TeachingWorks
UNIVERSITY of MICHIGAN

Resource Guide: *Leading a Group Discussion* in Mathematics

What is *leading a group discussion* in mathematics?

In a group discussion, the teacher and all of the students work on specific content together, using one another's ideas as resources. The purposes of a discussion are to build collective knowledge and capability in relation to specific instructional goals and to allow students to practice listening, speaking, and interpreting. The teacher and a wide range of students contribute orally, listen actively, and respond to and learn from others' contributions.

In a group discussion about mathematics, the teacher supports students to individually and collectively engage in sense-making about rich mathematical content. A mathematics discussion can provide opportunities for students to learn, practice, and refine habits of mind and discourse relevant to the field of mathematics.

How can *leading a group discussion* advance justice?

Teaching that advances justice requires that teachers attend to their students' development, both as intellectual beings and as citizens. The free and fair exchange of ideas is a bedrock of a healthy democracy. Being an engaged world citizen requires the ability to share, justify and defend one's ideas and – even more important – to listen attentively and thoughtfully to the ideas and perspectives of diverse others. Classrooms are an opportunity to practice the skills of reasoned argument, debate, and collective knowledge building toward common goals. Teachers can frame group discussions as opportunities for young people to make sense of something difficult together, and to support one another to both speak and listen in ways that advance the classroom community and common good.

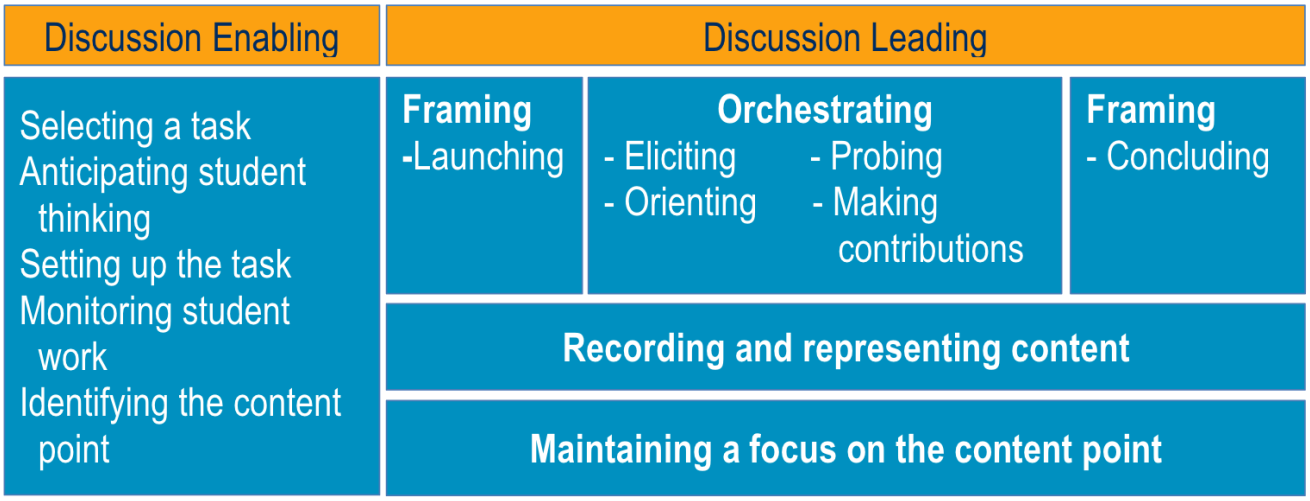
By explicitly teaching disciplinary discourse norms and engaging students in discussions about mathematics, teachers can provide opportunities for students to have their voices heard, respected, affirmed, challenged and refined. When teachers do this deliberately, attending to students who have lower status or are likely to be marginalized, teachers can intervene to disrupt inequitable patterns of student participation. Teachers do this by intentionally positioning particular students as capable and competent publicly in front of their peers, calling attention to their strengths and contributions as assets in collaborative work (see Featherstone et al., 2011). This is especially critical in mathematics, a content domain where what counts as competence is often narrowly defined.

When this practice is routinely done well, students have repeated opportunities to formulate, revise, and refine mathematical arguments and as a result to come to see themselves as people who are capable of reasoning and making sense of mathematics using what they know to build new understandings. In addition, when all students are treated respectfully, when they are truly listened to, when their ideas are valued and understood as resources in instruction, and when these norms extend to how students treat one another, then a teacher's work to lead a group discussion can serve as an opportunity to engender what Jo Boaler (2008) has termed relational equity. Like Boaler, we believe that when students experience equitable relations in mathematics classrooms, "the respect they learn to form for each other will impact the opportunities they extend to others in their lives in and beyond school" (p. 167).

How do we decompose the practice into learnable parts?

The practice of leading a group discussion is broken down into learnable and teachable components, as represented in the decomposition chart below. It is broken into two main areas of work: *discussion enabling* work and *discussion leading* work. Each area of work is further decomposed into discrete moves or techniques that can be examined, practiced, and refined.

Decomposition of leading a group discussion



Drawing on the decomposition chart above, discussion-enabling work includes both work the teacher does before the lesson begins, as well as the work that happens after they launch the task. Prior to the lesson, the teacher chooses a task that is not only "discussable," but also content that is worthy of discussing, identifies the mathematical point, and anticipates what students might do. After they launch the task, the teacher circulates and engages with students as they complete the task in order to probe student ideas, move student thinking forward, and gather information about student thinking for use during the discussion.

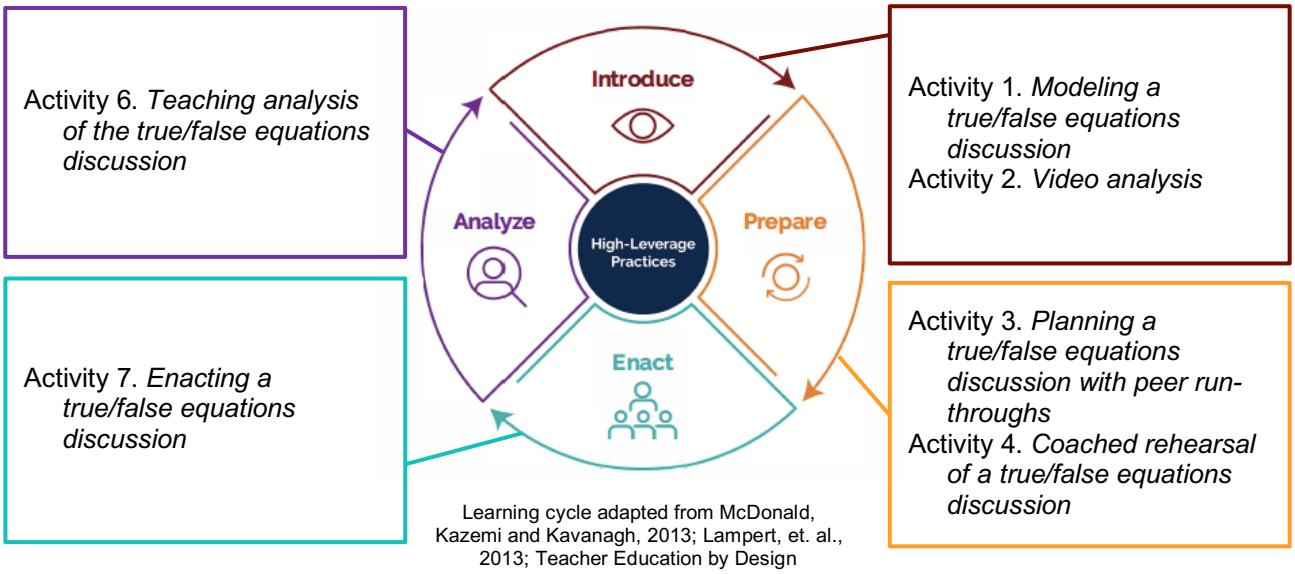
Discussion-leading work includes both the framing the teacher does to launch and conclude the discussion, as well as the work of orchestrating the discussion. During orchestration, the teacher elicits student thinking by asking probing questions that help get student thinking out onto the table, and employs orienting moves to help students connect to and build off one another's mathematical ideas. Throughout the course of leading the discussion, the teacher's decisions are driven by a commitment to maintaining an emphasis on the mathematical point. Finally, teachers record and represent the content of the discussion publicly, in order to support all students in having access to the ideas that are being shared.

Note that the work of leading a group discussion occurs in pursuit of the goal of building collective knowledge about mathematics.

What is challenging about learning this practice?
Many of us come to our roles as educators and teacher educators with strongly held beliefs about what it means to teach and learn mathematics based on our own experiences as learners of math. When we understand doing math as primarily about getting correct answers and teaching math as conveying procedures for arriving at correct answers, we may have strong inclinations to evaluate and remediate student thinking. As a result we may miss opportunities to identify and build upon students' existing knowledge and understanding, neglect innovative and mathematically rich student strategies, and fail to recognize the logic underlying students' misconceptions or errors. Ultimately, these inclinations can lead us to over-utilize certain teaching approaches that reduce the cognitive work students do, such as direct instruction. By utilizing a group discussion as a means to build collective knowledge, novices can develop first the skills and eventually the dispositions to probe student ideas, orient students to one another's ideas, make strategic contributions that maintain a focus on the mathematical point, and maintain accurate public records. Moreover, the practice is central to teaching math in a way that honors all students' contributions and positions all students as sense-makers capable of doing meaningful mathematical work.

Learning Cycle: A deliberate progression of work on *leading a group discussion*

In what follows, we provide an overview of a set of learning activities and associated resources designed to target the high-leverage practice of *leading a group discussion* in mathematics. These activities are deliberately sequenced to engage novices in a learning cycle (Lampert et al., 2013). The cycle involves four phases: introduce, prepare, enact, and analyze (McDonald, Kazemi, and Kavanagh, 2013). We use this learning cycle as a tool to design sequences of activities that develop novices' understanding and skill with a given teaching practice. Pedagogies are selected to fit candidates' likely level of experience as they are introduced to a new practice, coached in practicing and preparing to use it in the classroom, independently enacting it with actual students, and then analyzing their enactment for further skill development.



Learning cycle adapted from McDonald, Kazemi and Kavanagh, 2013; Lampert, et. al., 2013; Teacher Education by Design

The activities listed in this cycle need not be enacted in order, though it may make sense to go through the four quadrants sequentially. The most time-consuming of these for novices will be the field assignment where novices model for small groups in their classroom.

In this cycle, novices work on orienting students to one another's thinking, a central component of *leading a group discussion*. By focusing on orienting practices, novices have opportunities to consider the importance of attending to student positioning and to practice concrete strategies for intervening in classrooms to deliberately disrupt patterns of inequity while orchestrating mathematical discussions.

Work on orienting is embedded in the activity of True/False Equations. True/False Equations are designed to support students in developing a relational (as opposed to operational) understanding of the equal sign (Carpenter, Franke, & Levi, 2003) while providing opportunities for them to construct mathematical arguments and respond to the reasoning of others. Novices prepare to teach a True/False Equations activity in their field placements. To do this, they engage as learners in a True/False Equations activity modeled by the teacher educator, analyze a video of a True/False Equations discussion from a fourth-grade classroom, plan for and rehearse and then teach a True/False Equations activity in the field, and finally analyze their own teaching to consider the effectiveness of their own efforts to orient students to one another's ideas inside of a True/False Equations discussion.

NOTE: *Resources for two other learning cycles targeting work on discussion-enabling practices and discussion-framing practices (launching and concluding) are currently under development to complement these orienting resources.*

Introduce

Overview: Novices engage as learners of mathematics in a True/False Equations activity to develop content knowledge and analyze a video to examine the work of orienting students to one another's thinking.

Activity #1: Modeling a True/False Equations Discussion
In this activity, novices engage in a True/False Equations discussion with the teacher educator taking on the role of classroom teacher in order to model particular teaching moves. The problems selected for the True/False Equations task are designed to target multiplicative relationships. The teacher educator prepares for the True/False Equations discussion using a planning guide, and deliberately models a range of strategies for orienting novices to one another's thinking. Afterwards, the teacher educator facilitates a debrief, guiding novices to consider the structure of the True/False Equations activity, norms for student discourse, and the teacher's critical work of orienting students to one another's thinking.

Resources: *Annotated Plan*
Teacher Educator Planning Guide: Modeling True/False Equations
Activity 1 Slides

Activity #2: Video Analysis
In this activity, the teacher educator introduces the practice of orienting students to one another's ideas, making a distinction between teacher-driven discourse and discussions in which students are listening and responding to one another in order to build knowledge collaboratively. In addition, care is taken to deliberately link the work of orienting to concrete ways in which a teacher can disrupt patterns of inequity by attending to student positioning and status and intervening accordingly. Novices have an opportunity to consider eight key orienting practices identified in the decomposition. Then, they watch a video of a teacher facilitating a True/False Equations activity to consider a broad range of orienting moves and their function within the discussion. Novices use the "Orienting Students to One Another's Thinking: Observation Tool" to support their noticing. The teacher educator facilitates discussion of the set of orienting moves observed, drawing attention to the manner and tone of the teacher in the video and implications for student positioning and status.

Resources: *Annotated Plan*
Activity 2 Slides

Handouts: *Orienting Students to One Another's Thinking: Decomposing the Work*
Orienting Students to One Another's Thinking: Observation Tool
Orienting Students to One Another's Thinking: Building a Repertoire of Teaching Moves

Prepare

Overview: Novices plan True/False Equations activities in small grade-level groups and then engage in a coached rehearsal targeting work on orienting while *leading a group discussion*.

Activity #3: Planning a True/False Equations Discussion with Peer Run-throughs
Prior to methods class, novices work in small groups (based on their field-placement grade) to plan True/False Equations activities they will eventually enact with the children in their class. A planning guide helps novices to identify how the work of orienting happens within a True/False Equations discussion, providing space to anticipate possible student strategies and to consider opportunities for making connections across them. The plan is submitted prior to class, so that during the class session the teacher educator can meet with small groups to provide general feedback and answer questions. Small groups refine their plans in class and engage in peer run-throughs while the teacher educator circulates to offer support and feedback.

Resources: *Annotated Plan*

Handouts: *True/False Equations Planning Guide*

Activity #4: Coached Rehearsal of a True/False Equations Discussion
In this activity, one novice rehearses the True/False Equations activity they have planned and practiced with their small group while remaining group members act as students. The teacher educator may intervene during rehearsal in a range of ways to target work on the practice of orienting students to one another's thinking, including but not limited to providing the rehearsing novice with feedback and engaging the group in problem solving. During a structured debrief at the end, other novices provide the rehearsing novice with feedback using the "Orienting Students to One Another's Thinking: Observation Tool". The group also discusses the aspects of facilitating a True/False Equations discussion that may be generalizable across teaching contexts and activities.

Resources: *Annotated Plan*
Designing & Implementing a Rehearsal: Checklist
Preparing for a Rehearsal: Targeting Work on Orienting Students to One Another's Thinking

Handouts: *Orienting Students to One Another's Thinking: Observation Tool*

Enact

Overview: Novices conduct and video record a True/False Equation discussion with students focused on orienting students' to one another's thinking.

Activity #5: Enacting a True/False Equations Discussion
Having prepared using a structured planning guide and then rehearsing in Activity 4, novices teach their True/False Equations activity to a whole class in their field placements. They video record these enactments.

Handouts: Assignment Sheet: Whole Class True/False Equations Discussion

Analyze

Overview: Novices independently analyze their teaching videos, writing a formal reflection focused on patterns in their orienting students to one another's thinking while attending to student status and positioning.

Activity #6: Teaching Analysis of the True/False Equations Discussion
Outside of class, novices complete a teaching analysis assignment, individually reflecting on and writing about their teaching of a True/False Equations activity with the whole class in their field placements. To do this, they watch and annotate a video of their own teaching to identify patterns in their elicitation questioning and to critically consider the consequences of their questioning patterns in the distribution of intellectual work across students in their small group. In addition they characterize the clarity and organization of their use of mathematical representations. Finally, they identify specific areas for continued growth and development.

Handouts: *Teaching Analysis: Whole Class True/False Equations Discussion*

References

Ball, D.L., Thames, M.H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education*, 59 (5), 389-407.

Boaler, J. (2008). Promoting "relational equity" and high mathematics achievement through an innovative mixed ability approach. *British Educational Research Journal, 32*(4), 167-194.

Carpenter, T.P., Franke, M., & Levi, L. (2003). *Thinking mathematically: Integrating arithmetic and algebra in elementary school.* Portsmouth, NH: Heinemann.

Cohen, E. G., Lotan, R. A., Scarloss, B. A., & Arellano, A. R. (1999). Complex instruction: Equity in cooperative learning classrooms. *Theory into Practice*, 38(2), 80-86.

Featherstone, H., Crespo, S., Jilk, L. M., Oslund, J. A., Parks, A. N., & Wood, M. B. (2011). *Smarter together! Collaboration and equity in the elementary math classroom.* Reston, VA: National Council of Teachers of Mathematics.

Faulkner, K.P., Levi, L., & Carpenter, T.P. (1999). Children's understanding of equality: A foundation for algebra. *Teaching Children Mathematics, 6*(4), 232-236.

Lampert, M., Franke, M. L., Kazemi, E., Ghousseini, H., Turrou, A. C., Beasley, H., Cunard, A., & Crowe, K. (2013). Keeping it complex: Using rehearsals to support novice teacher learning of ambitious teaching. *Journal of Teacher Education, 64*(3), 226-243.

Langer-Osuna, J. (2017). Authority, identity, and collaborative mathematics. *Journal for research in mathematics education, 48*(3).

McDonald, M., Kazemi, E., & Kavanagh, S. S. (2013). Core practices and pedagogies of teacher education: A call for a common language and collective activity. *Journal of Teacher Education*, *64*(5), 378-386.

Website: "True/False Equations." In the *Teacher Education by Design* collection, University of Wisconsin. https://tedd.org/activities/truefalse-equations/

Teacher Education by Design. (2014). University of Washington College of Education.