

Changing the Way We Teach Global Climate Change

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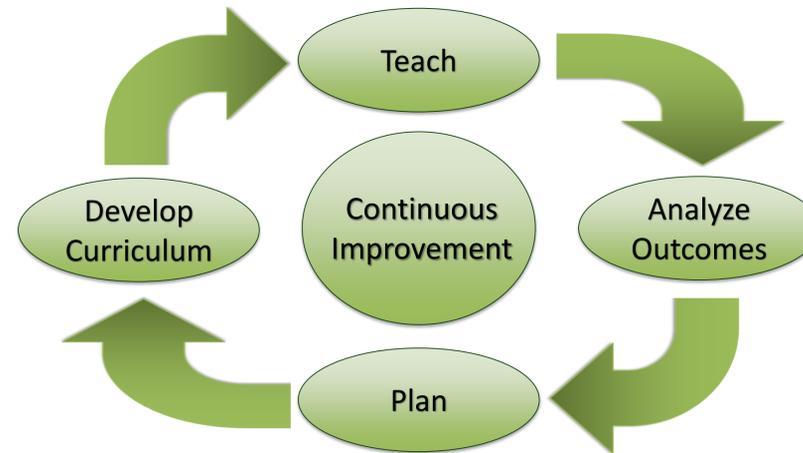
Abstract

The goal of the Climate Change Narrative Game Education (CHANGE) project¹, funded by NSF (DRL-1316782), is to help high school students learn complex GCC science by making it personally relevant and understandable. The CHANGE prototype curriculum, including standardized tests and surveys, was integrated into three high schools' elective Marine Science courses as a pilot during AY 2014-15. Following the continuous improvement model suggested by Imai², the student outcomes were analyzed, and two major areas for improvement were evident. (1) Student learning in specific topic areas was lower than expected and (2) student learning was inconsistent between instructors. Root-cause analysis of these shortcomings revealed that the first issue was due to gaps in the instruction and lab material provided to teachers. In the second case, the material was sufficient, however the material was outside the area of expertise of some teachers, resulting in inconsistent outcomes among student populations. In order to address these shortfalls, major portions of the classroom and laboratory curriculum were revised, along with the creation of sample class discussions and notes, which provide guidance to teachers on difficult topics.

Objectives

- ◆ Identify areas of CHANGE curriculum that need improvement.
- ◆ Recommend & obtain approval for realistic plan to overcome any major shortcomings before full implementation in is AY 2016-17.
- ◆ Upon approval of stakeholders, update curriculum as needed.

Approach



Continuous Improvement of Teaching²

Analysis

Students rank-order GCC causes, highlighting typical teacher misconceptions

Issue	Correct order ³	*Pre (N=243)	*Post (N=218)
Burning Fossil Fuels	1	6	1
Automobiles	2	3	3
Farming/Agriculture	3	1	6
Deforestation	4	2	5
Nuclear Energy	5	4	4
Ozone Depletion	6	5	2

*Pre - Marine Science student responses at beginning of AY

**Post - Marine Science student responses at end of AY

Student misconceptions about climate change science on EOC exam

- ◆ GCC causes skin cancer
(no actual link)
- ◆ Arctic sea ice melting is the primary cause of sea level rise
(floating ice cannot cause sea-level rise)
- ◆ Higher pH is more acidic
(lower pH is more acidic)
- ◆ Agricultural run-off is closely associated with climate change

Planning

- ◆ Must be complete before start of AY 2016-17.
- ◆ Rework instruction and lab material to address shortfalls.
- ◆ Create sample lessons and notes for teachers.

Curriculum Development

- ◆ Redesigned 6 slide decks
 - ❖ 73 slides encompassing 5 chapters
 - ❖ Addresses identified shortfalls
 - ❖ Emphasizes GCC science & effects in Tampa Bay region
- ◆ Authored 5 sample lessons (72 pages of text)
 - ❖ Teaches the teacher on difficult topics
 - ❖ Each slide highlighted for quick reference
 - ❖ Poses questions for students along with answers

Conclusions

- ◆ AY 14/15 pilot incorrectly **assumed teachers** already **possessed technical knowledge** about GCC
 - ❖ Misinformation presented to students, or
 - ❖ Lack of instruction for some topics
- ◆ **Student knowledge** of scientific concepts were **overestimated**
 - ❖ Better background information is needed
- ◆ Path ahead:
 - ❖ Pilot updated curriculum in AY 15/16
 - ❖ If successful, fully implement in AY 16/17

References

- 1-Climate Change Narrative Game Education (2015). <http://bit.ly/CHANGE-USF>
- 2-Imai, Masaaki - (1986). *Kaizen: The Key To Japan's Competitive Success*. McGraw-Hill. ISBN 0-07-554332-X.
- 3-Karl, T. R., Melillo, J. M. & Peterson, T. C. *Global Climate Change Impacts in the United States*. (2009).