Adventures in Alice Programming - K-12 Outreach

Prof. Susan Rodger
Computer Science Department
Duke University
www.cs.duke.edu/csed/alice/aliceInSchools

Supported by the National Science Foundation Grant ESI-0624642, with additional support from International Business Machines.
Motivation – Declining Enrollments, Few Women

Figure 1. Computer Science Listed as Probable Major Among Incoming Freshmen
Source: HERI at UCLA
How do we Teach Science?

• Physics – experiments

• Chemistry - experiments

• Biology - experiments
How do we Introduce Computer Science?

- Write a calculator
- Write a banking program
- Etc…
Why Can’t the Introduction of Computer Science be exciting?

• Programming – it’s always been
  – Hands-on
  – Interactive
  – Frustrating!

• What’s missing?
  – Not Getting Exciting Results
    • Easily, right away
  – Not appealing to today’s kids in which media and technology are a part of their life!
Our Approach to Making CS Exciting – Teach Alice – Especially at K-12

Outline

• Overview of Alice
• Usage of Alice at Colleges
• Usage of Alice at K-12
• Adventures in Alice Programming – teaching K-12 Alice
Demo: Greeting Card
by, Jeff Schultes
Community College Student
Alice Programming Language

• Create Pixar like animations in 3D!
• Kangaroo jumping..
Alice Programming Language

- Create interactive stories or games
- Learn programming in an easy way, drag-and-drop your code
- Learn computer science concepts:
  - Loops, classes, methods, functions, arrays
- Developed at Carnegie Mellon University
  - Professor Randy Pausch
- Alice is free: www.alice.org
Alice Programming Language

• Has libraries of 3D objects

• Keeps Track of objects you select
Objects Have Multiple Parts that are moveable
Alice Code is Easy to Learn

Select Code, Drag-and-Drop code in program
Play Alice Animation

- Chicken rises, cow turns head and talks

Moo Moo Moo
Usage of Alice at Colleges

- In 2006-07, Alice was used at more than 300 colleges
- Alice is free, so difficult to track usage, probably higher
- Most of the usage is an introductory course
  - Pre-CS 1
  - Part of CS 1
Teach Computer Science Concepts with Alice

• Conditional and Repetition
• Methods, functions
• Events
• Inheritance
• Recursion
• Lists, Arrays
Successes with Alice - Success with At-Risk Students

• Study of at-risk students in college
  – Less success in math/little or no programming
  – Average grade in CS 1
    • Exposed to Alice: 3.0 gpa
    • Not exposed to Alice: 1.2 gpa
  – Went on to CS 2
    • Exposed to Alice: 88%
    • Not Exposed to Alice: 47%

– Stephen Cooper et al. – SIGCSE 2004
Success – Alice Symposium

- Duke University – June 19-21, 2006
- Over 100 college and high school faculty came to learn Alice
CompSci 4 – Alice Class at Duke

- Lecture for 10-20 minutes
- Students work on problem with computers in pairs
- Bring students back together
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
  - Advertised in school paper
    - picture of ice skater
    - Web site of animations
Games Created by Duke CompSci 4 Students

- Non-majors
- Most never programmed before
- Final projects after 10 weeks of Alice
- 50% of students are women
- Spring 05, Fall 05, Fall 06
Game: Candyland

Select girl and boy to play

Click on red and green buttons to move them.
Game: Catch Apples

Game: At the Fair
Game: Frogger – Get frog across road
Game: Cat
catch mice before dog
gets cat

Game: Putt
golf ball
into hole
Game: Eragon

4 tasks to win the game
Game: Bumper Cars
Game: Tic Tac Toe

Score: 4.0

Game: DDR

Click on arrow keys,
Player moves foot to square
Game: Dating Game

Questions: 1 2 3 4

Choose Contestant!
Usage of Alice at K-12
Success - Alice Excites 4th-6th Grade Girls

- Duke Femmes Event, April 07
- 60 girls – 4 groups of 15
- Taught them Alice for an hour
- Handout to take home
Dear Susan,

Thank you for showing me the Alice program. I think it’s really cool. I got my mom to download it, and I’ve created a show world. Again, I think Alice is really cool and thank you for showing it to me.

From [Name]
Used Similar Tutorial

• 75 minute session with High school girls on July 19, 2007

• Three 2-hour sessions with teachers
  – Durham Public School on August 21, 2007
  – Grades 6-12 Science and Math Teachers

• Many Alice workshops around the U.S.
Magic Tree House Quiz world
Target 2nd-4th grade (chapter book)

10. What did Jack find in the grass?
- a wallet
- a magician's hat
- dinosaur droppings
- a medallion
- I don't know

score 6.0
Magic Tree House Quiz World (more)

- View the rules
- Select a player (click on Jack or Annie)
- Step through 13 questions
- See your score

Written by

Mercedes Lopez, undergraduate
Goals in K-12

• Use a creative and highly motivating technology for teaching and learning
  – Logical thinking skills
  – Introductory computer programming concepts

• Attract students to computer science and computer technology career paths
How it Works

• Begin with a story

• Appeal
  – Storytelling
    • particularly young women & minority students
  – Interactive computer games
    • particularly young men
  – Not threatening
    • builds students’ confidence

• Can be interdisciplinary
Interdisciplinary

- Middle school teams often use a thematic unit across several disciplines

Example: Australia

Math:
- Mapping
- Measurement

Science:
- Flora
- Fauna (esp. Marsupials)

Arts:
- Aboriginal art & culture

Social Studies:
- Aborigines
- Geography (Outback, Great Barrier Reef)
Interdisciplinary

- Middle school teams often use a thematic unit across several disciplines

Example: Ancient Egypt

Math:
- Egyptian Math

Science:
- Irrigation
- Flooding of the Nile

Social Studies:
- Social pyramid
- Geography

Language Arts:
- Hieroglyphics
An Australian Story

- A kangaroo is hopping through the outback looking for kangaroo food
- In this session, we’re only going to teach a kangaroo to hop
- This story could perhaps be expanded to be part of an obstacle course or as part of accomplishing some larger task
Visual Storyboard

• Now, create a visual storyboard
  – Sketch major scenes with pencil and paper

Scene 1
Initial setting

Scene 2
Kangaroo is in the middle of the hop
Textual Storyboard

• Create a "to-do" list

  Do the following steps in order
  Do the following steps together
    Kangaroo moves up
    Kangaroo’s legs turn backwards preparing to jump

    Do the following steps together
    Kangaroo moves back down
    Kangaroo moves forward
    Kangaroo’s legs turn forward as it lands
Many different stories to tell
Ideas for Usage in K-12

• Introductory Programming Course
• After school program
• Projects for Modules
  – instead of a poster or powerpoint presentation, create an Alice world
  – For any course! Ex/ English – book report
• Create advertisements for school events/clubs
• Create quizzes for younger kids
• Create public service announcements
Teacher Usage

- Create short animation to introduce a topic, give an example or just to spice up lecture
- Create a study guide and/or quiz
- Work with teachers at other grade levels, maybe get older students to create fun Alice worlds that elementary school kids
  - Math, Reading
Adventures in Alice Programming

• National Science Foundation  ITEST Grant
• IBM Faculty Award for Durham region
NSF ITEST Sites

- Durham, NC - 2008
- Virginia Beach, VA – 2006
- Charleston, SC - 2008
- Denver, Colorado - 2008
- Santa Clara, California - 2008
- Oxford, Mississippi - 2008
The Program at Duke University

• Summer 2008
  – Workshops for high school and middle school teachers to learn Alice (3 weeks)
  – Summer camp opportunities for high school and middle school students (1 week)

• Academic Year 2008-09
  – Teachers integrate Alice into schools
  – Duke students provide support

• Summer 2009
  – Followup workshop (3 days) for teachers
Summer 2008 Details

• Three weeks
  – Week 1: June 16-20
    • Learn Alice
  – Week 2: June 23-27
    • Develop curriculum materials
  – Week 3: Either July 7-11 or July 14-18
    • Summer Alice camp for kids at Duke
      – Testing with kids and continue development

• Teachers paid $1500 for three weeks
• 5 Duke Students providing support
• Wanda Dann (Alice author) a presenter
Future of Alice

• Alice 3.0 – includes Sims Characters
  – Drop Alice into Eclipse/Java
• StoryTelling Alice – easier version for middle school kids
  – Caitlin Kelleher, PhD Thesis, CMU
  – Multiple Scenes, Easier to move characters
Alice Software – is free!

- Runs on Mac and PC
- My Alice Materials web site
  
  www.cs.duke.edu/csed/alice

- Textbooks available – more coming…
  - Learning to Program with Alice by Dann, Cooper, and Pausch

- Download from web
  
  www.alice.org
Contact Information

Susan Rodger
rodger@cs.duke.edu
http://www.cs.duke.edu/~rodger