen

- **Assignment**
  - Character sprite asks for a number
  - Make sprite move that many steps
Session-2: Input and Output

- Assignment: Move sprite certain number of steps
Session-3: Conditional Branching and Boolean

- Conditional Branching
  - Flow of execution

- Boolean
  - Data Type
    - True / False

- Example
  - Given a dog and told to use branching and Boolean values
  - Make the dog rotate if a certain random value is chosen

- Assignment
  - Similar to example
  - On top of previous requirement, make something else happen to the dog if the random value is NOT chosen (if/else)
Session-3: Conditional Branching and Boolean

- Assignment: Rotate the dog or turn it into a cat
Session-4: Variables

- Storing data
  - How to utilize
  - Type
    - String
    - Numeric

- Example
  - A sprite asks for a distance and name
  - Store the answers for both
  - Move the sprite said distance and repeat back the name

- Assignment
  - A sprite asks a question about where to move on the screen
  - Store the answer in a variable
  - Move it to said location
Session-4: Variables

- Assignment: Use variables to rotate the sprite, make it ask a question, and move to a point on the screen
Session-5: Loops

- Loops - Repeat a sequence of steps
  - Repeat until (while)
  - Repeat # (for)
  - Forever (infinite)

- Example
  - Use a “Repeat until” (while) loop
  - Make a sprite do preprogrammed “laps” the given number of times

- Assignment
  - Utilize a “Repeat #” (for) loop for the same concept
Session-5: Loops

- Assignment: Use (for) loop to do “loops” # of laps
Session 6: Methods

- Create your own custom function blocks
  - Parameters
  - Return value

- Example
  - Create method with one parameter to shift a sprite left or right
    - Use Boolean and Conditional Branching

- Assignment
  - Create grow method to increase sprite size by 10%
  - Create shrink method to do the opposite
  - Map each respective method to an input key press
    - Ex: Up/Down
Session 6: Methods

- Example: Create method with a parameter to shift a sprite left or right
Session-7:
Lists

- **Data Structure for organization**
  - Starting at 0
  - Count indices for attaining values from lists
  - May store any type of variable (including strings and other lists)

- **Example**
  - Create a list
  - Populate the list
  - Display content and length of the list

- **Assignment**
  - Create a list using a loop
  - Add/remove items from the list
Session-7: Lists

- Assignment: Create list with a loop and add/remove items
Curriculum Materials Developed by Workshop Participants

- Participants designed their own curriculum using SNAP!
  - Covers wide range of subjects
    - Science
    - Math
    - English
    - Computing
  - Flexible platform to utilize various concepts
    - Variables
    - Classes
    - Methods
    - Lists
- Various projects listed in Table 1 on Slide 26
Curriculum Materials Developed by Workshop Participants

- **Sandcastle Cartesian Plane: 5th-7th Math**
  - Review of 4 quadrants of Cartesian Plane
  - Place shells in correct quadrant
  - Uses Booleans, Branching, and Loops

- **Home Row Keys: 7th Technology**
  - Tests on posture, technique, and home row key placement
  - Uses Booleans, Variables, Loops, and Lists

- **Intro to Chemical Equations: 9th-11th Chemistry**
  - Shows chemical equation representation of reactions
  - Users select answer to equations, and if wrong are given hints in the form of potential materials
  - Uses Booleans and Branching
## Curriculum Materials Developed by Workshop Participants

<table>
<thead>
<tr>
<th>Subject</th>
<th>Project Name</th>
<th>Target Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Computer Technology</strong></td>
<td>Business Information Management</td>
<td>10th-12th</td>
</tr>
<tr>
<td></td>
<td>Home Row Keys - A Pre-Test</td>
<td>7th</td>
</tr>
<tr>
<td></td>
<td>Digital Communications for the 21st Century</td>
<td>9th-12th</td>
</tr>
<tr>
<td><strong>English</strong></td>
<td>Vocabulary Review Game</td>
<td>2nd</td>
</tr>
<tr>
<td><strong>Math</strong></td>
<td>Multiplication Drills</td>
<td>1st-5th</td>
</tr>
<tr>
<td></td>
<td>Dinosaur Math</td>
<td>2nd</td>
</tr>
<tr>
<td></td>
<td>Sandcastle Cartesian Plane</td>
<td>5th-7th</td>
</tr>
<tr>
<td></td>
<td>Do You Know Where You Are?</td>
<td>10th-12th</td>
</tr>
<tr>
<td></td>
<td>M and M’s Multiplication Madness</td>
<td>3rd</td>
</tr>
<tr>
<td><strong>Science</strong></td>
<td>Introduction to Chemical Equations</td>
<td>9th-11th</td>
</tr>
<tr>
<td></td>
<td>Atomic Structure</td>
<td>6th-8th</td>
</tr>
<tr>
<td></td>
<td>The Water Cycle</td>
<td>10th-12th</td>
</tr>
<tr>
<td></td>
<td>Density</td>
<td>2nd</td>
</tr>
</tbody>
</table>
Curriculum Materials Developed by Workshop Participants

- Sandcastle Cartesian Plane
Curriculum Materials Developed by Workshop Participants

- Home Row Keys

When typing your feet should be __ on the floor.
Curriculum Materials Developed by Workshop Participants

- Introduction to Chemical Equations

\[ \text{What are the small numbers to the right of the symbols called?} \]

\[ \text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O} \]
Workshop Assessment

- **16 participants**
  - Taught grade range
    - 38.46% Elementary School
    - 15.38% Middle School
    - 46.15% High School
  - Taught subjects range
    - Science
    - Math
    - English
    - Computers
  - Average experience 9+ years

- **Pre- and Post- Self-assessment Surveys**
  - 10 Questions for each day
  - Rank themselves from 1 to 5 on comfort level with concepts
  - Pre-Workshop average was 2.52
  - Post-Workshop average was 3.76
Workshop Assessment

- Outside Evaluator collected pre- and post-workshop assessment materials
  - Two types of assessment (avoiding self-interest)
    • Participant self-assessment (SurveyMonkey)
    • Assessment by workshop instructors
  - Participants completed questionnaire and interview to provide feedback

<table>
<thead>
<tr>
<th>Day</th>
<th>Pre-Test Average</th>
<th>Post-Test Average</th>
<th>Score Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.28</td>
<td>4.87</td>
<td>+1.59 (48.30%)</td>
</tr>
<tr>
<td>2</td>
<td>1.46</td>
<td>3.22</td>
<td>+1.76 (121.17%)</td>
</tr>
<tr>
<td>3</td>
<td>1.98</td>
<td>3.54</td>
<td>+1.56 (78.80%)</td>
</tr>
<tr>
<td>4</td>
<td>1.47</td>
<td>2.99</td>
<td>+1.52 (102.99%)</td>
</tr>
</tbody>
</table>

Rubrics:
1. No understanding of the concept
2. Very little understanding of the concept
3. Little understanding of the concept
4. Moderate understanding of the concept
5. Complete understanding of the concept
Workshop Assessment

- **Pre- and Post-tests (Table 2, Slide 31)**
  - 35 Total Questions
    - 5 for day 1
    - 10 for days 2-4
  - Day 1
    - Basic SNAP!
    - Windows / Features
  - Day 2
    - Input
    - Conditional Branching / Boolean
  - Day 3
    - Variables
    - Loops
  - Day 4
    - Methods
    - Lists

- First session showed more improvement than computing concepts, implying they need more focus in the future
Workshop Assessment: Successful Strategies

Positive feedback

- No computing background necessary
- Information is relevant to their needs
- Schedule being available early allows preparation
- Working through examples carefully illustrates concepts to the audience
- Hands-on with code was helpful for retaining knowledge

- Tutors
  - Flexible
  - Numerous
  - Knowledgeable
  - Invested

- Interaction between participants encouraged
- Lack of awkward competitiveness
Workshop Assessment: Suggestions

- **Negative feedback**
  - Speed was rather abrasive at times
  - Two weeks suggested as preferred length
  - Hardcopies are preferred by some participants rather than just online availability
  - Participants wish to share with more teachers

- **Pre- and Post- Workshop evaluation questions**
  - 30.77% found the materials somewhat difficult
  - 61.54% found the materials moderate
  - 7.69% found the materials easy
  - As Table 2 showed in previous slide 31, improvement ranged from a significant 48.3% to 121.17%
Conclusions

- SNAP! Workshop for K-12 teachers
  - Drag and drop development
  - Many platforms to run on
  - Introduces fundamental computing concepts

- Teachers make curriculum for later semesters
  - Potentially teach students to make tools also

- Pre- and Post-workshop assessments show confidence in the concepts presented and learned
  - Increase of computing knowledge level by 25%
  - 92.31% rated the workshop as good/excellent
Thank You!

Any Questions?