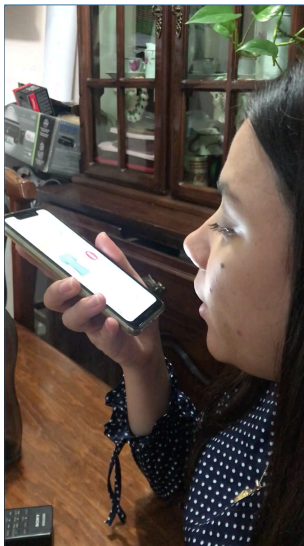
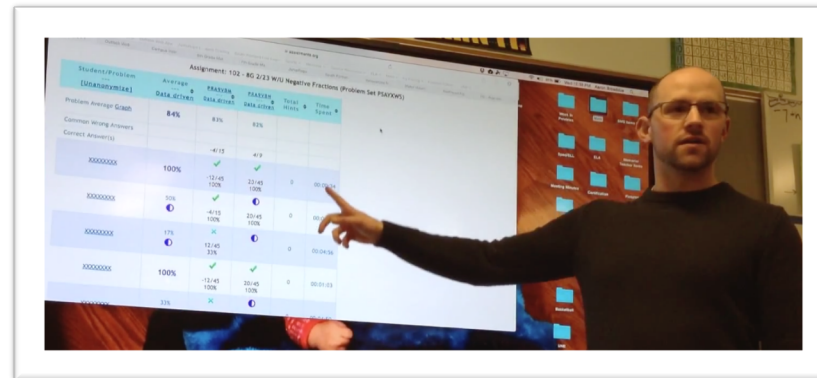




How AI Can Support Teaching Under COVID-19 and Beyond



Neil Heffernan, PhD and Lewis Johnson, PhD
www.alelo.com/AIED





Who is Neil?

Dr. Neil Heffernan

- Professor of Computer Science
- Director, Learning Sciences & Technologies Graduate Program
- Over 40 Peer-Reviewed Data Mining Studies
- About 2 dozen Peer-Reviewed Randomize Controlled Experiments.

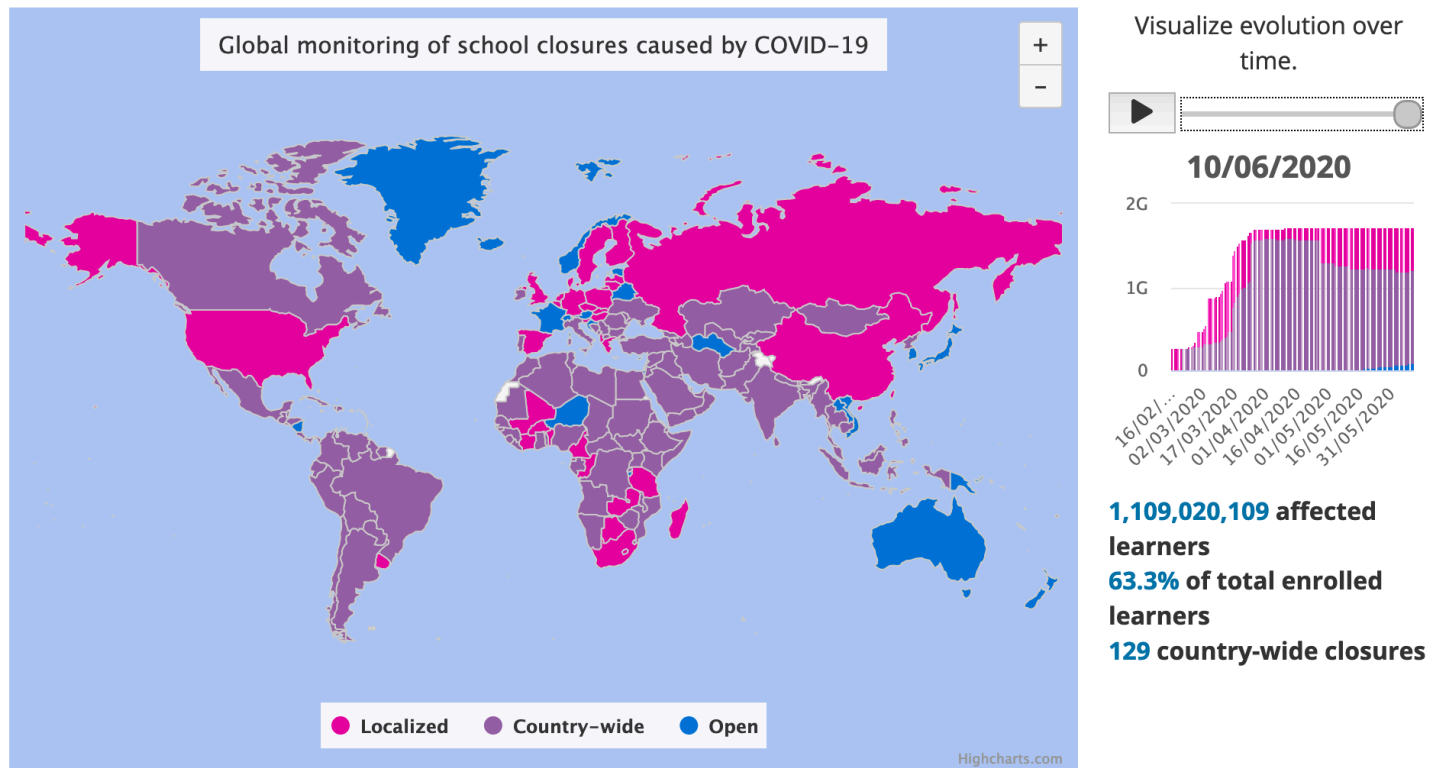




W. Lewis Johnson, PhD, CEO, Alelo

- Entrepreneur, thought leader, author
- DARPA Significant Technical Achievement Award
- IFAAMAS Influential Paper Award
- Host of webinar series on the Future of AI in Education and Training
- Past President, Intl. AI in Education Society
- Linguistics: Princeton; Computer Sci.: Yale

The Current Situation





Sudden Shift to Online Learning

The screenshot shows the Panopto web interface during a recording session. The top navigation bar includes "Create New Recording", "Manage Recordings", and "Settings". The user is logged in as "unitedsp@um@panopto.com" with a "Sign out" link. The recording status is "Recording" with a timer at "00:02:27". The folder is "My Folder" and the name is "Intro to Statistics - Significance Testing". The "Webcast Viewers" count is 0.

On the left, the "Primary Sources" section shows a video feed of a woman with blonde hair and glasses. Below the video, the "Video" source is "c922 Pro Stream Webcam", the "Audio" source is "Microphone Array (Realtek High Definition Audio)", and the "Quality" is set to "Ultra". There is an option to "Capture Computer Audio".

The "Secondary Sources" section has three checkboxes: "Capture PowerPoint" (checked), "Capture Main Screen", and "Capture Second Screen". A button "Add Another Video Source" is at the bottom of this section.

The main content area displays a PowerPoint slide titled "INTRODUCTION TO STATISTICS" with the subtitle "36-101 TESTS OF SIGNIFICANCE". The slide has a teal background with a circuit-like pattern on the left. Below the slide, the "Resolution" is "1920 x 1080", "fps" is "20", and "kbps" is "1500".

At the bottom, there is a "Discussion Posts from Viewers" section and a "Webcast Link" field containing the URL: <https://corp-hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=803d8019-7cb5-4d33-b5c3-a9de012b3bc2>. There are "Copy" and "Share" buttons next to the link.



Published on *Inside Higher Ed*
(<https://www.insidehighered.com>)

[Home](#) > Online learning is not the future of higher education (opinion)



Online learning is not the future of higher education (opinion)

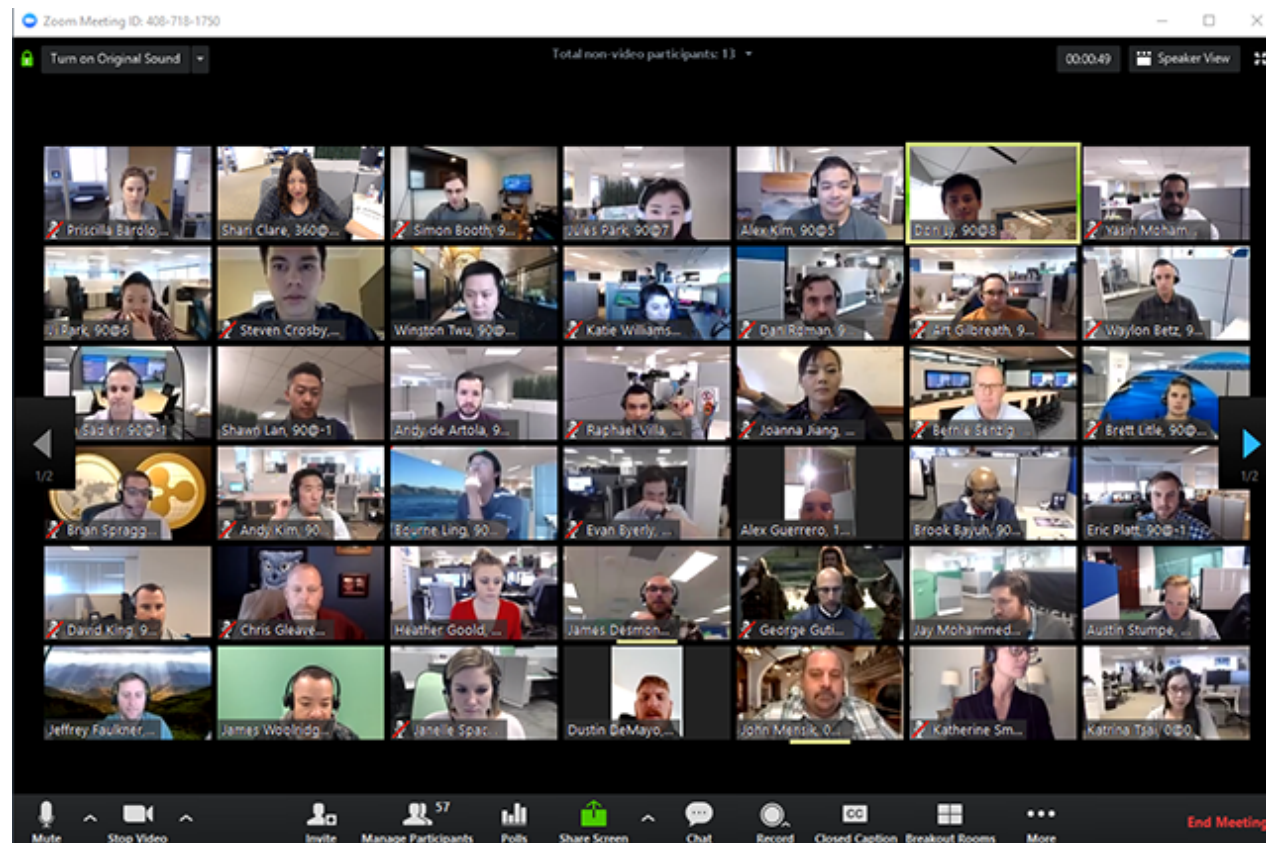
Submitted by Peter C. Herman on June 10, 2020 - 3:00am

The major advantage of online learning is asynchronicity, or, [“anytime, anywhere learning.”](#)

What this means in practice is that the student takes the class alone. There is no immediate interaction between the professor and the students, no immediate interaction among the students.

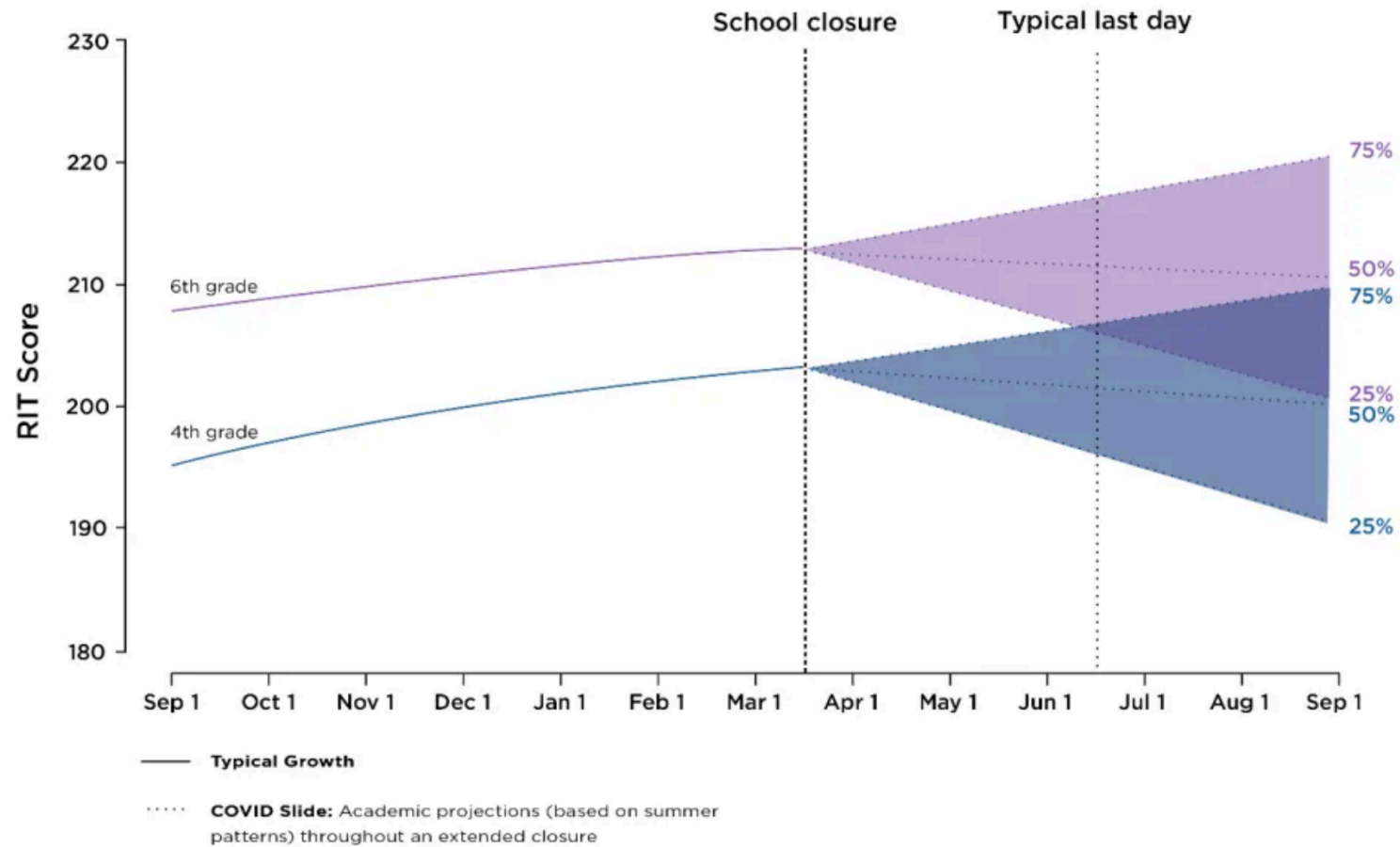
“We basically have to teach ourselves. It’s like paying tuition to watch YouTube videos.”

Sudden Shift to Zoom School





Forecasted Reading Learning Gains and Losses Through August





Impact of COVID-19 on Teaching

- Need good substitutes for classroom activities
 - YouTube U and Zoom School aren't sufficient
- It is harder to assess student knowledge and needs
- It is harder to address social and emotional needs
- It is harder to keep students engaged and accountable
- Inequities among students and differences in student learning are exacerbated
- Need teacher professional development and resources



How Can AI Help?

- How can AI compensate for and overcome these differences?
- Can they do it at the necessary scale to address the global need?



is not:
ALEKS,
Cognitive Tutor,
IXL, or
Khan Academy etc.

The New York Times Magazine The Machines Are Taking Over

By ANNIE MURPHY PAUL SEPT. 14, 2012

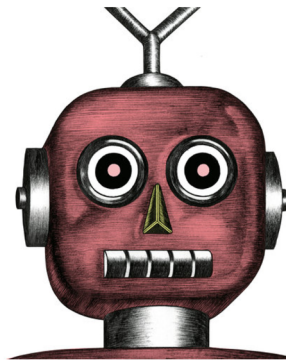


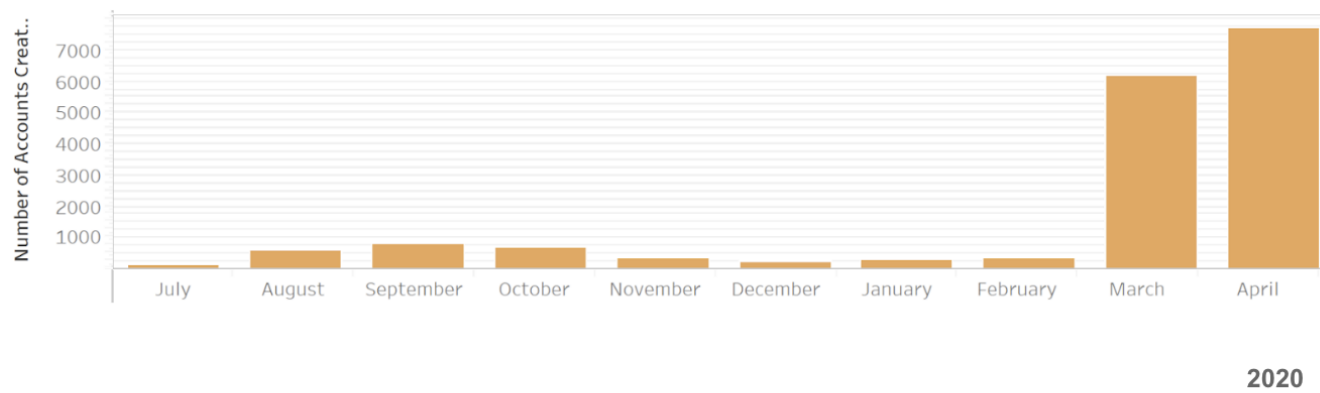
Illustration by Tim Enthoven

Neil Heffernan was listening to his fiancée, Cristina Lindquist, tutor one of her students in mathematics when he had an idea. Heffernan was a graduate student in computer science, and by this point — the summer of 1997 — he had been working for two years with researchers at Carnegie Mellon University on developing computer software to help students improve their skills. But he had come to believe that the programs did little to assist their users. They were built

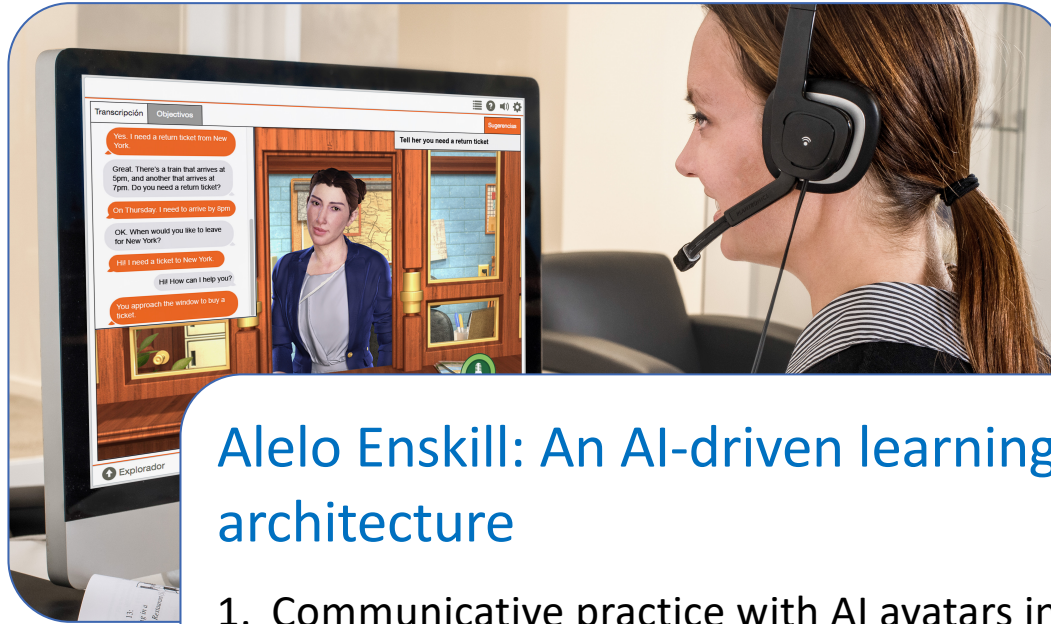
Information Divided into Account Creation Month Cohorts

Teacher

Account holders who have been verified as a teacher, have the teacher role



May 4, 2020

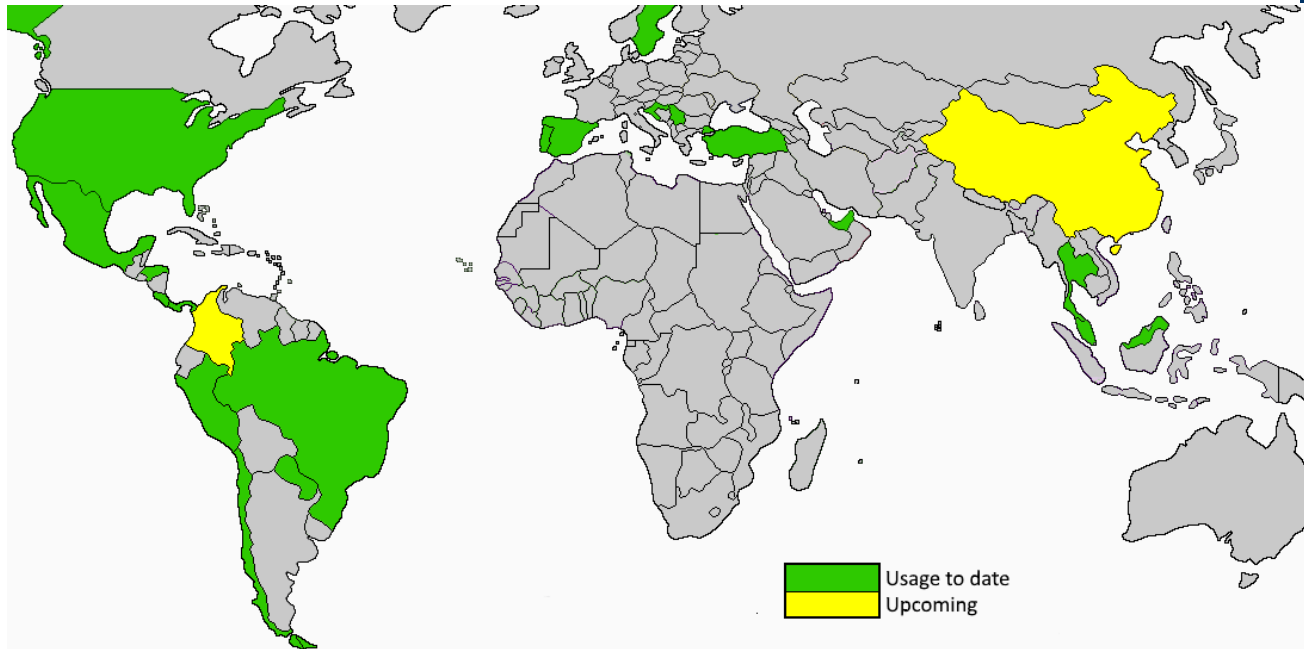


Alelo Enskill: An AI-driven learning architecture

1. Communicative practice with AI avatars in safe environment
2. Personalized learning
3. Analytics for teachers, learners, administrators, and developers



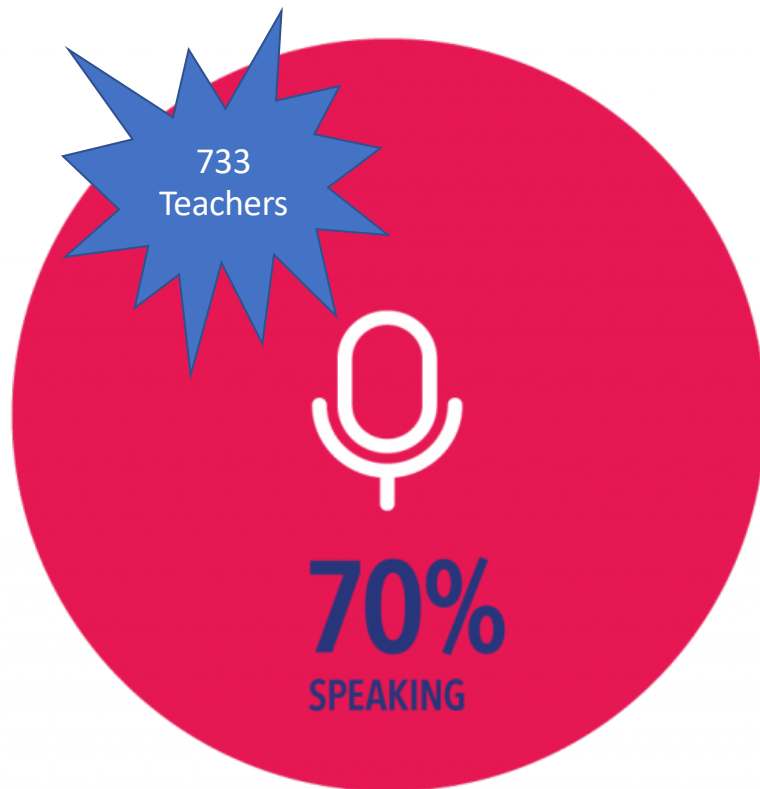
Enskill Around the World



Brazil • Chile • China • Colombia • Costa Rica • Croatia • Honduras • Malaysia • Mexico • Panama
Paraguay • Peru • Portugal • Serbia • Spain • Sweden • Thailand • Turkey • United States • United Arab Emirates



AI-driven substitutes for
classroom activities, with
automated feedback



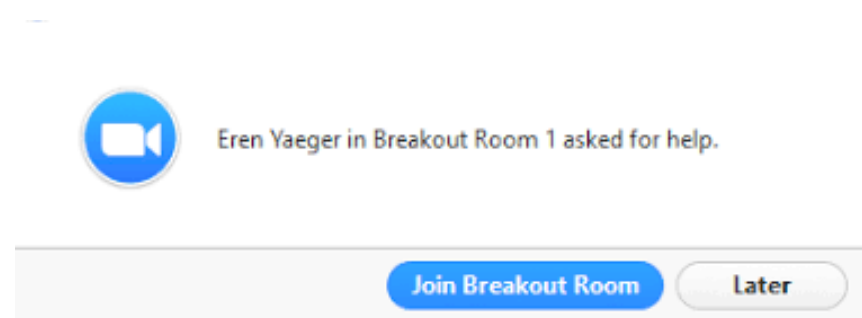
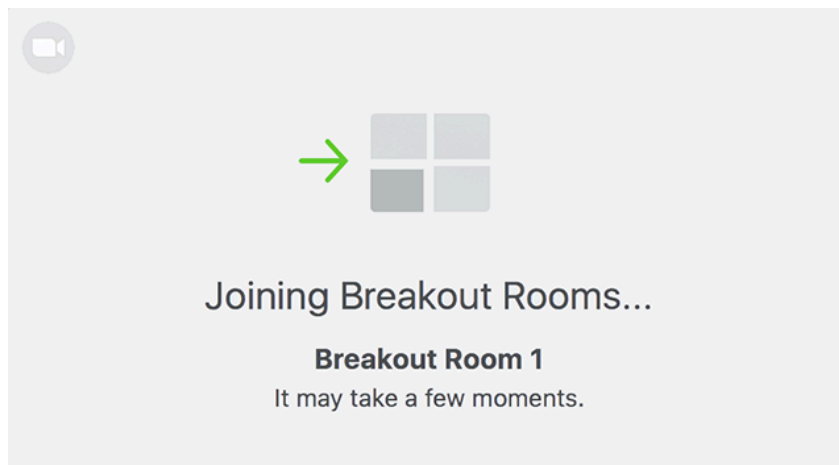
SKILLS RANK

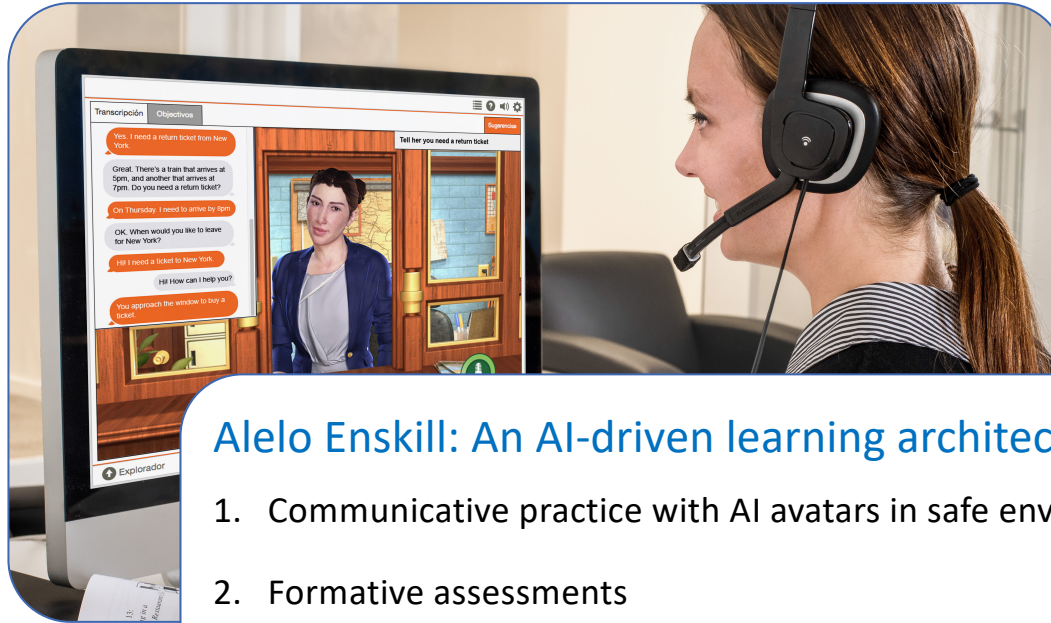
(IN ORDER OF IMPORTANCE)



Global Teaching Speaking Survey, Cambridge University Press

Zoom Breakout Rooms





Alelo Enskill: An AI-driven learning architecture

1. Communicative practice with AI avatars in safe environment
2. Formative assessments
3. Feedback
4. Personalized practice
5. Analytics for teachers, learners, administrators, and developers



Trip to New York

Transcripción

Objetivos

Sugerencias

train station. Where are you traveling to?

Good morning I'm interested in buying a ticket to New York please.

Great! I can help you plan your trip to New York. What day would you like to depart?

I'm thinking of leaving on May 7th
What do you have available that day?

[Typing]

I have a couple of trains that day.
Does the train leaving at 2 PM work for you?

Answer her question.

Ask when the train will arrive.

Ask if there is another train.

Ask her to repeat what she said.

Ask how long the trip is.



Trip to New York

Transcript

Objectives

Directions

Once you start conversing you will appear here.

Feedback



Excellent work! You were able to say everything you needed to say in the conversation. You clearly know this topic well and are ready to try another topic!

Goals

Mastery Score

Turns Per Minute

Time Spent

4/4

98%

4.94

04:27



Performance dashboard

Feedback



Unfortunately, you weren't able to say everything you needed to say in the conversation. Please review the information in the Feedback below and in the Practice Exercises that follow. That will help you to perform better on your next try. When you are ready, play again.

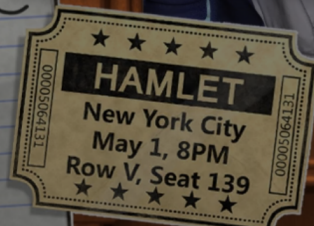
Ask questions about the departure and arrival times of trains. ❌

Remember, to ask when a train will leave and arrive, you can ask, "When does the train arrive?" or "What time does the train leave?"

Trip to NYC

o May 1 - May 7

o \$300 Budget



Practice Exercise



Ask the clerk what floor your room is on.

Click the Record button to respond.



Show a Correct Answer



Not quite.

I heard: What floor my room is on



Helping teachers track student
progress and assess needs



ASSiSTments example



Experimental Condition: Teacher goes
over homework differently

| Student/Problem --- [Unanonymize] | PRAHE5Y ⚡ | PRAHE5Z ⚡ | |
|--|-----------------------|---|-----------------------|
| Problem Average Graph | 27% | 61% | |
| Common Wrong Answers | $1/9^{10}$, 56% | $1/5^{13}$, 58% +feedback | |
| Correct Answer(s) | $1/3^{10}$ | $1/5^3$ | $1/16^2$ |
| XXXXXXXX | 🕒 | ✗ 5^3 0% | ✓ $1/16^2$ 100% |
| XXXXXXXX | ✗ 1^{-10} 0% | ✓ $1/5^3$ 100% | ✓ $1/16^2$ 100% |
| XXXXXXXX | ✗ $1/9^{10}$ 0% | ✓ $1/5^3$ 100% | ✓ $1/16^2$ 100% |



Using the Item Report

During Class

Player Dashboard



| | Finished/Started | Last Attempt | Time Spent |
|----------------------|------------------|--------------------------|------------|
| Jerry's Spaghetti | 0/0 | | 00:00 |
| Your Roommate Tony | 0/0 | | 00:00 |
| Music Festival | 1/1 | August 22, 2019, 05:23 | 01:58 |
| Hotel Check-In | 1/1 | May 22, 2019, 16:21 | 03:27 |
| Ken is Lost | 0/0 | | 00:00 |
| Hiring a Coworker | 0/0 | | 00:00 |
| Trip to New York | 3/3 | November 12, 2019, 13:26 | 07:23 |
| Setting up a Meeting | 0/0 | | 00:00 |
| At the Post Office | 1/7 | | |
| Finding an Apartment | 0/0 | | |

Number of times
learner attempted and
completed each
simulation; ✓ means
all objectives were
met at least once

Close

Trip to New York

Trip to New York

| Date | Objectives | Mastery Score | Turns Per Minute | Time Spent |
|--------------------------|------------|---------------|------------------|------------|
| November 12, 2019, 13:26 | 4/4 | 110% | 5.55 | 02:53 |
| November 12, 2019, 13:22 | 3/4 | 50% | 3.4 | 02:39 |
| November 12, 2019, 13:20 | 2/4 | 43% | 4.32 | 01:51 |

Back

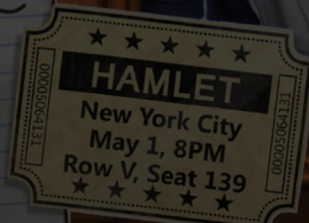
Close

| Objectives | Mastery Score | Turns Per Minute | Time Spent |
|------------|---------------|------------------|------------|
| 4/4 | 110% | 5.55 | 02:53 |

Trip to NYC

o May 1 - May 7

o \$300 Budget



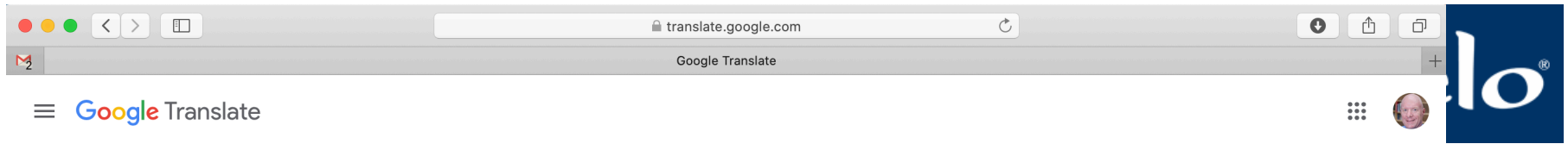
Performance on each attempt

Potential for intelligent orchestration systems





Keeping students engaged
and accountable



Text

Documents

DETECT LANGUAGE

RUSSIAN

SPANISH

ENGLISH

↔

SPANISH

RUSSIAN

ENGLISH

Buenos días, quisiera comprar un boleto a Nueva York, por favor.

×

Good morning, I would like to buy a ticket to New York, please.

☆

64/5000

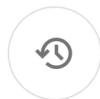
🔊

📄

✎

🔗

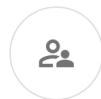
[Send feedback](#)



History

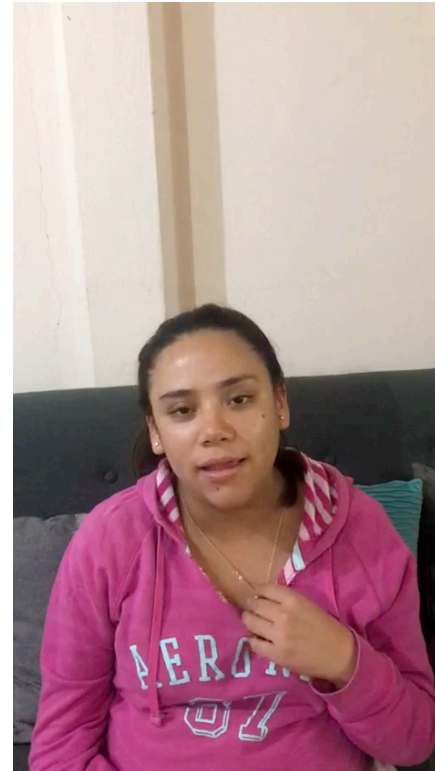


Saved

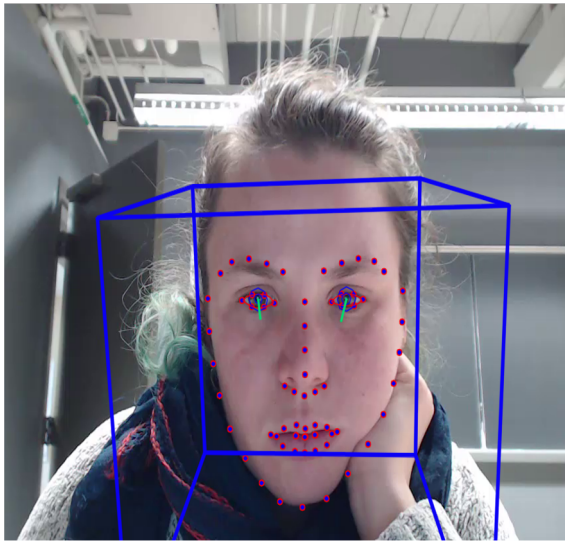


Community

WhatsApp Student Recordings



New research: Predictive models for effort, emotion



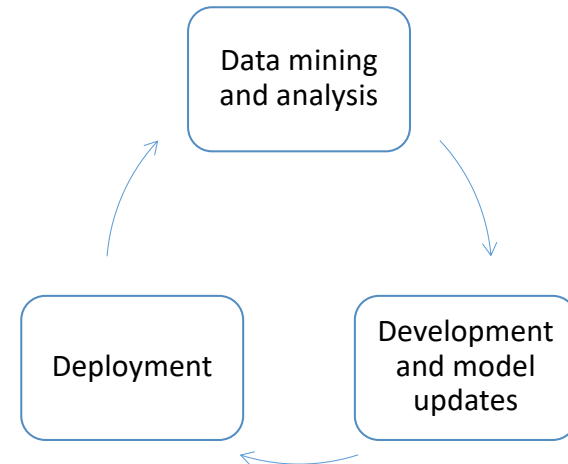
Beverly Woolf, U Mass Amherst



AI accountability to teachers

Data-driven development (D³) process

- AI simulations are developed iteratively, informed by learner data
- System is as much a data collection tool as a learning tool
- AI models are trained using machine learning techniques

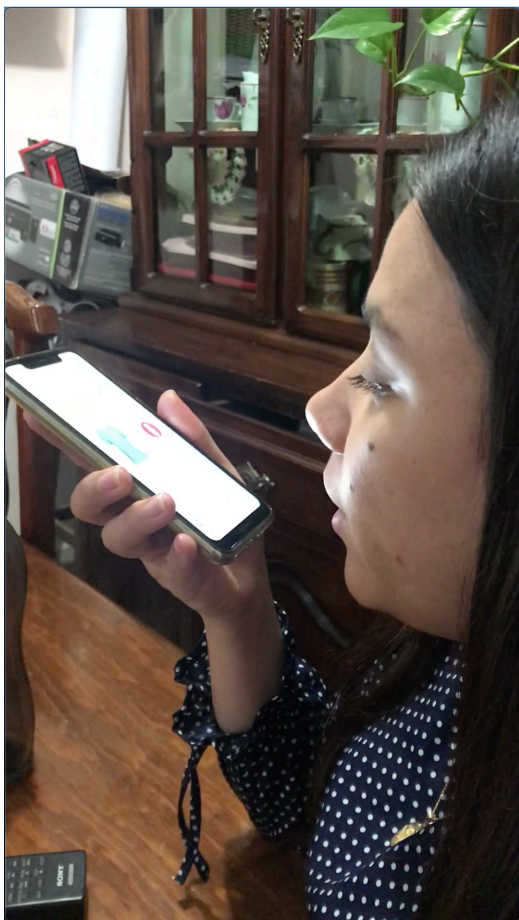


[Johnson, W.L. \(2019\). Data-Driven Development and Evaluation of Enskill English. *Int. Journal of AI in Education* 29, pp. 425-457.](#)

| | | |
|--|---------------------------------------|---|
| Ask Emma what time the train will arrive. | at what time will train arrive | https://s3-us-west-2.amazonaws.com/asr.alelo.com/english_a2_pilot/5bfec8a99748a520a83a3a1e/1544435323753.wav |
| Ask Ken how many bedrooms the apartment has. | how many bedrooms the apartments has | https://s3-us-west-2.amazonaws.com/asr.alelo.com/english_a2_pilot/5c0055309748a520a83a3aa1/1543534741785.wav |
| Ask Ken how many bedrooms... | how many bedrooms has the apartment | https://s3-us-west-2.amazonaws.com/asr.alelo.com/english_a2_pilot/5c0055309748a520a83a3aa1/1543534766051.wav |
| Ask Ken how many bedrooms... | how many bedroom apartment has | https://s3-us-west-2.amazonaws.com/asr.alelo.com/english_a2_pilot/5c0055309748a520a83a3aa1/1543534784079.wav |
| Ask Ken how many bedrooms... | how many bedrooms apartment have | https://s3-us-west-2.amazonaws.com/asr.alelo.com/english_a2_pilot/5c0055309748a520a83a3aa1/1543534894128.wav |
| Ask Ken how many bedrooms... | how many bedrooms have an apartment | https://s3-us-west-2.amazonaws.com/asr.alelo.com/english_a2_pilot/5c0055309748a520a83a3aa1/1543534902954.wav |
| Ask Ken how many bedrooms... | how many bedrooms does apartment have | https://s3-us-west-2.amazonaws.com/asr.alelo.com/english_a2_pilot/5bfec8a99748a520a83a3a1e/1544018772526.wav |
| Ask Ken how many bedrooms... | how many bedrooms D apartment has | https://s3-us-west-2.amazonaws.com/asr.alelo.com/english_a2_pilot/5bfec8a99748a520a83a3a1e/1544018832442.wav |
| Ask the clerk what floor your room is on. | on what floor my room is | https://s3-us-west-2.amazonaws.com/asr.alelo.com/english_a2_pilot/5c0055309748a520a83a3aa1/1543537524689.wav |
| Ask the clerk what floor... | what floor my room is on | https://s3-us-west-2.amazonaws.com/asr.alelo.com/english_a2_pilot/5c0055309748a520a83a3aa1/1543537538626.wav |
| Ask the clerk what floor... | at what floor is your room | https://s3-us-west-2.amazonaws.com/asr.alelo.com/english_a2_pilot/5bfec8a99748a520a83a3a1e/1544434495743.wav |
| Do you like to cook? | I like cook | https://s3-us-west-2.amazonaws.com/asr.alelo.com/english_a2_pilot/5c0f928110b55621a6e2e52a/1544554521684.wav |
| Do you play any sports? | yes I do play | https://s3-us-west-2.amazonaws.com/asr.alelo.com/english_a2_pilot/5bfec8a99748a520a83a3a1e/1544434662816.wav |
| Use the imperative to tell him he needs to make a right turn | turn the right | https://s3-us-west-2.amazonaws.com/asr.alelo.com/english_a2_pilot/5bfec8a99748a520a83a3a1e/1544434662816.wav |



Overcoming inequities



Martinez, Letizia - Jerry's Spaghetti

| Date | Objectives | Mastery Score | Turns per Minute | Time Spent |
|----------------------|------------|---------------|------------------|------------|
| June 27, 2020, 10:30 | 3/3 | 90% | 4.9 | 2:10 |
| June 25, 2020, 13:21 | 2/3 | 60% | 3.5 | 2:45 |
| June 25, 2020, 11:02 | 2/3 | 50% | 3.0 | 3:05 |

| Objective | Skills | Objectives | Objectives (Passed/ Attempted) | Score |
|-----------------|---|------------|-----------------------------------|-------|
| Order Appetizer | Appetizer Vocabulary Articles with Countable and Uncountable Numbers | Pass | 10/14 | 71% |
| Order Entree | Entree Vocabulary Articles with Countable and Uncountable Numbers | Pass | 9/14 | 64% |
| Order Beverage | Beverage Vocabulary Articles with Countable and Uncountable Numbers | Fail | 12/14 | 85% |



Professional development

**Report on 26 studies of K-12 math
intelligent tutoring systems**

(Steenbergen-Hu and Cooper 2013)

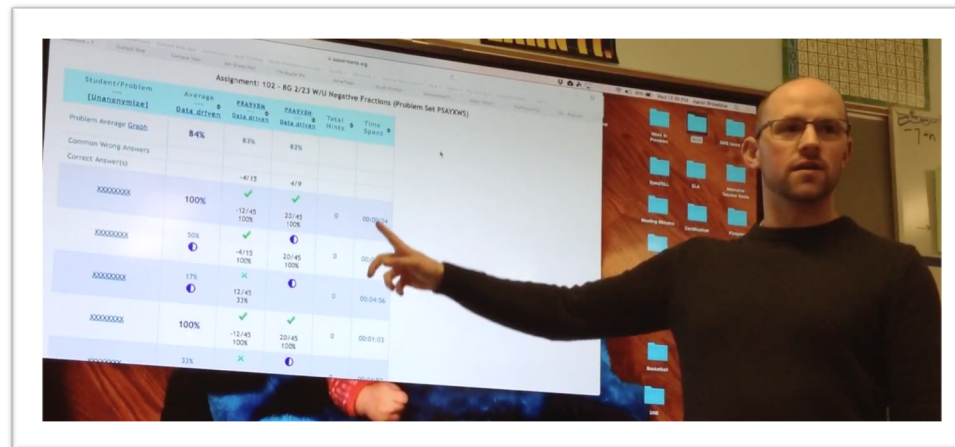
AERA Open
October-December 2016, Vol. 2, No. 4, pp. 1–12
DOI: 10.1177/2332858416673968
© The Author(s) 2016. <http://ero.sagepub.com>

Online Mathematics Homework Increases Student Achievement

Jeremy Roschelle
Mingyu Feng
Robert F. Murphy
SRI International
Craig A. Mason
University of Maine

In a randomized field trial with 2,850 seventh-grade mathematics students, we evaluated whether an educational technology intervention increased mathematics learning. Assigning homework is common yet sometimes controversial. Building on prior research on formative assessment and adaptive teaching, we predicted that combining an online homework tool with teacher training could increase learning. The online tool ASSISTments (a) provides timely feedback and hints to students as they do homework and (b) gives teachers timely, organized information about students' work. To test this prediction, we analyzed data from 43 schools that participated in a random assignment experiment in Maine, a state that provides every seventh-grade student with a laptop to take home. Results showed that the intervention significantly increased student scores on an end-of-the-year standardized mathematics assessment as compared with a control group that continued with existing homework practices. Students with low prior mathematics achievement benefited most. The intervention has potential for wider adoption.

Finding 1: Teachers Reliably Changed Practices



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