More Motivation, Adventures in Alice Project, Usage of Alice in K-12

Susan Rodger
Duke University
July 11-22 2011

Supported by the National Science Foundation Collaborative Grant NSF 1031351, CRA-W distributed mentor awards, and Faculty Awards from International Business Machines.
Computer Science Declining Enrollments, Few Women

Figure 1. Computer Science Listed as Probable Major Among Incoming Freshmen
Source: HERI at UCLA
CompSci 4 – Alice Class at Duke for non-majors

- 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
  – CompSci 4 Fall 2008 – 2 sections
    • 100 students -> 50% female
  – Similar in Spring 2009, Fall 2009, etc
  – 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, Fall 07, Fall 08, Spring 09
Game: Candyland

Select girl and boy to play

Click on red and green buttons to move them.
Game: Frogger – Get frog across road
Game: Eragon

4 tasks to win the game
Game: Tic Tac Toe

Score: 4.0

Game: DDR

Click on arrow keys, Player moves foot to square
Game: Dating Game
Rumble Putt
By Greg Halperin

Game:
Rumble Putt
Game: Sarah Palin’s Seaplane Adventure

TODD'S SNOW MACHINE HAS BROKEN DOWN... AND IT'S UP TO YOU TO SAVE HIM!

SARAH PALIN'S SEAPLANE ADVENTURE

INSTRUCTIONS  PLAY  CREDITS
Sarah Palin’s Seaplane Adventure (cont)
Transition - Alice into K-12

• Non-majors course at Duke
  – Popular, fills up with seniors
  – College students pretty set with their major before they come
• Students in middle school are starting to form decisions on careers
• They have exposure to Teachers, Doctors, Astronauts, etc.
  – BUT DON’T KNOW WHAT COMPUTER SCIENCE IS
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
• Event again every year since
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 Lime
Adventures in Alice Programming
Grades 5-12 Outreach

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

• Integrate Alice into high school and middle schools by training teachers

• Started with Six Regional sites in 2008:
  
  Durham, NC   Charleston, SC   Virginia Beach, VA
  Denver, CO    Oxford, MS      San Jose, CA

• Durham site

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

• We’ll go over the history of what we have done and plan to do
Duke: Adventures in Alice site

• Summer 2008
  – 3-week Teacher workshops
    • About 35 teachers, mostly middle school, some high school
    • All disciplines
    • Taught them Alice, Developed Lesson Plans
  – 1-week middle school camps
    • Taught Alice
    • Lots of time to build their own Alice worlds

• NSF ITEST grant, IBM support
How to Use Alice in Middle Schools

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

• Students
  – Projects (in place of a poster, a model)
    • Bonus – Learn programming while preparing project!
  – To learn concepts by interacting with worlds
  – To view and answer questions about a world
We have developed Introductory Tutorials

1. Simple, Short (15 min) tutorial to try Alice
   - Add an object, use built-in methods

2. One hour tutorial for younger kids
   - Writing methods, simple events, camera
   - two versions – we’ll do astronaut/moon

• Four part tutorial for middle school kids
  - More detailed on placement of objects, writing methods, events, camera control
  - three versions – we’ll do knight rescue princess from dragon

• 2-3 versions of each of these tutorials
Many short tutorials on CS Topics

- CS Topics
  - Programming – sequential and “at the same time”
  - Methods
  - Events
  - Looping
  - Conditionals (making a choice)
  - Functions (compute and return an answer)
  - Lists
  - Variables
Other “Fun” Topics Blended in

- Storyboards
- Changing camera views
- Scene changes and lighting
- Making Billboards
- Making objects invisible and visible
- Sounds
- Glueing objects to others
K-12 Example worlds and Lesson Plans

Developed by teachers from previous summers
Science Example:
How volcano is formed

Today, we are going to see how HOT SPOT volcanoes form.
Deep under the earth's crust heat from the core makes the mantle move like a lava lamp.
Over thousands of years, the volcano builds up...
And emerges above the ocean as an island.
Math Example:
Teacher Lesson Plan on quadrant plane

- Click on lighthouse
- Enter x,y position
- Objects randomly move
5. What type of tree is the treehouse on?

- maple
- oak
- a magic tree of no special type
- elm
- I don't know

score 5.0
Other Ideas for Projects

• Story from Ancient Egypt
• Spanish Quiz in which you see a word and have to click on the object the word represents
• Animate a scene from a book you have read or a poem you have written
• Create a world about school safety
• Memory game – remember a random color sequence
• Math Quiz – Answer the questions

Alice worlds for these and more are on our website.
Other Teacher Lesson Plans

• Math
  – Finding surface area
  – Rate of Change and Slope

• Science
  – Create a food chain
  – Sun, Earth and Moon system
  – Tornados
  – Physics – Newton’s law of gravity
  – Alternative Energy
Other Teacher Lesson Plans (cont)

- History/Social Studies
  - The continents – view world and answer questions
  - Animated overview of Japan
  - Animated overview of Egypt

- English
  - Write and animate a poem
  - Animate a poem or scene from a story
  - Write a movie trailer
Usage of Alice by Middle School Students in Alice Camp 2008
We examined the student’s worlds - What type of objects did they use?

• Girls top five
  – People, animals, environments, nature, 3D-text

• Boys top five
  – Vehicles, people, buildings, scifi, special effects
Typical Boy Example

take down those robots
SciFi, vehicles, fire
More fire
And more fire
And more fire!
Girl Examples – Dancing chicken
Girl Example 2 – Egypt story

behind me is where mummies lie.
Girl Example 3 – Attack of the lemurs

Hello I'm the chief of this island and we welcome you.
Girl Example 4 - carnival
Girl Example 5 – rescue baby
How did the Students use Alice?

- Examined worlds to see which concepts they used

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>at least once</th>
<th>3+ times</th>
</tr>
</thead>
<tbody>
<tr>
<td>parameters</td>
<td>34%</td>
<td>17%</td>
</tr>
<tr>
<td>loop</td>
<td>57%</td>
<td>23%</td>
</tr>
<tr>
<td>list</td>
<td>45%</td>
<td>8%</td>
</tr>
<tr>
<td>simple event</td>
<td>57%</td>
<td>34%</td>
</tr>
<tr>
<td>4 arrow event</td>
<td>60%</td>
<td>26%</td>
</tr>
<tr>
<td>if statement</td>
<td>43%</td>
<td>11%</td>
</tr>
<tr>
<td>vehicle property</td>
<td>88%</td>
<td>46%</td>
</tr>
<tr>
<td>camera controls</td>
<td>80%</td>
<td>51%</td>
</tr>
<tr>
<td>scene change</td>
<td>51%</td>
<td>26%</td>
</tr>
<tr>
<td>color property</td>
<td>66%</td>
<td>17%</td>
</tr>
</tbody>
</table>
Feedback from Parents

• “[My daughter] thoroughly enjoyed her week with you. It was a great experience!”
• “I’m convinced. Kids like Alice and Alice is a good way to teach kids programming. [My son] is doing my python course and he’s not all that interested in python and never touches it between the courses. However, in the evenings when he comes home from the Alice course, he works on his Alice worlds.”
Summarizing 2008

• We developed
  – Tutorials
  – Examples of possible use in Middle Schools

• Teachers developed
  – Lesson Plans for history, science, math, language arts, art, and technology
  – Animation Fair

• Middle School Students
  – Were engaged, developed their own worlds
  – Animation Fair
  – Difficult to get away from the computer

All materials are on our website.
Summers 2009-2010

• June 17, 2009 – Alice Symposium
  – Submit papers, about 120 attendees
    www.cs.duke.edu/csed/aliceSymposium2009/

• 1-week Teacher beginner workshops
  – Over 100 teachers, mostly middle school, some high school
  – All disciplines
  – Taught them Alice

• 2-day followup Workshops

• Supported by IBM, some NSF
Other Outreach

• Teachers use Alice during the school year
• Been in touch with teachers on feedback on Duke student work
• Visited one of the schools
• Presented at the Durham public school technology day
Current/Future Work

- National Science Foundation ITEST Grant for 2011-2016
  - New two-week workshop every summer
  - One-week followup workshop every summer for previous summer participants
  - 1 or 2 Alice Symposiums during the five years

- Scale-up grant
  - Reach throughout the state – NC, SC, MS
Future of Alice

• What we need from you....
  – Your usage of Alice, any materials/lesson plans you develop this summer/fall and use. They must meet NC teaching standards.
  – Troubles you encounter along the way with schools/Alice, anything
  – Come back next summer for one-week followup workshop
  – Come back and submit/attend Alice Symposia