Collaborations through Dialogues and Trialogues with Conversational Agents

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IIS: Integrating Methodologies
Unique interplay of Theoretical Research (cognitive science/psychology), technology development (computer sciences/engineering), educational practice, and empirical evaluation
Development of **GIFT**: Generalized Intelligent Framework for Tutoring

**GIFT**

- **Learner Model**
  - Domain-specific knowledge
  - Instructional Strategies

- **Experimental System**
  - Tutor vs. Traditional Tutoring
  - Intervention vs. Non-Intervention
  - Comparison of learner models
  - Comparison of instructional tactics
  - Ablative tutoring studies

- **Empirical Evaluation of Learning Outcomes**
  - Performance, retention, enhanced skills, etc.

- **Modify learner model**

- **Optimize strategies**
  - Adapt content
UM-IIS Learning Technologies

Computer literacy


Physics

(AutoTutor: Graesser, Chipman, Haynes, & Olney, 2005)

English literacy

(Greenberg, Graesser, & Lovett, 2012)

Physics (Again!)

(DeepTutor: Rus, D'Mello, Hu, & Graesser, 2013)

Biology

(Guru: Olney, D'Mello, Person, Cade, Hayes, Williams, Lehman, & Graesser, 2012)

Critical thinking

When a car without headrests on the seats is struck from behind, the passengers often suffer neck injuries. Why do passengers get neck injuries in this situation?
Learning Conceptual Physics
VanLehn, Graesser, Jackson, Jordan, Olney, & Rose, 2007)

Four conditions:

- Read Nothing
- Read Textbook
- AutoTutor
- Human Tutor

![Adjusted post-test scores]
Multiple Choice Tests on Deep Learning
(Computer Literacy and Critical Thinking)


Computer Literacy

Storey, Kopp, Wiemer, Chipman, & Graesser (2009)

Critical Thinking

Adjusted post-test scores
Speech Act Hierarchy

Human-Human kappa = .80
Human-Computer kappa = .73
Functions of Conversational Agents

• Help when initiated by the user
• Navigational guide
• Modeling action, thought, and social interaction
• Adaptive intelligent conversational dialog
• Many roles: peers, tutor, mentor
Adaptive Trialogs

Dr. Quinn
Expert

Glass
Fellow Student

Vicarious

Human
Player

Standard

Teaching
Trialogs in Learning

Low Ability  →  Vicarious learning

Medium Ability  →  Tutorial dialogue

High Ability  →  Teachable agent
Trialogs in Assessment

Low Ability → Short responses to prompts
Inaccurate or irrelevant
Little initiative
Violation of social norms

High Ability → Lengthier turns
Accurate contributions
Takes initiative
Social appropriateness
Center for the Study of Adult Literacy
Are you **new**? Click HERE!

I have used CSAL. Click HERE!
What is one of the specific uses of this drug?

- Give the body nutrients
- Relieve sneezing and runny nose
- Relieve headaches
Emotion Sensors and Channels

- Face
- Posture
- Speech
- Dialogue
In the fall semester, all students in one section of a statistics course were told that the textbook was optional. All students in another section of the same statistics course were told that reading the textbook was required. The same professor taught the two statistics courses and gave the same lectures to each. The professor found no difference on the final exam scores between the two classes. So the textbook does not matter. And if it doesn’t matter, why buy textbooks?

Chris: Well, I think there’s a problem because of how the participants were put into each condition.
Dr. Williams: I completely disagree. It wasn’t problematic.
Dr. Williams: Lauren, do you think there’s a problem with how the participants were put into each group? Please type problem or no problem.
Lauren: problem
AutoTutor with ALEKS Mathematics ITS
Annenberg Library

Library Hours: 8am - 6pm (Mon - Fri)
9am - 1pm (Sat.) Closed (Sun.)

Notice for library users:
1. Bring your student ID to the library.
2. No food or drink is allowed in the library.
3. Please keep quiet in the library.
4. Put books back where you find them when you are finished with the books.
5. You can check out up to two books.
6. You can keep the books for one week.
Definition of Collaborative Problem Solving for PISA 2015

Collaborative problem solving competency is the capacity of an individual to effectively engage in a process whereby two or more agents attempt to solve a problem by sharing the understanding and effort required to come to a solution and pooling their knowledge, skills and efforts to reach that solution.
<table>
<thead>
<tr>
<th>(1) Establishing and maintaining shared understanding</th>
<th>(2) Taking appropriate action to solve the problem</th>
<th>(3) Establishing and maintaining team organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(A) Exploring and Understanding</strong></td>
<td>(A1) Discovering perspectives and abilities of team members</td>
<td>(A2) Discovering the type of collaborative interaction to solve the problem, along with goals</td>
</tr>
<tr>
<td><strong>(B) Representing and Formulating</strong></td>
<td>(B1) Building a shared representation and negotiating the meaning of the problem (common ground)</td>
<td>(B2) Identifying and describing tasks to be completed</td>
</tr>
<tr>
<td><strong>(C) Planning and Executing</strong></td>
<td>(C1) Communicating with team members about the actions to be/ being performed</td>
<td>(C2) Enacting plans</td>
</tr>
<tr>
<td><strong>(D) Monitoring and Reflecting</strong></td>
<td>(D1) Monitoring and repairing the shared understanding</td>
<td>(D2) Monitoring results of actions and evaluating success in solving the problem</td>
</tr>
</tbody>
</table>

Note: The 12 skill cells have been labelled with a letter-number combination referring to the rows and columns for ease of cross-referencing later in the document.


