Discussion of Socioscientific Issues in Classrooms to Develop Youth's Scientific Literacy About Climate Change

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OBJECTIVES

(1) How do students enrolled in the Word Generation program compare with control students, in terms of their ability to participate in a classroom discussion of socioscientific issues related to the environment and climate change?

(2) What kinds of understandings about climate change do students enrolled in the Word Generation program show in their essays?

Background

Scholarly Interest

- Science education reforms focus on inquiry-based learning environments that use discussion of socioscientific issues tied to social controversies (e.g. global warming and climate change) to improve students' scientific literacy.
- Zohar and Nemet (2002) analyzed survey data from 9th grade students (*n*=186) that participated in a program, which provided classroom discussion opportunities to debate about topics related to human genetics. Compared to students receiving only conventional instructions, the treatment group outperformed the control group in every aspect of scientific literacy including scientific knowledge and argumentation skills

Word Generation

- *Word Generation* is a research-based program that supports middle school students' development of academic language skills, by highlighting target words used in brief passages about controversial topics such as federal funding for stem cell research and the environmental concerns related to nuclear power.
- Based on a curriculum featuring 72 different topics, teachers in all major content areas facilitate discussion of the weekly topics in ways that support the development of students' ability to reason and express differing perspectives.
- Previously published studies have documented *Word Generation*'s positive effects on students' reading comprehension, teacher practice and language development for limited English-proficiency students (Lawrence, Capotosto, Branum-Martin, White, & Snow, 2011; Snow, Lawrence, White, 2009)

Lawrence, J. F., Capotosto, L., Branum-Martin, L., White, C., & Snow, C. E. (2012). Language proficiency, home-language status, and English vocabulary development: A longitudinal follow-up of the Word Generation program. *Bilingualism: Language and Cognition* (15), 437-451.

Snow, C., Lawrence, J., & White, C.E. (2009). Generating knowledge of academic language among urban middle school students. *Journal of Research on Educational Effectiveness*, 2(4), 325-344.

Zohar, A. & Nemet, F. (2002). Fostering students' knowledge and argumentation skills through dilemmas in human genetics. *Journal of Research in Science Teaching*, (39) 1, 35-62.

Methods

Study Design

In 2010, 13 inner-city middle schools in a west coast school district participated in an experimental study of the Word Generation program. Schools were randomly assigned to treatment (7) and control (6) conditions

Analysis Plan

(1) Survey Analysis

- Survey analysis of students' discussion abilities (*n*=5,400) regarding environment topics that were taught in the Word Generation program
- Students were assessed on a series of questions "how confident are you in being able to participate in a discussion about the following topics?" based on a scale of "not at all" (1) to "extremely" (5)

(2) Essay Analysis

- Narrative analyses of students training essays to assess the extent to which students internalized climate change communication.
- Students wrote essays in response to the question "What should be done to prevent global warming?"

Directions for Future Work

- Compare environment-related reading comprehension scores for students in the Word Generation program with students in the control schools
- Evaluate the extent to which students' perception of classroom-based opportunities to discuss predicts their environment-related reading comprehension scores
- Compare training essays about climate change for students in the Word Generation program with students in a comparable control group

Preliminary Results

Figure 1. *Students' Perception of Their Ability to Discuss Environmental Questions in Class (n=5,367)*

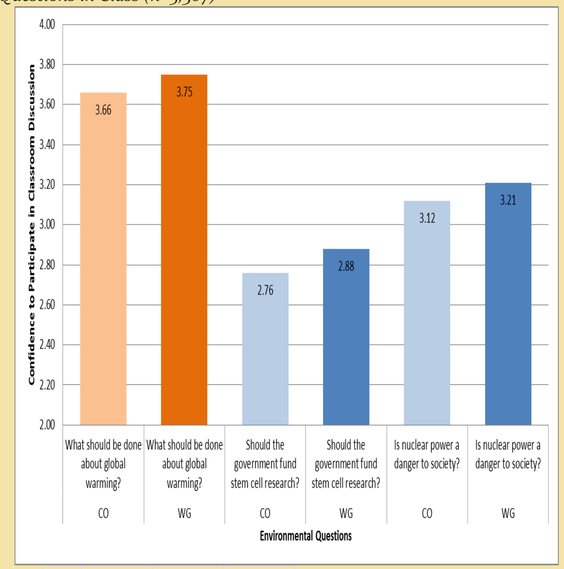

Figure 2. *Narrative Analysis Matrix of In-class Discussion Theme (n=3)*

			Student A	Student B	Student C
Word counts			105	98	50
Number of sentences			5	12	4
Sequence	Does the essay present a flow of reasoning, or of events, or of other logic?	Sequentiality	Yes	No	Yes
		Main story	Citizens of the work should take responsibility in global warming	People should take care of the earth	We should take care of the planet
		Relevance (# of the main story supporting sentences divided by total sentences)	100% (5/5)	8.3% (1/12)	100% (4/4)
Characterization	Who are the characters in the essay?		Hair spray	Weather, Earth	Factories
Voice /Focalization	Are there multiple focal points and voices? Who are they?		I, citizens of the world, we, some	I, people, scientists	we, they (unspecified)
Norms and Moral Judgment	Does the essay contain normative statements about right and wrong, correct versus erroneous paths of action, moral judgments?	Normative Statements	"Sometimes I still use hair spray which in some way is ignoring the problem for whatever reason we need the product." "Some might even say that is selfish."	"Scientists have hypothesis but they aren't always correct" "People try to be attentive to the earth but other people destroy it"	
		Recommended Action	"In order to prevent global warming, we as citizens should do our part by really trying to ignore such substances that will have a bad effect on global warming."		"They need to stop having factories" "They need to recycling and stop polluting"
Facts/Truth Claims	Does the essay present any statements that seem like statements of fact or truth-claims		"Hair spray is really bad for the ozone layer."	"If the earth get bad, we won't be able to live in it"	"Factories have smoke all in the earth's air". "Some of them have steam go into the air and that makes the earth hot."

Preliminary Results

Research Question 1

Word Generation students were given discussion opportunities for the series item (#1) about global warming, but not for the series items (#2) relating to stem cell research and nuclear power. Control students did not receive discussion opportunities for any of the series items.

- Students in the Word Generation program reported more confidence about their abilities to participate in a classroom discussion about global warming (3.75) than students in the control group (3.66). T-test report this to be statistically significance $t(5{,}365) = 2.58$, $p < .001$. (See Figure 1)
- Moreover, students in the Word Generation reported more confidence about being able to discuss topics that were not taught

Research Question 2

Students responded to the question "What should be done about global warming?" (See Figure 2)

All three students have recognized a need to take action against global warming which validates the effectiveness of the classroom discussion of global climate change (see sequence – main story for supporting evidence).

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Please visit www.wordgeneration.org for more information.