Weaving Computing into all Middle School Disciplines

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Outline

• Motivation
• Adventures in Alice Programming Project
• Curriculum Materials
• Impact
• Future Work
Problems with
Computer Science in Grades 1-12

1. Computer Science is not in many schools
   Few high schools teach AP computer science
   Fewer middle schools teach computing
   Not even required at the college level

2. Students don’t know what it is
   Not keyboarding, PowerPoint, spreadsheets

3. Where are the women and minorities?
   Number of underrepresented groups in computer science is low
Why Schools Should Teach Computer Science (CS) – (from NCWIT.org)

• Computer Science gives students vital 21\textsuperscript{st} century skills
  – C.S. underlies most innovation today

• C.S. means rewarding careers
  – Predicted shortage of technical jobs in the future
  – Wide range of options in CS (health, environment, finance, arts, security ...)

• C.S. is more than just technology
  – CS teaches design, logical thinking and problem solving
Where does Computer Science fit in middle and high schools?

- Technology
- Science
- Mathematics
- Language Arts

- History
- Foreign Language
- Music
- Art
Alice Programming Language

- Create interactive stories or games
- Learn programming in an easy way, drag-and-drop your code
- Problem solving with visual feedback
  - Logical thinking, Computational thinking
- Along the way, learn computer science concepts:
  - Loops, classes, methods, functions, arrays
- Developed by Randy Pausch at CMU
- alice.org
Why Alice?

- Lots of other great tools for teaching programming

- Alice is easy to use, drag-and-drop, objects already exist

- Storytelling - Attractive to both girls and boys
CompSci 94, Fall 2013

Home

Course Announcements

- August 27, 2013 is the first day of class. NOTE THE ROOM CHANGED and is now in LSRC D106.
- You will need to bring a laptop to class and install Alice version 2.3 by August 27 if possible. (NOTE, There are two versions of Alice that are quite a bit different. We will be using Alice 2.3 to start with, and later use Alice 3.1. DO NOT use the CD that comes with the book, but instead follow instructions on the Resources page)

CompSci 94
Introduction to Programming
Via Animation and 3D Virtual Worlds

CompSci 94 is an introductory programming course that teaches fundamental computer science concepts. This version of CompSci 94 uses the tool Alice to create 3-D virtual worlds. You will learn programming constructs such as looping, selection, and data structures, along with how to control objects (raise hands, flap wings, move, turn, spin, walk, etc.).

This is a hands on course. During class we will be writing programs with partners, designing 3-D virtual worlds. Outside of class projects will be done alone, unless otherwise stated.

- ATTENDANCE REQUIRED: Class attendance is REQUIRED since we program in class everyday. I need to know in advance if you have an excused absence for not attending class.

LAPTOP: If you have your own laptop, bring it to class. It will be much easier to keep all your work on your own laptop.
Success - Alice attracts diverse group

- At Duke
  - CompSci 4 Spring 2005
    - 22 preregister, 30 enroll (12 female + 3 African Amer.)
  - CompSci 4 Fall 2005
    - 20 preregister, 31 enroll (17 female – 1 African Amer.)
  - CompSci 4 Fall 2006 – 2 sections
    - 64 students, 33 female, 7 African Amer.
  - CompSci 4 Fall 2007 – 2 sections
    - 84 students -> 50% female
  - CompSci 4 Fall 2008 – 2 sections
    - 100 students -> 50% female
  - Same for Spring 2009, Fall 2009...
  - Advertised in school paper
    - picture of ice skater
    - Web site of animations
  - This course is now CompSci 94
Success - Alice Excites 4\textsuperscript{th}-6\textsuperscript{th} Grade Girls

- Duke Femmes Event, April 07
- 60 girls – 4 groups of 15
- Taught them Alice for an hour
- Handout to take home
Bring on Alice Virtual Worlds!

• Alice is
  – Hands-on!
  – Interactive!
  – Visual!
  – Less Error prone
  – Exciting Results right away!

• Alice has the potential to excite kids about computer science in the same way that experiments excite kids about chemistry, physics and biology!
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Adventures in Alice Programming
Grades 5-12 Outreach

www.cs.duke.edu/csed/alice/aliceInSchools
Adventures in Alice Programming

• 2-week Teacher workshops
  – Over 200 teachers, middle school, high school, some elementary
  – First week Teach Alice, Practice
  – Second week - Develop Lesson Plans
  – One-week follow-up workshop the following summer
  – Summers 2008-2015, funding for lodging

• Main Sites:
  – Duke University, Durham, NC
  – Charleston/Columbia, SC
  – San Jose, CA (starting 2014)
Integrating Computing into all Disciplines

• Teachers attending are from all disciplines:
  – Language Arts
  – Mathematics
  – Science
  – History
  – Foreign Language
  – Music, Art
  – Media, Technology
  – Business
Using Alice in Middle/High Schools

• Teachers
  – Examples in lecture
  – Make interactive quizzes
  – Make worlds on concepts for students to view

• Students
  – Projects (in place of a poster, a model)
  – To take or build quizzes
  – To view and answer questions about a world
  – Older students can do more with Alice.
Recruiting Teachers

• NC Dept of Instruction –
  – Mailing lists
  – send info on professional development opportunities

• Attend and present at conferences (ask teachers!)
  – North Carolina Career and Technical Education Conference
  – North Carolina Catholic Schools Education Conference
  – Durham Public Schools Technology Showcase

• Give them Education credits/hours

• Pay teachers – how much?
  – First Workshop - $500/week
  – Second Workshop - $50/week
Outline

• Motivation
• Adventures in Alice Programming Project
  • Curriculum Materials
    – Over 90 tutorials available for free
    – Beginner, advanced, challenges, projects
    – Paper handouts and video
• Impact
• Future Work
Getting Started Tutorials

• One-hour tutorial
  – Covers placing objects, setting camera views, basic commands, writing methods and events

• 3 versions of it – pick story your students will like
Getting started tutorial
One hour

Hey! Welcome to my island!
3-4 Part getting started tutorials

• One long story in three or four parts (about 3 hours)

• 4 stories to pick from
Example: Getting Started Tutorial teaches:

- Placing objects
- Moving objects
- Setting up Camera tripods and moving between views
- Using built in methods and writing your own
- Gluing objects together
- Adding sound, 2D pictures to enhance world
Getting Started Tutorial – 3 part
Topical Tutorials – CS Topics

• Who is taller? Making decisions
  – conditional
• Making a fancier chicken
  – Inheritance
• How to get all ninjas to kick at the same time
  – List
• How to visit all your friends
  – Making methods flexible - parameter
Animation Tutorials

- Camera
- Lighting
- Adding images and sound
- Invisible objects
- Changing scenes
- Putting real people in Alice
Animation tutorial: Scene Change
Animation Tutorial – Camera views following a person
You can put anyone in an Alice world

The ITiCSE 2014 boat trip
Sample Project Tutorials

• Discipline Specific
• Sample games
Tutorial for Project: Book Report

Charlotte's Web
by E.B. White
¡Bienvenido al programa de cocinar!
Cooking Spanish – More detailed

Vamos a hacer pan de plátanos!
Cooking Spanish – setting the table
Tutorial for Simple Game – Control boat, earn points

To win this game, you must steer the boat through each ring and beat the clock. You receive one point for each ring, and there are 10 rings, so if your score is less than 10 at the end, you lose!
Tutorial for Adventure Game – Find objects in order
Keyboarding
Challenges

• A world that is mostly built
• Has missing pieces (challenges)
Harry Potter Challenge

• Mix of programming and math challenges

Hailey Programmer and the Goblet of Java

You will receive a password at the end of each level that will be used to unlock the next level. WRITE THESE DOWN!
If this is your first time playing, select Charms.
Harry Potter – Math/computing
Level 1 Charms - before
Harry Potter – Math/Computing
Level 1 Charms - after
Biology – Punnett Squares
Other Example Challenges

Boat

To win this game, you must steer the boat through each ring and beat the clock. You receive one point for each ring, and there are 10 rings, so if your score is less than 10 at the end, you lose!

15.0

Calculator
Helper Objects

• Quiz objects
• Timer object
• Score object
• Fader object – for scene change world
Teacher Developed Lesson Plans

• Over 170 lesson plans
• Organized by discipline and grade level
• The teachers spend

  • Colonization by Deborah Aringe (2012)
    - Lesson Plan
    - Alice World (Finished)

  **English**

  **Pre-K/Kindergarten**
  • Seasons - by Susan Smith (2012)
    - Lesson Plan .pdf and .doc
    - Alice World Seasons.a2w

  **4th Grade**
  • Poetry - Haiku by Rachel Rodrigues (2008)
    - Lesson Plan .pdf and .rtf

  **6th Grade**
  • Vocabulary by Courtney Rudder (2012)
    - Lesson Plan (.pdf)
    - Vocabulary World (.a2w)
    - Word Trees (.a2w)
History Lesson on Civil War Battles

- Teacher created sample world
- Students add scenes to it

Go back in time and visit civil war sites

Fort Sumter: Where the Civil War Began
April 12, 1861

Question
Enter the number of casualties.

OK Cancel
Example Science lesson

When the condensation gets too heavy in the atmosphere, it falls back to Earth as PRECIPITATION.
Sample Science Lesson (cont)

- Objective: Learn to explain the water cycle using Alice
- Learn some Alice – beginner tutorial
- Hands on Experience with water
- View teacher demo world and answer questions
- Create a storyboard on your world
- Implement your world on the water cycle
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Impact

• Number of teachers
  – Over 200 teachers since 2008

• Number of students
  – Teacher Workshop 2012 and 2013
    • Our teachers have taught Alice to 2900 students

• Google Analytics on our curriculum website
  – Since Sept. 2012 – over 20,000 users
Recent Outreach Events with kids

• Taught 3 sixth grade math courses Alice for an hour
• Ran 1-hour to 3-hour Saturday workshops on Alice
Alice Symposium June 2013

• Around 120 people
• Papers, invited talks, posters
What a middle school kid can do with Alice – from teacher Chari Distler
What a 6th grader can do with Alice - teacher Chari Distler
No Superheros in Alice
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Future

• Beginner Workshop July 2014
  – More workshops in summer 2015
• Converting paper tutorials to video
• Developing Assessments for our tutorials
• Creating more challenges
• Integrating Alice with math
Adventures in Alice Programming web site

www.cs.duke.edu/csed/alice/aliceInSchools

Questions?