

# Tutor CoPilot: An Intervention on Real-Time Decision Aids for Improving Virtual Math Tutoring

Rose E. Wang, Ana Ribeiro, Carly Robinson, Dora Demszky, Susanna Loeb



NATIONAL STUDENT  
SUPPORT ACCELERATOR

*equalizing access to quality tutoring*

# Motivation

- High-quality tutoring is one of the most effective solutions to prevent and remediate learning losses
- **Challenge:** Scaling high-quality tutoring is hard.
  - Due to growing demand, many virtual tutoring platforms employ *novice* tutors who, unlike experienced educators, may struggle to address student mistakes and thus fail to seize prime learning opportunities.
  - Personalized coaching for these tutors is also costly!
- **Our study:** Could an AI-based expert-informed aid provide tutors real-time suggestions for tutors and raise tutoring quality?
- **Implications:** Training novices faster without hiring expensive, experienced educators!

## Randomized Controlled Trial with Tutor CoPilot

- Nine schools in your district participated in the study
- Identified 1787 students receiving virtual tutoring happening in the district
  - Students identified as eligible if they had performed below grade level on the state test the prior Spring.
- 874 tutors serving these students part of the study.
- Randomization at the tutor-level: Tutors were randomly assigned into:
  - (1) Treatment group: Tutors get access to Tutor CoPilot in their tutoring sessions (N=429)
  - (2) Control group: Tutors do not have access, and tutor as normal in their tutoring sessions (N=450).
- Tutor CoPilot is tutor-facing, not student-facing!

# Tutor CoPilot in Practice: Empowering the tutor in live tutoring

Instead of having the tutor struggle by themselves...

Tutor: Hi Robbie!

Student: hi

Tutor: Let's start with your first problem

Tutor: If Bob has 10 apples and gives 5 to Alice, how many apples does Bob have left?

Student: 3?

|

# Tutor CoPilot in Practice: Empowering the tutor in live tutoring

What if they had a language companion?

Tutor: Hi Robbie!

Student: hi

Tutor: Let's start with your first problem

Tutor: If Bob has 10 apples and gives 5 to Alice, how many apples does Bob have left?

Student: 3?



|

# Tutor CoPilot in Practice: Empowering the tutor in live tutoring

A CoPilot that provides tutors *real-time, expert-like* suggestions!

Tutor: Hi Robbie!

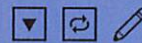
Student: hi

Tutor: Let's start with your first problem

Tutor: If Bob has 10 apples and gives 5 to Alice, how many apples does Bob have left?

Student: 3?

Let's help the student!



**Ask a question**

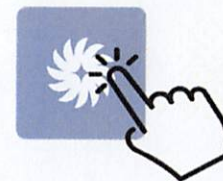
That's a good try, but let's try it together. If Bob originally has 10 apples and gives 5 to Alice, we subtract 5 from 10. Can you do the subtraction?

**Explain a concept**

Not quite, this is a subtraction problem. Can you try to identify what we should be subtracting?

**Provide a hint**




Good effort, but let's first draw the number of apples Bob starts with.



|

# Tutor CoPilot in Practice: Generates context-aware suggestions

- Takes 10 most recent messages.
- Three default strategies chosen because most commonly used by experienced teachers from our previous study.

**Let's help the student!**   

<b>Ask a question</b>	<b>Explain a concept</b>	<b>Provide a hint</b>
That's a good try, but let's try it together. If Bob originally has 10 apples and gives 5 to Alice, we subtract 5 from 10. Can you do the subtraction?	Not quite, this is a subtraction problem. Can you try to identify what we should be subtracting?	Good effort, but let's first draw the number of apples Bob starts with.

Tutor: Hi Robbie!

Student: hi

Tutor: Let's start with your first problem

Tutor: If Bob has 10 apples and gives 5 to Alice, how many apples does Bob have left?

Student: 3?






|

# Tutor CoPilot in Practice: Preserving tutor agency

Tutor initiates the help.

They can edit suggestions and pick other strategies:  
Provide a worked example, provide a similar problem, simplify the question, ...

**Let's help the student!**   

<b>Ask a question</b>	<b>Explain a concept</b>	<b>Provide a hint</b>
That's a good try, but let's try it together. If Bob originally has 10 apples and gives 5 to Alice, we subtract 5 from 10. Can you do the subtraction?	Not quite, this is a subtraction problem. Can you try to identify what we should be subtracting?	Good effort, but let's first draw the number of apples Bob starts with.

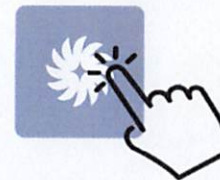
Tutor: Hi Robbie!

Student: hi

Tutor: Let's start with your first problem

Tutor: If Bob has 10 apples and gives 5 to Alice, how many apples does Bob have left?

Student: 3?



|



# Key Takeaway: This is a Human-AI approach to improving quality!

Tutor: Hi Robbie!

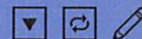
Student: hi

Tutor: Let's start with your first problem

Tutor: If Bob has 10 apples and gives 5 to Alice, how many apples does Bob have left?

Student: 3?

Let's help the student!



**Ask a question**

That's a good try, but let's try it together. If Bob originally has 10 apples and gives 5 to Alice, we subtract 5 from 10. Can you do the subtraction?

**Explain a concept**

Not quite, this is a subtraction problem. Can you try to identify what we should be subtracting?

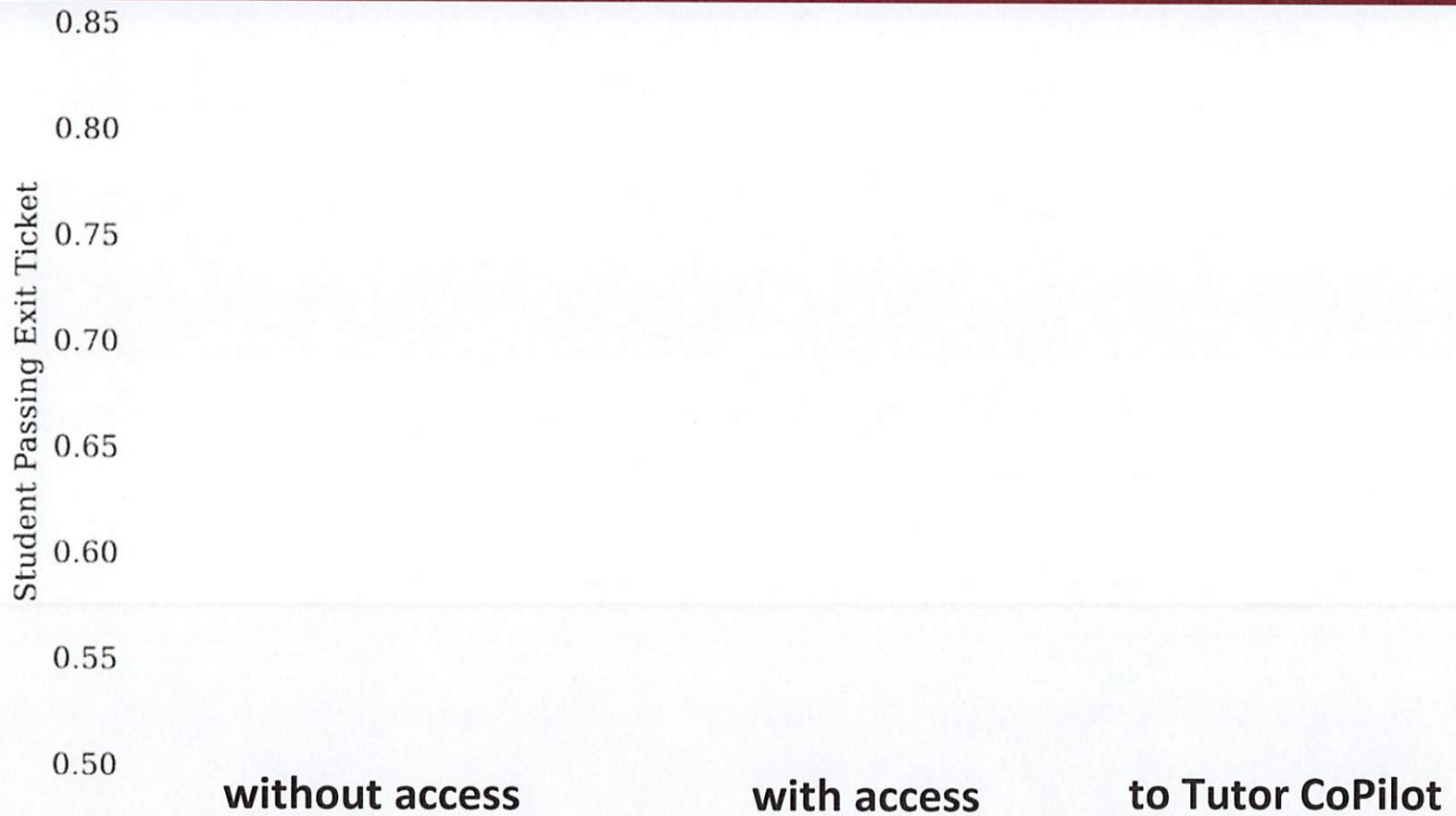
**Provide a hint**

Good effort, but let's first draw the number of apples Bob starts with.



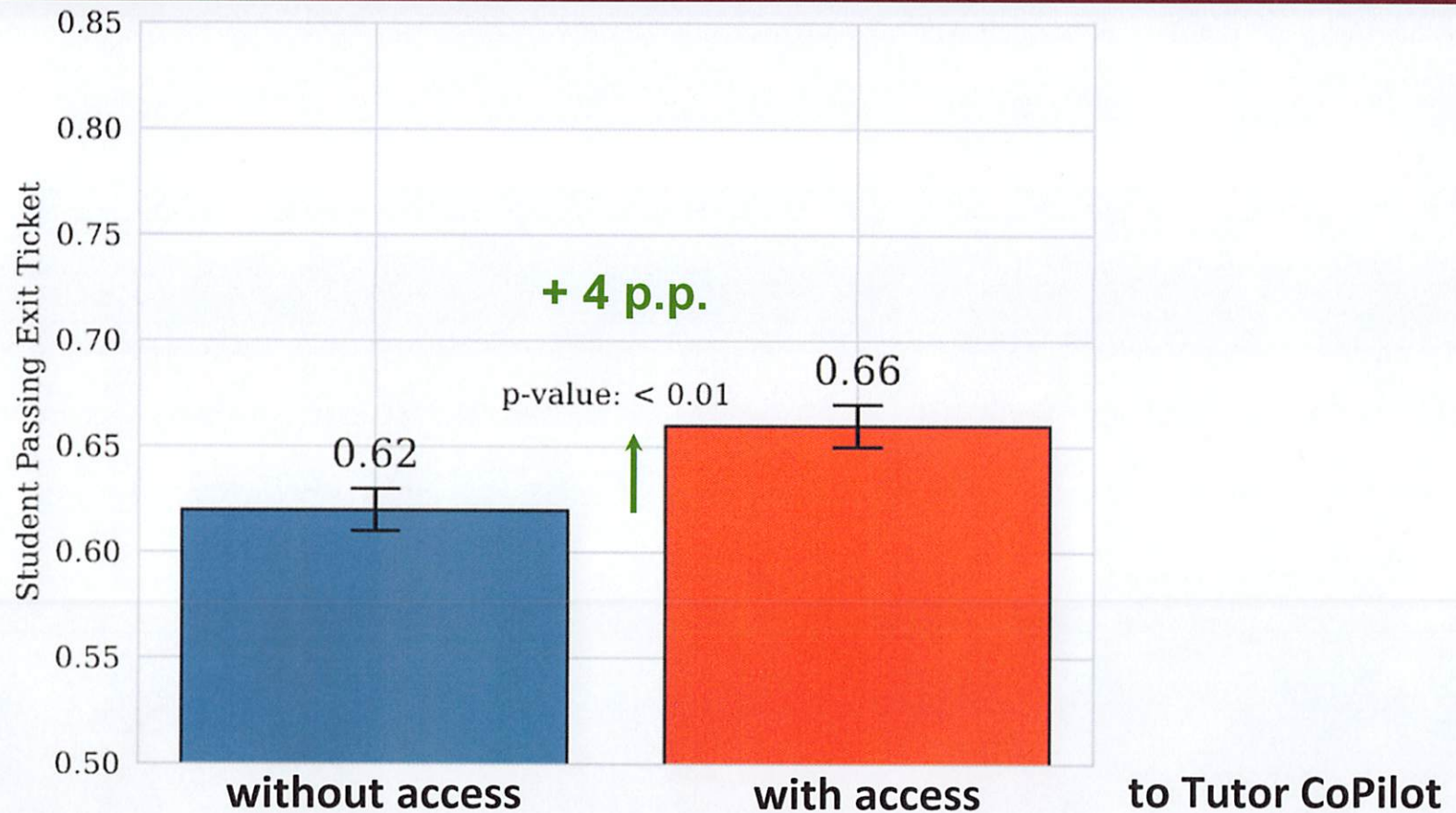
|

# Results on Exit Ticket Passing Rate



# Results on Exit Ticket Passing Rate

Students are 4 percentage points more likely to pass their exit tickets

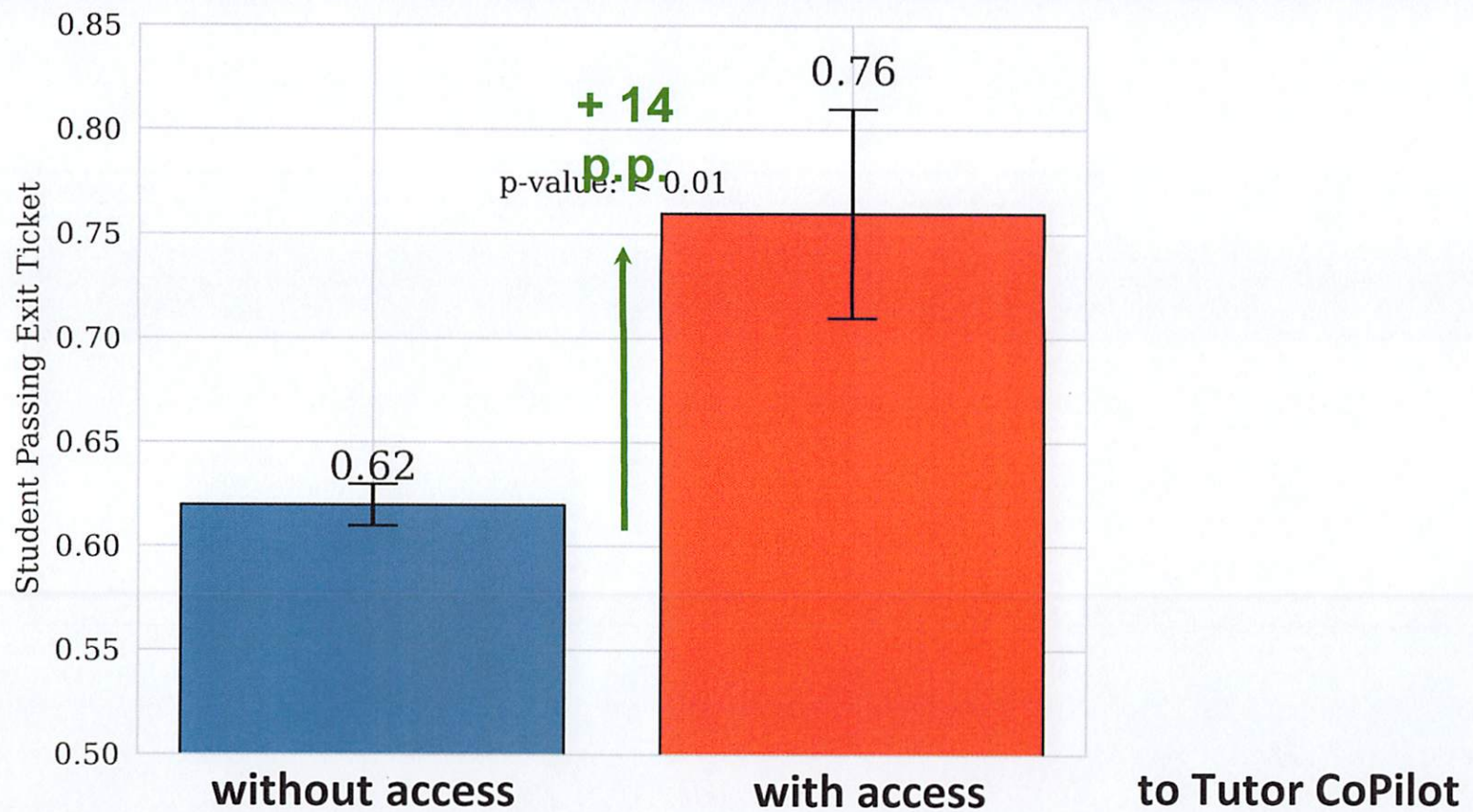


## Results on Exit Ticket Passing Rate *if tutors click on Tutor CoPilot*

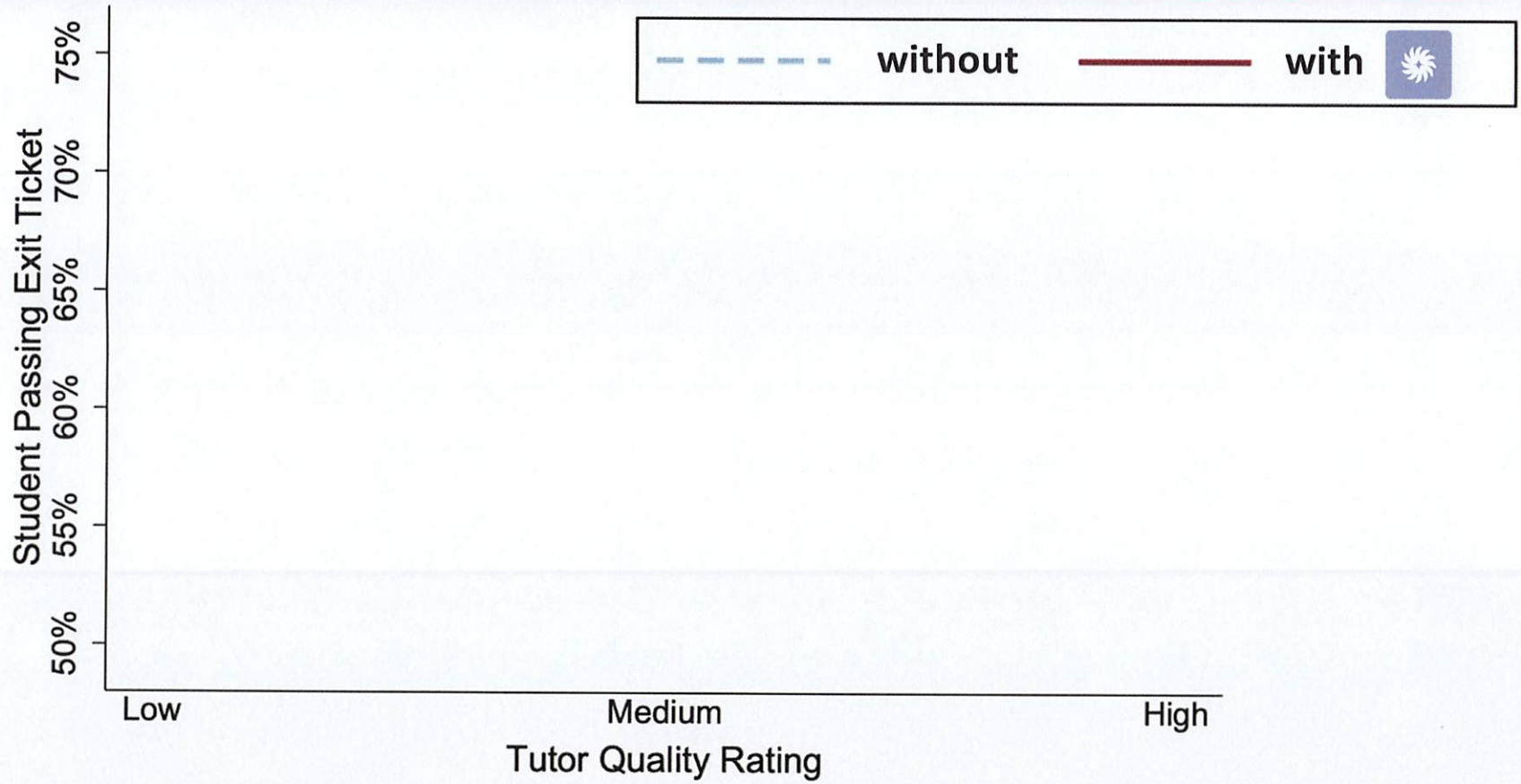


# Results on Exit Ticket Passing Rate *if tutors click on Tutor CoPilot*

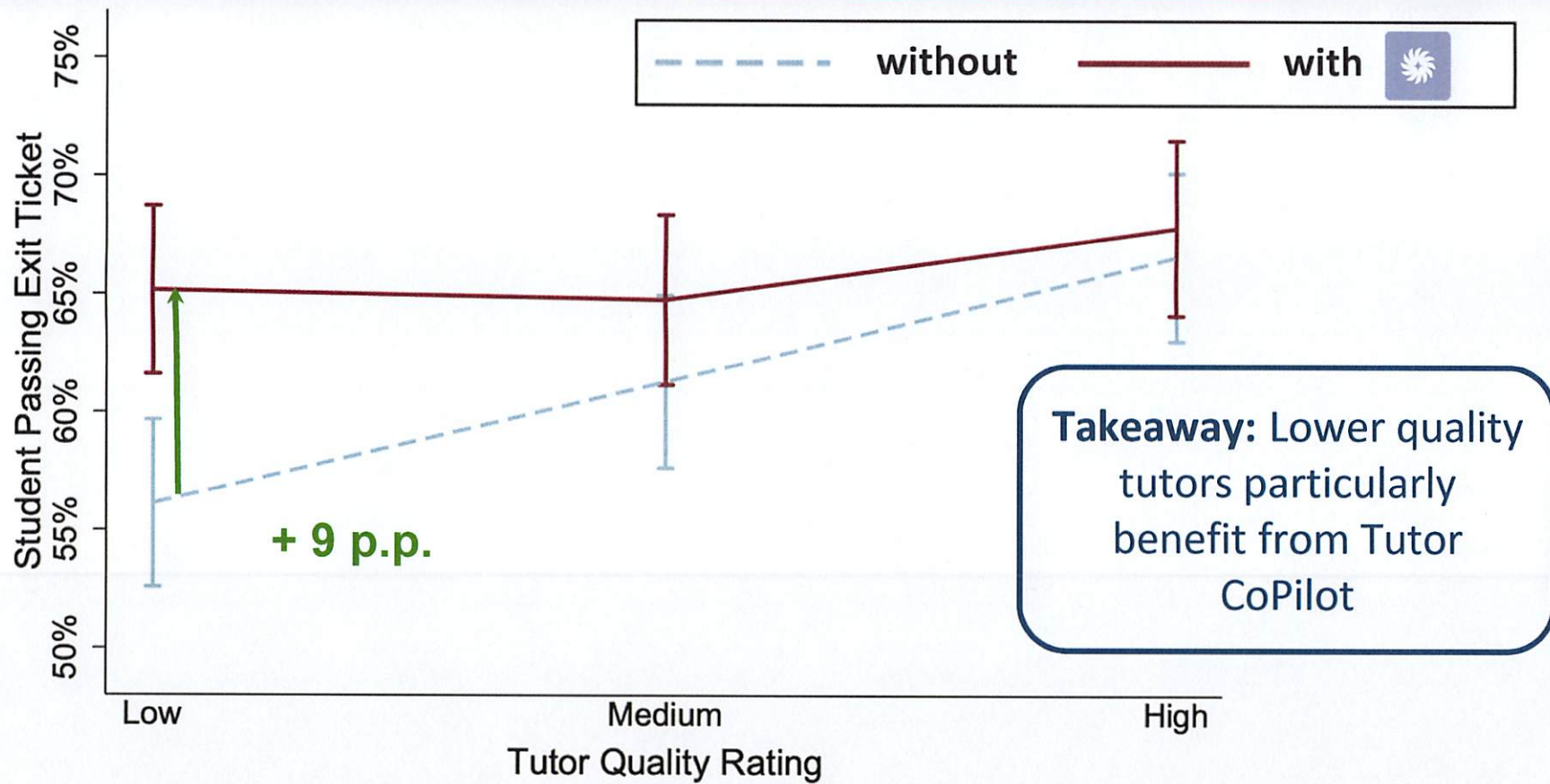
Students are 14 percentage points more likely to pass their exit tickets



# By Tutor Quality Score



## By Tutor Quality Score



# In what moments of tutoring did tutors use Tutor CoPilot?

During attempt of problem

After attempt of problem

End of exit ticket

Start of problem

End of session

Start of exit ticket

Start of session

0.0

0.1

0.2

0.3

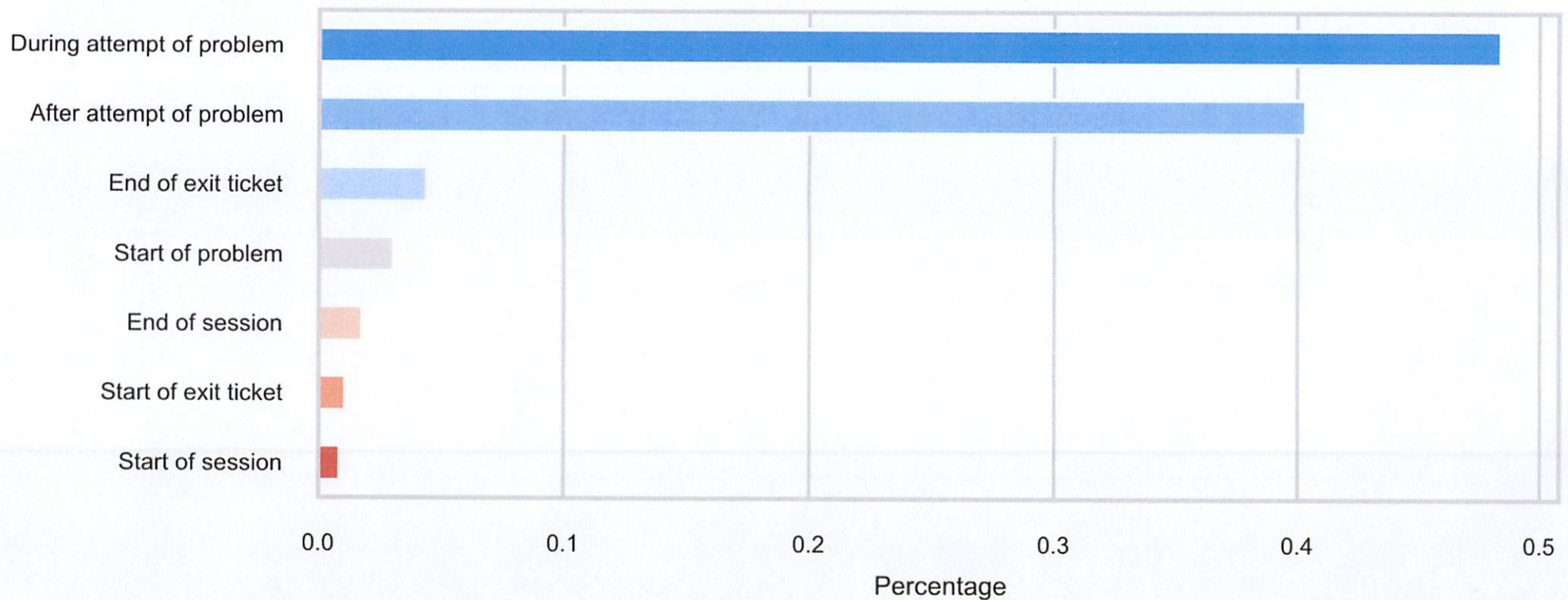
0.4

0.5

Percentage



# Tutors use Tutor CoPilot during the main stage of learning!



# What are tutors now saying?

## Tutors without Tutor CoPilot

## Tutors with Tutor CoPilot

Prompt Student to Explain

Ask Question to Guide Thinking

Affirm Student's Correct Attempt

Ask Student to Retry

Give Away Answer/Explanation

Give Solution Strategy

Encourage Student in Generic Way

-4

-2

0

2

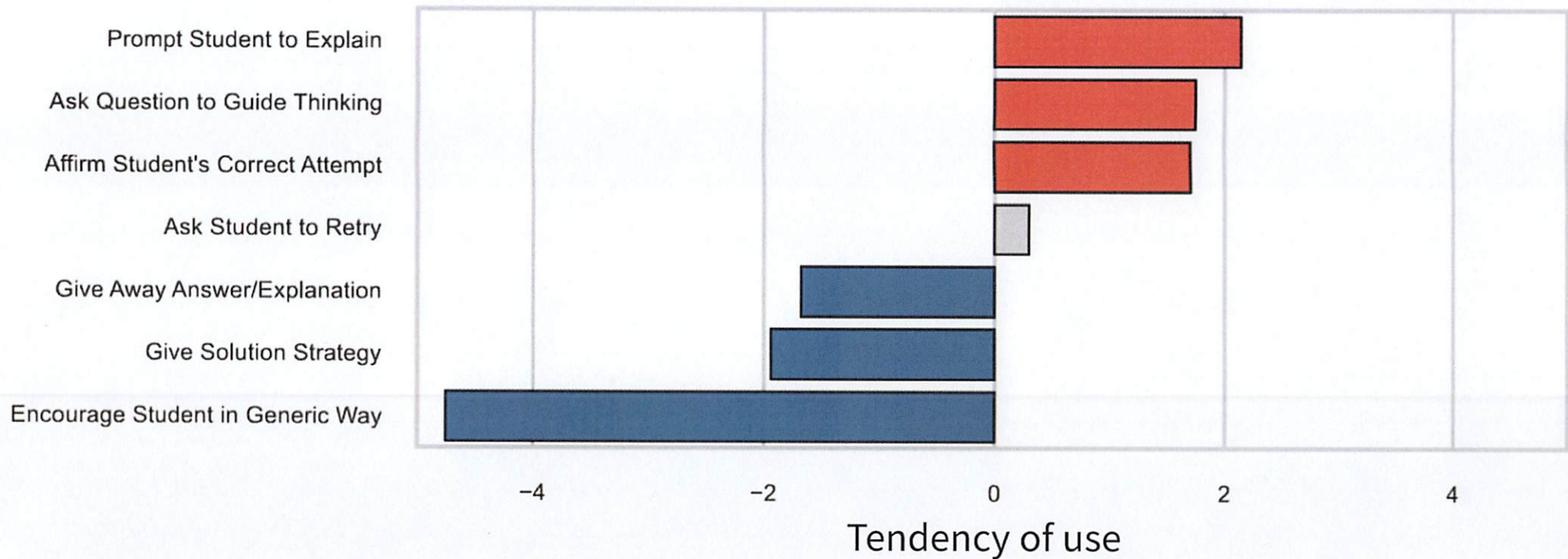
4

Tendency of use

# Tutors with Tutor CoPilot are using better pedagogy

Tutors without  
Tutor CoPilot

Tutors with  
Tutor CoPilot



## Summary of Tutor CoPilot study

- **Innovative tutor support:** Real time feedback with both AI and tutor input
- **Positive effect on exit ticket assessment:** 4 percentage points more likely to pass.
  - Currently can't look at the long run because students got both treatment and control tutors across sessions.
- **Greater positive effect on lower-rated tutors:** Bringing the lower rated to a level between the mid and high-rated tutors.
- **Shifted tutor language toward stronger pedagogy:** Including increasing prompts to explain work and decreasing providing correct answers and giving generic encouragement
- **Next steps?** All the research is *open-source*. So any tutoring vendor can use it if they want!

# Study Made the President's Economic Report

p.277

---

---

## ECONOMIC REPORT

OF THE

## PRESIDENT

---

---

TRANSMITTED TO CONGRESS

JANUARY 2025

TOGETHER WITH THE  
ANNUAL REPORT OF THE  
COUNCIL OF ECONOMIC ADVISERS

## Next steps for Tutor CoPilot

- **Ongoing effectiveness study:** Does it benefit students' end-of-year test scores?
- What we just presented: Only over two months and students had mixed exposure. We focused on *exit ticket assessments*.
- What is ongoing: Students and tutors with Tutor CoPilot over several months in academic year. We will focus both on exit ticket assessments and end-of-year test scores.

# Tutor CoPilot: An Intervention on Real-Time Decision Aids for Improving Virtual Math Tutoring

Rose E. Wang, Ana Ribeiro, Carly Robinson, Dora Demszky, Susanna Loeb



NATIONAL STUDENT  
SUPPORT ACCELERATOR

*equalizing access to quality tutoring*