Deeper Conversational AI for
Education, Training, and HR Automation

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Cognii

#ai4ed
Definition

Virtual Learning Assistant

= Virtual Assistant for Human Learning

= Virtual Assistant for Education, Training, and Recruitment
Virtual Assistants

Apple Siri

Google Assistant

Microsoft Cortana

Amazon Alexa

Samsung Bixby
Virtual Assistants

User Asks a Question

AI Provides an Answer
Virtual Assistants (success)

User: What is the weather like?

Siri: It should be nice today ... up to 59 °F

User: What is the height of Eiffel tower?

Siri: The Eiffel tower is 984 ft tall.
Virtual Assistants (limitations)

User: Can you ask me a question about Science?

Maybe you should do the asking. Siri

User: Ask me a question about History.

I am more of the answering type. Siri

User: Evaluate my Civics knowledge.

I am not sure I understand. Siri
Virtual Learning Assistants

**AI Asks a Question** (explanatory, not confirmatory)

**User Provides an Answer**

**AI Evaluates the Answer and Provides Tutoring Feedback**
What are the structures of a typical neuron?

Neurons are the basic building blocks of the nervous system. A neuron consists of dendrites and a cell body called soma.

Very close! Would you like to explain the neural transmitter?
Conversational Interaction
The Most Original Pedagogy
Conversation

Home  School  Community  Democracy
AI / Virtual Assistants

Conversation

School

Job Interview

Workplace Training

Meeting

#ai4edu
“Conversation is the foundational substrate on which education system has evolved.”
Current EdTech Products

- Textbooks
- Digital Content
- Assessments

Lack conversational capability
Conversational Pedagogy

**Instruction**

- One-to-one Tutoring

**Assessment**

- Open Response Questions

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**SUMMATIVE ACHIEVEMENT SCORES**

- Higher achievement
- Immediate feedback
- Multiple attempts

- Active recall
- Critical thinking
- Problem Solving

(B. Bloom, 1984)
Scalability Problem

- Classroom of 30 students
- Lecture Hall of 300 Students
- MOOC of 3,000 Students

Teacher/Student: one-to-many
Problem: Quality/Scale

- One-to-One Tutoring
- Small Class
- Lecture-Based Course
- Large Online Course

Quality:
- Open Response Questions
- Multiple Choice Questions

Scale:
Education System Problems

Instructor Overload

- Poor Quality of Assessment and Feedback
- Lack of Student Engagement
- Student Dropouts
- Low Graduation Rates
- Lack of Career Readiness
- National Competitiveness

Rising Tuition Costs

- Student Debt

Institutional Financial Sustainability
Virtual Learning Assistant Innovation

**Conversational Pedagogy**

+ **Conversational** Technology

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= **Conversational** EdTech
Virtual Learning Assistant

• Deeper Conversational Personalized **Tutoring**
• Automatic **Grading** of open Response Answers
• Rich Learning **Analytics**

What are the structures of a typical neuron?

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Neurons are the basic building blocks of the nervous system. A neuron consists of dendrites and a cell body called soma.

Student

Very close! Would you like to explain the neural transmitter?

Cognii
Natural Language Generation:
Zone of Proximal Development

What is the optimum quality conversational feedback to maximize learning gain?

- Student’s Current Level
- Proficiency Level
- Too Easy
- Too much Challenging
- ZPD
- VLA Feedback
VLA Technology

Natural Language Processing

- Language Syntax
- Deeper Semantics
- Conceptual Hierarchy

Cognitive Computing

Personalized Adaptive Learning
Human-Level Performance

Controlled study of inter-rater reliability

Automatic evaluation of students' answers using syntactically enhanced LSA

Latent semantic analysis (LSA) has been used in several intelligent tutoring systems (ITS's) for assessing students' learning by evaluating their answers to questions in the tutoring domain. It is based on word-document co-occurrence statistics in the training corpus and a …

Perfect agreement between raters

Teacher-to-Teacher

132/192

Cognii-to-Teacher

126/192

Close (96%) to human performance on scoring open response answers.
NLU: Intents, Semantics

General purpose
Virtual Assistants / Chatbots

• User asks a question, AI answers it
  - not ideal for learning assessments

• Input length - questions are short
  (1-10 words)

• Shallow NLP - only a few types of
  intents are generally recognized.

Virtual Learning Assistant

• AI asks a question, user answers it, AI
  evaluates - ideal for learning assessments

• Input length - answers are long (10-100
  words)

• Deeper NLP - robust semantic analysis,
  applicable to large number of content
  areas.
Scalability

Across Levels
- K-12
- Higher Education
- Professional
- Corporate Training

Across Subject Areas
- Language Learning
- Sciences
- Humanities
- Social Sciences

Across Depths of Knowledge (Webb’s)
- Recall & Reproduction
- Basic Skills & Concepts
- Strategic Thinking & Reasoning
- Extended Thinking
Students Feedback

“This AI is kind of creepy, but in a good way.”

“I learnt a lot with Cognii questions than I did in the classroom.”
Validation by Teachers

Brian White, Professor, UMass Boston

Open response answers are big pains to grade. Cognii was hugely valuable.

Ivy Carnabucci, Teacher, Medford High School, MA

Cognii helped students get instant feedback that would have taken me days to grade!
Benefits of Deeper Conversational AI

Students
Learning Outcomes

Educators
Productivity & Insights

Organizations
Scalable Quality
Deep Learning or Deeper Learning

Deep Learning
- the application to machine learning tasks of artificial neural networks (ANNs) that contain more than one hidden layer.

FOR

Deeper Learning
- the skills and knowledge that students must possess to succeed in 21st century jobs and civic life.

Machine Learning

Human Learning