

**ADAPTIVE
LEARNING
ENVIRONMENTS:
Informal learning
contexts**

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Alyssa Alcorn / (aalcorn@ed.ac.uk)

Plan for today:

- Activity 1: Museum vs. classroom
- Activity 2: Features of classrooms versus informal environments
 - What can we assume about the contexts?
 - How does this affect our goals, designs?
- Goals for informal environments (focus on informal science learning)
- Examples from projects (Coach Mike, Future Worlds. See also readings on CHES)

**With respect to
designing ALES,
what are features
of classrooms vs.
informal
environments?**

Designing for classrooms

We can assume that:

- Domain content learning will be important
- We will know who our user group is (age, maybe more)
- Users are a **captive audience**: they can't leave, even if they are bored, don't like material, etc.
- We may have other domain **resources** available
 - Help from **teacher** (while using ALE)
 - Class activities/lectures
 - Textbooks

Classrooms continued

- We know approximately how much **time** we have (per session, and across sessions). Sometimes, this is many hours of time.
 - Have enough user-system interaction to build meaningful **models**, use them for pedagogy
 - Time to give detailed **instructions**
 - Time to **repair misunderstandings** (on part of student OR system)
 - OK if it takes some time to learn the system
- Know **context of use**: individual, collaborative, only for homework...

Classrooms continued

- Likely there is **dedicated time** to use the ALE
 - It is not “competing” with other activities
 - ...only with student inattention, tiredness, etc.
- May assume that classroom is a **reasonably quiet, consistent environment** for learning
- Many options for **evaluation**. Need pre- and-post tests? No problem, we do tests anyway.
- Learners may expect the ALE to be “like work”, and may have an **incentive to persevere** (e.g. final exam grades)

Informal learning environments

- Not an “exact” definition of informal learning, but today usually talking about the following type of contexts:
 - Museums, especially science museums
 - Zoos
 - Visitor centres at natural or historical sites
 - *Other contexts in that general vein*
- Learning at home “for enrichment” could be considered informal, but not discussing that today.

Imagine an anti-classroom

We, as designers, do not *know* any of the following things when designing for an informal learning environment:

- User characteristics, even age
- How many users may be at the system at once
 - One older child, alone?
 - A parent with two arguing children?
 - Group of students on a field trip, with teacher?
- How much time users will spend (other than “not very much”)

Informal, continued

- We may have **no staff members available** to troubleshoot, answer questions, or help people get started
- May have loud, confusing, busy environment
- Our system is **one option among many things** to do and look at— must attract users in first place!

→ **No captive audience. The users have VETO POWER. They can walk away as soon as they are confused, bored, system not working...**

Informal, continued

So, we could say the following things about adaptive learning in an informal context:

- We need to attract users and then retain their attention, because they have veto power
- Should design for range of user ages, interaction types (e.g. individual, family, school class)
- Content needs to be limited, targeted because we have very little time (probably < 5 min)!
- Our possible ALE strategies (e.g. modelling) are limited, due to lack of use time, user information
- May have limited or no human support

**So, does it even
make sense to
make ALEs for
“informal” use?**

A qualified “yes”

- **Some of what we have learned may not be of much use here due to the context, such as:**
 - Constructing very long, complex tutorial dialogues
 - Modelling overall domain knowledge by examining performance on many individual problems
- **Other things we have learned are more clearly applicable, for example:**
 - How pedagogical agents can increase engagement, positive affect, invoke useful social schemata
 - What kinds of feedback we should give, and how quickly, and how often.

Content is not king!

- Informal learning is where the “**touchy-feely stuff**” often treated as a peripheral or secondary benefit of a system now becomes **much more important than pure content learning**
- So, Using **some parts** of ALE technology makes sense for **certain goals**.

→ **Suggestions from the class about the type of goals we may target in a museum, visitor centre, historical site, zoo, or other informal context?**

**Many goals more
about affect,
engagement,
reflection than
about “learning”**

No one wants to memorize stuff at the zoo

OVERALL, goals for visitors at an informal context like a zoo might be things like:

- Being able to understand important concepts and terms (ex. “deforestation” or what it means for animal to be endangered)
- Engagement with, or investment in, the topic(s) (ex. “I love the endangered tigers! How can I help them?”)
- Connect the experience to the self, to rest of world (ex. my actions impact environment, and those cute animals)
- Have fun!!! *(don't forget this one, it is key!)*

Six general goals for informal science learning

1. “Spark” interest, excitement in science
2. Enable understanding, generation, retention, and use of science concepts
3. Encourage testing, observation, exploration, questioning of natural and physical world
4. Foster reflection on scientific process
5. Create opportunities to participate in scientific activities
6. Encourage learners to think of selves as scientists

See Rowe, Lobene, Mott, & Lester (2014), p. 2

Also, no one wants to take a test at the zoo

- **Very different challenges with evaluation!**
- How to measure gains when no baseline info?
- May need to evaluate in a more traditional way with small groups (e.g. Follow-up surveys and/or interviews after exhibit use), use this to extrapolate to the rest
- May use **observations**, but this often runs into ethical issues

→ **Remember also that will have different evaluation goals, to go with different teaching goals**

Programming at Robot Park (Boston MoS)

- Museum volunteers usually helped visitors
- Very labour-intensive– could we have a virtual “coach”?
- Develop pedagogical agent (Coach Mike) to do things that volunteers did
 - Help “orient” people to exhibit
 - Encourage engagement
 - Offer help
 - Set programming challenges



Camera

**Visitors
use
tangible
interface**

From Lane et al., (2013) see *reading list*

“Coach Mike” pedagogical agent here



Puzzle pieces have *fiducial markers* (camera reads from above)



From Lane et al., (2013) see *reading list*

Coach Mike at Robot Park



Fig. 2. Mike is a 3D cartoon-style pedagogical agent designed to be approachable, supportive, and understanding (among others). These stills are from animations for thinking, giving positive feedback, and displaying a block (magically).

From Lane et al., (2011) see *reading list*

Coach Mike: effective?

Please see the following papers for details of how different versions of Coach Mike have been evaluated, and the types of goals that the authors and museum were trying to achieve.

Lane, H. C., Noren, D., Auerbach, D., Birch, M., & Swartout, W. (2011, January). **Intelligent tutoring goes to the museum in the big city: a pedagogical agent for informal science education.** In *Artificial Intelligence in Education* (pp. 155-162). Springer Berlin Heidelberg.

Lane, H. C., Cahill, C., Foutz, S., Auerbach, D., Noren, D., Lussenhop, C., & Swartout, W. (2013, January). **The Effects of a Pedagogical Agent for Informal Science Education on Learner Behaviors and Self-efficacy.** In *Artificial Intelligence in Education* (pp. 309-318). Springer Berlin Heidelberg.

This paper provides an "update" to the 2011 paper

Hot off the press: Future Worlds project

- Very recent project from Rowe, Lobene, Mott, & Lester (2014). *The Crystal Island people!*
- Goal: Users investigate paths of environmental sustainability
- Use research on narrative learning, strategy games, collaborative investigation



Figure 1. Early artist rendering of FUTURE WORLDS multi-display exhibit

Design principles from museum partners, review of exhibits

- 1. Low barrier to entry** (immediately useable)
- 2. Exploration and curiosity**
- 3. Immediate and dramatic feedback** (“use fireworks”)
- 4. Inviting visual aesthetics with broad appeal** (Authors note that “high-quality visual presentations are the norm, not the exception in museum-based learning.” p. 3)
- 5. Novel hardware platforms** (to attract learners’ attention, offer exciting experiences not available at home)



Figure 2. Successive stages of a virtual environment in FUTURE WORLDS

- Environment starts out looking dead to indicate its “unhealthiness” and lack of sustainability.
- User can seek in-game info and make choices about energy, waste management, water, etc.
- Colour, animations are “dramatic” feedback about how user choices affect the environment over time.
- Many possible “solutions” to challenges, with various trade-offs



Figure 3. FUTURE WORLDS paper prototype

From “Play in the Museum...”
Rowe,
Lobene, Mott,
& Lester
(2014)



**Museum
pilot test
with a
reduced-
functionality
prototype**

From “Play in
the
Museum...”
Rowe,
Lobene, Mott,
& Lester
(2014)

**Figure 4. Learners interact with the FUTURE WORLDS
exhibit**

Please see the paper for more information on design, piloting

Rowe, J. P., Lobene, E. V., Mott, B. W., & Lester, J. C. (2014). **Play in the Museum: Designing Game-Based Learning Environments for Informal Education Settings.** To appear in Proceedings of the Ninth International Conference on the Foundations of Digital Games, Fort Lauderdale, Florida.

This is an excellent, hot-off-the-press read with lots of concrete details and examples. I say that as someone who reads lots of papers! --A