

Study Guide for “How to Learn Math for Teachers”



Ideas for collaboration to accompany
Jo Boaler and Stanford University’s online course:

[How to Learn Math for Teachers](#)

Overview

This course study guide will help you and your colleagues build a shared understanding of the messages, research and practical ideas in each session.

The Course Study Guide includes many activities, all organized so that teams can **Make Sense** of the big ideas in the session, **Reflect** on their understanding, and **Plan** to use the new information in the classroom.

Make Sense

Opportunities for collaborative sense-making are just as valuable for adults as they are students. Together, colleagues can co-construct a shared understanding of what the ideas in each session mean for them. As you plan your collaborative time, the activities on this list will help your team make sense of the new information they have encountered in the course sessions.

Reflect

Reflection activities create a space for educators to think about how new ideas relate to their current beliefs and practices, consolidate their thinking, and make personal connections.

Plan

The best way to make sense of the ideas in the course is to try them and try them together! This list includes things to try in your classrooms to experience the ideas in each session. We encourage you to take some risks and choose the activity or activities that will be a good next step for your team.

How to get started with the course study guide?

Before you start the course it is a good idea to spend some time as a team deciding on the purpose and frequency of your collaborative meeting times while taking the course “How to Learn Math” and how it relates to ongoing work at your site.

Getting ready to talk about the Introduction

In this session, Jo introduces several of the big ideas she will explore more deeply throughout the course.

Activity Bank

Make Sense

- Create community norms for your team. Start with some time to individually write down norms that you think will help your team work together. Share individual norms and decide which of them will become community norms for the team.
- Read and discuss Jo's article, [When you Believe in Your Students They Do Better](#). Share stories about teachers (any teacher or mentor) who believed in you. What did they do? How did their belief in you impact your success? How did this impact your own beliefs about what you could do?
- Work together to solve and make sense of the problem [Painting Youcubed](#). Share with each other how the experience of doing this problem together compares to how you think about mathematics.

Reflect

- What were your experiences with math like as a child? Were your experiences similar or different from those shared in this session? Why do you think that is?
- What is your current relationship with math? Is your personal relationship with math the same or different from your relationship with math as an educator?
- Has stereotype threat played a role in your life or the life of someone you know? How so? Did this impact your or their attitudes towards academics or certain career paths?

Plan

- Discuss the kinds of relationships your students have with math. Brainstorm ideas about what you can do or say to students who may have negative relationships with math and to those who have positive relationships with math.
- Write down something you can commit to trying in your classroom between now and the next session. Consider sharing this with a friend who can check in with you about how things went.

Getting ready to talk about Maths and Mindset

Research tells us that when students develop a ‘growth mindset’ amazing things happen. This session teaches us ways to encourage a growth mindset in your students.

Activity Bank

Make Sense

- Work together to make sense of and solve [Leo the Rabbit](#), then discuss:
 - What would be hard about this task if a student had a fixed mindset?
 - How would students approach this task if they had a growth mindset?
 - What could a teacher do before, during and after this task to help students develop a growth mindset?
- Discuss what fixed messages you have been hearing in your classes and brainstorm responses you can use when you hear them. Role play ways to respond to fixed messages in your classroom.

Reflect

- What kind of mindset do you think you have about learning mathematics?
- What do you think is the mindset of your students? Give an example of ways students display fixed and growth mindsets.
- Describe your mindset about learning mathematics. Do you think it is similar to your students’ mindsets about learning mathematics? Why or why not?
- What about your teaching practice? Do you think you approach your own practice with a fixed or growth mindset?

Plan

- Choose a norm to bring into your classroom from [Positive Norms to Encourage in Math Class](#) or write your own!
- What do you think is the mindset of your students? Choose a question to answer using data you gather to see if your prediction matches what students actually believe.
- What mindset conversation do you want to start with students? What are you going to try with them before the next session?

Getting ready to talk about Mistakes & Persistence

This session begins to uncover a major cause of stress and anxiety among math students, making mistakes in math. The stress they experience is not that different from the anxiety a teacher might feel during a classroom observation. Discussing ways to frame mistakes, risk-taking and struggle as opportunities to grow brains can be a chance to open conversations about visiting each other's classrooms.

Activity Bank

Make Sense

- Work together to make sense of and solve [Hex](#). Discuss the role making mistakes played in your work.
- Choose a math activity you will use with your students soon. Work through the task together and discuss:
 - Where would you expect students to struggle in this activity?
 - How would this struggle be handled in a class that upholds the “didactic contract”? In a class that transcends the “didactic contract”?
- Design a role play that responds to a student who displays a fear/avoidance of mistakes.
- In what ways can speed be devalued? What can be done to encourage students to slow down?

Reflect

- How are mistakes treated in your classroom? How do you and your students react to mistakes? How do you and your students react when they do a problem correctly without making a mistake?
- How do your students respond to challenging work or work that appears to be easy for them?
- To what extent do your students value speed and doing well on tests? How do you think they would define success in your class?
- How is speed expected and/or rewarded?

Plan

- How do you plan to convey this session's messages about mistakes? Think about how you will show and communicate these messages through tasks, participation structures, feedback, seat assignments, etc.
- Choose one of the [math tasks](#) from the YouCubed website to give to students. Plan for ways to set up and encourage productive struggle. Include in your plan opportunities to give students feedback on their thinking about the problem.
- Discuss ways to start a conversation with students (and parents) about disassociating math from speed in your classroom, working for a deep understanding of mathematics, and how it requires them to think deeply about mathematics. Think about why this might be challenging for some students (and parents) and prepare for ways to reframe what they might say.

Teaching for a Growth Mindset

Getting ready to talk about Teaching for a Growth Mindset

This session introduces examples of teaching strategies and resources for math tasks that help to foster a growth mindset and a culture of learning. The focus on strategies and tasks might make it tempting for a group of teachers to move quickly to the “planning” stage. The “making sense” and “reflecting” stages are especially important here to create a space for deep thinking and learning.

Activity Bank

Make Sense

- Work together to make sense of and solve [Kite in a Square](#), then discuss how doing the task helps to communicate what it means to approach a problem with a growth mindset.
- Choose a math activity you will use with your students. Work through the task together and discuss:
 - How does the activity compare to the framework of a growth mindset task put forward in the session? What are specific examples in the task of:

Openness

Different Ways of Seeing

Multiple Entry Points

Multiple Paths/Strategies

Clear Learning Goals

Opportunities for Feedback

- What can you do to better align the activity to the growth mindset task framework?
- Watch [A Visit to China in 2014](#) and discuss what you see the teacher doing during the open discussion to create a public space for sense making.

Reflect

- How has your mindset (about math, your students, your teaching...) changed since the beginning of this course?
- What is the difference between learning and performing? What value does your classroom and school place on each?
- Did you experience ability grouping or tracking when you went through school? How did this shape your path as a learner and a teacher?
- How does being placed in a low track affect students mindset and learning path? How does being placed in a high track affect students mindset and learning path?

Plan

- Choose a [task from YouCubed](#) or from other sites as [NRICH](#) to try in your classroom. Discuss how you can add to the task or set it up using ideas related to the growth mindset framework.
- What is the purpose of groupwork in your class? What do you want students to understand about the purpose of groupwork? How will you communicate the purpose of groupwork to your students?
- Try the group work activity in day 1 of the [Week of Inspirational Math](#) published on youcubed.

Conceptual Learning

Part I: Number Sense

Getting ready to talk about Conceptual Learning Part 1: Number Sense

In this session Jo shares a strategy for teaching math facts and number sense to students.

Activity Bank

Make Sense

- Do [Friday 13th](#) together and discuss how the problem has space for building and deepening number sense.
- Find a math activity you will use soon with your students. How does this activity support students' number sense? What could you do to modify it so that it has space for students to think more conceptually than procedurally?
- Read and discuss Jo's article, [Fluency Without Fear](#) and play [How Close to 100](#). How is Jo's description of fluency the same or different from what you're familiar with? Are there ideas in this article that you could use in your school community? How could you go about implementing those ideas?

Reflect

- What supports are in place for low achieving students in your class or school? How do the supports in your class or school align with the information about number sense and compression that Jo presented in this session?
- When you were in school, how did you learn math? Would you say it was more procedural or conceptual? What role do you think this experience played in your success and in your teaching?
- Why do you think it is so important for students to see problems solved in different ways? What do you think are some mathematical and cognitive skills students gain when making sense of multiple strategies?

Plan

- Discuss your school's support for low achieving students. How does it compare to the information Jo presented in this session? How can you leverage existing strengths to accomplish your goals?
- Brainstorm some ways to make space for number sense in your classroom. Choose something from the list to try before the next meeting.
- How might you begin to discuss the importance of number sense with your students, parents or administration? What resources do you need to begin and sustain these conversations?

Conceptual Learning

Part II: Connections, Representations, Questions

Getting ready to talk about Conceptual Learning Part II: Connections, Representations, Questions

Students often experience math as a dry subject, the purpose of which is to memorize a huge collection of methods and rules. In this session, Jo describes how student thinking can be engaged so that mathematics comes alive for them. *Copyright © 2021 youcubed. All rights reserved.*

Activity Bank

Make Sense

- Try a task that seems less easy to interpret as a procedural task, like [Paper Folding](#). As you work, related but different questions may come up. Record these, and feel free to work on these new questions instead. Follow your curiosity!
- Choose a problem from your curriculum that could be interpreted as procedural (for example, out of a standard textbook), and revise it so it encourages explorations of the same concepts.

Reflect

- What elements of mathematical thinking did Jo describe? Which elements do you think might be easy or challenging to incorporate into your own teaching?
- What does it mean to you to have an inquiry relationship with mathematics?
- What are things you have tried in your teaching that seem to engage your students' curiosity?

Plan

- How could you structure the classroom experience for your students so that they are encouraged to follow their curiosity?
- How could problems be phrased so that students are more likely to see and make sense of multiple approaches?
- Write down 1-2 things you can commit to trying in your classroom between now and the next session. Share your commitments with a friend who can visit your classroom when you try them or check in with you about how things are going.

Getting ready to talk about Appreciating Algebra

Algebra is the new civil right! When planning this collaboration keep in mind that some people have very strong opinions about what Algebra is. Give your team the opportunity to make sense of the ideas about algebra in this session and to build appreciation of algebra as a problem solving tool.

Activity Bank

Make Sense

- Do [Circle Fever](#) together and discuss how the problem is an example of a structural Algebra task.
- Make a concept map to visually show how ideas about Algebra are connected. Challenge each other to dream big and be especially creative and curious about mathematics, nature, and the world.
- Watch the [video](#) of Jo Boaler doing a dot card number talk and discuss how this experience builds structural understanding of Algebra.

Reflect

- How do you move algebra or pre-algebra from a black and white to a multi colored subject for your students? What do you want to try or do more of?
- Describe the difference between Algebra (the course) and algebra (the problem solving tool).
- How do Jo's five principles of teaching Algebra (below) compare to the way you see Algebra?
 1. *Start with generalization through exploration of pattern tasks.*
 2. *Teach Algebra as a problem solving tool.*
 3. *Teach Algebra as a sense making experience.*
 4. *Represent Algebra in multiple ways.*
 5. *Teach Algebra through the Standards for Mathematical Practice.*

Plan

- Design some Number Talks so students can play with numbers and build a structural understanding of Algebra. Do each number talk so that you generate and make sense of as many approaches as possible.
- Choose a challenging group task students will experience in the near future and then plan a reflection as part of the closure of the task. In the reflection time ask students to write about how talking about math helped them to solve the problem.
- Plan a discussion to have with students to define what Algebra is. Make decisions about ways of recording to show connections between ideas.

Going From This Course To a New Mathematical Future

Getting ready to talk about Going From This Course to a New Mathematical Future

This is the time to dream. What do you want students to experience when they are doing math in your classroom and at your site? Make this collaboration time an opportunity to be reflective and make plans for creating the space for students to do the kind of learning discussed in this course.

Activity Bank

Make Sense

- Brainstorm a list of agreed upon changes to make when students work on mathematics together. Think specifically about what you want them to experience day to day. Highlight what on the list can be done immediately and what on the list will need more time. Collaboratively plan for what you will do immediately and decide on next steps for what will need more time.
- Read and discuss Chapter 3: A Vision for a Better Future: Effective Classroom Approaches, from What's Math Got to Do with It?, by Jo Boaler.

Reflect

- Take the survey individually and choose something to share with each other.
- Reflect on the course; what did you learn and what do you want to learn more about?
- How does the discussion of multidimensional mathematics compare to your school mathematics experience?

Plan

- Create a list of all the ways to be mathematical and choose some to share with students. This could be something you do individually and/or collaboratively.
- Think about Sarah Flannery's interview about the impact of puzzles and problems at home with parents. Identify some next steps about how to work with the parent/family group at your site to share ideas about what to do at home and make sense of other ways to share mathematics with your site's families.
- Generate a list of important partners in your journey to transform mathematics education. Consider parents, administrators, school counselors, teacher support personnel, other academic department members, etc.
- Confidently embrace the future of mathematics change and your own journey with mathematics teaching and learning. Embrace it with a growth mindset! You can do anything!