

## Putting Students on the Hot Seat to Stimulate Interest in Biology in Non-Science Majors

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### ABSTRACT

*The Hot Seat is a discussion-based activity that requires students enrolled in a biology course for non-majors to pose a question to the class that is related to the current lecture topic and facilitate a brief class discussion. This paper describes the Hot Seat, how it is assessed, and how it has influenced students' attitudes toward the course and biology in general. The Hot Seat has been successful in increasing students' understanding of biology, their appreciation of its relevance to their lives, and in-class participation.*

**Key Words:** *Non-majors biology; college biology; scientific literacy.*

Because of the impact that science has on students and society, it has been a longstanding goal of science-education reform to achieve a scientifically literate population that consistently makes informed decisions. Functional scientific literacy can be defined as having an understanding of the practice of science and its relevance to everyday life (Zeidler & Sadler, 2011). With respect to biology, a scientifically literate person needs to have a basic understanding of biological principles and processes in order to make sense of myriad instances when they come in contact with them in day-to-day life. As such, scientific literacy is not reserved for science majors; it is something everyone should strive for.

For many college students, science courses for non-majors are quite likely their very last opportunity to gain an appreciation of biology and the important role it plays in their daily lives. However, there are many challenges associated with teaching general biology to non-majors, including making the content understandable to the layperson, getting students to see its relevance to their lives, and encouraging students to participate in class (Ewing et al., 1987).

Prior studies have shown that active learning in non-majors biology courses increases students' understanding of the content (McClanahan & McClanahan, 2002; Crossgrove & Curran, 2008).

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However, in addition to strictly teaching content, my intention was to increase students' functional scientific literacy by enabling them to make the connection between science and society and promote informed decision-making skills. Thus, the Hot Seat activity was created as part of a college-level non-majors biology class. The purpose of the Hot Seat activity was to (1) facilitate students in making connections between content learned in biology lecture and the real world, (2) increase class participation, and (3) act as an informal assessment of students' critical thinking and scientific literacy.

### ○ Method

A total of 178 students enrolled in one of three sections of a non-majors biology course were given the assignment as part of their course. The students represented a wide variety of majors and included several who were planning to become science teachers in the middle grades. Each week, 1–5 students were randomly selected to be Hot Seat participants. The five seats closest to the lecture podium were designated Hot Seats. Those who were selected to sit in a Hot Seat were required to ask a question directly related to that week's topic and generate a 5-minute class discussion based on that question. Students were encouraged to come to class with a question prepared, in case they were picked to be a Hot Seat participant. Because all students were required to sit in the Hot Seat at least once during the semester as part of their course grade, students who had already been selected were removed from the pool of names. Once the entire class had a turn in the Hot Seat, the names of all the students were again returned to the pool. Students whose names were chosen a second time had the option of sitting in the Hot Seat for an extra point or declining with no penalty. All students, regardless of whether they had a turn in the Hot Seat, were expected to participate in the class discussions generated by Hot Seat participants.

**Table 1. Scoring rubric for the Hot Seat assignment.**

Quality of the Question (15 points possible)	Points
• Presenter directly relates the topic to current topic in lecture.	15
• Topic is directly related to lecture, but not explicitly.	12
• Topic is related to biology but not to topics covered in class.	9
• Topic is not related to biology.	0
Generation of Class Discussion (10 points possible)	Points
• Topic is relevant to students and catches their interest and immediately generates vigorous discussion.	10
• Topic is relevant to students but the presenter has to prompt them to generate discussion.	7
• Topic is not relevant to students, does not capture their interest, and the presenter has to prompt them heavily to generate discussion.	4
• Topic is not relevant to students, does not capture their interest, and the presenter does not attempt to prompt them to generate a discussion. No discussion occurs.	0
<b>Total possible points</b>	<b>25</b>

Criteria used to score the activity were divided into two sections, the quality of the question and generation of class discussion. The quality of the question was worth up to 10 points. In order to receive full credit for this section, students were required to explicitly relate their question to the current topic in lecture. Generation of a class discussion was worth up to 15 points. In order to receive full credit for this section, the topic needed to be relevant to students, catch their interest, and generate vigorous discussion. Please see Table 1 for the grading rubric.

Students were asked to anonymously complete a survey at the end of the course. A total of 53 students (29.7%) took the survey. The survey questions were as follows:

1. In what ways, if any, has the Hot Seat assignment helped you understand that there is a relationship between biology and society?
2. In what ways, if any, has the Hot Seat assignment made biology seem more personally relevant to you?
3. In what ways, if any, has the Hot Seat assignment made you feel like you were participating in class?
4. In what ways, if any, has the Hot Seat assignment helped you learn to use science or evidence when coming to decisions about things that may be related to science?
5. Do you have any additional comments or suggestions about the Hot Seat assignment that would help make it better for next semester?

In addition to the short-answer survey questions, students were asked to rate the activity on a scale of 1 (really disliked it) to 5 (really enjoyed it).

## ○ Results & Discussion

With the exception of one, all the student-generated questions were controversial in nature and also related, in some way, to society. About two-thirds of the questions were related to society in a broad manner, such as the use of genetically modified foods, whether or not people should limit activities that contribute to acid rain, whether or not embryonic stem-cell research should be legal, the effectiveness of the ban on flavored cigarettes, the effects of inbreeding, and cord-blood banking. The remaining one-third of the questions were either more local in nature, such as the water-sharing dispute among Georgia, Florida, and Alabama and the effects of the H1N1 virus on our campus, or they were of a more personal nature, such as science and faith and factors related to the acceptance of evolution.

Results from the end-of-course survey indicated that overall, most of the students enjoyed the activity. Of the 47 students who rated the Hot Seat, 42.6% rated it as a five, 34.0% gave it a four, 14.9% a three, 6.4% a two, and 2.1% a one. The mean rating was 4.09 (SD = 1.01)

Students felt that the Hot Seat activity successfully helped them make connections between content learned in lecture and the real world (question 1) either in a general sense (62.3%) or with a specific example (18.9%). Two students (3.8%) indicated that they became more aware of the connection between biology and society, that some things in biology extend beyond the scientific community's concern, that there is a lot more that we as a society still need to learn, and that they learned just by coming up with their question for the assignment. Three students (5.7%) claimed that they were already aware of the connection between biology and society, and four students (7.5%) did not respond to the question.

As for increasing personal relevance (question 2), the second goal of this assignment, 52.8% of students reported an increased appreciation of the biological sciences. An additional 18.9% claimed to have gained a deeper understanding of biological topics. Another 9.4% of students responded that the disease and/or genetic topics were relevant to their family or friends, and 7.5% claimed to have changed their habits, such as promptly refrigerating leftover food. Another 7.5% did not respond to the question. One student claimed to already understand the personal relevance of biology.

Results of the survey also indicated that students felt more like participants in the class (question 3). For 7.5% of the students, this was because it was a mandatory assignment. However, 47.2% reported that they enjoyed input from and discussions with other students, and 34% commented that they felt they were able to share their point of view without feeling wrong or uncomfortable and that their voice was heard. Only one student (1.8%) reported no change in participation level, and 7.5% did not answer the question.

The third goal of this assignment was to act as an informal assessment of students' critical thinking and scientific literacy. According to student respondents (question 4), 28.3% were more aware of ways to seek reliable information and to question the source of reported research, and 20.8% were more likely to research facts before making a decision and not "go off of gossip." Another 7.5% responded that they now wanted to look at things from different angles to get a better understanding of them. A total of 16.9% claimed that they already used scientific evidence when making decisions, and another 16.9% did not address the question and instead reiterated a prior response. A total of 9.4% did not answer the question at all.

This in-class activity increased students' awareness of the relationship between biology and society as well as making it more personally relevant. Although this was partly due to students presenting their own question, it was listening to the myriad topics from other students that enabled such an impact, as exemplified by the following students' comments:

- "I was able to make the connection through listening to others' questions and responses as well as researching what I would do for my assignment."
- "It has showed me that Biology and society has a very strong bond. Because every time somebody had a question, it seemed like the whole class had an opinion on the subject."
- "I think the hot seat allows us to discuss so many different topics and really understand how biology and society correlates with one another."

Moreover, students felt like a community of learners and experienced heightened awareness of the necessity for informed decision-making skills, as can be seen in these comments:

- "I learned to question the source of the research or experiment."
- "It has helped me to research the facts before I make decisions in science and other things."
- "It taught me how to truly research a topic and not go off of gossip."

This was a course that fulfilled the required science portion of the core education requirement. Although students could have instead chosen to take a chemistry course to fulfill this requirement, many were far from eager to enroll in any science course. However, students' attitudes toward science improved greatly by the end of the course, much of which they attributed to the Hot Seat, as exemplified by these responses:

- "It has helped me tremendously. When I first reentered school, I dreaded taking any science class. That is the reason I waited until the last two semesters to take the required class to graduate."
- "I have decided that science is not as dreadful as I first thought. Now I am not majoring in science but I will at least give it a chance."

## ○ Limitations, Implications, & Recommendations

Most students seemed to enjoy the Hot Seat activity, but there were a few who did not. Of the two students who rated the activity with a score of 2, one did not enjoy speaking in front of peers, and the

other did not want to have to participate in class. The one student who rated the activity with a 1 did not respond to any other questions, other than to say to "86 it," so it is unclear why that student disliked the Hot Seat.

One of the benefits of this assignment as opposed to a traditional class debate or presentation is that students must come to each class prepared with a question because they don't know which class their name will be drawn. A limitation to this is that students who have already had a turn at the Hot Seat may begin coming to class less prepared to ask a question, because they no longer have to worry about having their name drawn. Some of this can be reduced by offering students a chance at doing a second Hot Seat for an extra point, but that would eliminate the problem only for students who choose to do it again. One way to counteract this would be to assign all students to submit a question on a weekly basis.

With respect to the goals of the activity, a limitation to the results is that they were based on self-reported data from the students enrolled in the courses. Although the results show promise that the Hot Seat helps to increase students' functional scientific literacy, further investigation is needed to make that determination. Specifically, future studies should examine whether or not regular participation in the Hot Seat activity has an impact on informed decision making beyond the classroom. A future study would also be strengthened by comparing results to those from another class taught by the same instructor that does not include a Hot Seat activity.

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