Addressing Climate Change Through Biology Concepts

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Background

Climate change is a critical environmental issue with serious impacts that will require a knowledgeable public able to make informed decisions. Despite their interest in learning more, high school students currently have a limited knowledge of climate change.[1] This lack of knowledge is in part due to an inconsistent treatment of climate change in schools, and prompted the recent inclusion of climate change in the Next Generation Science Standards.[2] As states adopt these standards teachers could choose among several options for including climate change in the classroom, such as integrating it with concepts already covered in the curriculum or making room for a climate unit. By integrating climate change into the biology curriculum, through concepts such as the carbon cycle, a majority of students would learn about this issue.[3] Connecting carbon to this real world issue could increase student interest[4] or decrease interest for some students if they do not believe climate change has anthropogenic causes.[5] A number of factors associated with adults' climate change attitudes could also impact students' climate change attitudes.

Research Questions

1. Does teaching about the carbon cycle, carbon sequestration, and climate change in an integrated manner increase student interest in and knowledge about these carbon concepts?
2. To what extent are the following factors associated with student attitude about climate change?
   a) Students' perception of their parents' attitude about climate change
   b) Religiousity
   c) Prior knowledge
   d) Political preferences

Methods

Integrating Climate Change and Carbon Concepts

Data were collected from two summer science programs, Science Quest and Student Science Training Program, organized by the UF Center for Precollegiate Education and Training.

The first research question was answered with data from students in Science Quest. Participants were rising high school sophomores in two one-week offerings. Students were split into the following two treatment groups. Words in red highlight the difference between the treatments.

Week 1 - Activities in context of climate change (n=23)
- Pre-test on carbon knowledge
- Activities
  - Students move through the carbon cycle as an atom and discuss human changes to the carbon cycle
  - Students measure carbon in a tree, calculate their state's sequestration rate, and compare to emissions rate
- **Post-test**
- Interviews

Week 2 - Activities not in context of climate change (n=24)
- Pre-test on carbon knowledge
- Activities
  - Students move through the carbon cycle as a carbon atom
  - Students measure carbon in a tree and calculate carbon in the forest
- **Post-test**
- Human changes to carbon cycle, state's sequestration rate compared to emissions rate
- Interviews

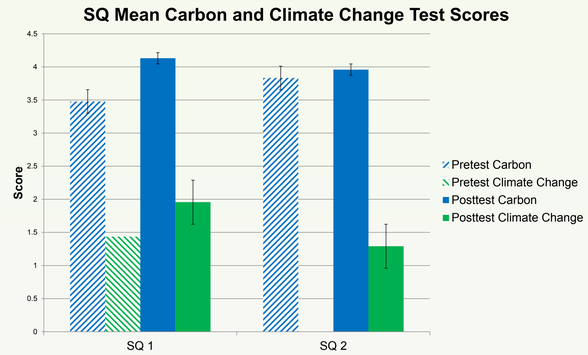
Factors Associated with Student Attitude

Research question two was answered with data from both programs. The pretests and posttests asked students about their climate change attitudes, perception of their parents' climate change attitudes, religiousity, political views, and knowledge of climate change. Spearman's correlation and a forward stepwise regression were used to explore the relationship between students' climate change attitudes and the other variables.

Results

Student Knowledge and Interest

A t-test ($p < 0.05$) found that students in Week 1 scored significantly higher on the *climate change* knowledge questions on the posttest than students in Week 2, confirming that the two treatments were different. There was a significant difference between the Week 1 pretest and posttest and no significant difference between the Week 2 pretest and posttest. There was no significant difference between the posttests. A majority (44/47) students felt learning about the connection between the carbon cycle, carbon sequestration, and climate change made the activities more interesting.



Factors Associated with Student Attitude

Two of the three groups had a significant correlation between students' climate change attitudes and their perceptions of their parents' climate change attitudes. The same two groups had a strong R square value and perception of parents' attitudes was the most significant term.

Factor Correlated with Student Attitude	SQ 1 (n=23)	SQ 2 (n=24)	SSTP (n=42)
Perception of Parents' Attitude	0.0065	0.6081	0.5881 pre 0.4338 post
Religiousity	0.0192	-0.0886	0.0832
Pretest Score	--	--	0.0438
R Square and Most Significant Term	0.15 Students' political view	0.41 Perception of parents' attitudes	0.46 Perception of parents' attitudes

Conclusion

In exploring whether integrating climate change information with biological concepts such as the carbon cycle could be beneficial, this study found that students who learned about carbon in the context of climate change made significant improvements in their knowledge of the carbon cycle and carbon sequestration over those who did not. Comments from the interviews confirm that learning about how these concepts are connected made the activities more interesting for nearly all the students. Future research could test this connection for other biology concepts since this appears to be a strategy which offers multiple benefits.

The study also suggests that with some groups, parents play an important role in shaping students' climate change attitudes. It may be important to engage adults in their child's climate change education. Student's climate change homework could involve parents so they can think about the issue together. Complementary adult education on climate change in the community could improve knowledge of the issue.

References

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