

ADAPTIVE LEARNING ENVIRONMENTS: Deploying ALEs

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On the menu today

- Working definition(s) of deployment
- Deploying the “core systems”: How did I look for information?
- Comments on how the core systems are deployed, or not
- Discussion of what factors may contribute to systems being widely used
- Summary thoughts on deployment

Quick-and-dirty deployment survey

Materials:

A folder of PDFs, 5 project websites, and Google.

Participant:

N=1, F, drinking coffee and mumbling

Method:

Try to get a snapshot of if, and how, core systems were deployed. NOT an exhaustive review, at all!!!

**Deployment of
core systems, but
not Autotutor**

Cognitive Tutors

- Researchers Dr. Ken Koedinger, Dr. John Anderson and Dr. Steve Ritter founded very successful academic spin-out company, **Carnegie Learning**.
 - Remains very research and evidence driven.
 - <https://www.carnegielearning.com/specs/cognitive-tutor-overview/>
 - Has the cognitive tutors we have talked about, and many other projects
- Note that they are **selling a “package” of content:**
Tutoring system with related materials, teaching strategies.
Selling new curricula as well as a new way of doing.



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COGNITIVE TUTOR SOFTWARE

[TRY A DEMO NOW](#)

BROWSE:



Documents & Brochures

2014 Program Guide (Middle & High School)

Explore our Middle School and High School Math Series featuring our innovative, research-based software and textbooks for students in grades 6-12, and Professional Development for educators of Grades K-12.

Carnegie Learning High School Math Series Brochure

An overview of our textbook, software, and professional development offerings for high school.

Intelligent mathematics software that adapts to meet the needs of ALL students.

Our adaptive curricula, Cognitive Tutor software, is based on over 20 years of research into how students think and learn. The software was developed around an artificial intelligence model that identifies weaknesses in each individual student's mastery of mathematical concepts. It then customizes prompts to focus on areas where the student is struggling, and sends the student to new problems that address those specific concepts. The result is a powerful learning tool with the most precise method of differentiating instruction available.



- [Download the Cognitive Tutor Software Requirements Document](#)
- [View Our Cognitive Tutor Accessibility Support Page](#)
- [What's New for 2013-2014? Cognitive Tutor Software Enhancements](#)

Innovative Research-Based Pedagogy

- Engages students directly in problem solving
- Uses concrete, real-world scenarios
- Makes use of informal student knowledge

ANDES

The glorified physics textbook

Screenshot from
Van Lehn et al.,
(2005)

ANDES Physics Workbench - [dt5a.fbd]

File Edit Diagram Variable View Help

A 2000-kg car in neutral at the top of a 20.0 deg inclined driveway 20.0 m long slips its parking brake and rolls down.

If we ignore friction and drag, what would the magnitude of the velocity of the car be when it hits the garage door?

Answer:

T: Now that you have stated all of the given information, you should start on the major principles. What quantity is the problem seeking?
S: The magnitude of the instantaneous Velocity of car at time T1
T: Yep. What is the first principle application that you would like to work on? Hint: this principle application will usually be one that mentions the sought quantity explicitly. Therefore it's equation may contain the sought quantity that the problem seeks.

Variables

Name	Definition
T0	car starts rolling
T1	car hits garage door
x	axis
mc	mass of car
d	magnitude of the Displacement of
Fw	magnitude of the Weight Force or

- mc = 2000 kg
- d = 20.0 m
- Fw_y = mc * g
-
-
-
-
-
-
-
-
-

270 degrees

“Although Andes is called an intelligent tutoring system, it actually replaces only the students’ pencil and paper as they do problem-solving homework. Students do the same problems as before, study the same textbook, and attend the same lectures, labs and recitations.” (Abstract)

Van Lehn et al., (2005) on “Andes...Lessons Learned.”
I will refer to further material from this paper as ALL

Designed for deployment

- Result of collaboration between academics and US naval research, to meet specific goal (A.L.L.)
- Idea of a **minimally invasive system**
 - No changes to course content
 - Instructors teach courses as usual, and with usual books, materials, etc.
 - Only “outsource” homework to ANDES
- Suitable for a range of contexts: High school physics, introductory college physics, distance learning (ANDES website)

“the Andes project was not...interested in changing the curriculum significantly ...sections had to use the same textbooks, same final exams, similar labs and similar lectures as the non-Andes sections of the course. Thus, the challenge was to improve student learning while coaching only the student’s homework. That is, the tutoring had to be minimally invasive...we hoped that this would facilitate incorporating Andes into existing physics classes around the world.” (ALL, p. 4)

ANDES in action

- ANDES (version 2, with 2 semesters content) was used at USNA, in multiple classrooms, every year from 2003-2008. This is about ~160 students per year. (ANDES website)
- Unclear if USNA is using ANDES now: no publicly visible results re: ANDES on their website.
- ANDES project over– is anyone updating or continuing to support it? Not clear.
- Can use/obtain a free version online.

Mr. Davis: Well hi there, ALE-class! Welcome back to Betty's Brain. Now um...what were we supposed to do today?



Nicola



Mr. Davis

Betty's Brain

Continue

Start Conversation

Causal Map Science Book Notes Quiz Results Teacher's Guide



- Introduction
- Introduction
- Concepts
- Wolves
- Deer
- Hunters
- Grass
- Cows
- Rainfall



Mr. Davis

Start Conversation

Add a note

Introduction

Forests contain many different living things, such as [wolves](#), [deer](#), and [grass](#).

Other factors can affect these animals. [Hunters](#) kill the wolves and deer. The amount of [rainfall](#) can affect the grass.



creatures of the forest

Scaling up BB to a real teaching tool

Very useful 2008 conference paper describes how BB was changed for whole-class, teacher-led use.

- Wagster, J., Kwong, H., Biswas, G., & Schwartz, D. (2008, July). Bringing CBLEs into Classrooms: Experiences with the Betty's Brain System. In *ICALT* (pp. 252-256).
- *I will refer to this paper as “Wagster”*

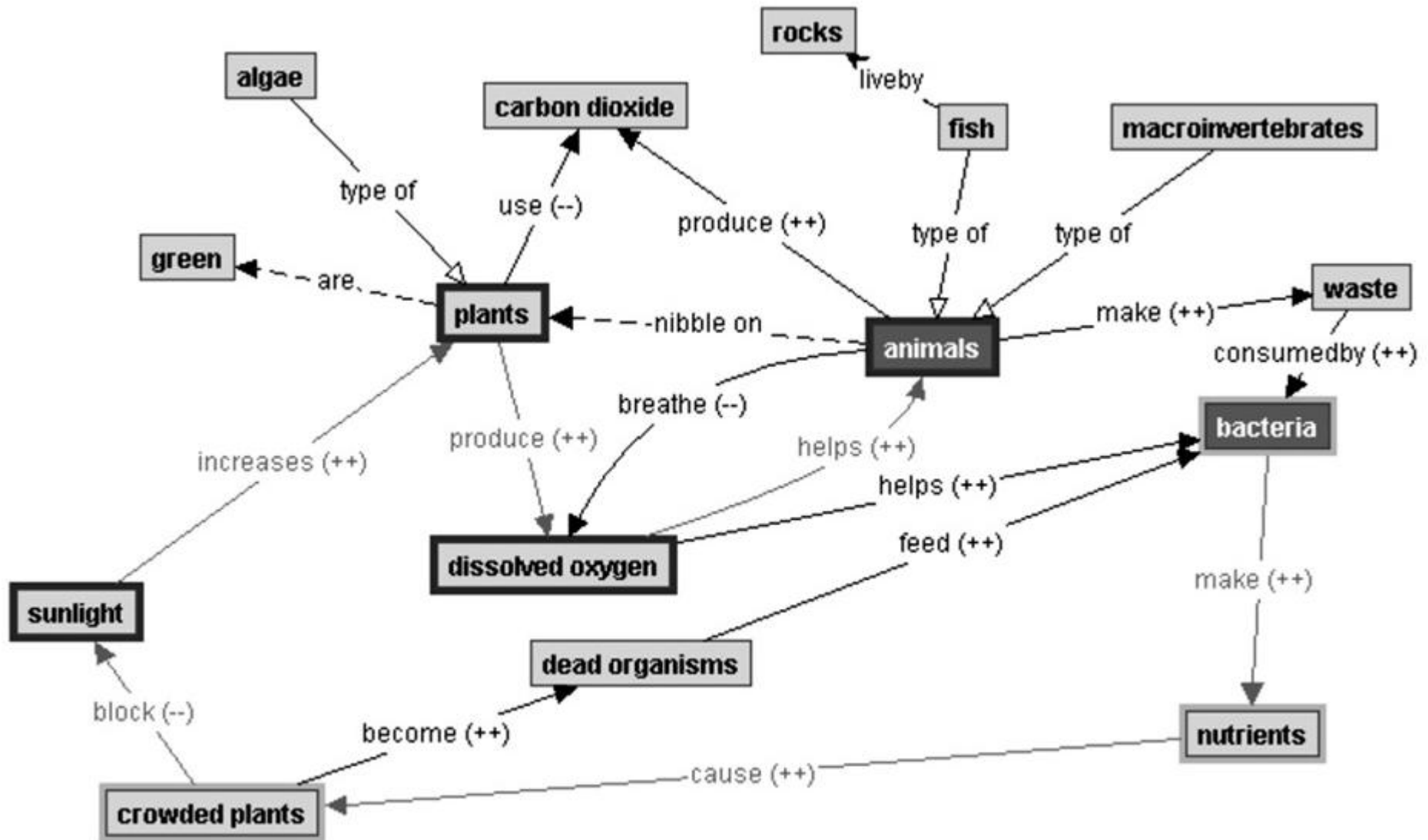
Research studies with BB:

- Researchers in school, use “research” version of BB on a mix of school, uni equipment
- **“Pull out format”**: take groups of 10-12 students outside main classroom, rotate through everyone.

Changes for the classroom

Overall goal: Adjust BB for teacher to use system as a tool for full-class lessons. Main changes as follows:

1. Provide admin, marking features for teachers
2. Back-end changes to...
 - Skirt tech difficulties introduced by feature changes
 - Accommodate school equipment and policies
 - Improve robustness
3. Introduce a new mode: **Front of the Class Betty (FOC)**
 - In addition to individual use, does not replace
 - Allows teacher-led activities, review, discussion



BB concept map example, reproduced from Biswas et al., (2005), p. 371

BB in schools now

[Feb 21, 2014 article from “The Tennessean”](#) describes BB’s use in a local magnet school to study climate change:

Students enhance learning with Betty's Brain software

Learning enhanced by interacting with inquisitive avatar

“James Parsons, a teacher at [school], has been using Betty’s Brain as a teaching tool since 2008. The causal maps of climate change help lay the foundation for students to work on projects in which they present real-world solutions to reducing greenhouse gas emissions.”

Students enhance learning with Betty's Brain software

Learning enhanced by interacting with inquisitive avatar

Feb. 21, 2014



Betty's Brain Computer Software helps Meigs Magnet students master scientific processes: The learning-by-teaching computer agent called Betty's Brain helps Meigs Magnet School students master complex scientific processes.

Written by
Jamie McGee

Studying the causes and effects of climate change, sixth-graders at

NATIONWIDE
ROBERT I
REAL ESTATE I
REAL ESTATE • AUCTIONS
FARM EQUIPMENT

CLIC
for more
EMAIL **auctio**
www.blackfor

RUSSELLVILLE
CENTRAL CITY

LOVE TO
SHOP HERE

Coupon clip
always

START SAVING

Crystal Island Outbreak

- **Overall, little talk of deploying Crystal Island**
- Some other narrative learning environments (River City, Quest Atlantis) have been fairly widely deployed, produce good results
- Thus, seems deployment feasible and valuable
- So why not CI?

Speculation: Perhaps it was not a goal (or a main goal) to build a classroom tool, to develop a new and ongoing piece of curriculum.

Deployment not a goal?

Possible sources of evidence that deployment may not be main CI goal:

1. Project goals on [webpage](#):
 - Do NOT talk about curricula (creating, embedding, anything!)
 - Do NOT talk about creating new tools/techniques for the classroom
 - THEY DO discuss developing Bayesian pedagogical agents, providing accounts of various cognitive processes.



Alex Reid
(User)

2. Content: is clearly relevant to existing curriculum (use North Carolina state science standards)

- BUT is one small piece of content.
- Can't really embed into *ongoing* classroom practice.

3. Publication record: Most pubs. are focused on specific issues (motivation, inquiry learning, Bayesian techniques, etc.)

- There are NOT big summative “efficacy” publications
- NOT reporting on “complete” versions of CI.

THUS, CI as a project seems to be much more about “building-blocks” type questions for narrative learning environments, and about creating underlying tools and strategies that can be widely re-used.

**Zooming out to
the bigger picture**

System summaries

- **ANDES:** Minimally invasive homework replacement. Clearly can be successfully deployed at scale, unclear how widely used right now (perhaps because project over, not supported, also for Windows 95...)
- **BB:** Changes to software features makes it a more appropriate classroom tool. Some teachers already using regularly. Clear potential for wider deployment. Ongoing research/development.
- **CI:** Potentially not intended for “deployment”, but only as research tool? Ongoing research/development.

Discussion Qs, if time:

1. What are possible challenges to deployment?
→ *Look at our “design lists” we made in previous lectures*
 2. Why aren't teachers, parents, administrators rushing to get these into schools?
→ Or are they, and there are other stumbling blocks?
-
1. Does it really seem feasible to make ALEs a regular, ongoing part of classroom instruction?
 2. **Think back:** would *you* want to be in a classroom/school with prevalent use of ALEs? Or use them for your homework?

Uncomfortable questions!

Discussion today presupposes that we are working to build ALEs that “fit” current educational systems, curricula, and support current educational goals.

BUT

- Is this the right or “best” thing to do?
- Is it feasible use ALE research as a lever to challenge/change the system and its goals?
- ...and change it to what alternative?
- Is ALE research *too vested* in the system (and its goals) to create radical change?

Sleep on those.