Computer Games as Intelligent Learning Environments: A River Ecosystem Adventure

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Why Video Games?

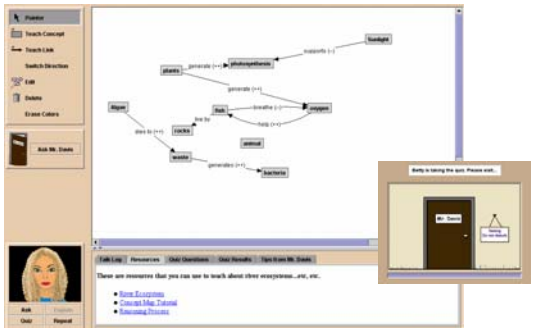
- Why has the video game industry been so successful?
  - Innovative, state-of-the-art
- Immersive, engaging, challenging, fun
- Flow, continuity
- A mix of fantasy and realism
- Students will use the system outside of the classroom

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

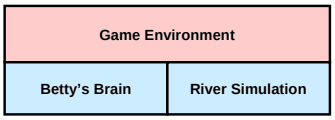


Key features of Betty's Brain

- 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



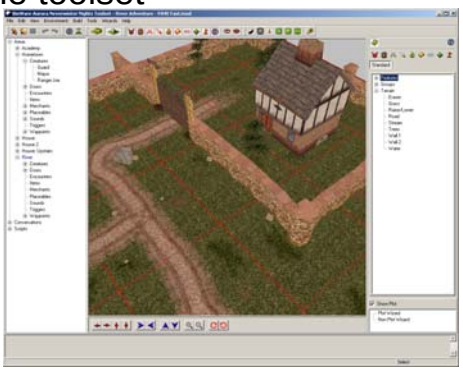
Choosing a game environment

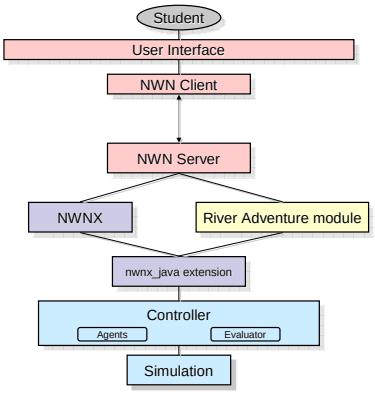
- Game genre
  - Adventure game
    - Promotes inquiry and complex problem solving
- Game engine
  - NeverWinter Nights
    - Aurora toolset
    - Bioware Corp.

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

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 mayor with the solution 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

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