Title

The Role of Preservice Teachers' Quantitative and Covariational Reasoning in Understanding Climate Change

Abstract

This article analyzes how three mathematics preservice teachers (PSTs) reasoned quantitatively and covariationally while making sense of the Earth's energy budget (EB)—a model of energy circulation within the Earth's climate system—and discusses how their quantitative and covariational reasonings influenced their understanding of climate change. The PSTs completed the EB task during an individual, task-based interview; the task explored two concepts that are key to understanding climate change: The Earth's EB and the link between carbon dioxide (CO2) pollution and global warming. The results showed that quantitative and covariational reasoning played an important role in shaping the PSTs' understanding of climate change, extending the usefulness of these theories from the mathematics education domain to the science education domain. More specifically, when these two types of reasoning supported the realizations of an EB with multiple equilibriums and an increase in global temperature as a response to increasing CO2 levels, the PSTs could describe and model why CO2 pollution causes global warming. Conversely, if their reasoning did not support those two realizations, then they develop misconceptions about the EB and global warming. The results suggest that strengthening quantitative and covariational reasoning in connection to climate change can prepare mathematics and science teachers to teach it.

Authors

González D.A.

Author full names

González, Darío A. (57222173387)

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57222173387

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Affiliations

Facultad de Educación, Universidad Autónoma de Chile, Santiago, Chile

Authors with affiliations

González D.A., Facultad de Educación, Universidad Autónoma de Chile, Santiago, Chile

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Correspondence Address

D.A. González; Facultad de Educación, Universidad Autónoma de Chile, San Miguel, Ricardo Morales 3369, Santiago, Chile; email: dario.gonzalez@uautonoma.cl

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