# Every day teachers make many decisions that influence the opportunities students have to learn and engage with content. Imagine these scenarios:

> During class, your students are working in groups of four to solve a proportional reasoning task. While you anticipated many of the solution paths the groups would follow, including thinking additively rather than multiplicatively, you realize that one group is using a method that you had never seen before.  Their thinking seems reasonable for this particular problem, but you aren't sure if their method only works in this case, or if would be more generalizable. How do you make sense of the students' thinking?
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> You've been assigned to a district level committee on science teaching by your department chair at your high school. The committee also has representatives from the elementary schools and middle schools. The assistant superintendent of curriculum has stated the purpose of the committee is to align the district's curriculum to the new state standards and testing. How do you draw on your understanding of teaching chemistry to help you in considering the curriculum and standards across K-12?
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> Your department is adopting new textbooks and the chair has asked that each member of the department review the options that have been selected at the district level. You have noticed over the last few years that many students struggle with linear and quadratic functions, so you decided to examine each potential text for how it presents this topic. You assumed the books would be similar, but actually, the books varied a lot, including in the order of the chapters. How do you evaluate the texts to determine which will best support student learning of linear and quadratic functions?
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> You bumped into a colleague in the hallway and she shared that earlier in class, the students were getting emotional during group work when they were discussing the notion of the scientific method. One student was arguing that the method had to be followed exactly, or it wouldn't really be science; another said his dad worked in a lab and never used the scientific method linearly. She asked me: "What messages do you think we're sending as a department about science?"

While these four scenarios might seem different, one theme that unites them is

that they each require the teacher to draw on a knowledge and understanding of the content that is unique to the work of teachers and teaching.  Teaching requires making a multitude of decisions—both in the moment and over time—that require an understanding of the discipline and content, beyond just getting the "right" answer. It's true that a strong foundation of knowledge in the discipline is a necessary component of teaching, but that is just a first step for developing the type of content knowledge that is needed for the work of teaching.

KSTF's view of Content Knowledge needed for Teaching (CKT) is influenced by educators such as Deborah Ball, Heather Hill and Lee Shulman. Specifically, we draw on the mathematical knowledge needed for teaching framework of Ball and her colleagues (Ball, Thames & Phelps, 2008). While the framework is specific to mathematics, we see parallels to the sciences. Drawing on Hill et al's (2009) definition, we see CKT as the "[content specific] knowledge teachers use in the classroom to produce instruction and student growth (p.374)."  That is, CKT extends well beyond content knowledge alone to include the content work in which teachers engage. Teachers leverage their CKT to make content informed instructional decisions in their classroom on a regular basis. For example, on any given day, a teacher may need to:

> analyze correct and incorrect solutions and make sense of the reasoning behind the solutions, both in the moment and while reviewing student work;
> make content specific connections between solutions;
> ask a particular question during a discussion to push the content of the lesson;
> organize discussions to facilitate progress along a content trajectory; and
> use representations to convey content specific meaning.

We see this playing out in the first scenario described above. The teacher has to draw on his own understanding of the content to both anticipate student solutions and then make sense of the solution he hadn't anticipated. In that moment at the student's desk, he needed to consider why their method might work or anticipate where it might fail, and find a way to help students see that, too. However, CKT extends beyond the walls of the classroom. We see developing a strong content knowledge for teaching as the foundational first step to becoming an exceptional leading teacher.

In the second scenario, the science teacher will need to consider how scientific ideas develop across the K–12 curriculum. As she works with others to unpack

and make sense of the standards and assessments, she will draw on her specialized understanding of the content she has developed about and through teaching. This is similar to the work in which the math teacher in the third scenario will engage, as she must be able to consider the perspectives on teaching, learning and mathematics each text presents, and the possible implications for student learning those might have, as well as try to unpack what impact the different sequence of topics across the books would have. For example, what does it mean for student learning if a text first presents the definition of slope and then provides tasks to use that mathematical idea throughout the rest of the unit, versus if the unit begins with tasks that engage students in developing the idea of slope, but it's not until later in the text that the term "slope" is officially introduced? The teacher will engage with others at the district around these questions and will need to communicate her ideas to her colleagues back at her school.

The final scenario, considering the message about science that students are receiving, is a critical component of CKT. What are the big ideas of the discipline? What does it really mean to be mathematically or scientifically literate? How do we communicate about those ideas with other teachers, and then how do we explicitly and implicitly communicate those ideas to students? What opportunities do we provide in our classrooms to engage students in learning the essence of mathematics and science?

The KSTF Teaching Fellowship is grounded in the understanding that the fundamental work of teachers is helping students learn content. We recognize that while teachers enact pedagogical strategies to help students learn, those strategies need to be grounded in and driven by a teacher's understanding of her content. For that reason, we see a strong foundation in CKT as fundamental to developing outstanding leading teachers. During the first phase of the Fellowship, we work together to inquire into the many specific ways teachers need to understand content knowledge. Recognizing that there is no one best approach for all topics or contexts, we explore student-focused instruction within larger conceptual frameworks and build our capacity to critically evaluate our options and make choices appropriate for our own teaching contexts. While we start with the understanding that our Fellows have strong content backgrounds, we know that CKT is something that teachers continue to develop and deepen.