Perspectives on teaching climate science to first year undergraduate students by integrating sociopolitical contexts of climate change

Shaina Sadai[1]

[1]University of Massachusetts Amherst

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Abstract

This study investigates how course design for a first year introductory class on climate change impacts student understanding of this global issue. The course was developed to situate the scientific knowledge of climate change alongside the political, economic, and social dimensions of this human-caused crisis. This intentional course development was to give students a more holistic understanding of the causes, impacts, and solutions. The curriculum is widely interdisciplinary with scientific concepts, like the functioning of the climate system and tools of climate system research, taught alongside politics, economics, media analysis, and social justice. A teaching as research project was conducted to assess how adding the sociopolitical context impacted student's ability to situate their knowledge of the scientific basis of climate change using systems thinking. As climate change, and scientific research, operate within the social and political landscape students became more informed citizens through learning these connections. Student participants in the study have a range of backgrounds and were all majors within the college of natural sciences during their first semester of college, though not all majoring in earth sciences

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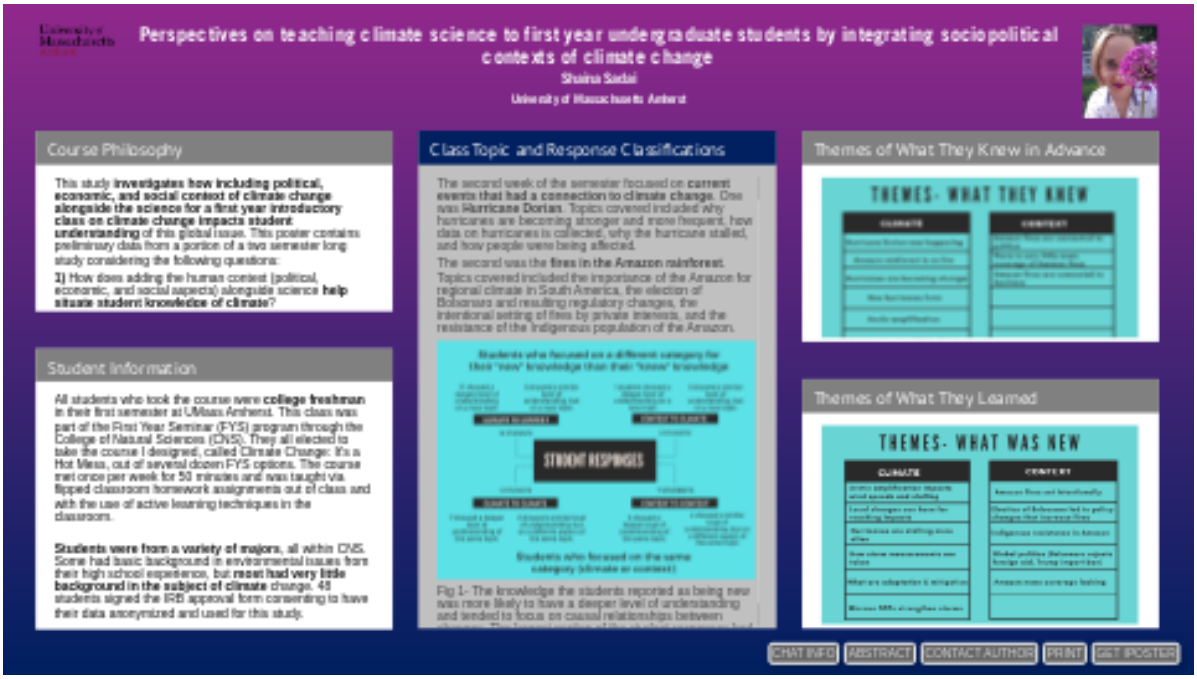

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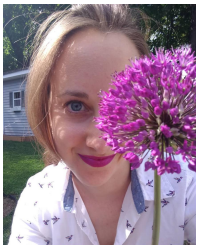

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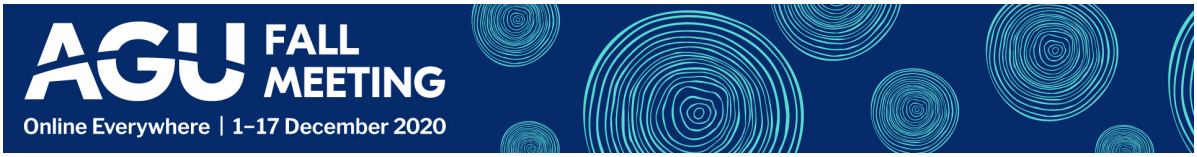

COURSE PHILOSOPHY

This study investigates how including political, economic, and social context of climate change alongside the science for a first year introductory class on climate change impacts student understanding of this global issue. This poster contains preliminary data from a portion of a two semester long study considering the following questions:

1) How does adding the human context (political, economic, and social aspects) alongside science **help situate student knowledge of climate**?

2) Which aspects are they likely to have known from outside sources prior to class and **which elements are new ways of approaching the subject** matter for them?

STUDENT INFORMATION

All students who took the course were college freshman in their first semester at UMass Amherst. This class was part of the First Year Seminar (FYS) program through the College of Natural Sciences (CNS). They all elected to take the course I designed, called Climate Change: It's a Hot Mess, out of several dozen FYS options. The course met once per week for 50 minutes and was taught via flipped classroom homework assignments out of class and with the use of active learning techniques in the classroom.

Students were from a variety of majors, all within CNS. Some had basic background in environmental issues from their high school experience, but most had very little background in the subject of climate change. 48 students signed the IRB approval form consenting to have their data anonymized and used for this study.

Methods

This poster shows learning outcomes from one day of class. Students (n=38 on that day) were asked to write written reflections after class on one thing they had known about this material before attending class, and one thing they learned that was new. The responses were then classified by whether they wrote about climate or contextual information (politics, social justice), the depth of understanding in their answers, and the specific knowledge they discussed.

Classifications for basic understanding included knowing that something was happening, for instance: "I knew the fires were occurring" or "I knew hurricanes were getting stronger." Classifications for intermediate and advanced understanding provided information on why things were occurring or drew connections between topics. For example: "I learned warmer ocean temperatures give energy to hurricanes making them stronger."

CLASS TOPIC AND RESPONSE CLASSIFICATIONS

The second week of the semester focused on current events that had a connection to climate change. One was Hurricane Dorian. Topics covered included why hurricanes are becoming stronger and more frequent, how data on hurricanes is collected, why the hurricane stalled, and how people were being affected.

The second was the fires in the Amazon rainforest. Topics covered included the importance of the Amazon for regional climate in South America, the election of Bolsonaro and resulting regulatory changes, the intentional setting of fires by private interests, and the resistance of the Indigenous population of the Amazon.

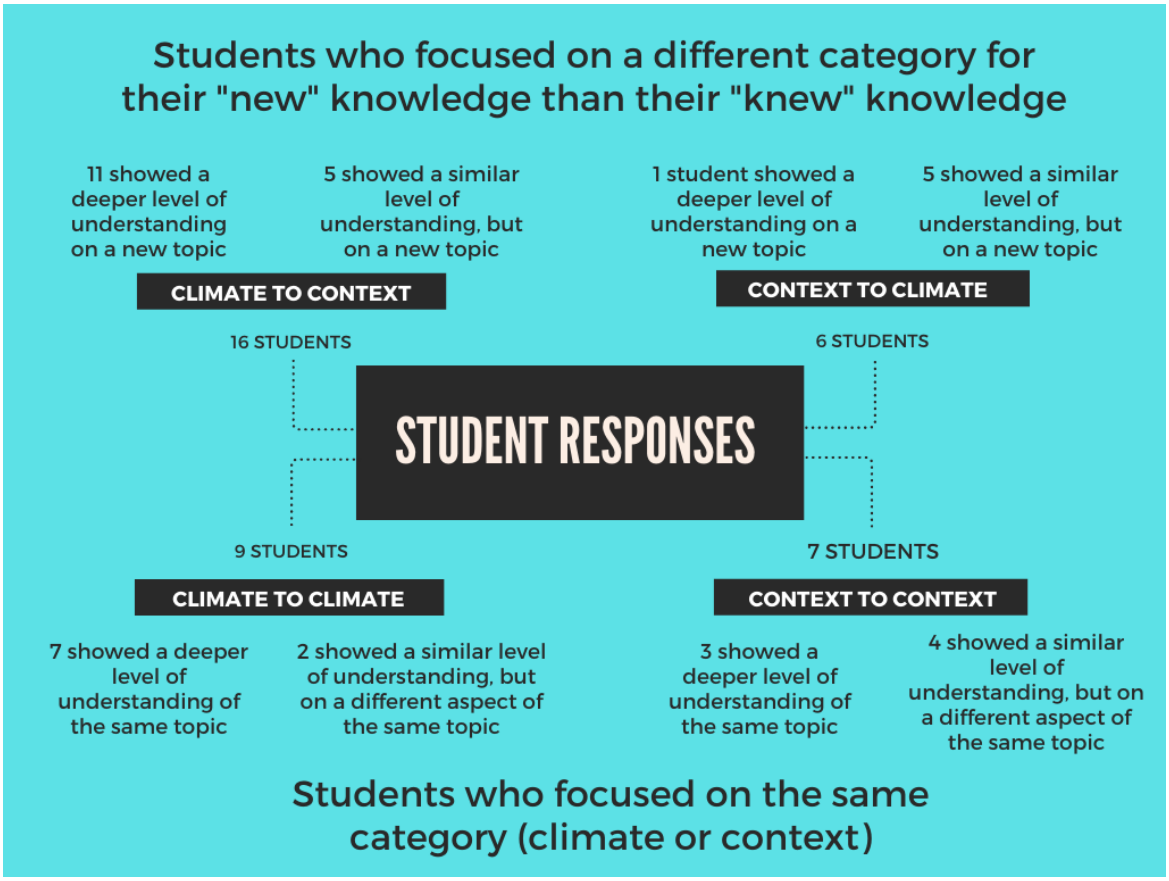

Fig 1- The knowledge the students reported as being new was more likely to have a deeper level of understanding and tended to focus on causal relationships between changes. The largest portion of the student responses had as their "knew" knowledge information that was climate based, and their "new" knowledge things that were contextual. Of this fraction of the students more than 2/3 also showed a deeper level of understanding of the material.

THEMES OF WHAT THEY KNEW IN ADVANCE

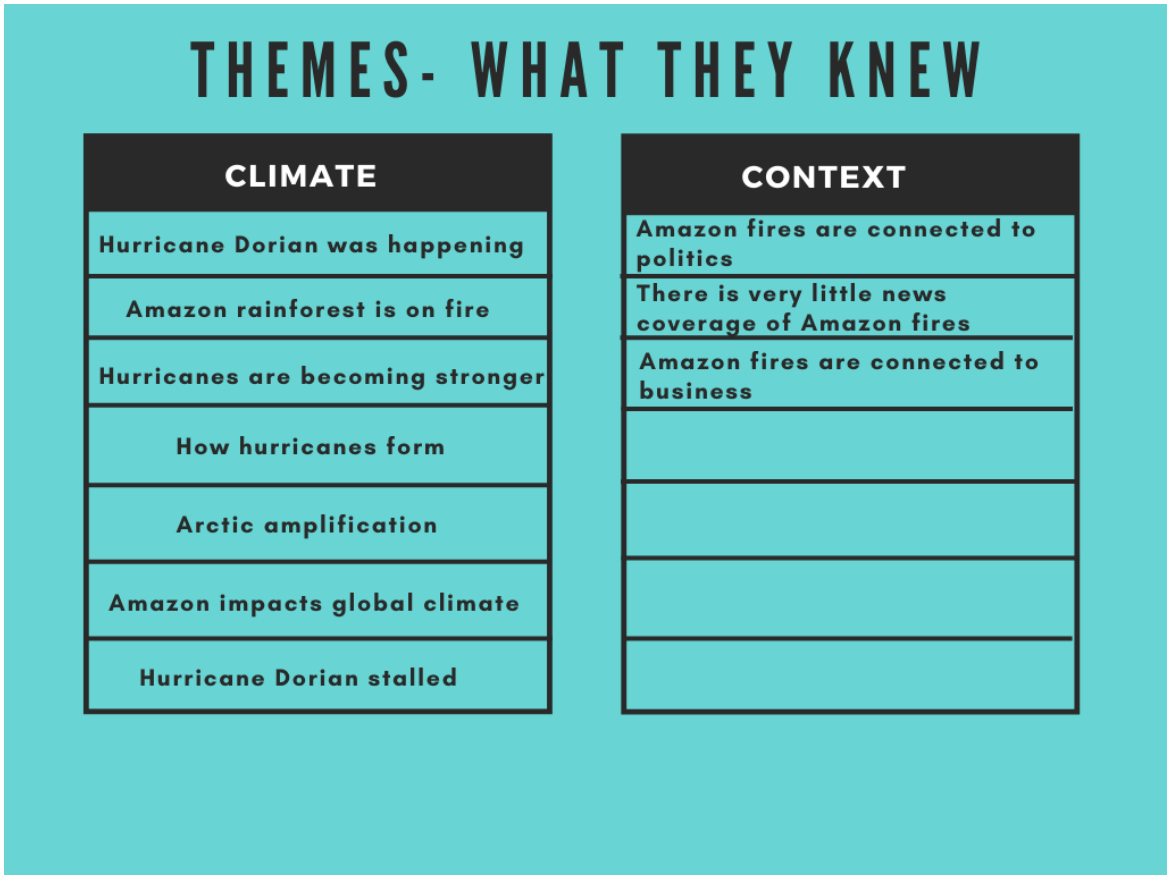

Fig 2- The knowledge that they had coming into class focused more on climate than on socio-political context. The understandings were likely to be basic, for instance that hurricanes are becoming stronger, that the fires and hurricane were occurring, or that the Arctic was becoming warmer. There was more emphasis on the fact that changes were occurring, but less emphasis on why. Themes shown here are in order of the frequency with which that topic appeared among all the student reflections.

THEMES OF WHAT THEY LEARNED

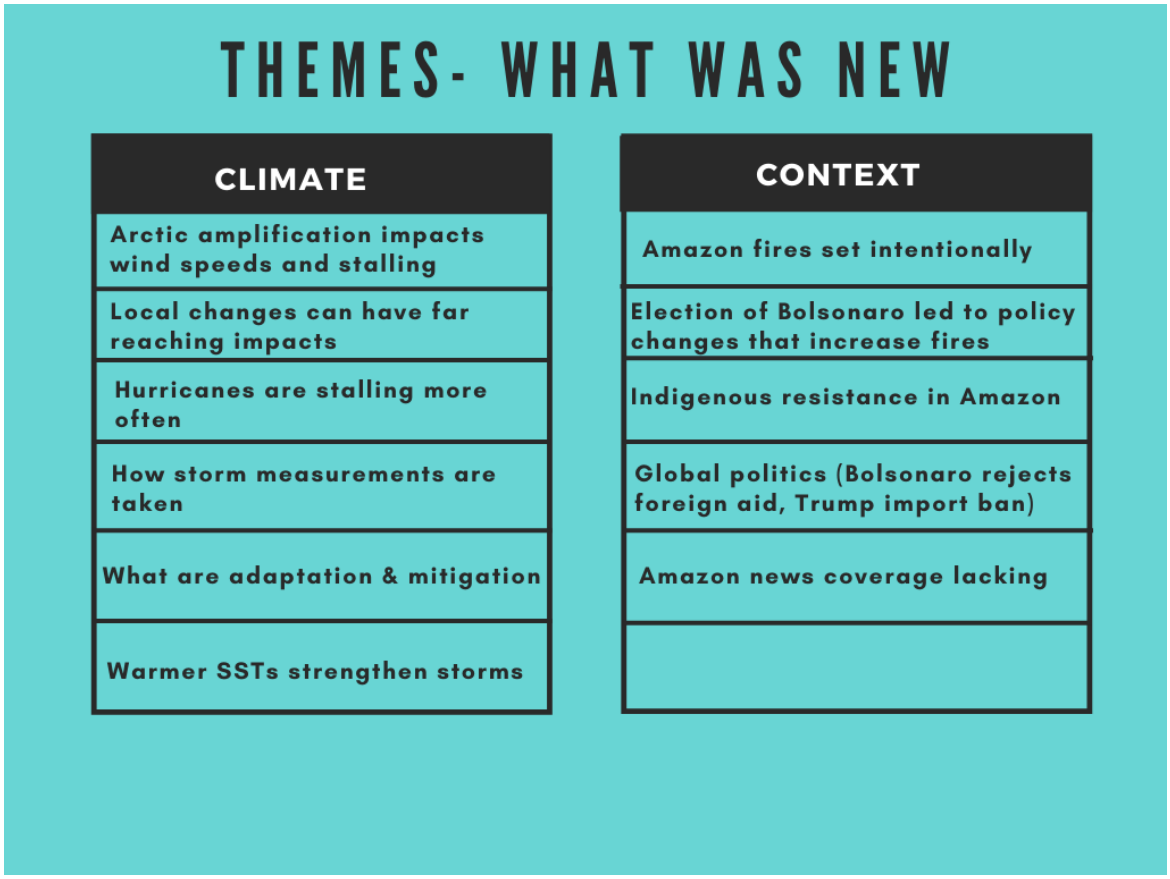

Fig. 3- In their reflections on their "new" knowledge the students had a better understanding of the context in which climate change is occurring, which is essential for becoming more informed global citizens. After class they were better able to articulate why changes were occurring and provide information on what led to the outcomes seen in both Hurricane Dorian and the Amazon fires. The order is again by frequency.

Conclusion

Including contextual information on politics and social justice had positive learning outcomes for the students. It allowed them to situate their knowledge, draw connections between the new material and what they knew prior to class, and led to increased discussion of causal connections between related topics.

ABSTRACT

This study investigates how course design for a first year introductory class on climate change impacts student understanding of this global issue. The course was developed to situate the scientific knowledge of climate change alongside the political, economic, and social dimensions of this human-caused crisis. This intentional course development was to give students a more holistic understanding of the causes, impacts, and solutions. The curriculum is widely interdisciplinary with scientific concepts, like the functioning of the climate system and tools of climate system research, taught alongside politics, economics, media analysis, and social justice.

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