Computer Games as Intelligent Learning Environments: A River Ecosystem Adventure

Jason Tan, Ruchi Gupta, Chris BeersGautam Biswas
Vanderbilt University
The Teachable Agents Group
www.teachableagents.org

jason.tan@vanderbilt.edu
Why Video Games?

- Why has the video game industry been so successful?
  - Innovative, state-of-the-art
- Immersive, engaging, challenging, fun
- Flow, continuity
- A mix of fantasy and realism
- Students will use the system outside of the classroom
Attempts in the past

- Drill and practice
- Fail to meet expectations of students
- Potentially educational games, but not enough pedagogical emphasis, and no formal evaluation
Our approach
Betty's Brain

These are resources that you can use to teach about river ecosystems...etc, etc.

- River Ecosystem
- Concept Map Tutorial
- Resembling Process
Key features of Betty’s Brain

- Learning by teaching
- Teach, query, quiz
- Shared representation and responsibility
Build upon the success of Betty’s Brain

- Take the “Learning by Teaching” approach to the next level:
  - Prepare students for problem solving
- Create a game where the task matches the domain content
Choosing a game environment

- **Game genre**
  - Adventure game
    - Promotes inquiry and complex problem solving

- **Game engine**
  - NeverWinter Nights
    - Aurora toolset
    - Bioware Corp.
Advantages and disadvantages of NWN

- **Advantages**
  - Elaborate toolset for graphics, character editing, and scripting
  - Cheap! ($10 USD on Amazon.com)

- **Disadvantages**
  - Limited flexibility
The toolset
Screenshots

Mayor Thompson
You haven't been to the library yet? I would recommend going there to read up on the river ecosystem before going to teach Betty.

1. Ok. Thanks for the help!
2. Could you tell me more about the dying fish in the river?
Gameplay: Phase 1

- Betty has been called upon by the mayor of a river town to solve a problem in the river (e.g. Figure out why their fish are dying)

- Betty doesn’t know much about river ecosystems, so it is up to the player to teach her

- The player learns through available resources, and from experimenting in the pond
Gameplay: Phase 2

- The player and Betty go to the river town
- Underlying simulation starts
- Clues are gathered by talking to various people and by obtaining information directly from the river
- The player and Betty must present the solution to the mayor to complete the level
An example problem and solution

Problem: the fish in the river are dying

Solution: a fish farm has been created upstream

Reasoning:
- fish stocking → decrease in macroinvertebrates → increase in algae → increase in dead algae → increase in bacteria → decrease in dissolved oxygen → decrease in fish
Assessment and evaluation!

- Did they learn?
- Did they acquire problem solving skills?
Some initial feedback

- Students preferred using the game environment over the original Betty’s Brain system
- Students were motivated
- Students were successful in solving the complex diagnostic problem
Future work

- Display and animate the concept map in the game environment
- Perform a formal study
Summary

- Extend Betty’s Brain and the river ecosystem simulation into a video game environment
- Leverage the advantages of video games to take learning-by-teaching to the next level
- Facilitate learning, deep understanding, and the development of problem solving skills
Questions / Discussion

jason.tan@vanderbilt.edu

www.teachableagents.org