



The Mathematical Discourse webinar will begin momentarily.



Mathematical Discourse

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Mathematical Discourse



What is it and why is it important?



Poll Question

Which of the following are examples of mathematical discourse?

- A. A student asks whether she should show her work on an assignment.
- B. A student writes in his journal to explain his mathematical reasoning.
- C. A student says, “I notice a pattern that I think will always work...each number is 3 more than the one before.”
- D. The teacher provides a counter example to a method posed by a student.
- E. A group of students discuss the mathematical conditions in which an idea won't always work.



What is Mathematical Discourse?

The National Council of Teachers of Mathematics (NCTM) describes discourse as ways of representing, thinking, talking, agreeing, and disagreeing; the way ideas are exchanged and what the ideas entail; and as being shaped by the tasks in which students engage as well as by the nature of the learning environment.



What is Mathematical Discourse?

Structure	Multidirectional and responsive
Content	Dynamic, connected, and responsive
Purpose	Participate and engage in deep inquiry
Product	Shared understanding and new insights

Discourse requires *participation*, *commitment*, and *reciprocity*.

“From Classroom Discussions to Group Discourse” Web.

<http://mathforum.org/pcmi/hstp/sum2009/morning/Manouchehri_discussion_to_discourse.pdf>










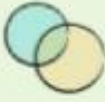
Types of Mathematical Discourse

Answering	Short answer to a direct question
Sharing	Simple statement or share that does not involve an explanation of how or why
Explaining	Provides process without justification
Questioning	Asks to clarify understanding of an idea or procedure
Challenging	Pushes someone to reevaluate thinking using a question, statement or counter example
Relating	Makes a connection or sees a relationship to prior knowledge or experience
Predicting	Making a conjecture based on understanding of mathematics
Justifying	Provides justification of validity through explanation of thinking that lead to idea
Generalizing	Shift from a specific example to a general case

“Assessing the Quality and Quantity of Student Discourse in Mathematics Classrooms” Web.
<http://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1019&context=ci_fac>

Facilitate meaningful mathematical discourse

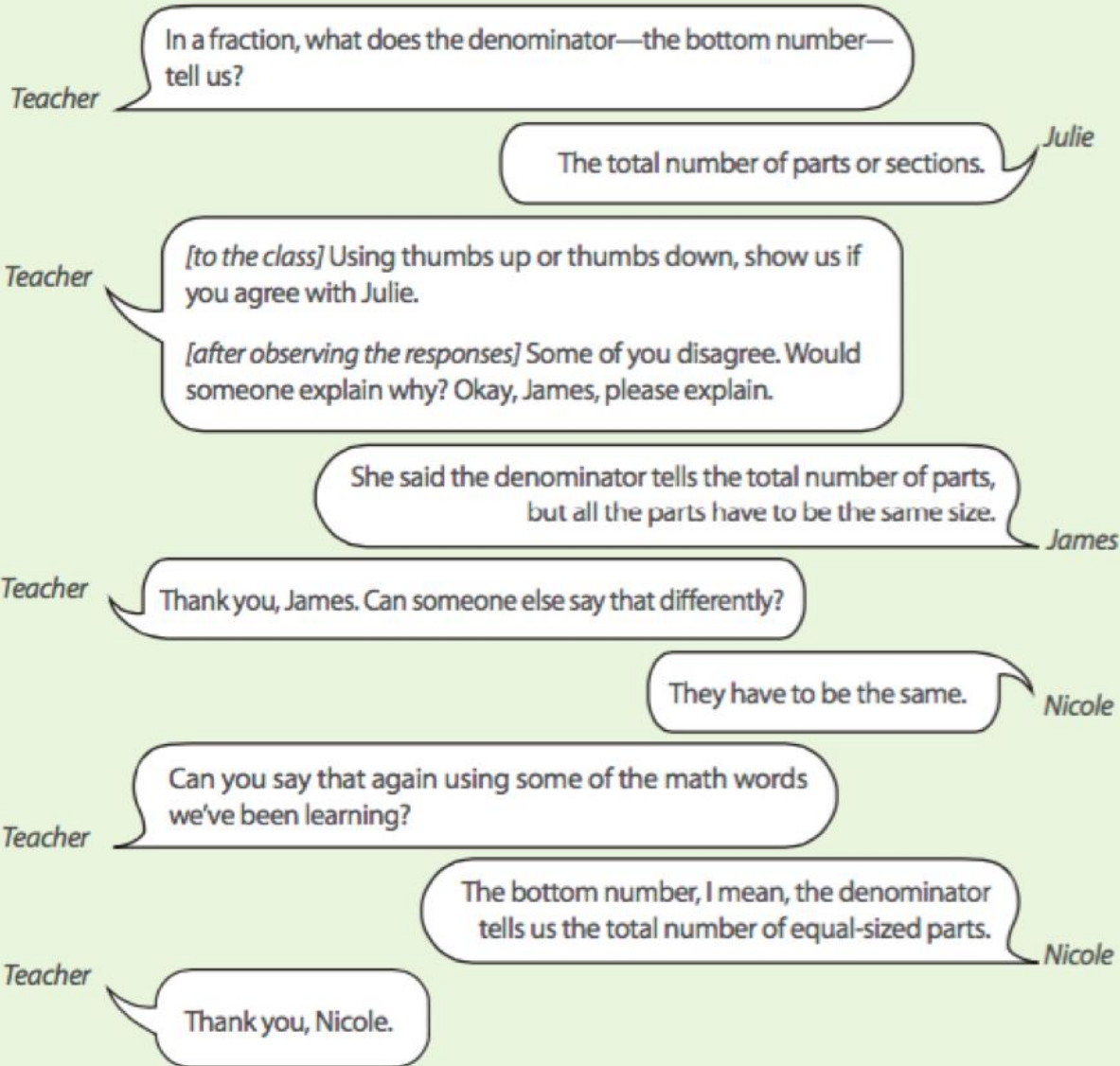
Teacher and student actions

What are teachers doing?	What are students doing?
 <p><i>Engaging students in purposeful sharing of mathematical ideas, reasoning, and approaches, using varied representations.</i></p>	 <p><i>Presenting and explaining ideas, reasoning, and representations to one another in pairs, small groups, or whole-class discourse.</i></p>
 <p><i>Selecting and sequencing student approaches and solution strategies for whole-class analysis and discussion.</i></p>	 <p><i>Listening carefully to and critiquing the reasoning of peers, using examples to support or counterexamples to refute arguments.</i></p>
 <p><i>Facilitating discourse among students by positioning them as authors of ideas, who explain and defend their approaches.</i></p>	 <p><i>Seeking to understand the approaches used by peers by asking clarifying questions, trying out others' strategies, and describing the approaches used by others.</i></p>
 <p><i>Ensuring progress toward mathematical goals by making explicit connections to student approaches and reasoning.</i></p>	 <p><i>Identifying how different approaches to solving a task are the same and how they are different.</i></p>

“Talking Math: How to Engage Students in Mathematical Discourse” Web. <<http://www.gettingsmart.com/2015/09/talking-math-how-to-engage-students-in-mathematical-discourse/>>



A Classroom Example



“Talking Math: How to Engage Students in Mathematical Discourse” Web.
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Why is mathematical discourse important?

- Builds mathematical fluency
- Establishes the student as an expert, building confidence
- Enables students to demonstrate mastery of concepts
- Allows students to share ideas which increases interest and participation
- Provides teachers an opportunity to push thinking and address gaps understanding

Mathematical Discourse



How do I encourage discourse?



Strategies to encourage mathematical discourse

- Choose tasks and/or questions that allow for multiple paths and/or multiple answers; that engage and challenge all students' thinking in your classroom
- Encourage students to listen carefully to one another's ideas, to disagree, and to question; shift from teacher-to-student conversations to student-to-student conversations
- Ask questions that extend student thinking; support students to clarify and justify their ideas

Choose tasks and/or questions that allow for multiple paths and/or multiple answers; that engage and challenge all students' thinking in your classroom.





Let's try this.

Task 1:

Find the **mean**, **median**, and **mode** of the following set of numbers: 6, 5, 5, 5, 7, 9, 11

"Digging Into Mathematical Discourse; Selecting and Sequencing Student Solution Samples" Web.
<http://embed.vidyard.com/share/rDuSh7qZemusxKR3K5tWgN?utm_campaign=CCS-101360-NATL-161026-EdWeek-MathDiscrs-WBNR-Thankyou-GladisKersaint&utm_medium=email&utm_source=Eloqua>.



Let's try this.

Task 2:

Create a data set with at least 7 values so that the **mean** is 20, the **median** is 12, and the **mode** is 23.

"Digging Into Mathematical Discourse; Selecting and Sequencing Student Solution Samples" Web.
<http://embed.vidyard.com/share/rDuSh7qZemusxKR3K5tWgN?utm_campaign=CCS-101360-NATL-161026-EdWeek-MathDiscrs-WBNR-Thankyou-GladisKersaint&utm_medium=email&utm_source=Eloqua>.



What did you notice?

Task 1:

Find the **mean**, **median**, and **mode** of the following set of numbers: 6, 5, 5, 5, 7, 9, 11

Task 2:

Create a data set with at least 7 values so that the **mean** is 20, the **median** is 12, and the **mode** is 23.

What is the difference in the types of discourse supported by each task?

“Digging Into Mathematical Discourse; Selecting and Sequencing Student Solution Samples” Web.
<http://embed.vidyard.com/share/rDuSh7qZemusxKR3K5tWgN?utm_campaign=CCS-101360-NATL-161026-EdWeek-MathDiscrs-WBnr-Thankyou-GladisKersaint&utm_medium=email&utm_source=Eloqua>.

Encourage students to listen carefully to one another's ideas, to disagree, and to question; shift from teacher-to-student conversations to student-to-student conversations.





Mathematical Sentence Starters

Reporting a Solution

- I believe this is the correct answer because...
- I can verify my answer by...

Reporting a Partner's Solution

- ___ shared with me that...
- ___ concluded that...

Reporting a Group Solution

- We decided/agreed that...
- We group used a different approach.

Offering a Suggestion

- Maybe we could...
- What if we...

Holding the Floor

- As I was saying...
- If I could finish my thought...
- What I was trying to say was...

Asking for Clarification

- Will you explain that again?
- How did you find your answer?

Soliciting a Response

- What do you think?
- Do you agree?

Acknowledging Others

- My plan is similar to ___'s plan.
- I agree with ___ that...

Affirming

- That's a different way. I hadn't thought about that
- I agree with ___ because

Disagreeing

- I don't agree with you because...
- I got a different answer than you.
- I see it another way.

"Academic Language Frames/Sentence Starters For Mathematical Discourse." Web.
<http://www.rosedalecurriculum.com/uploads/2/3/4/2/23429024/sentence_frames_for_math_discourse.pdf>.

Ask questions that extend student thinking; support students to clarify and justify their ideas.





Questions to Encourage Discourse

- Encourage students to **work together** to make sense of mathematics
- Empower students to **rely on themselves** to determine whether something is mathematically correct
- Support students in learning to **reason mathematically**
- Teach students to **evaluate their own processes** and engage in productive peer interaction
- Support students with **problem comprehension**
- Teach students to **conjecture, invent, and solve problems**
- Encourage students to **connect mathematics, its ideas, and its application**
- Show students how to **persevere**
- Enable students to focus on the **mathematics in activities**



Questions to Encourage Discourse

Encourage students to **work together** to make sense of mathematics

1 What strategy did you use?	2 Do you agree ?	4 Would you ask the rest of the class that question?	5 Could you share your method with the class?
6 What part of what he said do you understand ?		7 Would someone like to share _____?	8 Can you convince the rest of us that your answer makes sense?
9 What do others think about what [student] said?	10 Can someone retell or restate [student]'s explanation?	11 Did you work together ? In what way?	13 Have you discussed this with your group? With others?
12 Would anyone like to add to what was said ?	14 Did anyone get a different answer ?	16 Did everybody get a fair chance to talk, use the manipulatives, or be the recorder?	
15 Where would you go for help ?	17 How could you help someone without telling them the answer ?	18 How would you explain _____ to someone who missed class today?	

"100 Questions That Promote Mathematical Discourse." Web. <<http://www.curriculumassociates.com/products/ready-100-q-promoting-math-discourse.aspx#.Wli7EdUrJpg>>.



Questions to Encourage Discourse

Empower students to **rely on themselves** to determine whether something is mathematically correct

19

Is this a **reasonable answer**?

20 Does that **make sense**?

24 Does anyone want to **revise** his or her answer?

21

Why do you think that?
Why is that true?

22

Can you **draw a picture or make a model** to show that?

23

How did you reach that conclusion?

25

How were you sure your answer was right?

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Questions to Encourage Discourse

Support students in learning to **reason mathematically**

26 How did you **begin to think** about this problem?

27 What is **another way** you could solve this problem?

28 How could you **prove** _____?

29 Can you **explain how your answer is different from or the same as** [student]'s answer?

30 Let's **break the problem into parts**. What would the parts be?

31 Can you explain this part more **specifically**?

32 Does that **always work**?

33 Can you think of a case where that **wouldn't work**?

34 How did you **organize** your information? Your thinking?

"100 Questions That Promote Mathematical Discourse." Web. <<http://www.curriculumassociates.com/products/ready-100-q-promoting-math-discourse.aspx#.Wli7EdUrJpg>>.



Questions to Encourage Discourse

Teach students to **evaluate their own processes** and engage in productive peer interaction

35

What do you need to do **next**?

36

What have you **accomplished**?

37

What are your **strengths and weaknesses**?

38

Was your **group participation appropriate and helpful**?

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Questions to Encourage Discourse

Help students with **problem comprehension**.

39 What is this problem about?
What can you **tell me about it**?

40 Do you need to **define or set limits for** the problem?

41 How would you **interpret** that?

42 Could you **reword that in simpler terms**?

43 Is there something that can be **eliminated** or that is **missing**?

44 Could you **explain** what the problem is asking?

46 What do you **know** about this part?

47 **Which words were most important?**
Why?

45 What **assumptions** do you have to make?

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Questions to Encourage Discourse

Help students learn to **conjecture, invent, and solve problems.**

"100 Questions That Promote Mathematical Discourse." Web.
<<http://www.curriculumassociates.com/products/re-ady-100-q-promoting-math-discourse.aspx#.Wli7EdUrJpg>>.

48 What would happen if ____?	49 Do you see a pattern ?	51 Where could you find the information you need?	52 How would you check your steps or your answer?
50 What are some possibilities here?	53 What did not work?	54 How is your solution method the same as or different from [student]'s method?	
55 Other than retracing your steps, how can you determine if your answers are appropriate?	56 How did you organize the information? Do you have a record ?	57 How could you solve this using tables, lists, pictures, diagrams , etc.?	
58 What have you tried? What steps did you take?	59 How would it look if you used this model or these materials ?	60 How would you draw a diagram or make a sketch to solve the problem?	
61 Is there another possible answer ? If so, explain.	62 Is there another way to solve the problem?	64 Is there anything you've overlooked ?	
63 Is there another model you could use to solve the problem?	65 How did you think about the problem?		
66 What was your estimate or prediction ?	67 How confident are you in your answer?	68 What else would you like to know?	
69 What do you think comes next ?	70 Is the solution reasonable , considering the context?	71 Did you have a system ? Explain it.	73 Did you have a design ? Explain it.
		72 Did you have a strategy ? Explain it.	



Questions to Encourage Discourse

Help students to **connect mathematics, its ideas, and its application.**

"100 Questions That Promote Mathematical Discourse."
Web.
<<http://www.curriculumassociates.com/products/ready-100-q-promoting-math-discourse.aspx#.Wli7EdUrJpg>>.

74 What is the **relationship** between ___ and ___?

75 Have we ever solved a problem **like this before**?

77 What is the **same**?

78 What is **different**?

79 Did you use skills or build on concepts that were **not necessarily mathematical**?

76 What uses of mathematics did you find in the **newspaper** last night?

80 Which **skills or concepts** did you use?

81 What **ideas** have we explored before that were useful in solving this problem?

82 Is there a **pattern**?

84 How does this **relate** to ___?

83 **Where else** would this strategy be useful?

85 Is there a **general rule**?

86 Is there a **real-life situation** where this could be used?

88 What other problem does this seem to **lead to**?

87 How would your method work with **other problems**?



Questions to Encourage Discourse

Help students **persevere**.

89 Have you tried making a **guess**?

90 **What else** have you tried?

91 Would **another method** work as well or better?

92 Is there **another way** to draw, explain, or say that?

93 Give me another **related problem**. Is there an easier problem?

94 How would you **explain** what you know right now?



100 Questions to Encourage Discourse

Help students focus on the **mathematics from activities**.

95 What was **one thing you learned** (or two, or more)?

96 Did you **notice any patterns?** If so, describe them.

97 What **mathematics topics** were used in this investigation?

98 What were the **mathematical ideas** in this problem?

99 What is mathematically **different about these two situations?**

100 What are the **variables** in this problem? What stays **constant?**

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Q&A

For questions after the webinar, please email monisha.Karnani@dc.gov



Analyzing Student Dialogue

Invite a colleague into your classroom to scribe student conversations while you teach.

- In looking at the student dialogue, **what do you notice?**
- What **types of discourse** are your students engaging in?
- How can you **elevate the quality and quantity of mathematical discourse** in your classroom?

Answering

Sharing

Explaining

Questioning

Challenging

Relating

Predicting

Justifying

Generalizing



Professional Development Opportunities

The OSSE Teaching and Learning Team offers a wide variety of professional development opportunities.

Ways to stay informed:

1. LEA Look Forward Weekly Newsletter
osse.dc.gov/newsroom/newsletters
2. Teaching and Learning PD Calendar
osse.dc.gov/publication/2016-17-school-year-k-12-program-calendar
3. OSSE Events Calendar
osse.dc.gov/events

District of Columbia
Office of the State Superintendent of Education
LEA LOOK FORWARD
Oct. 26-Nov. 1, 2016

In this issue...

- [2017 DC Green Ribbon Schools Application Released](#)
- [Join RaiseDC for the Graduation Pathways Summit](#)
- [SLED Training](#)
- [Introduction to Secondary Transition for Middle Schools](#)
- [ESSA Engagement Update: Surveys and Upcoming Focus Groups](#) (webinar recap, surveys closing, and future engagement opportunities) (reminder)
- [Teacher Data Collections](#) (update and reminder)
- [Access to Emergency Epinephrine in Schools Amendment Act of 2015](#) (reminder)
- [OSSE Statewide Student Information System Lunch and Learn](#)

OSSE DISTRICT OF COLUMBIA OFFICE OF THE STATE SUPERINTENDENT OF EDUCATION

November 2016

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3 RSP SEDS Train-the-Trainer ELs in the Math Classroom Book Study	4	5
6	7 DC STEM Summit "STEM in the City"	8	9	10	11 Holiday	12
13	14 ACCESS Test Prep	15 ACCESS Test Prep SY 2016-17 School Based Medicaid Re- imbursement Training	16 LEA Sped POC Monthly Webinar	17 ELs in the Math Classroom Book Study	18	19
20	21	22	23	24 Holiday	25	26
27	28	29 LEA Institute II Takes a City	30 Nonpublic SEDS POC Webinar			

Please submit any additional questions to OSSE via the OSSE Support Tool or to OSSE.tta@dc.gov



Thank you!

Next Monthly Webinar:

Wednesday, March 29, 2017

Topic: Math Anxiety