Selective Presentation of Peer Commentary on Web Objects Through a Modeling of User Similarity and Reputability:

Reducing Information Overload in Social Networks

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Outline of Talk

PhD work

10+5

Connect (and provide background) on ITS

Intelligent Tutoring Systems

Tutoring Systems (eLearning, Computer-Aided Instruction, On-line learning, computer-based instruction)

Intelligent: Adaptive, Personalized

Generative (problems, hint, help)

Student Modeling

Expert Modeling

Mixed Initiative

Interactive Learning

Instructional Modeling (adaptive to student learning)

Self-Improving (system's performance)

PhD Work

Ecological, Peer-Based Approach

Challenges

- Which Learning Objects?
- Which Peers?

Example learning objects:

- Books, web pages, research articles, videos

Annotations

Short text message, left by a student interacting with a learning object

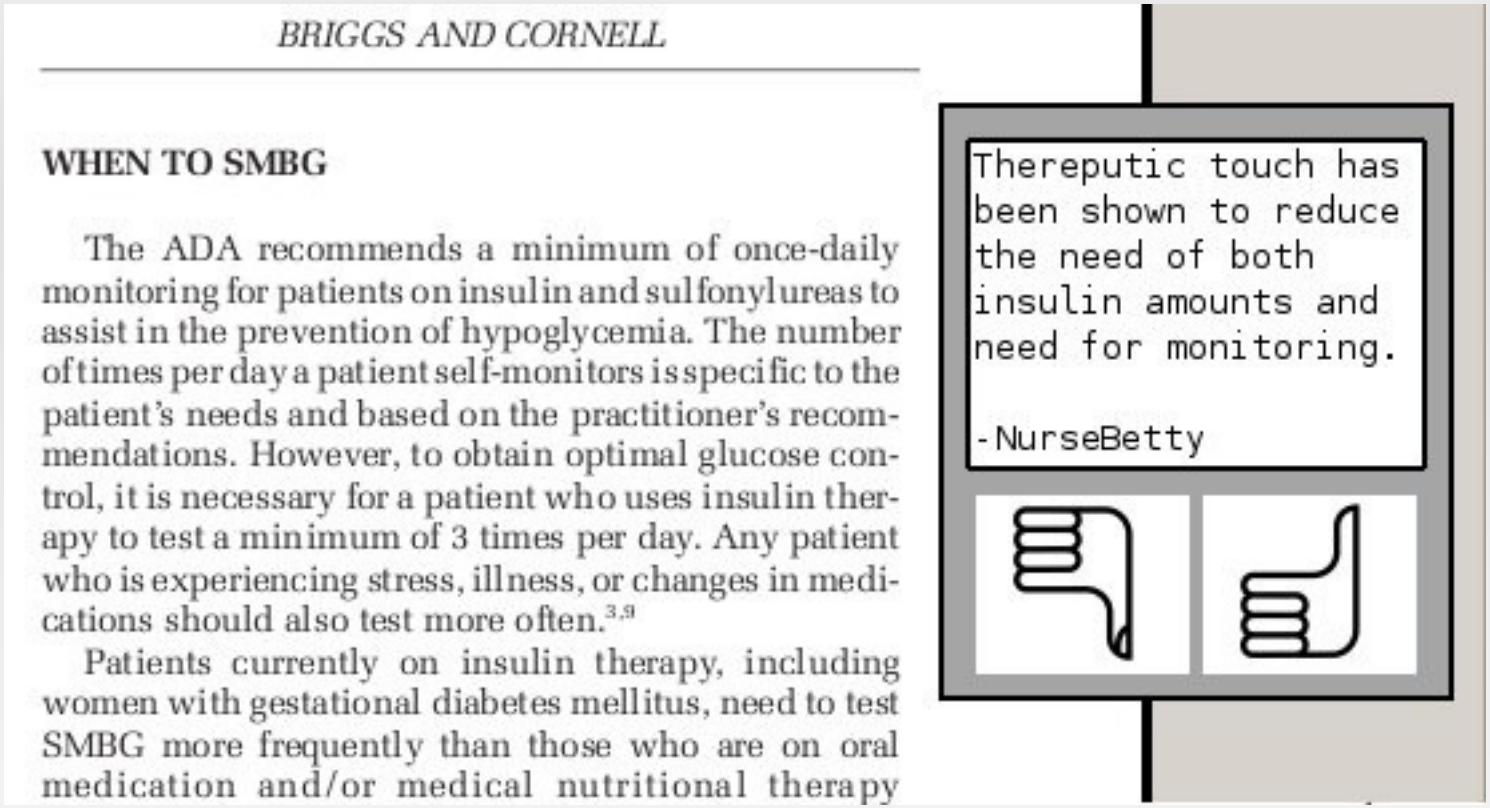
Can be a question about content, some insight the student had connecting the concept with another part of the class, or a link to related material

Need to show worthwhile annotations and avoid showing bad annotations

Zhang's trust modeling approach

- from an e-commerce domain

Example (Bad) Annotation



BRIGGS AND CORNELL

WHEN TO SMBG

The ADA recommends a minimum of once-daily monitoring for patients on insulin and sulfonylureas to assist in the prevention of hypoglycemia. The number of times per day a patient self-monitors is specific to the patient's needs and based on the practitioner's recommendations. However, to obtain optimal glucose control, it is necessary for a patient who uses insulin therapy to test a minimum of 3 times per day. Any patient who is experiencing stress, illness, or changes in medications should also test more often.[3,9]

Patients currently on insulin therapy, including women with gestational diabetes mellitus, need to test SMBG more frequently than those who are on oral medication and/or medical nutritional therapy

Text is about insulin monitoring, while annotation suggests an alternative medicine treatment

Trust Based Decision Procedure for Showing Annotation

Algorithm 1: Student Reputation

```
//Consider student as an annotator
calStudentReputation (Student s)
if num of annotations by s == 0 then
  | R(s) = 0.5;  //Reputation of s
else
  | R(s) = 0;
  | foreach annotation a of s do
  |   |_ R(s) += calcAnnRep(a);
  |_ R(s) /= num of annotations by s;
return R(s) ∈ [0,1];
```

Algorithm 2: Student Similarity

```
Similarity (Student c, Student r)
vS = 0;  //num of voted same
vD = 0;  //num of voted different
foreach annotation voted by both do
  | if current.vote == rater.vote then
  |   | vS += 1;
  | else
  |_ |_ vD += 1;
similarity = (vS – vD) / (vS + vD);
return similarity ∈ [-1,1];
```

Calculate student reputation and similarity between students

Trust Based Decision Procedure for Showing Annotation

Algorithm 3: Annotation Reputation

```
calAnnRep (Annotation a)
foreach vote on annotation do
  | if vote.for then
  |   |   vF += 1;
  | else
  |_ |_  vA += 1;
 return adjust(a.initRep, vF, vA);
```

Algorithm 4: Specific Annotation Rep

```
calAnnRepSpecific (Ann a, Student s)
foreach vote on annotation do
  | sim = similarity (s, voterStudent);
  | if vote.for then
  |   |   vF += 1 * sim;
  | else
  |_ |_ vA += 1 * sim;
return adjust (a.initRep, vF, vA);
```

Calculate annotation reputation and adjust this for a specific student

Show most reputable annotations that brought benefit to similar students

Annotation Assignment

Random

Greedy God

Tally $$pred-ben[a, current] = \frac{Rating_{for} - Rating_{against}}{Rating_{for} + Rating_{against}}$$

Cauchy $$\text{pred-ben}[a, current] = \frac{1}{\pi}\arctan\left(\frac{(vF^a - vA^a) + T_q}{\gamma}\right) + \frac{1}{2}$$

Trust Based $$\text{pred-ben}[a_i, current] = min(1, \frac{|R^{a_i}|}{N_{min}}) \frac{\sum_{j=1}^{|R^{a_i}|} r_j^{a_i}}{|R^{a_i}|} + max(0, (1 - \frac{|R^{a_i}|}{N_{min}})) \frac{\sum_{i=1}^{|A_q|} V^{a_i}}{|A_q|}$$

Simulation

During the simulated “course of instruction” simulated students matched with variety of LO

Simulated Learning occurs

The results of these interactions are used to reason about which students to match with which learning objects in the future

Simulation Design Decisions

3 annotations per learning objects

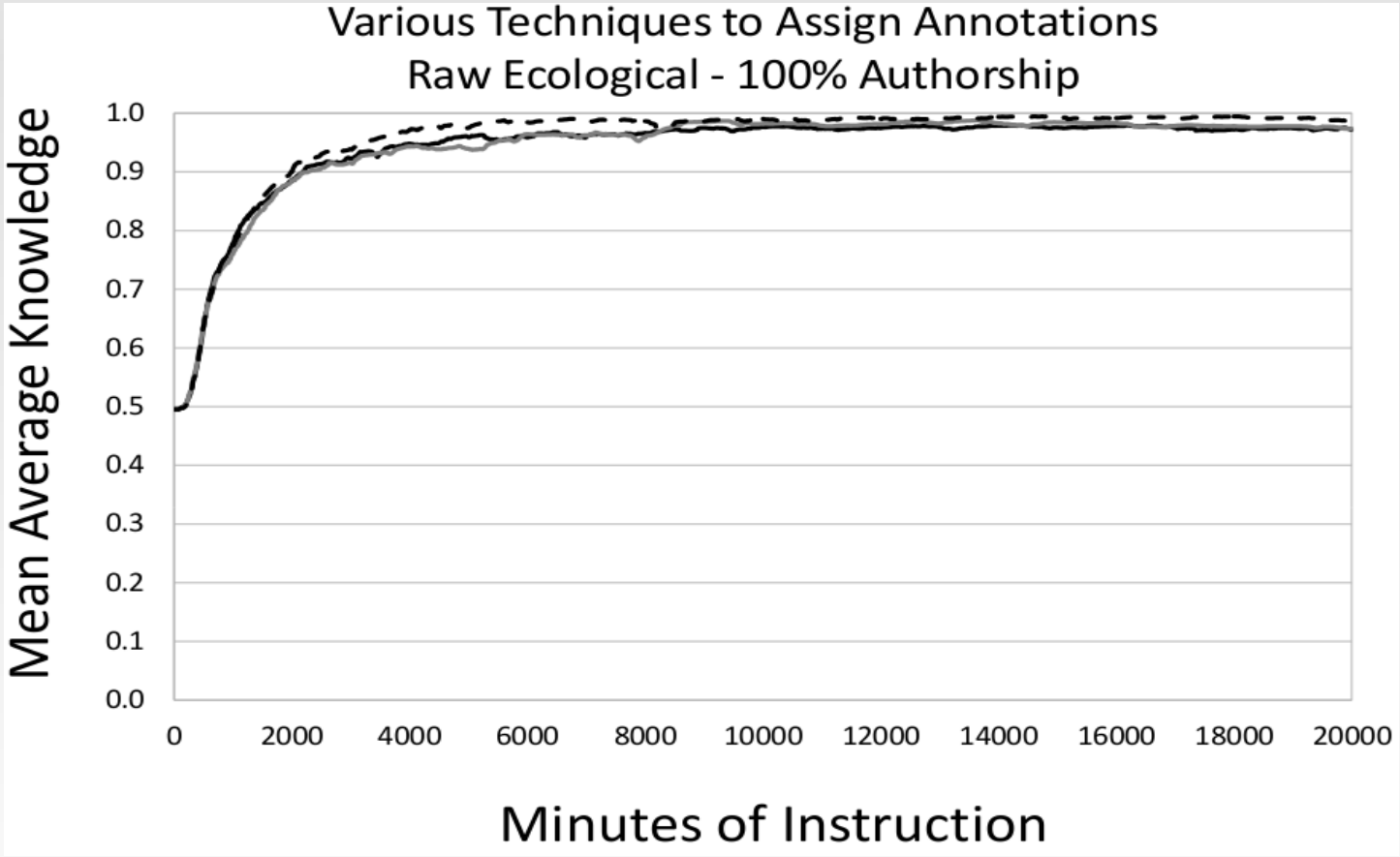
Evaluated using average knowledge for all students

100 learning objects, 20 students, 20 iterations

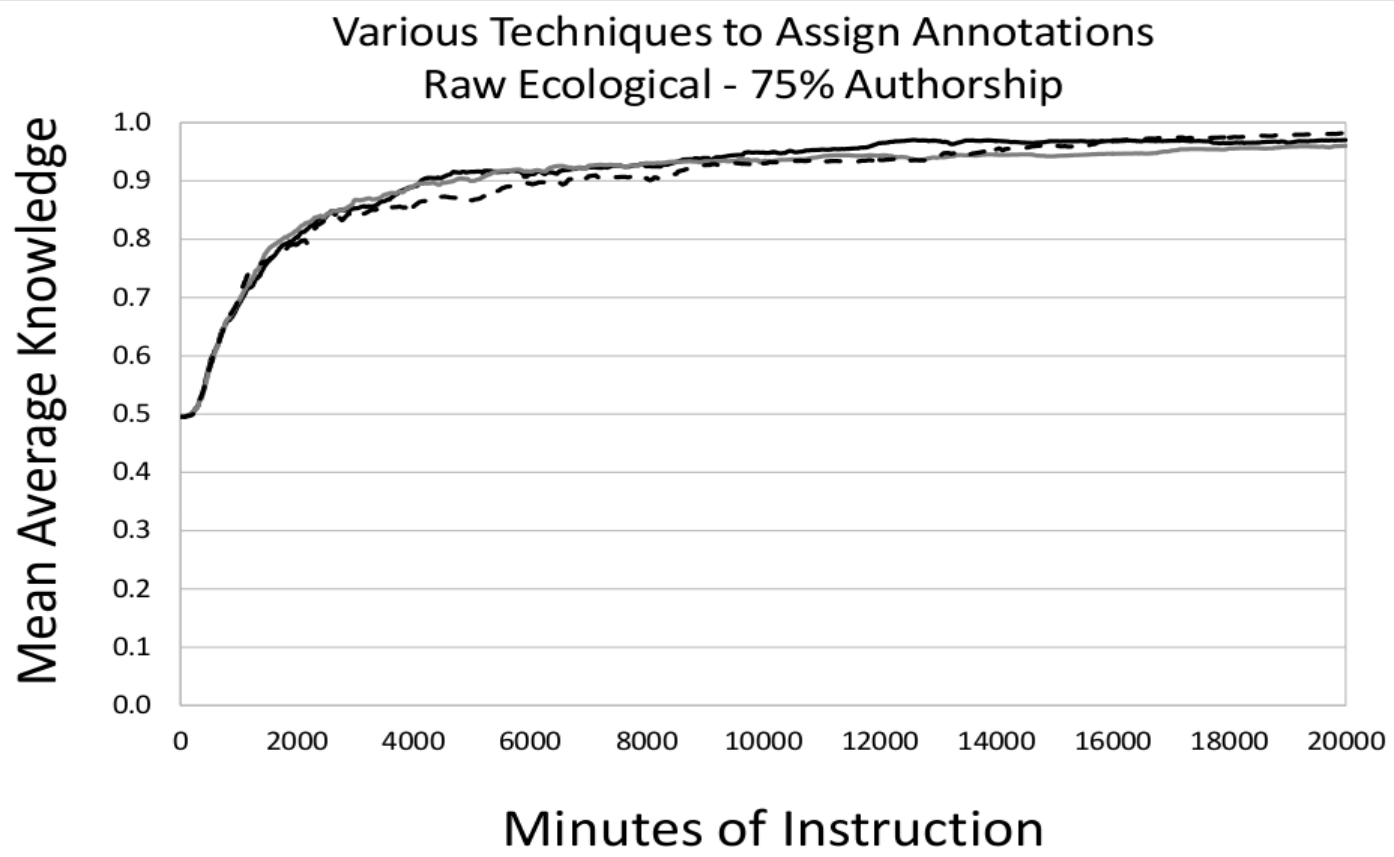
Learning objects ranged in length from 30 to 480 minutes

Each student has a 20% chance of leaving a new annotation on a learning object they experienced

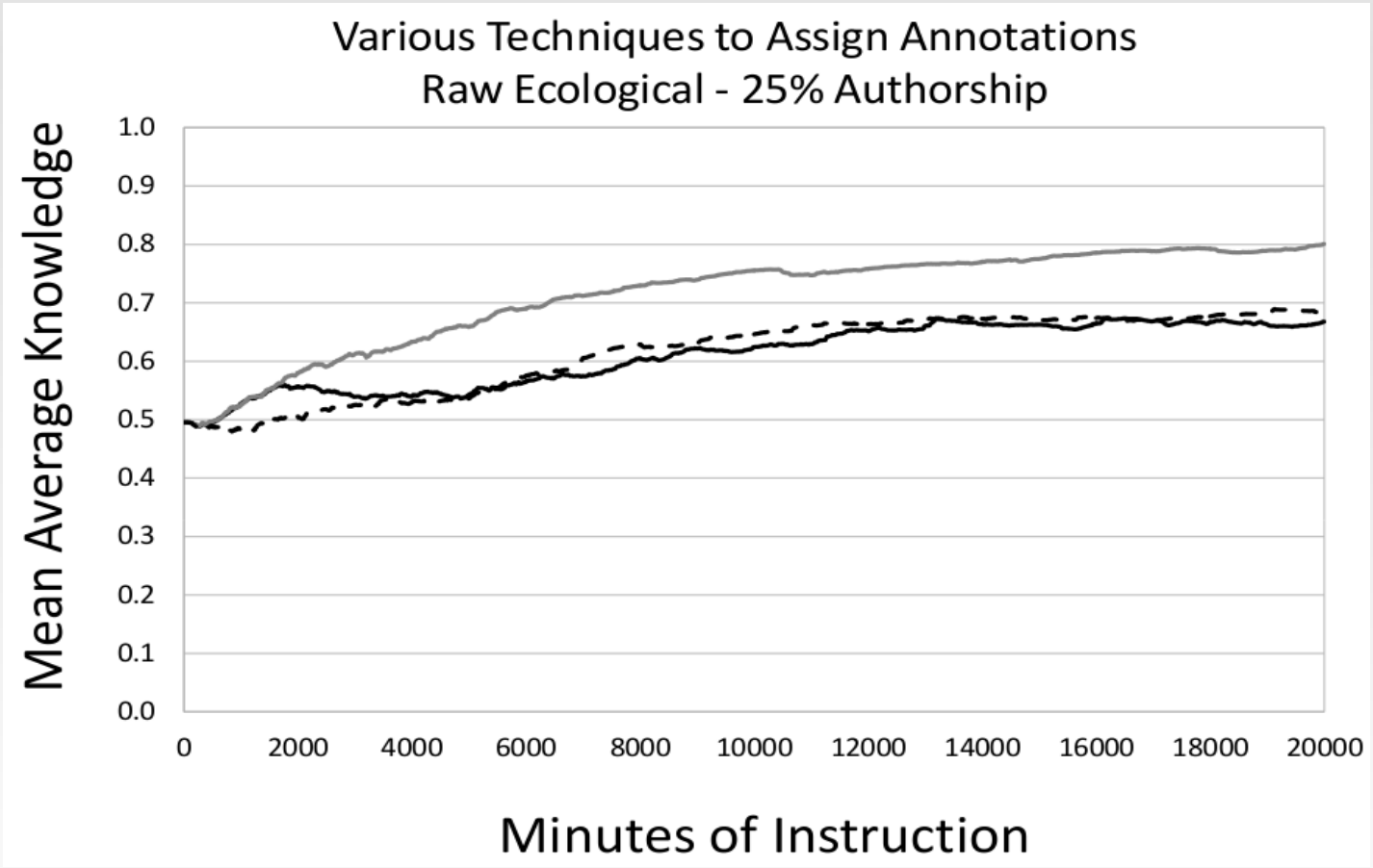
100% Authorship



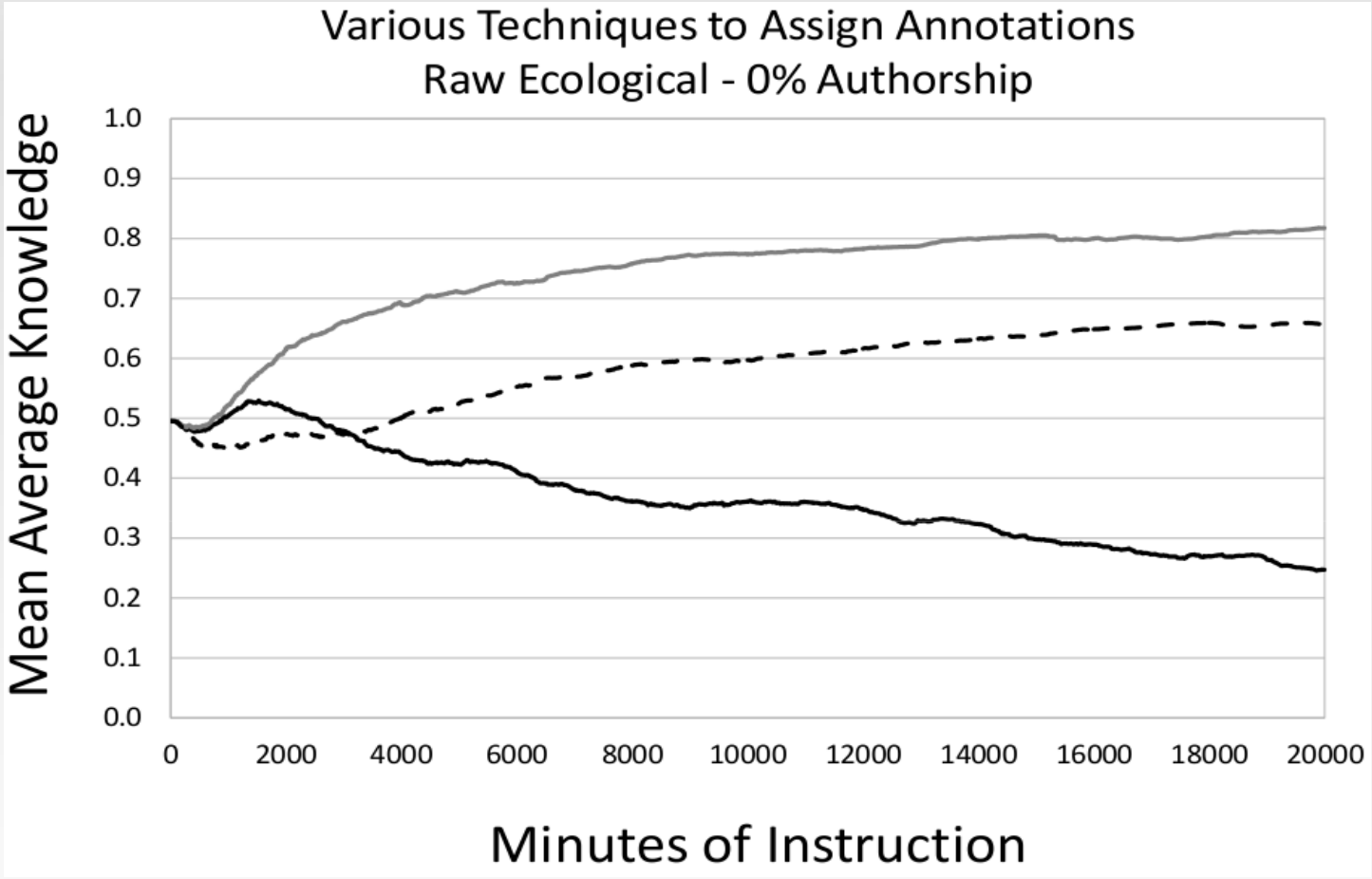
75% Authorship



25% Authorship



0% Authorship



Future Work

Real World Repository

Clustering

Additional Simulations

Additional Human Studies

Incentive to Participate

Possible criticism that students won't leave annotations or author LOs to help other students

Participatory culture (1%, 0.1%, 0.001%)

Possible approaches:

- Unlocking system
- Social capital perspective, intrinsic reward
- COMTELLA style incentive mechanisms
- Leaderboard
- World of Warcraft style achievements
- Domain of instruction
- Pay them! $$$

Contributions

- McCalla's ecological approach realized in a comprehensive framework
- Beyond other peer-based ITS to leverage past experiences
- Annotations
  - supporting commentary
  - reasoning about what to show
  - avoiding poor annotations
- Framework for simulated student learning
  - of value for validating ITS

Questions?

Comments?

Concerns?