

# LESSON 2:

## “Stupidity” in Science: A Text-based Discussion

### INTRODUCTION

In this lesson, students participate in a text-based discussion of the article “The importance of stupidity in scientific research” by Martin Schwartz. Using evidence found in the text, students consider how success is defined in scientific research. They also discuss how scientific pursuits may require persistence despite setbacks and a tolerance for **not knowing** much of the time. Students then relate their experiences of **not knowing** during the gummy bear lab from *Lesson One* to the social nature of scientific research. This type of text-based discussion is known as a **Socratic Seminar**.

### CLASS TIME

One class period of 55 minutes.

### KEY CONCEPTS

- Scientists actively seek out what they do not know or understand in order to learn and understand new concepts. This type of discovery and learning about the world may be different from other ways of gathering information.

### LEARNING OBJECTIVES

#### **Students will know:**

- Scientific research requires the scientist to actively seek out what he or she does not know or understand in order to learn/discover new concepts (“**productive stupidity**”).

#### **Students will be able to:**

- Demonstrate their understanding of how scientists accept uncertainty by participating in a text-based class discussion.
- Move the discussion forward by referring to evidence from the text.

### MATERIALS

Materials	Quantity
Student Handout 1.1— <i>Guided Reading Questions</i>	1 per student
Student Handout 2.2— <i>Post-Discussion Reflection</i>	1 per student
<b>Optional:</b> Student Handout 2.3— <i>Discussion Partner Evaluation</i>	1 per student
“The importance of stupidity in scientific research” article by Martin Schwartz. [ <b>Note:</b> This can be freely downloaded from the <i>Journal of Cell Science</i> website: <a href="http://jcs.biologists.org/content/121/11/1771.full.pdf">http://jcs.biologists.org/content/121/11/1771.full.pdf</a> . The article is also available through PubMed with the following PMID: 18492790.]	1 per student

### NOTE TO THE TEACHER

A **Socratic Seminar** is a high-level text-based discussion. Teacher resources for this type of discussion can be found in the *Appendix* and in the *NWABR Ethics Primer* found at <http://nwabr.org>.

Students often misunderstand the term “scientific research.” Instead of understanding it as a process requiring persistence in the face of setbacks and a tolerance for ambiguity, “research” is sometimes thought to be the same thing as doing a “research paper” on some topic.

It is helpful for students to sit in a circle for this type of discussion. If students don’t know each other’s names, name plates or name tags are recommended. If the class is large, teachers may choose a **fishbowl variation**, in which the students are divided into two groups and sit in two concentric circles facing the center. One half of the class is in the inside circle, facing each other and discussing the text, while the remainder sit in the outer circle observing and listening. Members of the outer circle can take notes or use an evaluation form (see Student Handout 2.3—*Discussion Partner Evaluation*) to track the overall conversation. Some

teachers reserve an empty “hot seat” in the inner circle for those in the outer circle who really want to jump in to make a contribution and then leave. The groups switch halfway through the discussion to allow the outer group a chance to discuss the text.

## TEACHER PREPARATION

- Make copies of *Student Handouts*, one per student.
- Download “The importance of stupidity in scientific research” article. Number each paragraph, 1–8, so that students can easily refer to passages during the class discussion. Make copies of the article, one per student.

## PROCEDURE

1. Assign as homework, or read together in class the article “The importance of stupidity in scientific research” by Martin Schwartz.
2. Hand out copies of Student Handout 2.1—*Guided Reading Questions*, one per student. Tell students to answer the questions after they complete the reading.
3. You may ask students to use some reading strategies to help them better understand the article. These strategies could include:
  - Reading the article through twice: the first time provides a general overview and the second time is more detail-oriented.
  - Defining any unknown vocabulary for students, such as **undergraduate**, **graduate**, and **PhD student**. (Do not define the terms **absolute stupidity** or **relative stupidity**, as the students will focus on this during the discussion.)
  - Asking students to mark up their article using the following symbols:
    - ? for something the student does not understand.
    - ! to signify a good point made by the author.
    - \* to signify a point with which the student disagrees.A fully marked article can then be used as an “entrance ticket” to the discussion.
4. Arrange the classroom for the discussion (see *Note to the Teacher* section above for more information).
5. Tell the class they will be having a class discussion using ideas covered by the reading to better understand the way scientists approach their work. The purpose of the

discussion is not to complete the reading guide but to **achieve a deeper understanding** about the ideas and values expressed by the author. They can use the guided questions for note-taking or reference, but active participation in the discussion should be their main focus.

6. Begin the discussion by reviewing the group discussion norms. If you have not previously set classroom norms for whole group discussions, information for doing so can be found in the *Appendix*.

Some classroom norms particularly important for a Socratic Seminar include:

- Don’t raise hands.
  - Listen carefully.
  - Address one another respectfully.
  - Base any opinions on the text.
7. Direct students to the numbered paragraphs. Explain that they need to base their opinions and questions on the text and be sure to refer to the paragraph number so that the rest of the class can see where the idea/question came from. Pulling evidence from the text is an important part of this type of discussion.
  8. Explain that since this is a whole group discussion, students should not feel they need to raise hands and be called upon. Encourage them to listen carefully to one another’s ideas and comment during natural breaks in the conversation.
  9. Begin by posing the question:

**“Why does the author think that stupidity is important in science?”**

Encourage a variety of students to comment on this question, referring to the text as they share their ideas.

10. Follow up this initial question using the suggested questions below, or come up with your own. However, make sure to ask those questions in **bold** since the ideas discussed in answering them will be built upon in later lessons:
  - Why was the realization of the author’s ignorance infinitely “liberating”?
  - What does the author mean by productive stupidity? How is it different from other types?
  - Is “stupidity” the best word?
  - **What qualities make a successful scientist?**
  - **How do you think success is defined in science?**
  - Do you think “stupidity” is important in science?

- Does creativity play a role in science?
- **How did you experience “stupidity” in the gummy bear lab?**
- **How is the science described by the author similar or different from how science is taught in schools?**
- Allow students to pose their own questions, if desired.

“Thoroughly conscious ignorance is the prelude to every real advance in society.”

~James Clerk Maxwell, 1831-1879

“In an honest search for knowledge you quite often have to abide by ignorance for an indefinite period.”

~Erwin Schrödinger, 1948

11. Debrief the discussion by asking students if they have any other ideas they would like to share about the text. Point out for students that creativity plays a role in science. For example, when the author realized that Taube could not solve the research problem, he felt liberated to solve it himself. In other words, he could not solve the problem because he was looking for the “right” method when no such method existed. It was only when the author was free to develop his own method that he could solve his research problem. This is the very essence of creativity in science.
12. Ask students how they thought the discussion went and whether the class met the goal of the discussion (to better understand the ideas presented by the author).
13. Relate the discussion to the lab meeting from the gummy bear activity in *Lesson One*. Both are collaborative endeavors that rely on evidence to analyze and critique something. In the case of the gummy bear lab meeting, students were critiquing each other’s data and methods. In the case of the reading, students were critiquing Martin Schwartz’s ideas about scientific research. Did these things feel the same or different? In what ways? Is it harder to critique a friend or acquaintance than a stranger?
14. Hand out copies of Student Handout 2.2—*Post-Discussion Reflection*, one per student. This handout can be used as an “exit ticket” or can be completed as homework.

## Closure

15. Have students retrieve their *Unit Graphic Organizer* handouts and look at the first column titled “Research Process.” Ask students if they would like to add anything to this based on today’s discussion. Students may also put an exclamation point or star next to phrases that have been reinforced through this lesson, such as “tolerance of ambiguity” or “persistence despite setbacks.”

## HOMWORK

Student Handout 2.2—*Post-Discussion Reflection* can be assigned as homework.

## GLOSSARY

**Absolute stupidity:** A complete lack of knowledge or understanding of a given topic.

**Graduate student:** A person who has earned a college degree and is pursuing additional education, such as a master’s degree or PhD.

**PhD student:** A person pursuing a doctorate degree, the highest degree awarded for graduate study.

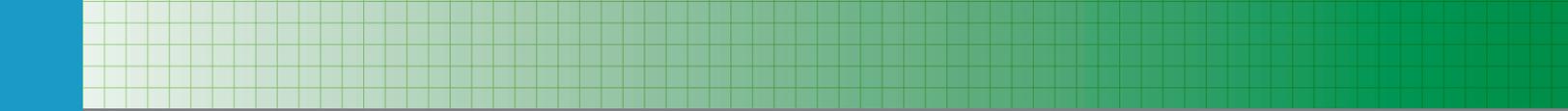
**Productively stupid/Productive stupidity:** The attribute of realizing how little one knows in order to develop good questions.

**Relative stupidity:** Willful indifference to becoming informed or enlightened, especially in relation to others who make the effort to read, learn, or think about important material.

**Undergraduate student:** A person studying at a university or college after high school with the goal of earning a bachelor’s degree. This is usually a four-year degree.

## SOURCES

Schwartz, M. (2008). The importance of stupidity in scientific research. *Journal of Cell Science*. 121 (Pt 11): 1771. Retrieved from <http://jcs.biologists.org/content/121/11/1771.full.pdf>



# STUDENT HANDOUT 2.1

## Guided Reading Questions

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

### **“The importance of stupidity in scientific research” by Martin Schwartz**

1. Why did the author’s friend drop out of graduate school?
2. Why do people like subjects they are good at? How does doing well on an assignment or test make you feel?
3. What realization did the author have after being told Nobel Prize winner Henry Taube didn’t know the answer to a question?
4. What is the difference between “productive stupidity” and “relative stupidity”?
5. How did making mistakes and feeling “stupid” impact you during the gummy bear lab?
6. Write your own question:

# STUDENT HANDOUT 2.2

## Post-Discussion Reflection

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

1. Do you feel like you understand the article better than you did before the discussion? Explain.

2. Is “stupidity” the best word for the ideas the author is sharing in his article? What other words could you use to describe his ideas?

3. What qualities make a successful scientist? How is success defined in science?

4. Why are mistakes and feeling stupid important to scientific research?

5. How was our discussion similar to our gummy bear lab meeting in which we critiqued each other's data and methods?

# STUDENT HANDOUT 2.3

## Discussion Partner Evaluation

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

Name of person you are observing \_\_\_\_\_

1. Record a check mark for each time your partner contributed in a meaningful way.
2. On a scale of 1 – 5, with 5 being the highest, how well did your partner do at the following?

### \_\_\_\_\_ **Analysis and Reasoning**

Did your partner....

- Cite reasons and evidence for his statements with support from the text?
- Demonstrate that she had given thoughtful consideration to the topic?
- Provide relevant and insightful comments?
- Demonstrate organized thinking?
- Move the discussion to a deeper level?

*Notes/Comments:*

### \_\_\_\_\_ **Discussion Skills**

Did your partner....

- Speak loudly and clearly?
- Stay on topic?
- Talk directly to other students rather than the teacher?
- Stay focused on the discussion?
- Invite other people into the discussion?
- Share air time equally with others (didn't talk more than was fair to others)?

*Notes/Comments:*

### \_\_\_\_\_ **Civility**

Did your partner....

- Listen to others respectfully?
- Enter the discussion in in a polite manner?
- Avoid inappropriate language (slang, swearing)?
- Question others in a civil manner?

*Notes/Comments:*

