

Appendix A: Discussion Frame Template

Instructions: Please replace the blue text and Xs throughout the document according to the directions provided. Note that in some cases, I have provided responses or examples **in red**. I completed Part IV for you entirely, but please read through it, and feel free to add to it. Note that each classroom team will have approximately 20 minutes to facilitate a discussion.

Part I. Student Learning Goal (SLG)

Students will identify the ways in which Karl's injured beak affects aspects of his survival, behavior, and reproduction and connect these ways/aspects to prior learning about animal survival, behavior, and reproduction in the Turtle Trouble unit.

Part II. Leading a Group Discussion Organization (HLP 1)

Launching: How will you launch the discussion? Describe your introduction and/or include parts of your script here. *Don't forget to share the Student Learning Goal!*

Discussion Question: X

Who will launch the discussion and how: X

Orchestration: What is your overall plan for the major parts of the discussion? *Include a list or flow chart here.*

1. X

Closing: How will you close the discussion? Describe your closing or include parts of your script here.

- X

Part III. Questions, Prompts, and Strategies to Support Orchestration

For each section, include two or more example questions or other prompts that are specific to this discussion (e.g., Mina and Will, what questions do you have for Jayla, Emily, and Carlos about their claim that hunting is important for hornbills because it allows them to catch their own food?) You can also include some more general questions and prompts (e.g., Do you agree or disagree? Why?). I have provided one or more examples in red for each section and am asking you to provide two or more example questions/prompts beyond what I have provided.

Eliciting Both Groups' Whiteboard Ideas:

- X

Encouraging Student-to-Student Talk:

- Strategy: Using wait time.
- Strategy: Not interrupting!

- Mina and Will, what questions do you have for Jayla, Emily, and Carlos about their claim that hunting is important to hornbills because it allows them to catch their own food?
- X

Encouraging Students to Determine How Karl's Beak Impacts His Ability to Find a Partner/Mate:

- Now that we've had a chance to hear from both groups, let's see if we can determine how else Karl's beak impacts him and why we think so. [Follow up by asking each team if they agree and why.]
- X

Encouraging Students to Make Connections to the Key Ideas of the Turtle Trouble Unit:

- X

Part IV. Connections to and Ideas From the Turtle Trouble Unit That May Help Teams Move Towards the SLG

It is important to keep in mind the accurate ideas and connections that the students made in their initial work that might be useful to draw from during the discussion. I'm giving you a list here, but feel free to add.

Correct conceptions unique to each team:

- Mina and Will know it's difficult for Karl to eat due to his injured beak (external part). From the unit, they know that to grow and survive, all animals, including humans, need to eat. Karl's short lower beak (external part) affects his ability to crush and tear his food.
- Jayla, Emily, and Carlos know that Karl's behavior is affected because he can't hunt for food like other hornbills do. This potentially could cause Karl to be bored because hornbills roam up to seven miles a day to catch things like spiders and lizards.

Correct conceptions and connections to the unit (relevant to all students):

- That a hornbill like Karl would die in the wild if it was unable to hunt for its own food.
- That an injury to a turtle's esophagus (internal part) might not allow food to travel to its stomach to be digested, affecting its growth and survival.
- That a turtle's internal and external structures have specific names and functions.
- That a turtle in the wild with an injured or missing flipper, like Calypso, might not be able to swim or hunt like the other turtles, and it could be seen as weaker. Weaker animals are going to have a difficult time finding a mate/partner.
- That turtles use their sense of smell to attract mates.

Appendix B: Scenario

Connecting Bird Beaks and Sea Turtle Flippers: Impacts on Animal Survival, Behavior, and Reproduction

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Avatars

Mina, Will, Jayla, Emily, and Carlos (in the Mursion Mixed Reality Upper Elementary Simulated Classroom Environment)

Summary

Five students are present for this culminating discussion: Mina, Will, Jayla, Emily, and Carlos. These upper elementary students are nearing the end of the fourth-grade Turtle Trouble unit—part of the Baltimore County Public Schools (BCPS) curriculum (2022)—which addresses how an injury to a plant or animal impacts its survival, growth, behavior, and/or reproduction. Additionally, they read the non-fiction book *Karl's New Beak: 3D Printing Builds a Bird a Better Life* by Lela Nargi (2019), which describes the challenges an Abyssinian ground hornbill faces due to an injury of his lower beak. Prior to this discussion, student avatars Mina and Will and Jayla, Emily, and Carlos engage in smaller group discussions regarding the impact that Karl's beak has on his survival, behavior, and reproduction. Practicing HLP1 Leading a Group Discussion, the teacher candidates will elicit (1) student ideas and reasoning regarding the impact Karl's beak has on his survival, behavior, and reproduction; (2) connections between Karl's shortened lower beak and the content presented in the Turtle Trouble unit; and (3) the impact of Karl's shortened lower beak on his ability to mate/reproduce, which neither group determined during their smaller group discussions. They will also track the development of student ideas throughout the discussion using a graphic organizer.

Audience

Teacher Candidates majoring in Elementary Education.

Standards

From the TeachingWorks High Leverage Practices

1 Leading a group discussion

In a group discussion, the teacher and 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, interpreting, agreeing and disagreeing. The teacher and a wide range of students contribute orally, listen actively, and respond to and learn from others' contributions. (TeachingWorks, 2023)

From the Next Generation Science Standards (NGSS) Performance Expectations

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

[*Clarification Statement:* Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.] [*Assessment Boundary:* Assessment is limited to macroscopic structures within plant and animal systems.] (NGSS Lead States, 2013, p. 38)

PST-Facing Vignette

Before the Discussion

You had Mina and Will and Carlos, Emily, and Jayla engage in smaller group discussions and write their ideas on a whiteboard regarding the impact that Karl's injured lower beak has on him. Your hope was that students would address how his injured beak impacts his survival, behavior, and reproduction. Mina and Will's whiteboard looks like this:

Mina and Will
• It's hard for Karl to eat! • He can't eat like other ground hornbills. • He must eat meatballs and mice the Zoo staff gives him. • Zoo staff weigh him to make sure he is eating enough.

Jayla, Emily, and Carlos focus on Karl's inability to hunt. Their whiteboard looks like this:

Jayla, Emily, and Carlos
• Karl can't hunt for food like other hornbills do. • Other hornbills roam up to 7 miles a day to catch things like spiders and lizards!!! • Hunting is important because it keeps hornbills busy and allows them to catch their own food.

Lesson Objectives (for Avatar Student Learning)

Students will be addressing NGSS PE 4-LS-1. Specifically, the discussion will support students to:

- **Identify the ways in which Karl's injured beak affects aspects of his survival, behavior, and reproduction.** Specifically, Karl's injured beak:
 - Impacts his survival by making it difficult for him to forage, kill prey, and eat.
 - Impacts his behavior by making it difficult for him to hunt.
 - Impacts his ability to mate/reproduce since he is unable to deliver food to his family, making him less desirable.

- **Connect these aspects to prior learning about animal survival, behavior, and reproduction in the Turtle Trouble unit.** Specifically, in the Turtle Trouble unit, students learned:
 - **In general**, the external and internal structures of a loggerhead sea turtle each have a specific function to allow for their survival, behavior, and reproduction.
 - **About the beak:**
 - That the beak has a sharp cutting edge which is used for tearing and crushing food.
 - *An injury to the beak could impact their survival/growth by making it difficult to tear and eat the food they find, hunt for food, and attract a mate/partner.*
 - **About the plastron (bottom shell):**
 - It is often yellow in color and helps to camouflage the turtle's body. This prevents their prey or predators from seeing them when they look up from below.
 - *An injury to the plastron could impact their survival/growth by making it more difficult for them to catch and eat their prey and making it easier for predators to find and eat them. It could also cause an infection by allowing germs to get into their internal organs.*
 - **About the carapace (top shell):**
 - This reddish-brown shell protects the turtle's internal organs and is covered by scutes (sections of the carapace). Scutes help the turtle blend in with the bottom of the sea and provide an extra layer of protection for the turtle's top shell.
 - *An injury to the carapace could impact their growth/survival because it is fused with the spine. It could also impact the spinal cord, which would affect the turtle's nervous system. It could also cause an infection by allowing germs to get into their internal organs. This type of injury could also make it easier for predators to find and eat them.*
 - **About the flippers:**
 - That the flippers allow the turtle to dig and swim. Turtles use their front flippers to propel themselves through the water and their rear flippers to steer and stabilize while swimming.
 - Calypso was a female green sea turtle who was rescued from Long Island Sound when she was young and weighed just six pounds. To prevent an infection from spreading, her front left flipper had to be amputated. The staff at the National Aquarium in Baltimore took care of her, and she eventually grew to be 500 pounds. She passed away in 2020.
 - *An injury to their flippers could impact their ability to dig, swim, hunt, and reproduce.*

Performance Objectives (for Teacher Candidate Learning)

Through this discussion, the teacher candidate will:

1. Elicit each group's initial ideas (from their whiteboards).
2. Encourage each group to elaborate upon those ideas.

3. Prompt students to connect these ideas to key ideas addressed in the Turtle Trouble unit.
4. Prompt students to consider another impact of Karl's injured beak (related to reproduction) not included in each group's initial ideas—and connect that to ideas addressed in the Turtle Trouble unit.
5. Encourage students to listen actively and respond to others' contributions.
6. Track student ideas throughout the discussion by using a simple graphic organizer.

Regarding the latter objective, the graphic organizer will be a table with two columns: (1) impacts of Karl's injury and (2) connection to Turtle Trouble. Learners will generate this chart during the discussion on chart paper or a whiteboard. And will ask the students to create the chart in their science notebooks as well. This will be constructed during the discussion as student ideas are contributed. (Note that the learner cannot see what the students are recording on their tables.)

The blank graphic organizer looks like this:

Key idea	Problems with Karl's beak	Connections to the Turtle Trouble unit

A completed graphic organizer might look like this:

Key idea	Problems with Karl's beak	Connections to the Turtle Trouble unit
Survival	- Karl's beak injury = can't eat insects and mammals - Zoo staff must feed him	- Turtle beak injury = can't tear and crush food - Could lose weight and die
Behavior	Can't nibble and hunt for food, which could make him bored	- Injured beak or flipper = can't hunt for food - Injured beak means can't smell, so can't escape from predator
Reproduction	- Can't gather food for his family. - Not as attractive to mates	- If can't hunt for food, can't find mate - Can't use smell to attract a mate

When Teacher Candidates “Hit” (i.e., Use Successful Discussion Strategies)

The Successful Teacher Candidate:

1. Questions and prompts student(s) from each smaller group to share the idea they listed on their whiteboard and elaborate and explain their reasoning.
2. Encourages students to make connections between Karl's beak and key ideas they learned from the Turtle Trouble unit. Does so through questioning and other prompts (as opposed to telling).
3. Prompts students through questions to consider another impact of Karl's injured beak (related to reproduction) and how that connects to key ideas from the Turtle Trouble unit.
4. Incorporates talk moves that encourage students to:
 - a. Elaborate their ideas.
 - b. Apply their own reasoning to another student's reasoning
 - c. Contribute to the discussion by agreeing, disagreeing, or adding to what was already shared
 - d. Explicate their reasoning
5. Tracks student ideas throughout the discussion using the graphic organizer and encourages students to add to their graphic organizers (in their science notebooks on their tablets) as well.
6. Frames the discussion as an opportunity to elicit their ideas, make connections to the unit, and listen and respond to one another.

Possible Avatar Responses (in Response to a Teacher Candidate "Hit"):

- If asked to elaborate on their whiteboard ideas, Mina and Will could explain that:
 - Their ideas were about growth/survival since food is needed to grow and survive.
 - Karl must tilt his head to the side and scrape his beak on the ground.
 - Hornbills with normal beaks can pinch insects and small mammals between the tips of their long, curved beak, toss them in the air, catch them in their mouth, and then swallow them whole.
 - Karl's diet lacks variety, which is another reason he must be weighed every week to ensure he is eating enough.
- If asked to comment on Mina and Will's idea, Jayla, Carlos, or Emily could say that they hadn't thought about how Karl ate—but that since he couldn't hunt, he couldn't feed himself and depended on the Zoo staff to feed him.
- If asked to elaborate on their whiteboard ideas, Jayla, Carlos, and Emily could explain that:
 - Hunting is a behavior—so Karl couldn't act like other hornbills did.
 - Since Karl could not hunt, he could not find his own food. It would be like having to go to the same restaurant all the time.
- If asked to comment on Jayla, Carlos, or Emily's initial ideas, Mina and Will could say that since Karl could not hunt, that related to what they said about his diet lacking variety.
- If asked about other results of Karl's shortened lower beak (in general), the students might be unsure—but if asked about "finding a mate" or "reproduction," any of the students could elaborate by saying:
 - Because he was different and couldn't hunt, it would be hard for him to find a mate.

- If he can't find a mate since he's different, he can't help to reproduce and make other hornbills.
- If asked about connections between food (survival/growth) and the Turtle Trouble unit, Mina and Will could explain that to grow and survive, all animals, including humans, need to eat. If a turtle has an injured beak (external part), that would affect its ability to crush and tear its food. It would not get the food it needs to survive/grow and would die.
- If asked about connections between food (survival/growth) and the Turtle Trouble unit, Jayla, Carlos, and Emily could explain that an injury to a turtle's esophagus (internal part) would not allow food to travel to its stomach to be digested, affecting its growth and survival.
- If asked about connections between hunting and behavior and the Turtle Trouble unit, any of the students could explain that a hornbill in the wild would die if it was unable to hunt for its own food and that Karl was lucky that the Zoo staff gave him meatballs and small mice to eat.
- If asked about connections between hunting and behavior and the Turtle Trouble unit, Jayla, Carlos, and Emily could explain that besides their beaks, turtles need their flippers to swim so they can hunt for food. Having an injured or missing flipper could also impact a turtle's ability to hunt.
- If asked about connections between reproduction and Turtle Trouble unit:
 - Mina and Will could explain that if a turtle has an injured or missing flipper, it might not be able to swim or hunt like the other turtles, and it could be seen as weaker. Weaker animals are going to have a tough time finding a mate/partner. Karl was lucky that the Zoo staff created a lower-beak prosthesis for him that helped him to eat and hunt so that he would be able to meet a partner/mate.
 - Jayla, Carlos, or Emily could explain that turtles smell well underwater and that they have barbels or nerves that help them to do this instead of nostrils like humans. They use their sense of smell to attract mates, so an injury to their barbels would make it difficult for them to reproduce.
- Students write on their tablets to complete the graphic organizer with the teacher if prompted.

When Teacher Candidates “Miss” (i.e., Do Not Use Successful Discussion Strategies):

The unsuccessful teacher candidate:

- Does not prompt students to share the ideas they wrote in groups on their whiteboards.
- Does not prompt students to make connections between those ideas and key ideas and activities in the Turtle Trouble unit.
- Does not prompt students to consider what effect Karl's injured beak has on his ability to reproduce/mate (an idea that neither student group included on their whiteboards).
- Tells the students about the idea that neither student group included on their whiteboards (that Karl's injured beak reduces his ability to mate/reproduce) before attempting to elicit this idea from the students.
- Does not seek elaboration from students as students share their responses.

- Does not ask students to respond to other students' ideas.
- Does not track students' ideas and ask them to track them using the graphic organizer.

Possible Avatar Responses (in Response to a Teacher Candidate “Miss”):

- Will answer closed-ended questions with one-word or short answers.
- Will not share their whiteboard ideas if not prompted or encouraged to do so.
- Will not elaborate on their whiteboard ideas if not prompted or encouraged to do.
- Will not make connections between Karl's beak and the Turtle Trouble unit if not prompted.
- Will not spontaneously provide the idea of the impact of Karl's injured beak on reproduction if the teacher does not prompt students to do so.
- Will not comment upon other students' ideas if not prompted or encouraged to do so.
- Will not write on their tablets to complete the graphic organizer if not prompted to do so.

Curriculum References

- Baltimore County Public Schools. (2022). *Science year at a glance 2022-2023: Grade 4*.
https://cdns5-ss3.sharpschool.com/UserFiles/Servers/Server_9046958/File/YAG-Pacing/Grade%204/Sci_Grade%204%20YAG%2022-23.pdf
- Nargi, L. (2019). *Karl's new beak: 3-D printing builds a bird a better life* (H. Popham, Illus.). Capstone Editions.