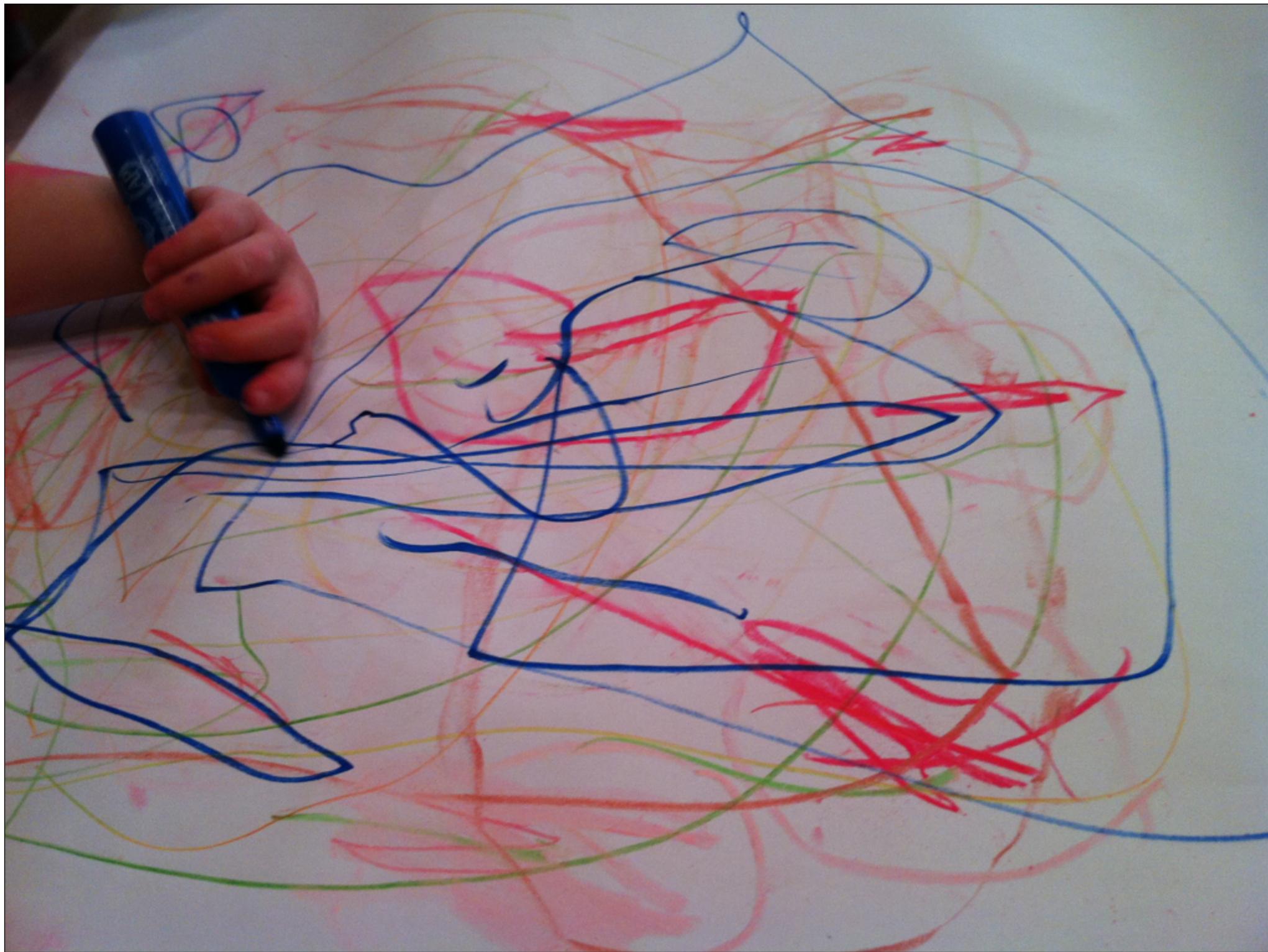
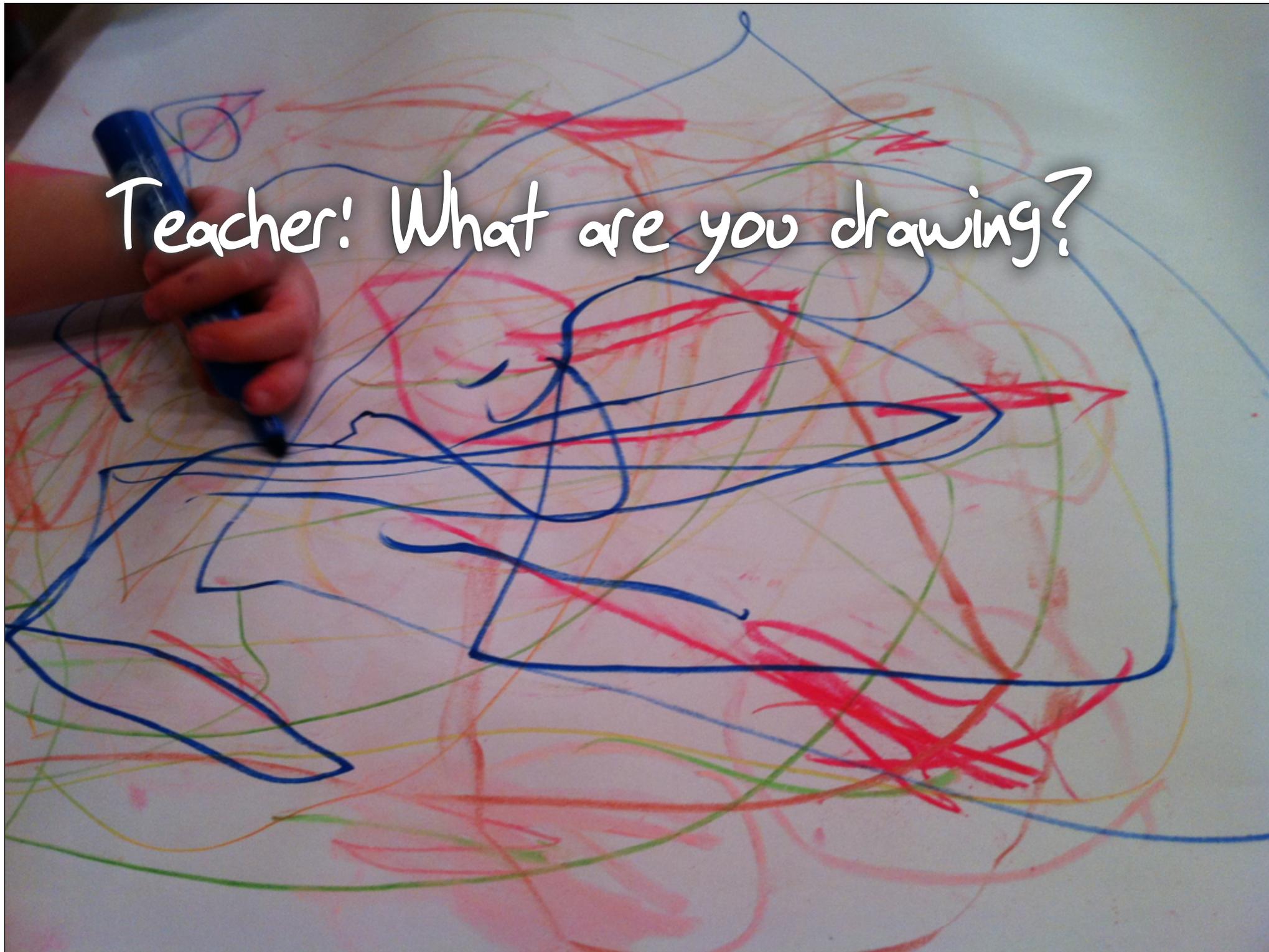


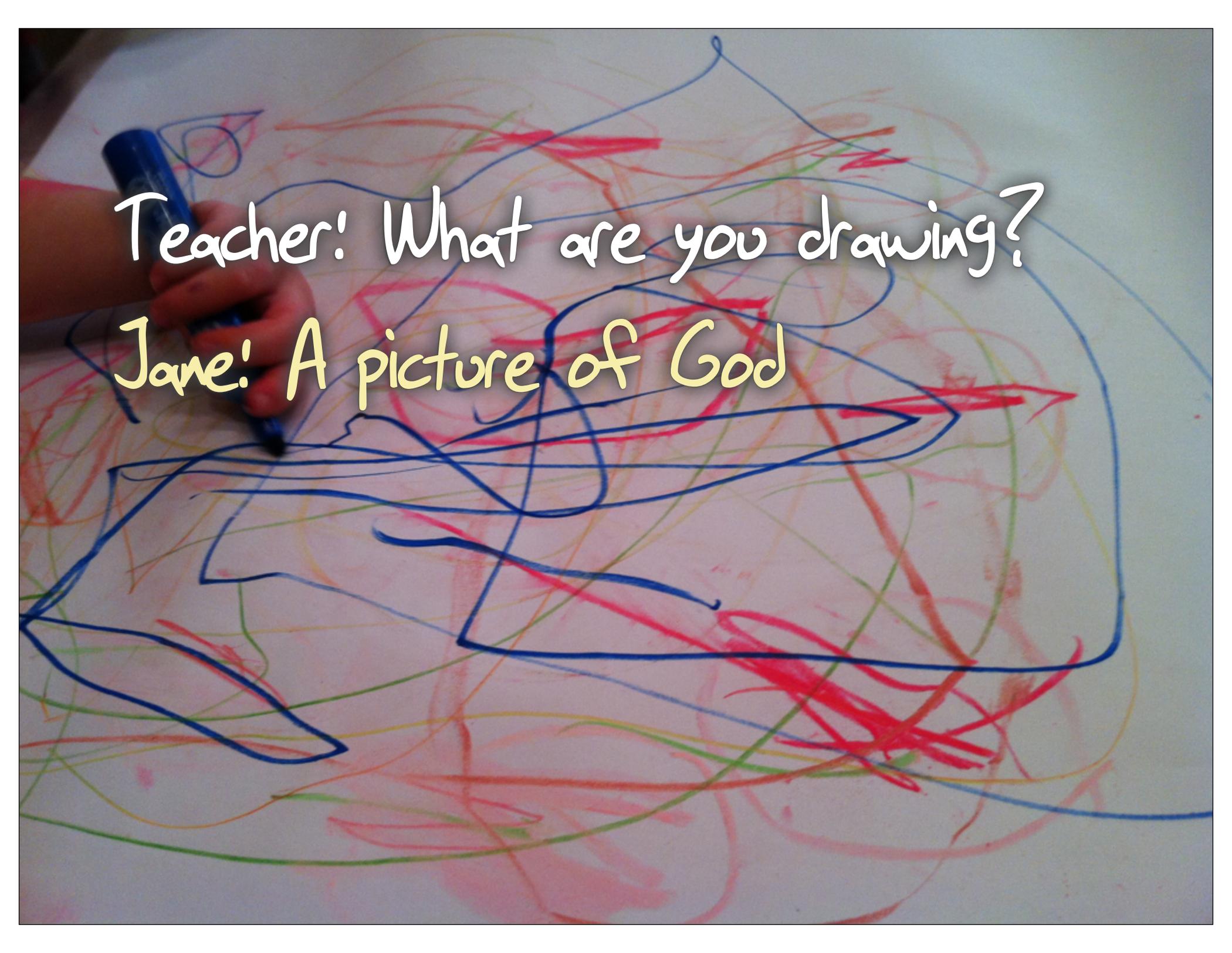
Catalyzing Learner Engagement Using Cutting-Edge Classroom Response Systems in Higher Education

Julie Schell, Brian Lukoff, & Eric Mazur
School of Engineering and Applied Sciences
Harvard University
January 15, 2013



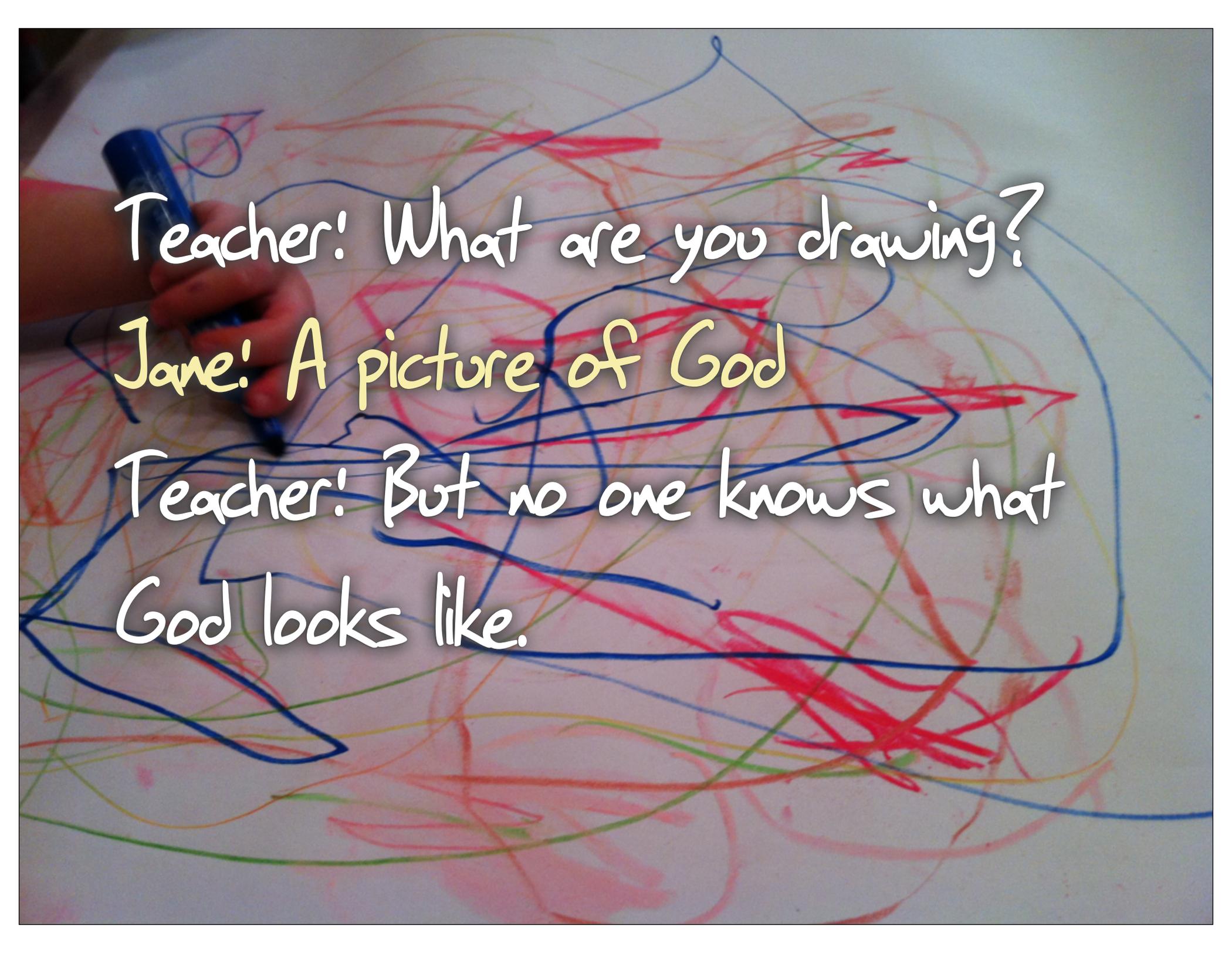
Teacher! What are you drawing?



A hand holding a blue marker is drawing a picture of God on a whiteboard. The drawing consists of several overlapping, scribbled lines in blue, red, and green, forming a complex, abstract shape. The background of the whiteboard is filled with these same scribbled lines, creating a chaotic and colorful scene. The text is overlaid on the drawing.

Teacher: What are you drawing?

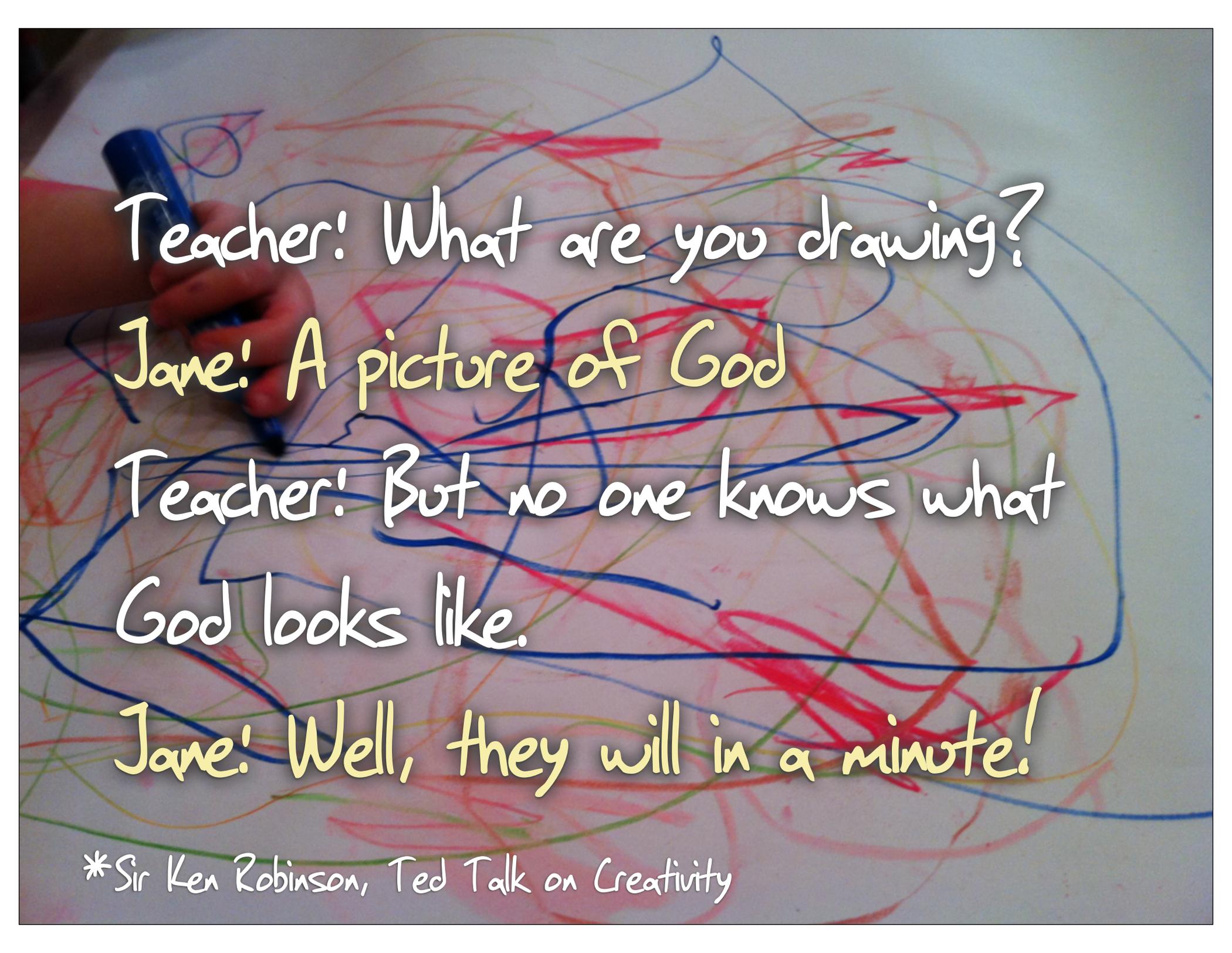
Jane: A picture of God

A hand holding a blue marker is shown in the upper left corner, actively drawing a chaotic scribble on a white surface. The scribble consists of numerous overlapping, tangled lines in various colors, including blue, red, green, and orange. The lines are thick and expressive, creating a complex, abstract pattern that fills most of the frame. The background is a plain, light-colored surface, possibly a piece of paper or a whiteboard.

Teacher: What are you drawing?

Jane: A picture of God

Teacher: But no one knows what
God looks like.

A hand holding a blue marker is shown in the upper left corner, actively drawing a chaotic scribble on a whiteboard. The scribble consists of numerous overlapping, tangled lines in blue, red, and green, filling most of the frame. The text is overlaid on this background.

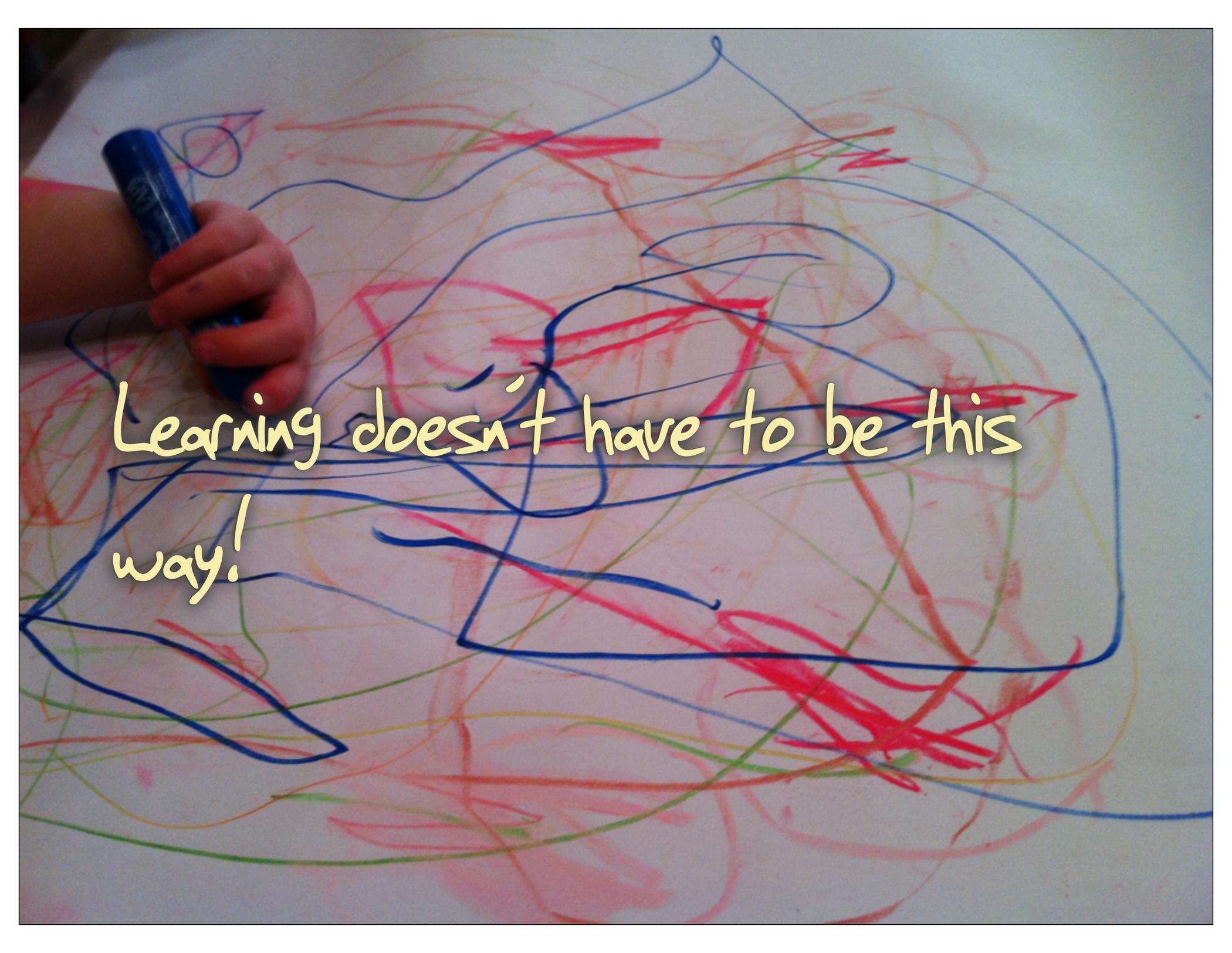
Teacher: What are you drawing?

Jane: A picture of God

Teacher: But no one knows what
God looks like.

Jane: Well, they will in a minute!

*Sir Ken Robinson, Ted Talk on Creativity

A hand holding a blue marker is positioned on the left side of a whiteboard. The whiteboard is covered in a dense, chaotic pattern of colorful scribbles in shades of blue, red, green, and orange. The text "Learning doesn't have to be this way!" is written in a yellow, handwritten font across the center of the board, partially overlapping the scribbles.

Learning doesn't have to be this way!

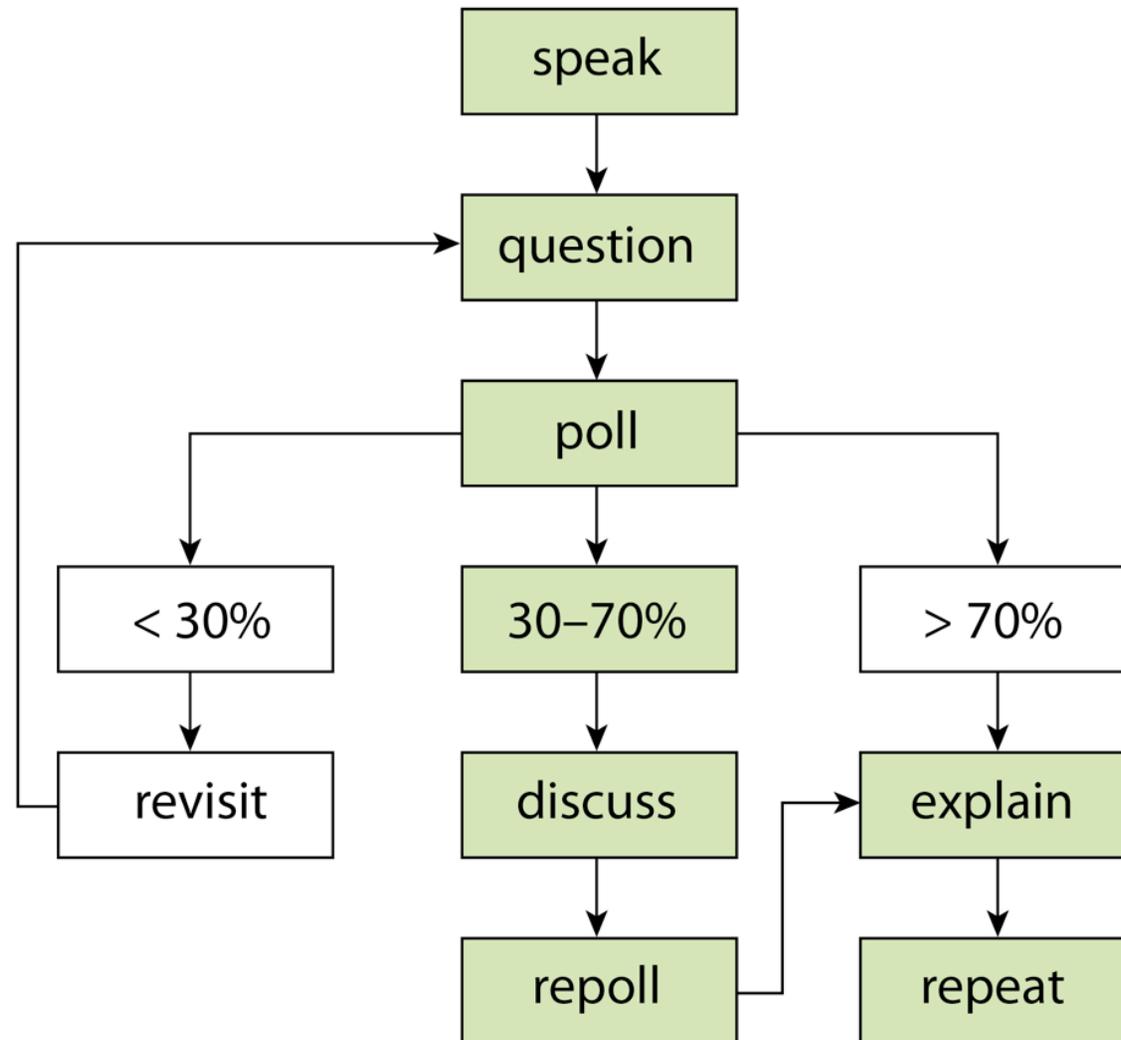
Expert learners and effective learning

- ◉ Metacognition
- ◉ Retrieval practice
- ◉ Effortful retrieval

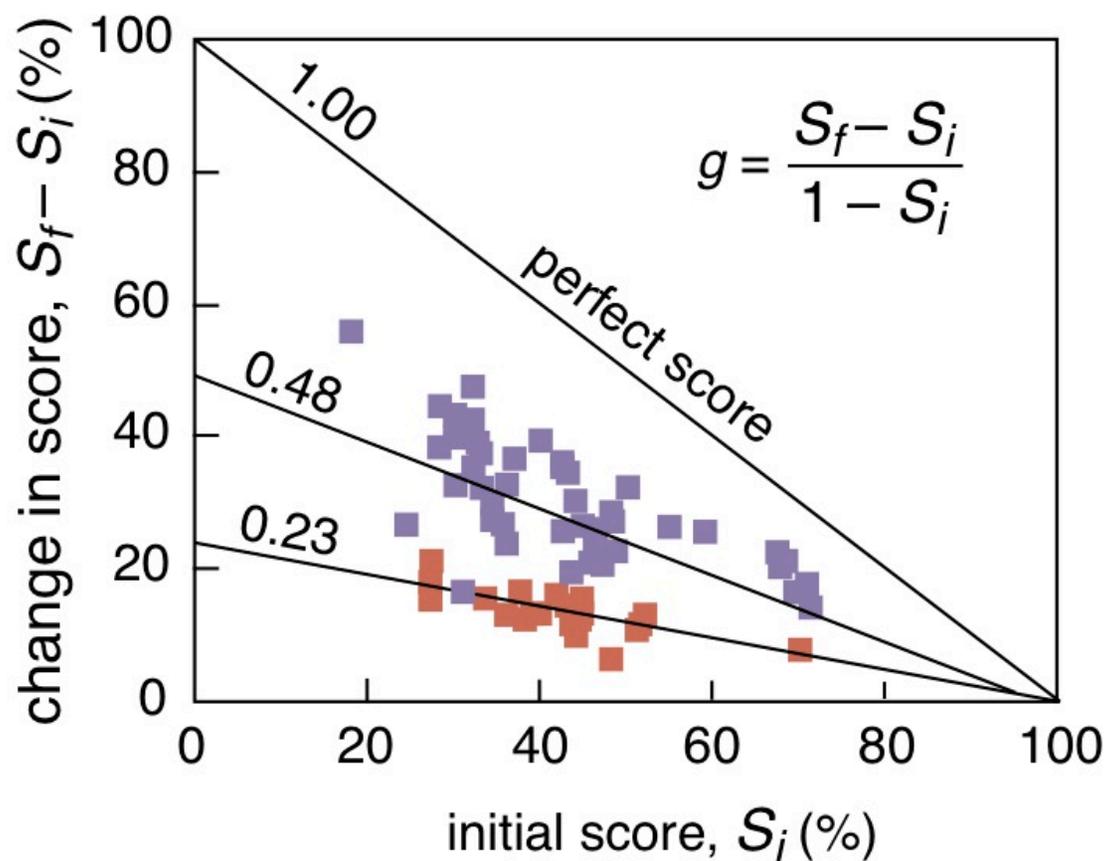
Interactive teaching

- Instructor poses a question to the class
- Could be knowledge-based, conceptually-based, or opinion-based
- Responses are solicited from **all** students
- Results used to inform instructional direction and strategy

Peer instruction



It works



Interactive learning
Traditional lecture

Source: Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *Am. J. Phys.* 66(1).

Typical implementation tools: Then



Typical implementation tools: Now



What's wrong with what we have?

- Largely restricted to multiple-choice questions
- Limited productivity of some peer instruction groups
- Not always easy to make use of student response data
- And why should students be using clickers when they all are already bringing other, more powerful devices to class?

Learning Catalytics: A new cloud-based platform for interactive teaching

Many different constructed-response question formats (graphical, numerical, algebraic, textual, ...)

The image shows a desktop browser window and a smartphone displaying the Learning Catalytics interface. The desktop browser window shows the URL <https://learningcatalytics.com/courses/11/lectures/203> and the user is logged in as Brian Lukoff from Harvard University. The page title is "learning catalytics" and it shows navigation links for "Classrooms", "Account", and "About". The current session is 766079 with 69 students. The question is about light reflection off two perpendicular mirrors. The desktop interface shows a "Jump to" menu with options 1 through 15, and a "Play" button. Below the question, there are two rounds of student responses. Round 1 has 57 responses with 58% correct. Round 2 has 51 responses with 73% correct. The desktop interface also shows a "feedback & support" button.

learning catalytics

Brian Lukoff | Harvard University | [Log out](#)

Classrooms Account About

current session: 766079 | 69 students

Review results Seat map Show floating session ID Edit PDF Delete

Jump to 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

horizontally into the combination of two perpendicular

Stop delivery Deliver again Assign groups Show all results

Round 1 57 responses, 58% correct

Round 2 51 responses, 73% correct

8 get it now
0 still don't get it

feedback & support

Carrier 1:32 PM

Refresh session 766079 Logout

Light enters horizontally into the combination of two perpendicular mirrors as shown below. Indicate the direction of the incident light after it reflects off of both mirrors.

Submit response

Switch to text response

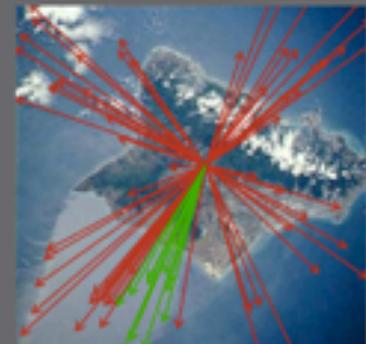
Current seat: A2 Change seats IM the instructor

4. direction This image shows Oahu as seen from the Space Shuttle. The image provides several clues about the direction of prevailing winds in Oahu. Indicate this direction by drawing an arrow on your screen. [Deliver](#) [Show all results](#)



Round 1 [✕](#) [📊](#)

77 responses, 16% correct



✓ 17 get it now
✕ 3 still don't get it

1. highlighting What do you see as the most important part of this Shakespeare sonnet? [✕ Stop delivery](#) [🔄 Deliver again](#) [👤 Assign groups](#) [📊 Show all results](#)

For shamel deny that thou bear'st love to any,
Who for thyself art so unprovident.
Grant, if thou wilt, thou art beloved of many,
But that thou none lovest is most evident;
For thou art so possess'd with murderous hate
That 'gainst thyself thou stick'st not to conspire.

Round 1 [✕](#) [📊](#) [👤](#)

3 responses

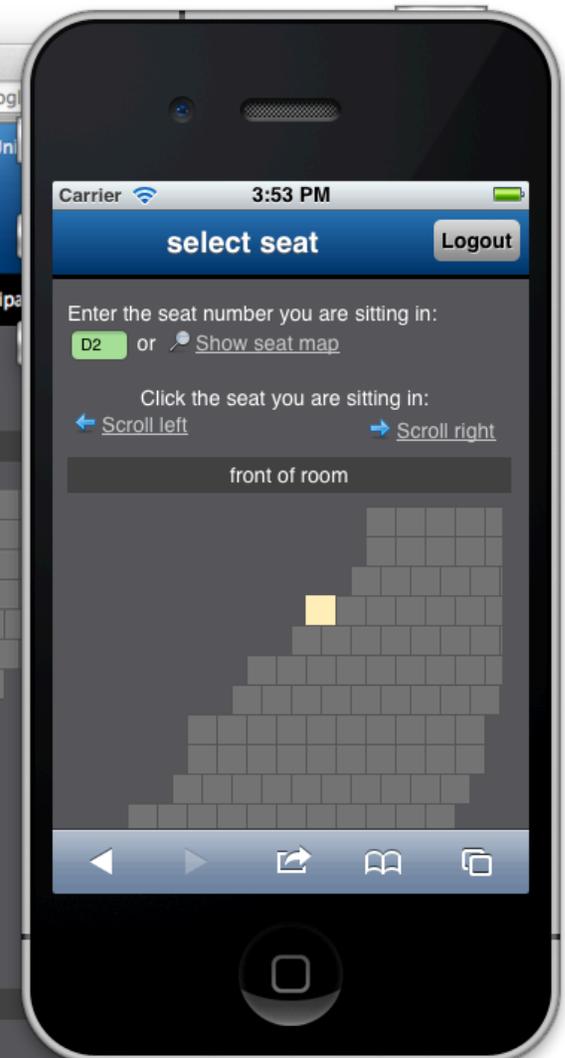
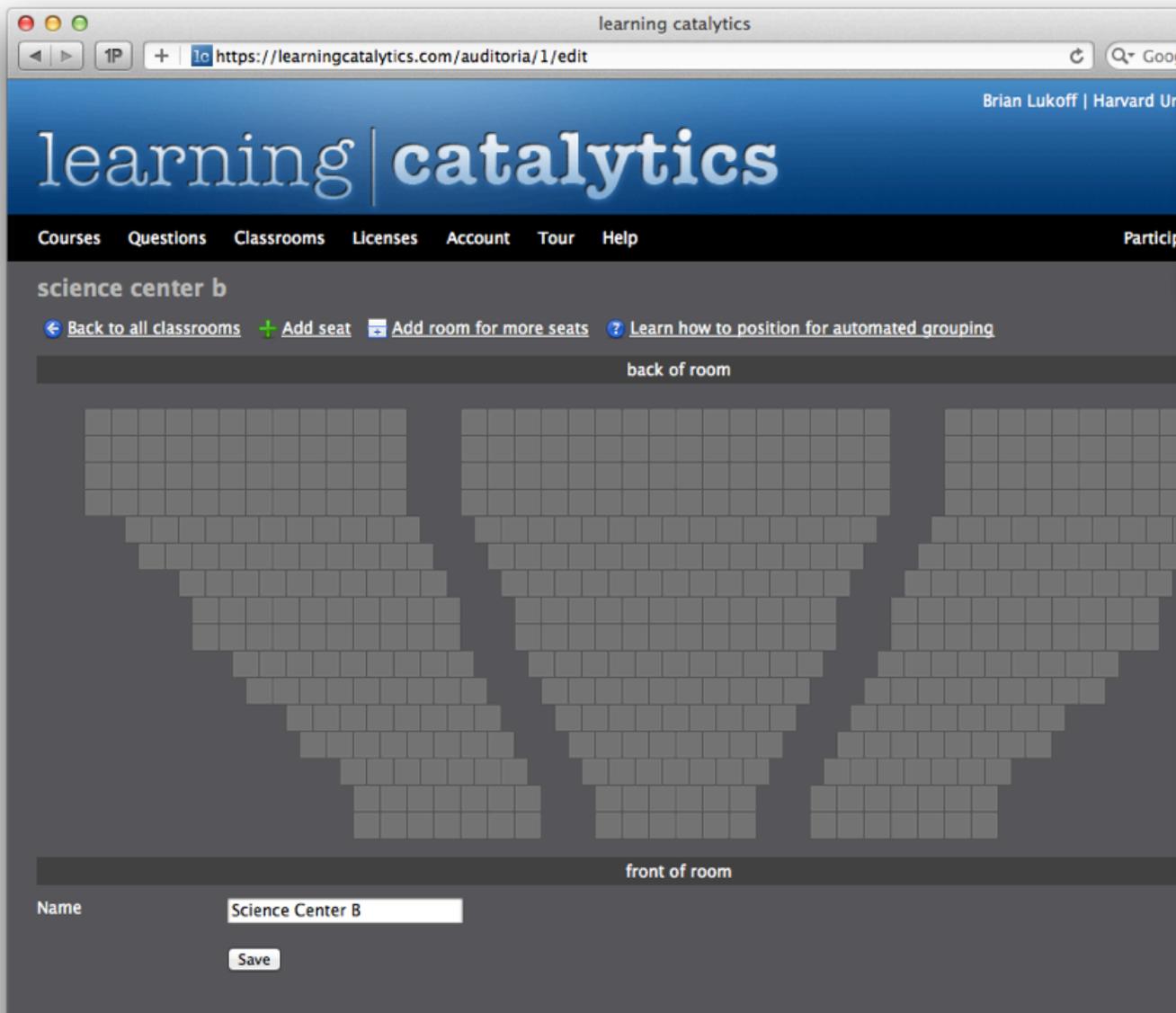
For shamel deny that thou bear'st
love to any,

This is a gr

Carrier
Refresh
This is
of the d

2. word c
question.

Use real-time analytics to generate discussion



Use real-time analytics to generate discussion

learning catalytics

https://learningcatalytics.com/courses/11/lectures/189

Brian Lukoff | Harvard University | Log out

learning catalytics

2. multiple choice A positively charged rod is held near a neutral conducting sphere as illustrated below. A positively charged particle is moved from point A to point B at constant speed. The potential difference from A to B is

A. positive
B. zero
C. negative
D. depends on the path taken from A to B
E. cannot be determined without knowing more about the polarization induced in the sphere

Round 1
74 responses, 61% correct

A. 61%	Round 2 75 responses, 83% correct
B. 4%	B. 0%
C. 35%	C. 17%
D. 0%	D. 0%
E. 0%	E. 0%

Carrier 11:17 AM

Leave session 399757 Logout

A positively charged rod is held near a neutral conducting sphere as illustrated below. A positively charged particle is moved from point A to point B at constant speed. The potential difference from A to B is

Please discuss your response with:

- Brian Lukoff (to your left)

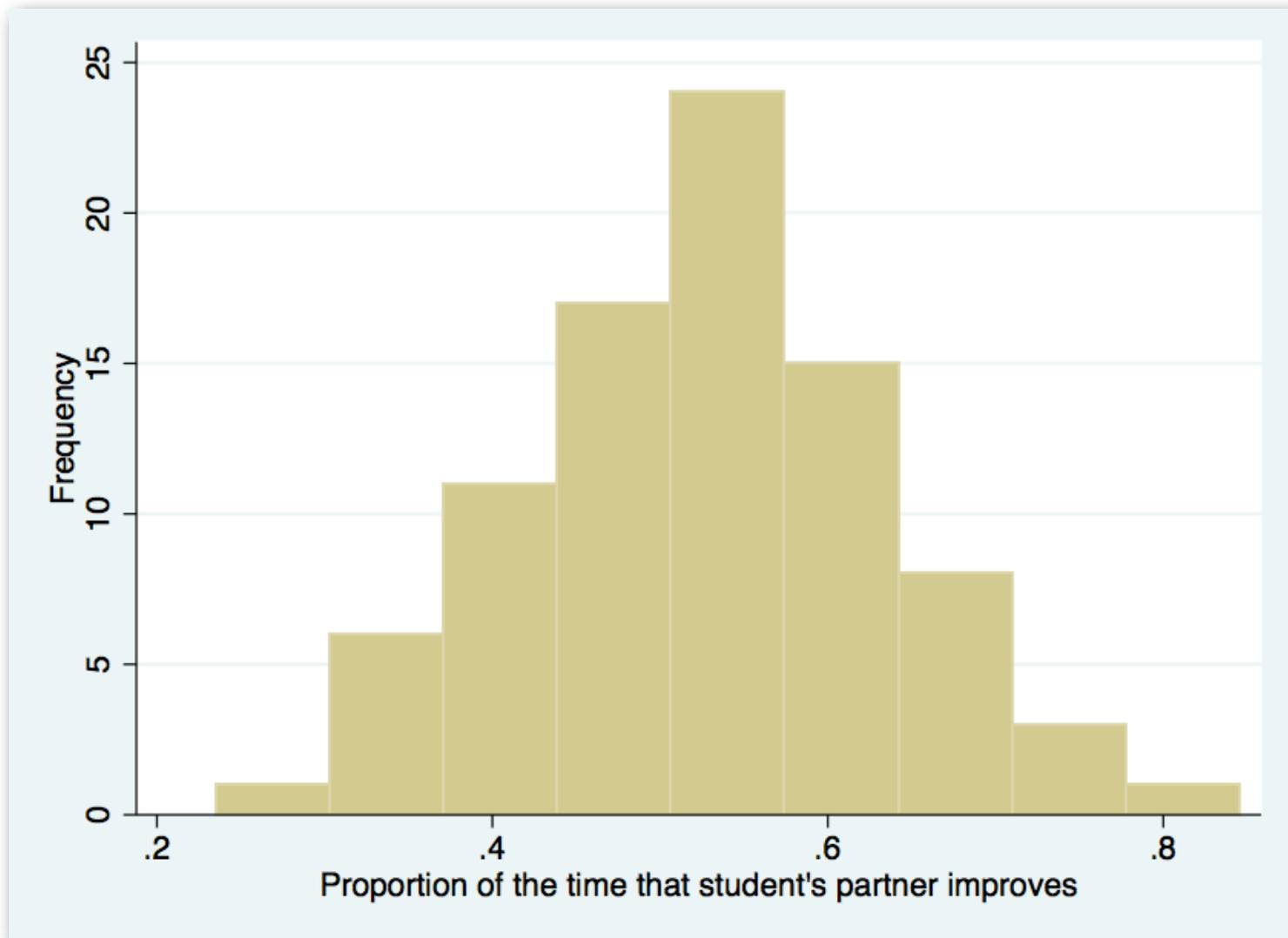
I am talking to this person/people

Measuring learner engagement: Finding “natural teachers”

Who among the students are the “natural teachers”?

- When students are engaging in discussions, both learning and teaching occurs
- When a particular student’s partners consistently improve, they are, in a sense, a “natural teacher”
- We can identify these students using the Learning Catalytics data

Who among the students are the “natural teachers”?



Thank you!

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learningcatalytics.com

peerinstruction.net