Discourse in Science

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Time Frame 60 minutes

Essential Question(s)

- Why is discourse important to science instruction?
- How do we foster discourse in the science classroom?

Summary

Participants consider the benefits of discourse in science and explore three strategies that support discourse in the classroom by role-playing as students. They then discuss the benefits of each of the three strategies for incorporating discourse in their classroom. In small groups, participants discuss which strategies they could use in their classroom and consider how they would modify them to best serve their students. Participants also reflect and discuss in small groups how these strategies can be effective at promoting discourse.

Learning Goals

- Explore instructional strategies and resources that promote discourse in the science classroom.
- Analyze how these instructional strategies and resources promote discourse in the science classroom.

Attachments

- Cystic Fibrosis Reading—Discourse in Science.docx
- Cystic Fibrosis Reading—Discourse in Science.pdf
- Honeycomb Harvest Cards—Discourse in Science.docx
- Honeycomb Harvest Cards—Discourse in Science.pdf
- Note Catcher—Discourse in Science.docx
- Note Catcher—Discourse in Science.pdf
- Presentation Slides—Discourse in Science.pptx
- Say Something—Discourse in Science.docx
- Say Something—Discourse in Science.pdf

Materials

- Presentation Slides (attached)
- Honeycomb Harvest Cards (attached, 1 per participant or small group)
- Cystic Fibrosis Reading (attached, 1 per participant)
- Say Something (attached, 1 per participant)
- Note Catcher (attached, 1 per participant)
- Pens/pencils
- Devices to access the Internet
- Sticky notes

5 minutes

Engage: What is Discourse?

Presenter's Note

Use Mentimeter to set up a Word Cloud generator to use during the presentation. In Mentimeter, create a new presentation using the Word Cloud option for slide 1 and the following prompt: *What words or phrases would you use to describe discourse as it relates to the science classroom?*

Once participants have created their collaborative Word Cloud, have them share their insights about the words. Offer your own perceptions and interpretations, if time permits.

Display **slide 3**. Briefly review the Essential Questions:

- Why is discourse important to science instruction?
- How do we foster meaningful discourse in the science classroom?

Display **slide 4**. Identify the learning goals of the session:

- Explore instructional strategies and resources that promote discourse in the science classroom.
- Analyze how these instructional strategies and resources promote discourse in the science classroom.

Display **slide 5**. Divide participants into small groups. Ask the groups to explore the definition of discourse in a classroom setting by considering the following question: *What words or phrases best describe discourse as it relates to the science classroom?*

Ask participants to use their phones or other devices to go to menti.com and use the custom Mentimeter code to connect them with the presentation. As participants enter their responses, use presentation mode on Mentimeter to display the Word Cloud on the board as it is being created. Once all responses have been submitted, call on participants to share their observations about the ideas that were contributed to the Word Cloud. Offer your own perceptions and interpretations, if time permits.

Display **slide 6.** As a concluding activity, invite the groups to discuss the notion that classroom discourse encompasses a variety of written and spoken forms of communication, including students' engaging in expressing their ideas, discussing their reasoning, and representing their thinking. Discourse can be talking, listening, writing, reflecting, or representing.

5 minutes

The Value of Discourse

Show **slide 7**. Review the list of items illustrating the importance of classroom discourse.

Presenter's Note

Return to the Menti presentation and move to the second slide. Ask participants to use the "ranking" option to rank the following items in order of importance:

1. Students develop a deeper understanding of the content.
2. Students participate in content-centered discussions.
3. Students share ideas and respond to the ideas of others.
4. Students use higher-order thinking skills like organizing, synthesizing, and interpreting.
5. Students express their ideas by constructing supported explanations of their thinking, both written and verbal.
6. Classroom is student-centered.

Direct participants to return to the Menti site. Ask them to read through the items on the poll screen. Have participants choose the statement they feel best captures the importance of promoting discourse in the classroom.

Before displaying the results of the poll, ask participants to discuss with their small groups which item they believe is most important. Ask each person to share what they chose and explain their rationale.

After groups have had a chance to share with each other, display the results of the poll and ask for volunteers to share their thoughts.

Return to **slide 7** and conclude the discussion by noting that each of these items is equally important. Share with participants that they will next examine several strategies that can be used to integrate and sustain discourse in the classroom.

2 minutes

Exploring Discourse Strategies

Presenter's Note

For each of the following strategies introduced, there is an Explore, Explain, and Extend cycle.

Explain to participants that they are going to explore three instructional strategies, each of which can be used to support discourse in the classroom.

Participants first explore the strategy by role-playing as students using a science content example. After an introduction to the strategy, they explain in their own words how using this strategy can integrate and sustain discourse in the classroom. After they have explored all of these strategies, they extend their thinking by considering how they might use these strategies in their own classrooms.

10 minutes

Discourse Strategy 1: Analyzing Texts with Surprising, Interesting, Troubling

Presenter's Note

The first strategy participants will explore is S-I-T: Surprising, Interesting, Troubling. Explain to participants that the S-I-T strategy teaches students how to analyze texts, videos, or images. For this strategy, teachers give students a text to read, a video to watch, or an image to observe. Then ask students to identify one surprising fact or idea, one interesting fact or idea, and one troubling fact or idea. Once students have had a chance to consider their individual responses, have them share their ideas and reasoning with small groups and/or during a whole class discussion.

Explore

Show **slide 8**.

Give each participant a copy of the **Cystic Fibrosis Reading**. Advise the participants they will role-play students using the S-I-T strategy. Identify the document as one they might use if teaching a biology course. The document discusses what cystic fibrosis is, how one contracts it, how it is diagnosed, and the treatments for it.

Show **slide 9**. Have participants read the document closely. Ask them to note an idea or fact that *surprises* them, an idea or fact that *interests* them, and an idea or fact that *troubles* them.

Once participants have had a chance to read the document individually, ask them to discuss their responses in small groups. Give each group three sticky notes and ask that they work together to write a response for S-I-T, one response on each sticky.

Presenter's Note - Sample Responses

- **S** - We were surprised that doctors diagnose CF by using a sweat test since people with CF have 2–5 times the amount of sweat as a person without CF.
- **I** - We thought it was interesting that one of the treatments for clearing the mucus is clapping the person's back, a relatively basic, non-technological treatment.
- **T** - We thought it was troubling that more than 10 million Americans have the gene for CF and don't know it.

When all groups have finished writing their responses, call on each group to share out. Ask a representative from each group to post their stickies on a white board or large poster paper that has been labeled Surprising, Interesting, Troubling.

Presenter's Note - Optional Technology Integration

Instead of sticky notes, you could use Padlet to create a board with three columns (Surprising, Interesting, and Troubling) and ask that participants post their responses to Padlet.

Conclude the discussion by commenting on shared responses from using the S-I-T strategy, which generated conversation about cystic fibrosis. Inform the participants that this activity is used in Cystic Fibrosis: A DNA Case Study lesson on K20's LEARN website.

Explain/Extend

Show **slide 9**. Pass out the **Discourse in Science Note Catcher** handout (see Attachments). Tell participants that based on their experience with the S-I-T strategy, consider the following question: *How can the S-I-T strategy foster discourse in your classroom?*

Ask participants to discuss this in their small groups. Request that they fill out the S-I-T Strategy section on the Note Catcher handout.

When groups are finished discussing the strategy, reassemble as a whole group. Have groups share their thoughts with the whole group.

Presenter's Note - Sample Responses

- S-I-T enables students to use specific talking points to stay on topic.
- S-I-T provides a framework for students to analyze the document.
- The prompts are open-ended, which encourages students to react to the text authentically.
- S-I-T gives students the opportunity to list and respond to the ideas of others.

Summarize the discussion, highlighting that S-I-T can promote discourse because it provides students with a structure for content-centered discussions in which students share their thinking with their peers. They must make a claim and then support that claim with evidence and reasoning. This could be done both verbally and in writing.

10 minutes

Discourse Strategy 2: Making Connections with Honeycomb Harvest

Presenter's Note

Review of Honeycomb Harvest: The Honeycomb Harvest strategy uses hexagonal cards to encourage students to make physical connections to represent their learning. Each hexagon contains a term related to the course content. For this strategy, students place cards that are related to one another with their sides touching. They can work individually or in groups to arrange their honeycombs. Once they have completed their honeycombs, they explain their reasoning.

Explore

Show **slide 10**. Identify the next strategy, Honeycomb Harvest, and review how to implement this strategy.

Show **slide 11**. Explain to participants that the terms for this activity are related to DNA.

Provide sets of the **Honeycomb Harvest** cards to each participant or small group of participants. Give participants 5–10 minutes to arrange the honeycombs to best represent their understanding of the relationship among these concepts.

Consider giving an example to help participants get started. For example, you could say that the "gene" and "recessive" honeycombs could touch because one is a type of gene.

When the participants have completed the task, have each individual share their reasoning with their small group. If small groups complete their Harvests together, have them rotate to another group to see other arrangements to compare and contrast.

Bring the group back together and discuss the variety in the arrangements. Emphasize that it is likely that students will also produce a variety of arrangements. As long as students can explain their reasoning, their arrangement should be considered correct.

Presenter's Note - Honeycomb Harvest Sample Response

A participant might explain their reasoning for this arrangement this way: *I started with DNA because all these terms are part of DNA. I placed Gene below that and connected Alleles to it because alleles make up a gene. Then I surrounded Alleles with Heterozygous, Homozygous, Dominant, and Recessive because the alleles could be any of these things depending on the type of alleles that make up the gene. I connected the Punnet Square to Gene and Allele because the Punnet Square shows how the alleles from parents make up the genes of their children. Lastly, I left the mRNA outside because it only has single strand of code whereas DNA is a double strand.*

Explain/Extend

Show **slide 11**. Based on their experience with the Honeycomb Harvest, have participants consider the following question: *How can the Honeycomb Harvest strategy foster discourse in your classroom?*

Have participants discuss this topic with their small groups. Have them fill out the Honeycomb Harvest strategy section on their Note Catcher handout.

After the groups have discussed their perceptions, bring the groups back together and ask them to share their thoughts with the whole group.

Presenter's Note - Sample Responses

- Students can use the Honeycomb Harvest exercise to demonstrate their understanding of terms and events prior to the start of a lesson to show what they already know. After they have completed the lesson, they can identify any changes in their understanding.
- The Honeycomb gives students a tool to represent their thinking in a visual way.
- Students can explain their rationale and reasoning with their peers.
- Students can compare and contrast honeycombs while explaining their reasoning.
- Students can analyze how multiple interpretations can all be correct.

reasoning and negotiate their thinking with their peers to represent their understanding of the content.

15 minutes

Discourse Strategy 3: Academic Conversations with Say Something

Presenter's Note

The video Encouraging Academic Conversations with Talk Moves is used as an illustration of the Say Something strategy. While it has a different name, the intention is the same for both Talk Moves and Say Something. As time permits, either explain the strategy or watch the video as an explanation. If you choose to watch the video, clarify the difference in the names of the strategies with participants prior to watching the video on **slide 12**.

Embedded video
https://youtube.com/watch?v=kSl4imt0dXg

Ask participants to look over the Say Something handout as they watch the video. Give them five minutes with small groups for practice using the Say Something sentence starters to engage in an academic conversation about the video and its genetic significance.

Presenter's Note - Sample Responses

- ***In the video,*** when the speaker says they were "too used to being outcasts," ***it seems to me that*** society stigmatizes people who are different and those outcasts see their difference with shame.
- ***In the video,*** when the speaker says, "Coal mining and the railroads brought new people to Kentucky," ***I think*** that helped stop so many people from being blue ***because*** the new people had dominant genes that were passed on instead of the blue ones.
- **I wonder** what other recessive genes are out in the world that we don't know about?
- **I think** it is important to consider genetics when encountering anomalies in humanity.

8 minutes

Extend/Evaluate: Reflecting on Discourse

Conclude the discussion by reviewing **slide 15**. Ask participants to consider their students and reflect on how these strategies would look in their classroom. Discuss the following questions in their small groups:

- *Which of today's strategies do you plan to implement in your classroom? Why?*
- *How can these strategies be effective in promoting discourse? Explain.*
- *How can you modify these strategies to work with your students? Explain.*

Encourage participants to record their responses on the back of the Note Catcher handout, if they wish.

Presenter's Note - Sample Responses

- Each of these strategies helps students formulate responses to share with a group.
- Say Something can help students have respectful conversations.
- Honeycomb Harvest is effective because it enables students to connect ideas and justify their connections, which allows them to deepen their knowledge.
- I think the S-I-T strategy would be helpful because students can feel empowered in their learning.
- These strategies all provide students with guidelines to participate in a conversation if they don't know where to start.

After groups have had a chance to discuss, ask participants to record their answers on their Note Catchers and have volunteers share responses to the whole group.

3 minutes

Research Rationale

Authentic learning—exploring meaningful concepts, their relationships, and real-world context—is inherent in disciplined inquiry and complex understanding. Rule (2006) noted that rich problems adhere to principles such as "personal meaningfulness to students; construction, refinement, or extension of a model; self-evaluation; documentation of mathematical thinking; useful prototype for other structurally similar problems; and generalization to a broader range of situations."

Not surprisingly, these traits are similar to the traits of good essential questions. There are a number of academic benefits for students and teachers that can be accomplished by giving time and space in the classroom for students to have conversations. When student conversation is an integrated part of the learning, students get practice working with one another; they get practice being accountable to others, listening, sharing their ideas in ways that others can understand, and working together to make decisions (Gillies, 2016; Resnick, Michaels, & Connor, 2010; Gibbs, 2006).

The learning that results from student conversations increases student motivation, self-esteem, and problem-solving outcomes. For teachers, giving students a space to speak provides insight into how students organize their thoughts and can serve as formative assessments of what students are learning over the course of a lesson.

2 minutes

Follow-Up Activities

If time allows, move to **slide 16**. On this slide, participants will be directed to K20's LEARN site where they can find LEARN 5E lessons that served as content for this professional learning experience. They can explore LEARN lessons, strategies, or focus on the lessons used in this professional development to discuss what they could apply to their classrooms.

LEARN: https://learn.k20center.ou.edu/

Cystic Fibrosis: A DNA Case Study

Why So Blue?

Resources

- Edutopia. (2018, Nov. 16). Encouraging academic conversations with talk moves. https://www.youtube.com/watch?v=kSI4imt0dXg&feature=youtu.be
- Genetic Science Learning Center (n.d.). *Single Gene Disorders*. http://learn.genetics.utah.edu/content/disorders/singlegene/
- Gibbs, J. (2006). Reaching all by creating tribes learning communities. Windsor, Calif: CenterSource Systems.
- Gillies, R. M. (2016). Cooperative learning: Review of research and practice. *Australian Journal of Teacher Education*, *41*(3). http://dx.doi.org/10.14221/ajte.2016v41n3.3
- K20 Center. (n.d.). Collaborative word cloud. Strategy. https://learn.k20center.ou.edu/strategy/103
- K20 Center. (n.d.). Honeycomb harvest. Strategy. https://learn.k20center.ou.edu/strategy/61
- K20 Center. (n.d.). Mentimeter. Tech tool. https://learn.k20center.ou.edu/tech-tool/645
- K20 Center. (n.d.). Padlet. Tech tool. https://learn.k20center.ou.edu/tech-tool/1077
- K20 Center. (n.d.). Say something. Strategy. https://learn.k20center.ou.edu/strategy/778
- K20 Center. (n.d.). S-I-T. Strategy. https://learn.k20center.ou.edu/strategy/926
- K20 Center. (2022, May 26). Cystic fibrosis: A DNA case study. 5E lesson. https://learn.k20center.ou.edu/lesson/496
- K20 Center. (2022, June 12). Why so blue? Recessive gene inheritance. 5E lesson. https://learn.k20center.ou.edu/lesson/391
- Resnick, L. B., Michaels, S., & O'Connor, M. C. (2010). How (well-structured) talk builds the mind. In D. D. Preiss & R. J. Sternberg (Eds.), *Innovations in educational psychology: Perspectives on learning, teaching, and human development* (p.163–194). Springer Publishing Company.
- Rule, A. (2006). The components of authentic learning. *Journal of Authentic Learning*, *3*(1), 1–10.
- Weird History. (2021, November 26). *Facts and stories about the blue Fugates*. [Video]. YouTube. https://www.youtube.com/watch?v=kSI4imt0dXg&feature=youtu.be