

Discourse Workshop 1

Thinking About Talk in Elementary Mathematics

OVERVIEW

The purpose of Quality Talk (QT) Discourse Workshop 1 is to introduce QT and situate the QT approach within the goals of the *Teaching Elementary Mathematics* course. Preservice teachers (PSTs) need to know that talk is important to their own learning to teach mathematics, as they will use talk to think with each other about mathematical ideas.

This workshop also introduces the QT pedagogical principles, each of which encompass a core idea about teaching and learning through productive talk. Next, the workshop introduces how the QT instructional frame supports productive talk.

Finally, Workshop 1 overviews the first three types of questions (i.e., authentic questions, test questions, and uptake questions) as mechanisms for promoting productive discussions that lead to critical-analytic thinking and reasoning about, around, and with a given mathematical task.

OBJECTIVES

At the end of this workshop, PSTs will be able to:

- ◆ explain the purpose and benefits of a QT discussion;
- ◆ describe the QT instructional frame, including learning goals, student and teacher roles, and discourse expectations;
- ◆ identify and generate authentic questions, test questions, and uptake questions; and
- ◆ begin to consider how to implement QT discussions in an elementary classroom.

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 - 3.2 Practice Writing Authentic, Test, and Uptake Questions

MATERIALS

- ◆ QT Workshop 1 PowerPoint Slides
- ◆ Post-It Notes and the Question Tree

Part 1. Why Talk?

1.1 Talk in Elementary Mathematics

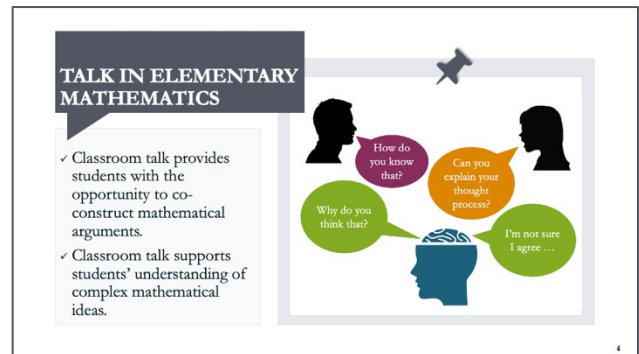


Display **Slide 3**.

Explain to preservice teachers (PSTs) that in this course, we will be learning about talk because research has shown that the people in a classroom who are doing the most talking are often the people doing the most thinking. Because it is often the teacher who is doing the most talking, it is also the teacher doing the most thinking.

One of our goals for elementary mathematics teaching is for students to develop deep mathematical understandings, and we know that in order for them to do this, they must have multiple opportunities to think about complex mathematical ideas. This means they have to learn how to talk about mathematics.

Equally important, we care about helping our students learn how to talk about mathematics because our public schools are a keystone of the U.S. democratic process. We need to learn how to live and learn together, and this includes learning to achieve common goals and solve shared problems. This requires us to be able to talk and listen, to construct and analyze arguments, and to do so in productive ways even across our differences and disagreements. Mathematics class is a particularly good setting for kids to practice these skills.

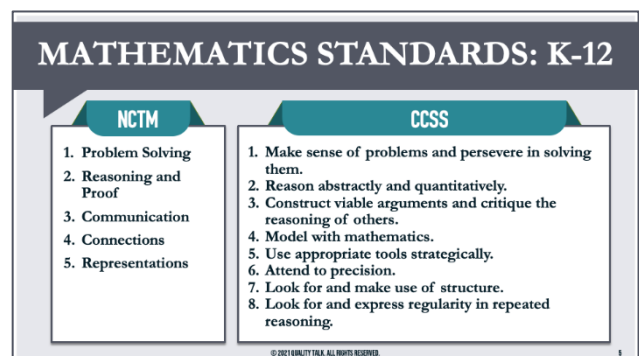


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Inform PSTs that mathematical argumentation is widely considered an important practice in mathematics education. Classroom talk can provide students with the opportunity to co-construct such arguments with their peers. In other words, although students may not be able to individually provide complete explanations for complex mathematical tasks, classroom discussions can serve as a time for them to voice their ideas and work together to reach a shared understanding.

Explain that because talk provides students with these opportunities, it is an essential tool in supporting thinking about and understanding of sophisticated mathematical principles and ideas.

1.2 Mathematics Standards

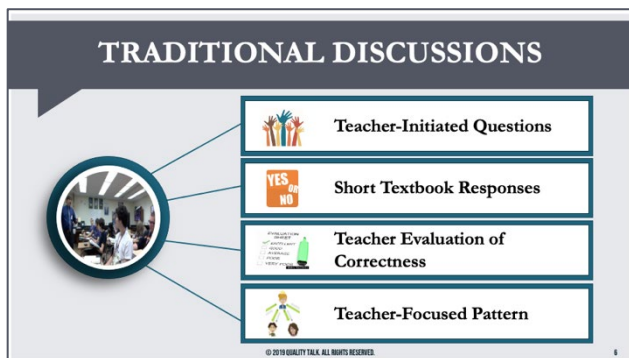


Display **Slide 5**, which lists the National Council for Teachers of Mathematics (NCTM) Process Standards and the Standards for Mathematical Practice in the Common Core.

Part 1. Why Talk?

Tell PSTs that the standards for K-12 mathematics education include crucial mathematical practices including problem-solving, reasoning, and argumentation. K-12 students are also expected to be able to communicate effectively about mathematics principles and ideas and to use models and representations to aid their mathematical understandings. These standards further underscore the importance of talk in elementary mathematics education.

1.3 Traditional Mathematics Discussions



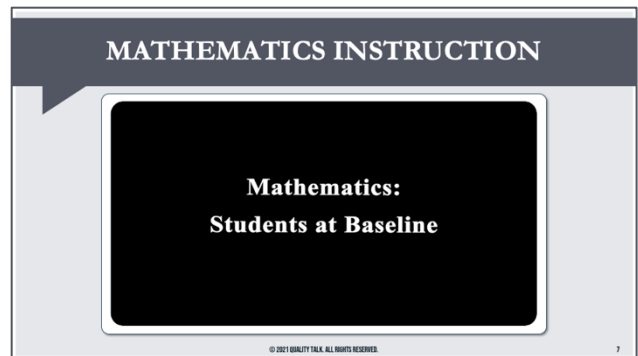
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Explain that although teachers understand the importance of such mathematical practices as argumentation and reasoning, supporting students' engagement in these practices through pedagogical tools like discussion is not easy. Because mathematics is often thought to center around factually-based questions and answers rather than mathematical reasoning, many teachers and students struggle to enact reasoning-based mathematics teaching in the classroom.

Inform PSTs that this often leads to teacher-led discussions, as described on the slide. These discussions are often characterized by:

- ◆ Teacher-initiated questions;
- ◆ Short textbook responses;
- ◆ Teacher evaluation of correctness; and,

- ◆ Teacher-focused discussion pattern.



Display **Slide 7**.

Inform PSTs that they will be watching a video with a traditional classroom discussion about patterns in multiples of ten. Explain that this is a very good example of a teacher using whole-class discussion to check and reinforce students' knowledge of mathematics content.

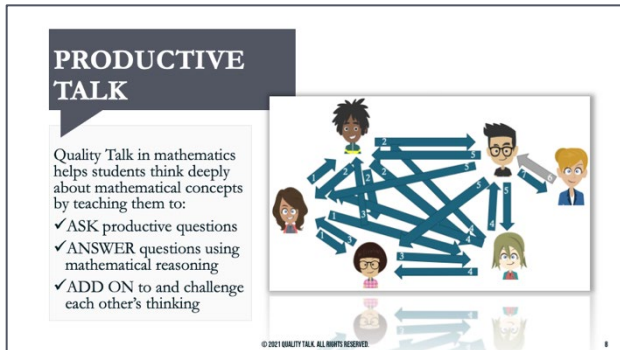
Play the video.

Explain to PSTs that the teacher is using a strategy in which she asks a question and invites one student at a time to explain how they are thinking about the problem. The teacher then responds to the student who was called on.

Inform PSTs that although this type of discussion serves an important purpose in elementary mathematics classrooms, it does not provide students opportunities to engage in argumentation or to develop deeper mathematical understandings.

Part 1. Why Talk?

1.4 Quality Talk Discussions

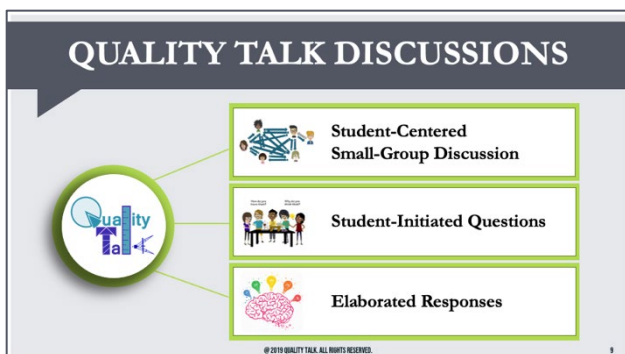


Display **Slide 8**.

Inform PSTs that in order for classroom discussions to engage students in the type of talk that will help them think deeply about mathematical concepts, the students should be doing the majority of the talking.

Explain that these discussions involve students:

- ◆ Asking productive questions
- ◆ Answering questions using mathematical reasoning, and
- ◆ Adding on to and challenging each other's thinking.

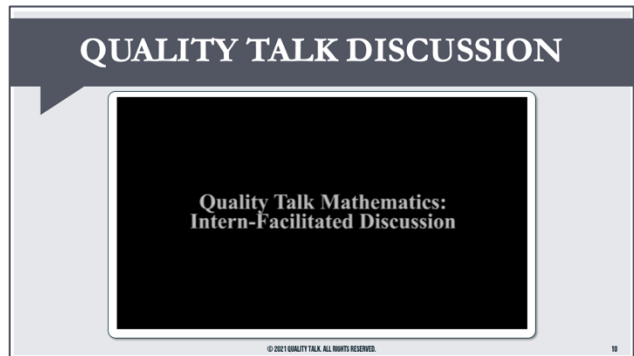


Display **Slide 9**.

Inform PSTs that Quality Talk discussions are designed to empower young students to discuss complex mathematical ideas and think more deeply about relevant content.

These discussions are characterized by:

- ◆ Student-centered, small-group discussions about, around, and with mathematical tasks;
- ◆ Student-initiated questions; and
- ◆ Elaborated responses.



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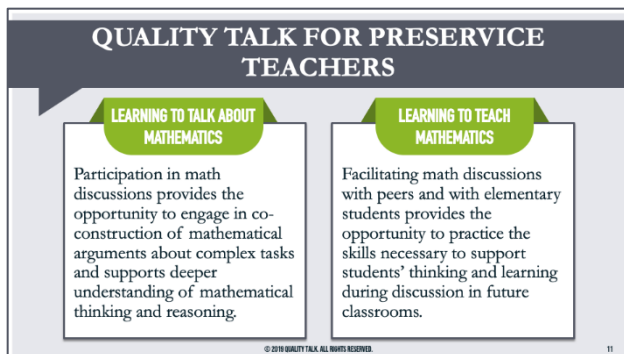
Inform PSTs that they will be watching a video of a Quality Talk discussion facilitated by a previous PST in this course. The students are discussing a mathematics task about how many bikes and trikes they would have given a certain number of wheels and seats.

Play the video.

Explain to PSTs that this is an example in which even young students express their thinking and build on each other's responses in order to reach a deeper understanding of the task. The PST in the video is supportive, allowing students to explore their ideas and stepping in only when needed to redirect and refocus their thinking.

Part 1. Why Talk?

1.5 Quality Talk for Preservice Teachers



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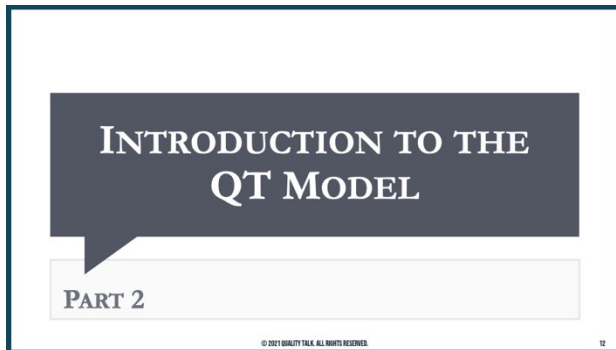
Explain that, in this course, PSTs will be engaged with Quality Talk in two distinct but interrelated ways.

Inform PSTs that they will be participating in QT discussions about complex mathematical tasks during class. Participation in these discussions will provide PSTs with the opportunity to engage in co-construction of mathematical arguments and will support their development of deeper understanding of mathematical thinking and reasoning. Additionally, participating in these discussions will provide PSTs with insights about what it is like for students to engage in talk about sophisticated mathematics ideas.

Inform PSTs that they will also facilitate QT discussions with their classmates and with the elementary students in their field experiences classrooms. This will provide PSTs with the opportunity to learn how to teach elementary mathematics by practicing the skills necessary to support students' thinking and learning during discussions.

Part 2. Introduce to the Quality Talk Model

2.1 Introduction to Quality Talk



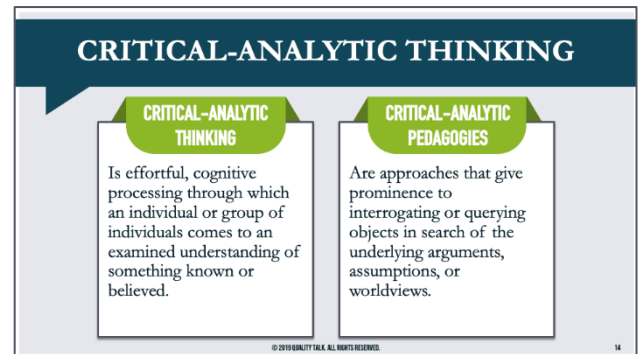
Display **Slide 12**.

Inform PSTs that in this lesson, they will be introduced to the Quality Talk model.



Display **Slide 13**, which summarizes Quality Talk (QT).

Inform PSTs that QT is a small-group discussion approach that encourages students to use talk as a tool for **thinking** and **interthinking** (thinking together). QT is a multifaceted approach that aims to improve students' comprehension and critical-analytic thinking about, around, and with text and content.



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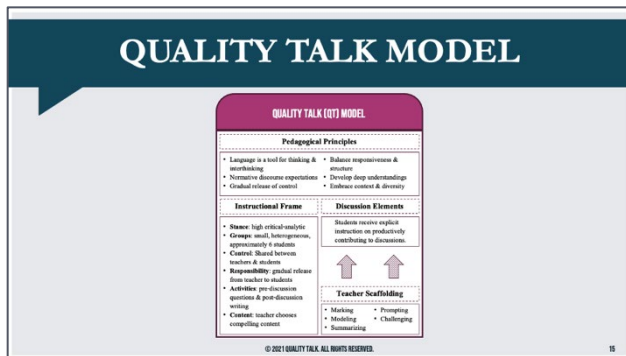
Inform PSTs that the term critical-analytic thinking refers to the type of cognitive processing that Quality Talk aims to enhance.

Explain that **critical-analytic thinking** is defined as effortful, cognitive processing through which an individual or group of individuals comes to an examined understanding of something known or believed. This examination is characterized by asking questions and then weighing and scrutinizing the possible arguments posed in response to those questions.

Tell PSTs that critical-analytic thinking is characteristic of **critical-analytic pedagogies**, or approaches that give prominence to interrogating or querying objects in search of the underlying arguments, assumptions, or worldviews. Quality Talk is a critical-analytic pedagogy because it requires students to ask meaningful questions and to use argumentation and reasoning to explore mathematical ideas and concepts.

Part 2. Introduction to the Quality Talk Model

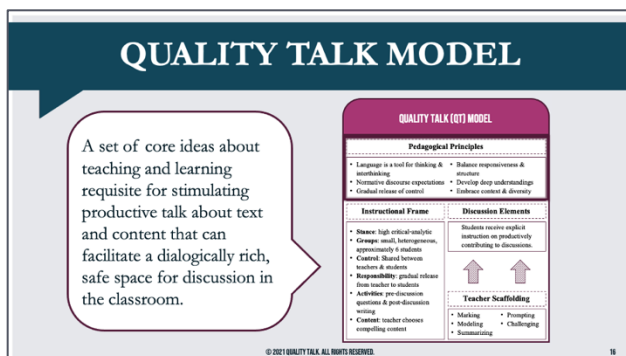
2.2 The Quality Talk Model



Display **Slide 15**.

Inform PSTs that the graphic on the slide represents the Quality Talk model. The QT model includes four parts, which will be introduced over the course of the Quality Talk discourse workshops:

- ◆ Pedagogical principles
- ◆ Instructional frame
- ◆ Discourse elements
- ◆ Teacher scaffolding

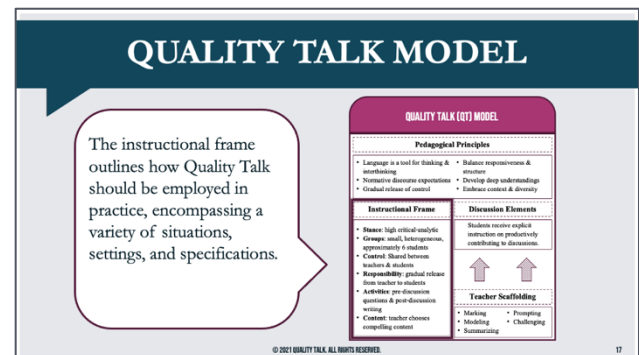


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Inform PSTs that the pedagogical principles are a set of core ideas about teaching and learning requisite for stimulating productive talk about text and content that can facilitate a dialogically rich, safe space for discussions in the classroom.

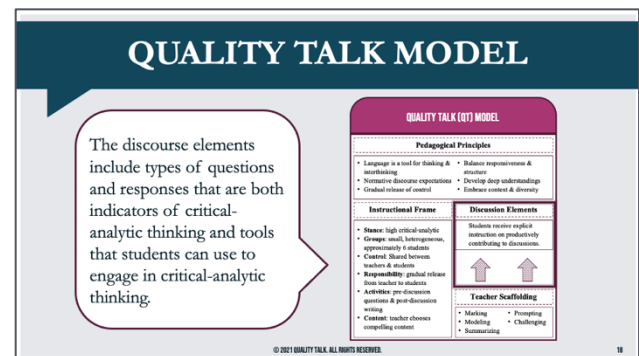
Explain that the pedagogical principles are meant for the teachers who implement QT discussions, not for the students. These principles provide teachers with an

understanding of the foundations on which the other parts of the QT model are based.



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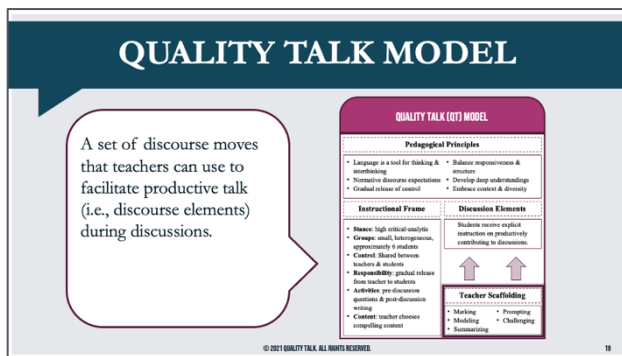
Inform PSTs that the instructional frame outlines how Quality Talk should be employed in practice, encompassing a variety of situation, settings, and specifications. For example, the QT instructional frame specifies the ideal group size and stance towards content, who controls talk during the discussion, and what activities should take place before and after discussion.



Display **Slide 18**.

Inform PSTs that the discourse elements include types of questions and responses that are both indicators of critical-analytic thinking and tools that students can use to engage in critical-analytic thinking. In QT, students are taught about the discourse elements in a series of workshops prior to discussion. Teachers can also use the presence of these discursive practices as a way of knowing that students are engaging in critical-analytic thinking.

Part 2. Introduction to the Quality Talk Model

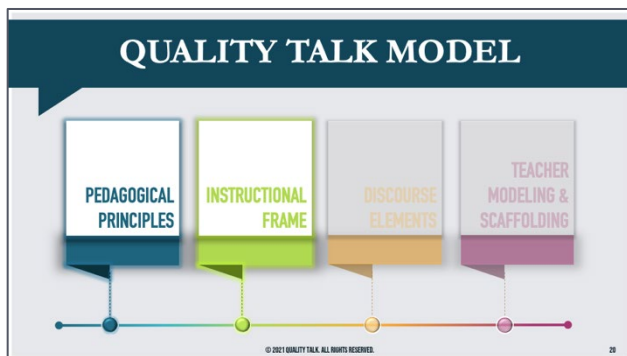


Display **Slide 19**.

Inform PSTs that the teacher scaffolding part of the model consists of a set of discourse moves that teachers can use to facilitate students' productive talk during discussion. In other words, teachers can use these talk moves to promote students use of the discourse elements.

Tell PSTs that they will be introduced to the first three parts of the QT model during this discourse workshop and will learn about teacher scaffolding during a future workshop.

2.3 Instructional Frame



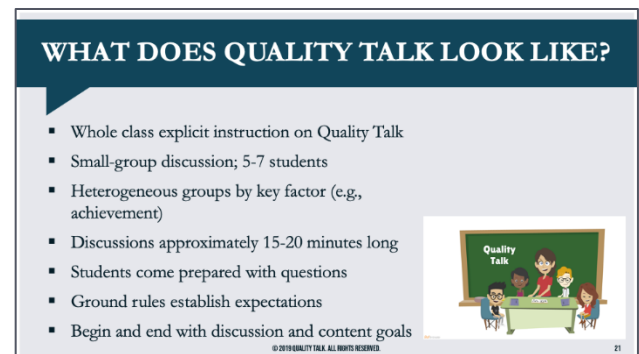
Display **Slide 20**.

Inform PSTs that in this section, they will be learning about the QT instructional frame, as well as the pedagogical principles that undergird it.

Explain to PSTs that the instructional frame is a set of instructional decisions that a teacher makes that impact the talk that emerges during discussion. This can include things such as the

goal of learning when solving a problem or engaging with another form of content, the roles of the teacher and the students during small-group discussions, the way that the small-group discussions are structured, and the normative expectations for behavior during discussion.

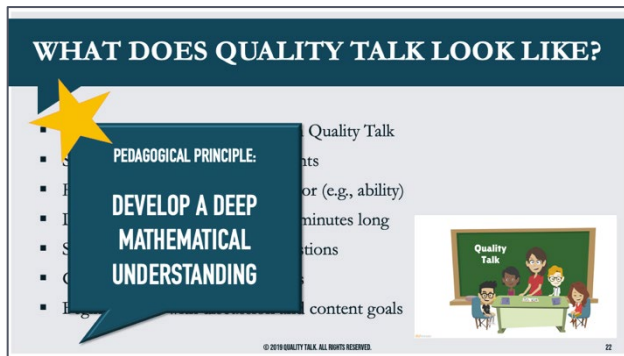
2.3.1 What Does Quality Talk Look Like?



Display **Slide 21**, which shows how Quality Talk discussions are structured. Inform PSTs that the following points are descriptive of what QT looks like in the classroom:

- ◆ Whole class explicit instruction on Quality Talk,
- ◆ Small-group discussion (5-7 students),
- ◆ Heterogeneous groups by key factor (e.g., achievement),
- ◆ Discussions approximately 15-20 minutes long,
- ◆ Students come prepared with questions,
- ◆ Ground rules establish expectations, and
- ◆ Begin and end with discussion and content goals.

Part 2. Introduction to the Quality Talk Model

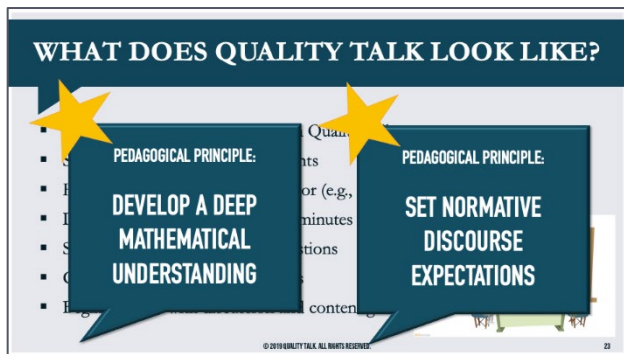


Display **Slide 22**.

Inform PSTs that the first pedagogical principle related to instructional frame is: **Develop a deep mathematical understanding**.

Explain that it is important to establish strong knowledge of the key mathematical concepts related to the task prior to the discussion, including a well-formed idea of the key content students need to glean from the discussion.

Inform PSTs that developing a deep mathematical understanding of the task is necessary in order to establish content and discussions goals, and that the teacher should take this into account when preparing for and facilitating QT discussions.



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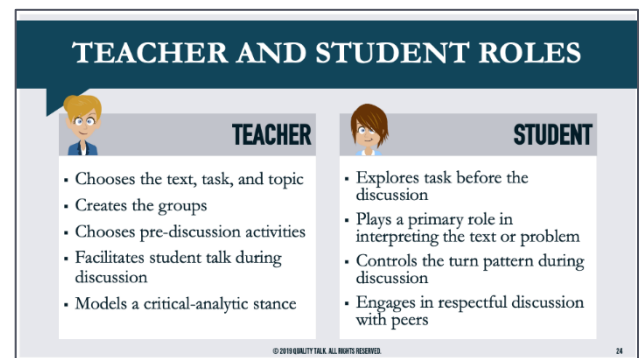
Inform PSTs that the second pedagogical principle related to instructional frame is: **Set normative discourse expectations**.

Explain that establishing discourse expectations (i.e., ground rules) sets the tone of the discussion and are necessary for fostering an

environment for productive talk. Students should ask questions and express their ideas freely and respectfully during each discussion. Emphasize that when they disagree with someone, they need to support their position with evidence and reasoning because doing so communicates interest in others' thinking, and that they are not disagreeing for the sake of disagreeing.

Tell PSTs that a set of discourse expectations used in Quality Talk will be discussed further on a later slide.

2.3.2 Teacher and Student Roles



Display **Slide 24**.

Inform PSTs that during Quality Talk discussions, the teacher and students each have defined roles which help to maximize the productive talk that occurs.

The teacher:

- ◆ Chooses the text, task, and topic,
- ◆ Creates the groups,
- ◆ Chooses pre-discussion activities,
- ◆ Facilitates student talk during discussion, and
- ◆ Models a critical-analytic stance.

The students:

- ◆ Read before the discussion,
- ◆ Play a primary role in interpreting the text or problem,

Part 2. Introduction to the Quality Talk Model

- ◆ Control the turn pattern during discussion, and
- ◆ Engage in respectful discussion with peers.

Note that in the video of a traditional discussion, the students did not embody many of these roles. The teacher was primarily in charge of interpreting the task and controlled the turn pattern during the discussion. In most cases, the students answered directly to the teacher, rather than addressing their responses to questions toward their peers.

On the other hand, in the video of the QT discussion, students were able to interpret the task, offering reasoning for their contributions beyond what was stated in the problem. They controlled the turn pattern, talking directly to one another, and the teacher facilitated only when needed.

2.3.3 Discourse Expectations

DISCOURSE EXPECTATIONS

- We don't need to raise hands.
- We talk one at a time.
- We share our ideas and listen to each other.
- We provide reasoning to explain our ideas.
- We respect others' opinions.
- We give others time to speak.
- We question or argue about ideas not people.
- We consider others' ideas.
- If we disagree, we ask "Why...?" and "How...?"

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Introduce the discourse expectations shown on **Slide 25**.

Explain that these expectation guide how students should engage in QT discussions during this course and that they will use these expectations for establishing an environment conducive to QT discussions in their elementary field experience classrooms:

- ◆ We don't need to raise our hands.
- ◆ We talk one at a time.
- ◆ We share our ideas and listen to each other.

- ◆ We provide reasoning to explain our ideas.
- ◆ We respect others' opinions.
- ◆ We give others time to speak.
- ◆ We question or argue about ideas, not people.
- ◆ We consider others' ideas.
- ◆ If we disagree, we ask "Why do you think so?" or "How do you know that?"

Remind PSTs that the rules set the tone of the discussion and are intended to foster an environment for productive talk. Students should ask questions and express their ideas

freely and respectfully during each discussion. Emphasize that when they disagree with someone, they need to support their position with evidence and reasoning because doing so communicates interest in others' thinking, and that they are not disagreeing for the sake of disagreeing.

2.3.4 Starting a Quality Talk Discussion

WHAT DOES QUALITY TALK LOOK LIKE?

Starting a Quality Talk discussion:

PENNSTATE

Quality Talk

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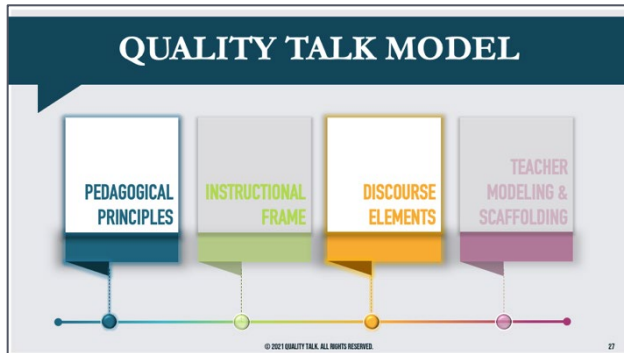
Display **Slide 26**.

Inform PSTs that this is an example of how to open up a Quality Talk discussion in the classroom in order to draw students' attention to the learning goals of the discussion. Note that the teacher reminds students to give everyone a chance to speak, to ask questions like, "Why do you think that?" and to use evidence and reasoning to back up their claims. The teacher also reads the QT discourse expectations so that

Part 2. Introduction to the Quality Talk Model

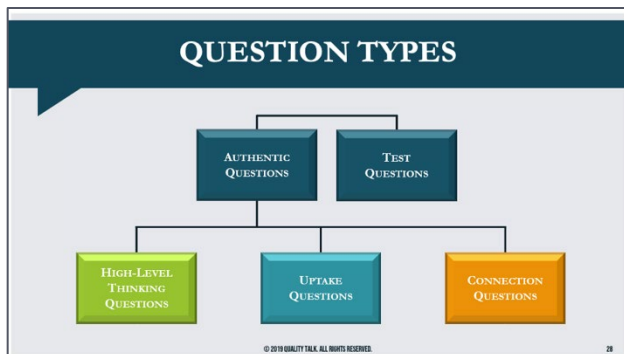
students are familiar with them going into the discussion.

2.4 Discourse Elements and Question Types



Display **Slide 27**.

Inform PSTs that in this section, they will be learning about the QT discourse elements, as well as the pedagogical principles that undergird them.

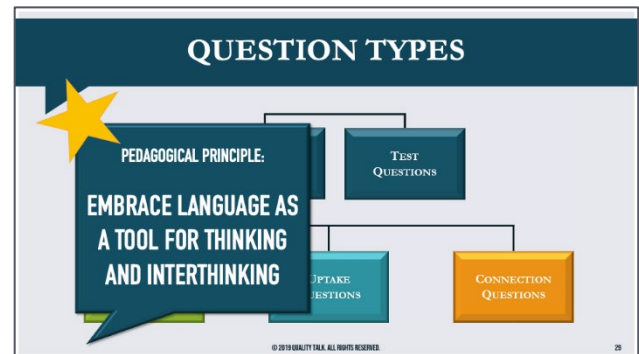


Display **Slide 28**, which shows the main question types and categories of secondary questions taught in Quality Talk.

Explain that there are two primary types of questions in Quality Talk: authentic questions and test questions. There are three subclasses of authentic questions: uptake questions, high-level thinking questions, and connection questions.

Inform PSTs that during this workshop, the first three question types will be introduced, and PSTs will practice writing and utilizing these

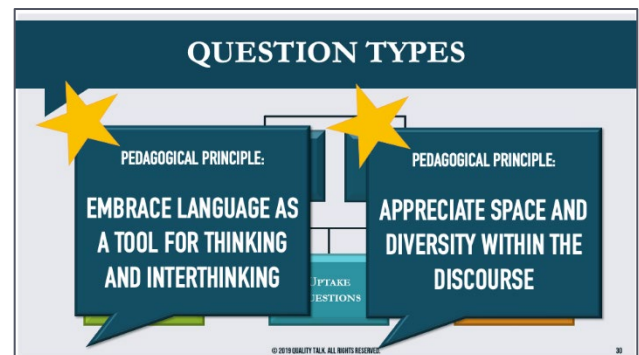
types of questions during discussion. In future workshops, PSTs will learn about additional secondary question types, as well as how to respond to these kinds of questions.



Display **Slide 29**.

Inform PSTs that the first pedagogical principle related to the discourse elements is: **Embrace language as a tool for thinking and interthinking**.

Explain that talk is the external representation of cognitive processing and that the question types are tools that students can use to engage in critical-analytic thinking, both individually and as a group. Similarly, recognizing the question types allows teachers to reflect on and assess their own discussions, providing them with insights about how to employ teacher moves as the discussion unfolds.



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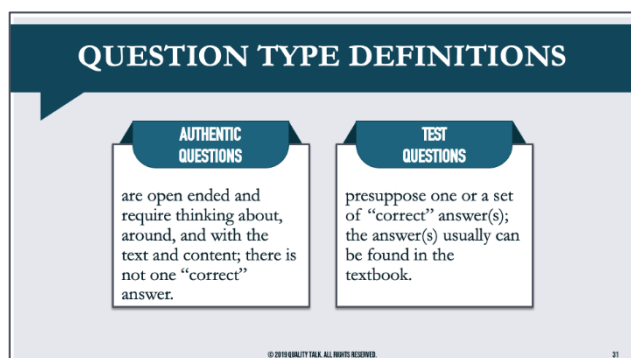
Inform PSTs that the second pedagogical principle related to the discourse elements is:

Part 2. Introduction to the Quality Talk Model

Appreciate space and diversity within the discourse.

Explain that teachers should embrace space and diversity within the discourse and that no two discussions will be the same. Students come to discussion with a range of experiences, knowledge, and cultural competencies that necessarily influence the questions they pose and how they respond to the questions posed by others. The goal is not to have identical conversations, but to use talk to understand and think more deeply about mathematical concepts and properties and how they relate to a given task.

2.4.1 Authentic and Test Questions



Display **Slide 31**.

Tell PSTs that **authentic questions (AQ)** are questions where the answers come from thinking about the mathematics of the task – not directly from the task. They can have more than one correct answer or approach and are open to argument, debate, and discussion. Answers to authentic questions should be supported by evidence and reasoning from the task, our own mathematical work and representations, or our own thinking about mathematical concepts, properties, and relationship.

Inform PSTs that **test questions (TQ)** are questions where the answers can often be found in the task. They generally have only one

current answer and can be answered in only one way.

AUTHENTIC QUESTION EXAMPLE

✓ Open ended
✓ Open to argument, debate, or discussion
✓ Elicits an elaborated response

Eight students are standing in line for ice cream and half of the students want vanilla. How many want vanilla ice cream?

What are some different ways to represent the "part" and the "whole" in this situation?

We could draw eight ice cream cones and circle every other one. The circles would be the people who want vanilla.

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Display **Slide 32**.

Remind PSTs that authentic questions:

- ◆ Are open-ended,
- ◆ Are open to argument, debate, or discussion, and,
- ◆ Have elaborated responses.

Draw PSTs' attention to the ice cream task: Eight students are standing in line for ice cream and half of the students want vanilla. How many want vanilla ice cream?

Read the following example of an authentic question to PSTs:

Audrey: What are some different ways to represent the "part" and the "whole" in this situation?

Jason: We could draw eight ice cream cones and circle every other one. The circles would be the people who want vanilla.

Explain that there are multiple ways that Jason could respond to Audrey's question. Additionally, the answer cannot be found in the task and requires Jason to think about the task. Finally, point out that it is possible to ask authentic questions about a relatively closed task.

Part 2. Introduction to the Quality Talk Model

TEST QUESTION EXAMPLE

✓ Limited number of answers
✓ Not open to argument, debate, or discussion
✓ Short textbook responses

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Display the example of a test question on **Slide 33**.

Remind PSTs that test questions:

- ◆ Have a limited number of answers,
- ◆ Are *not* open to argument, debate, or discussion, and
- ◆ Have short textbook responses.

Read the following example of a test question to PSTs:

Jason: How many students are in line for ice cream?

Audrey: 8.

Jason: What is one-half of 8?

Audrey: 4.

Jason: Okay.

Explain that Jason poses two test questions in this example. Eight is the only possible correct answer to Jason's first question and it can be found directly in the problem. Similarly, the second test question that Jason poses can be answered with a quick calculation.

2.4.2 Uptake Questions

QUESTION TYPE DEFINITIONS

UPTAKE QUESTIONS

ask about something that someone else said previously. They must be content related and can be directed to a group or an individual.

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Display **Slide 34**.

Remind PSTs that there are different types of authentic questions. **Uptake questions (UT)** are authentic questions about something that someone else said previously and open the discussion to deeper thinking. They must be content related and are often used to elicit a more detailed explanation of someone's thinking.

Explain that students need to listen carefully to what other group members are saying so they can ask for more information. Common examples of uptake questions are when students ask each other, "How do you know that?" and "Why do you think that?"

UPTAKE QUESTION EXAMPLE

✓ In response to something someone else said previously

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Display **Slide 35** with an example of an uptake question.

Remind PSTs that uptake questions are always in response to something someone else previously said or asked.

Part 2. Introduction to the Quality Talk Model

Read the following example of an uptake question:

Audrey: What are some different ways to represent the “part” and the “whole” in this situation?

Jason: We could draw eight ice cream cones and circle every other one. The circles would be the people who want vanilla.

Elaine: I was thinking about making two rows of four dots. One row would be half. Why would we circle every other ice cream cone?

Explain that in this example, Audrey asks an authentic question about representing the “part” and the “whole” to which Jason responds. Elaine takes what Jason said and extends the discussion by posing an uptake question, asking Jason to explain his thinking further.

Part 3. Practice

3.1 Practice

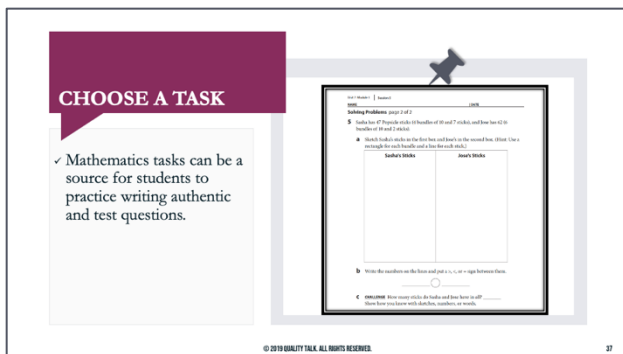
Display **Slide 36** to introduce Part 6 of the workshop.



Explain to PSTs that in addition to participating in QT discussions during this math methods course, they should also consider how to implement QT with elementary students in their field experience classrooms.

3.2 Choose a Task

Show PSTs the story on **Slide 37**. Explain that mathematics tasks, such as the first-grade task shown here from the Bridges curriculum can be used as a source for students to practice writing authentic and test questions.

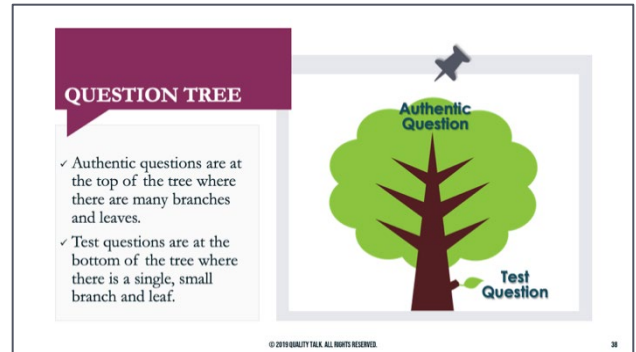


In this problem, students are working on two-digit addition problem with a sum greater than 99 (How many sticks to Sasha and Jose have in all?) by modeling the quantities using bundles of 10 sticks and single sticks that do not comprise a bundle of 10. Students are asked to show how they know how many sticks Sasha

and Jose have in all with sketches, numbers, or words.

3.3 Question Tree

Display the Question Tree model on **Slide 38**, which shows different types of questions.



The Quality Talk Question Tree is a way to visually represent the QT question types to elementary students. The label for *authentic question* is at the top of the tree where there are many branches and leaves because authentic questions stimulate rich discussions about the mathematical ideas and promote high-level comprehension.

The label for *test question* is at the bottom of the tree where there is a single, small branch and leaf. This is because test questions usually lead to singular, short replies that can be found in the text, and they do not generate much discussion about the text.



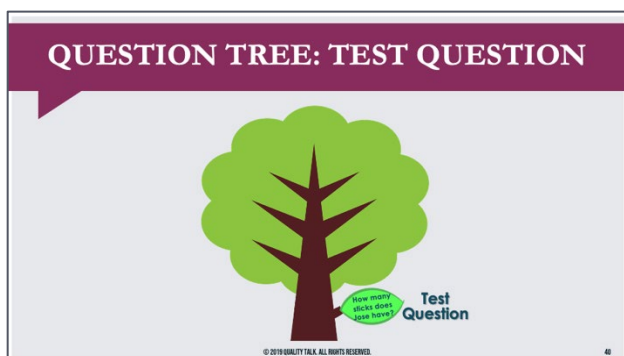
Show PSTs the Question Tree on **Slide 39** with an example of an authentic question:

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- ◆ How does your sketch show that 62 is more than 47?

Explain that this is an authentic question because there is not one correct answer; students could give multiple responses. Additionally, it requires students to think about information not given to them directly in the text. This question is found higher up on the tree because it is the type of question that stimulates rich discussion.

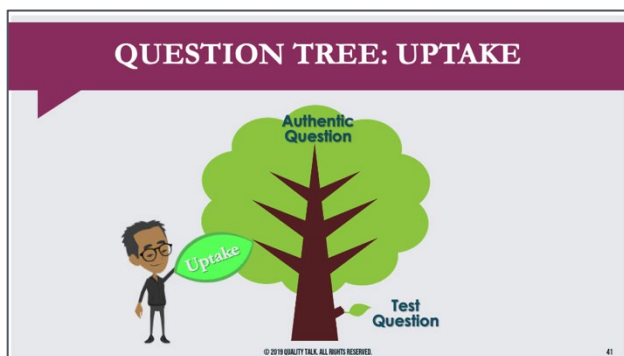
Remind students that in Quality Talk, we encourage them to ask authentic questions because they stimulate thinking and reasoning.



Display **Slide 40**, which contains the following example of a test question:

- ◆ How many sticks does Jose have?

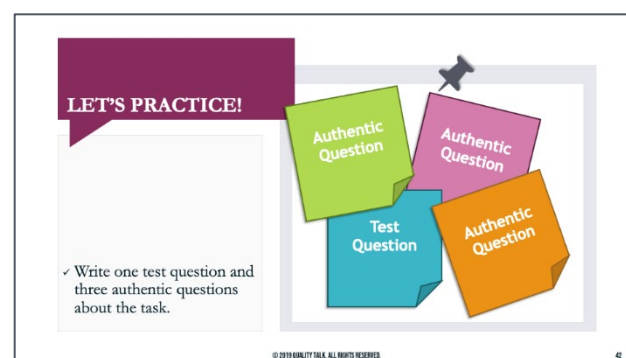
Explain to PSTs that this question can be answered directly from the text, and it does not lead to further discussion. It is found at the bottom of the tree because test questions should be used sparingly during discussions.



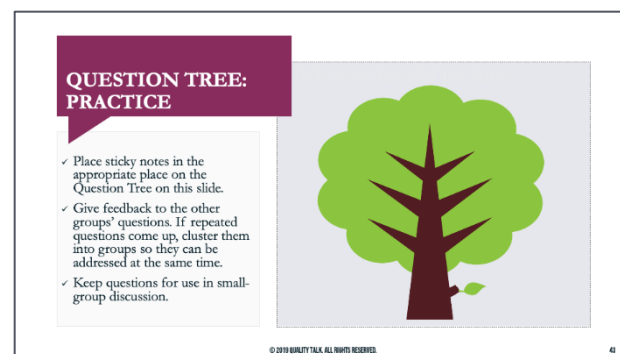
Display **Slide 41** with an uptake question leaf on the tree.

Explain that because uptake questions are based on what someone else said or asked previously, they cannot be written prior to a discussion. However, uptake questions are also found higher up on the tree because they are authentic questions that lead to further discussion.

3.4 Practice



Display **Slide 42**. Inform PSTs that they are going to practice writing authentic and test questions in preparation for a future discussion. Ask the PSTs to write one test question and three authentic questions about the task. PSTs should write each question on a separate sticky note.



Once PSTs have written their questions, display **Slide 43**.

Have the PSTs copy their questions to sticky notes in the appropriate place on the Question Tree projected on the board. Then have PSTs

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give feedback to the other groups' questions. For example, PSTs could note questions that will likely spur conversation or may be incorrectly categorized. If repeated questions come up, cluster them into groups so they can be addressed at the same time. When finished, PSTs can select a key question to begin their small-group discussion.

Remind PSTs that elementary students could complete the same practice activity using an appropriate task.