PINEMAP

UF IFAS UNIVERSITY of FLORIDA

Addressing Climate Change through Biology Concepts

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Executive Summary

An experimental test of a high school science activity suggests that connecting the biology concepts of the carbon cycle and carbon sequestration to climate change increases student interest and knowledge gain about those biological concepts. Students' perception of parents' attitude about climate change was significantly correlated with student attitude about climate change for two out of three groups.

Background

Climate change is a critical environmental issue with serious impacts that will require a knowledgeable public making informed decisions. As states meet this need by adopting education standards to include climate change, teachers could choose among several options for including the topic in the classroom, such as integrating it with existing concepts or making room for a climate unit. Integrating the basic biological concept of the carbon cycle with a real world issue like climate change could increase student interest (Bennett et al., 2007). However, students' attitudes could also be a barrier to learning if they do not believe climate change has anthropogenic causes (Robinson, 2011). A number of factors associated with adults' climate change attitudes could also impact students' climate change attitudes, including political orientation, religious views, and knowledge (Leiserowitz et al., 2007; Leiserowitz et al., 2011). Students' climate change attitudes could also be impacted by their perceptions of their parents' opinion about climate change (Eagles & Demare, 2010; Tedin, 1974).

Research Questions

1. Does teaching climate change with the carbon cycle and sequestration in an integrated manner increase student knowledge gain about carbon and interest in the activities?
2. Which of the following factors are associated with student attitude about climate change?
   a. Parents' attitude toward climate change
   b. Student's political views
   c. Student's religiosity
   d. Student's climate change knowledge

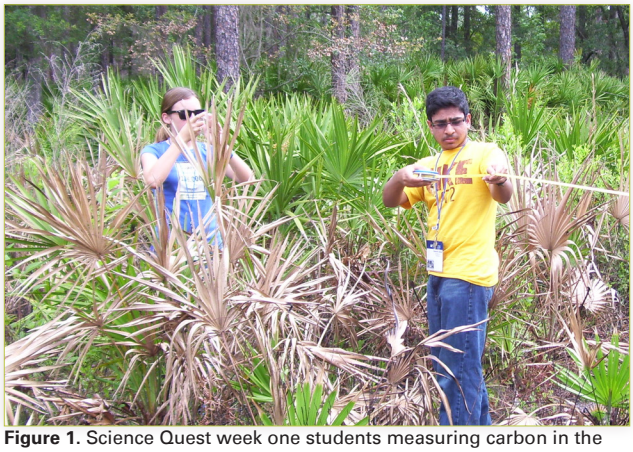

Figure 1. Science Quest week one students measuring carbon in the forest. Photo by Jessica Ireland.

Methods

Data were collected from two summer science programs, Science Quest (SQ) and Student Science Training Program (SSTP), organized by the University of Florida Center for Precollegiate Education and Training.

The first research question was answered with data from rising high school sophomores participating in Science Quest. Students were split into two treatment groups (Table 1). The first treatment group took part in activities that integrated carbon sequestration and the carbon cycle with climate change (Figure 1). The second treatment group participated in the same activities without the connection to climate change. Students' attitude about climate change and knowledge of climate change and carbon concepts were measured using pre and post surveys. Students' interest in the activities was measured using group interviews.

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.

SQ1 group - Carbon cycle activities in the context of climate change (n=23)	SQ2 group - Carbon cycle activities with no mention of climate change (n=24)
• Pretest on carbon cycle knowledge • Activities – Students move through the carbon cycle as a carbon atom and discuss human impacts on the carbon cycle – Students measure carbon in a tree, calculate their state's sequestration rate, and compare to emissions rate • Posttest • Interviews	• Prestest on carbon cycle knowledge • Activities – Students move through the carbon cycle as a carbon atom – Students measure carbon in a tree and calculate carbon in the forest • Posttest • Discussion of human impacts on the carbon cycle, state's sequestration rate compared to emissions rate • Interviews

Table 1. Comparison of SQ treatment groups.

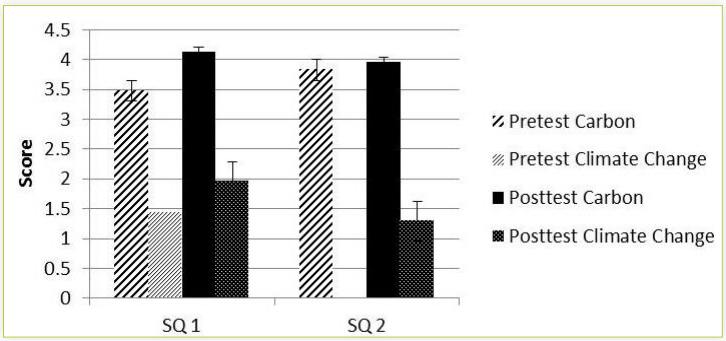

Figure 2. SQ mean carbon and climate change test scores.

Results

A t-test ($p < 0.05$) found that students in the SQ1 group scored significantly higher on the climate change knowledge questions on the posttest than students in the SQ2 group, confirming that the two treatments were different (Figure 2). There was a significant difference between the SQ1 pretest and posttest and no significant difference between the SQ2 pretest and posttest on carbon cycle knowledge. 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.

Students' climate change attitudes were significantly lower for SQ 1 than SQ 2 and SSTP. Two of the three groups had a significant correlation between students' climate change attitudes and their perceptions of their parents' climate change attitudes. None of the other factors were significantly correlated with students' attitudes about climate change. The same two groups had a strong R square value and perception of parents' attitudes was the most significant term (Table 2).

Factor correlated with student attitude	SQ1 (n=23)	SQ2 (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' attitude	0.46 Perception of parents' attitude

Table 2. Correlations between factors and student attitudes on climate change.

Implications

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 learned about carbon without climate change. Comments from the interviews confirm that learning about how these concepts are connected made the activities more interesting.

The results also suggest that with some groups, parents may 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 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.

Future research could expand the population of students and test the integration of climate change with other concepts in the biology classroom.

USDA United States Department of Agriculture National Institute of Food and Agriculture

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