

# Reconceptualizing teacher professional development for climate literacy using learning progressions

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## Introduction

Our study investigates a model of professional development for informal and formal science educators. We focus on the inclusion of learning progressions in a professional development academy on climate change.

## Background

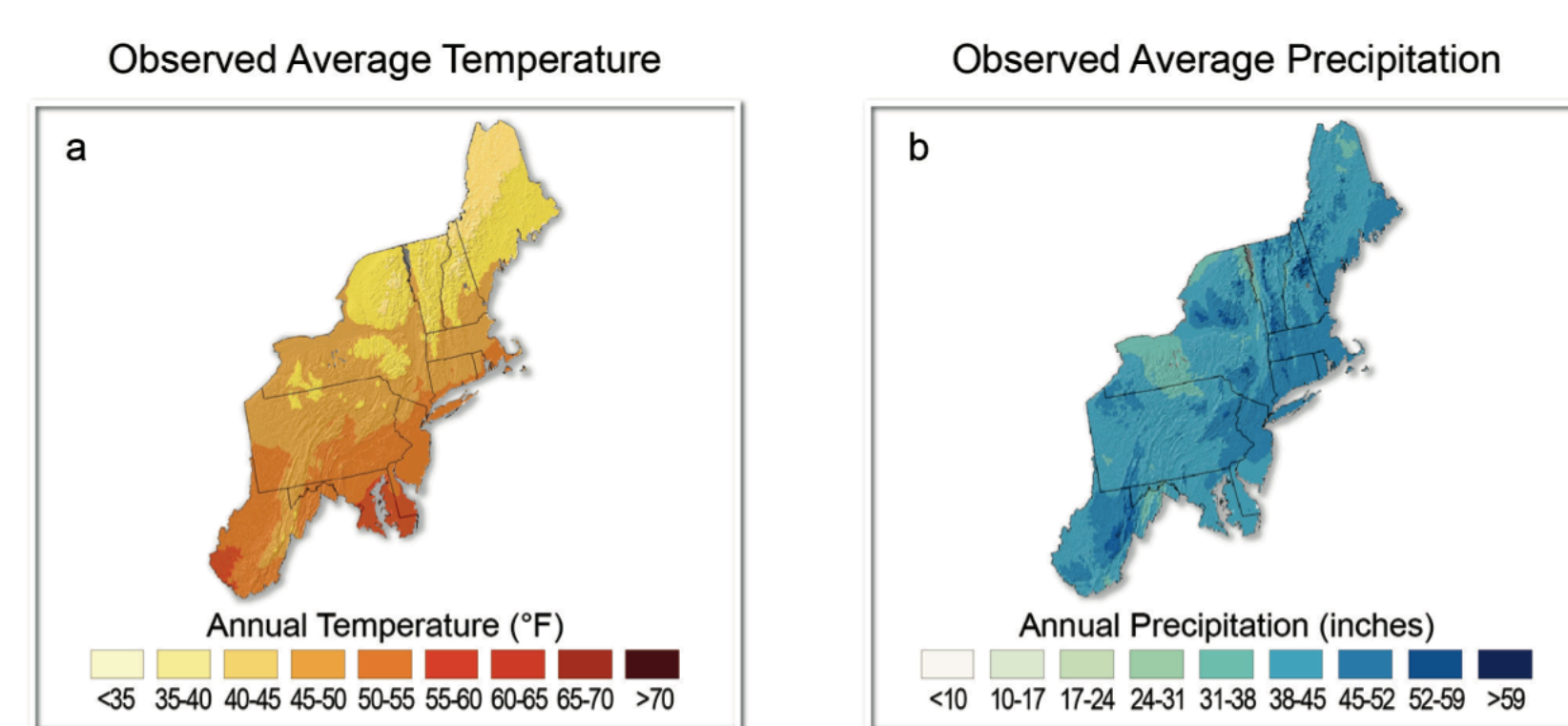
**Learning progressions** theory posits that “big ideas can be understood in progressively more sophisticated ways as students gain in cognitive abilities and experiences with phenomena and representations” (Smith et al., 2004, p. 5).



We are developing and empirically testing three hypothetical learning progressions:

- sea level rise
- extreme weather
- urban heat island effect

Our project addresses climate change education through the lens of **regional observations** (NCADAC, 2013), with the goal of supporting learners in constructing explanations about climate change relevant to their own lives and communities.



|               |  |
|---------------|--|
| Northeast     | Heat waves, coastal flooding due to sea level rise and storm surge, and river flooding due to more extreme precipitation events are affecting communities in the region.                             |
| Coastal areas | Coastal lifelines, such as water supply infrastructure and evacuation routes, are increasingly vulnerable to higher sea levels and storm surges, inland flooding, and other climate-related changes. |

Regional observations from National Climate Assessment (2013), maps from p. 550

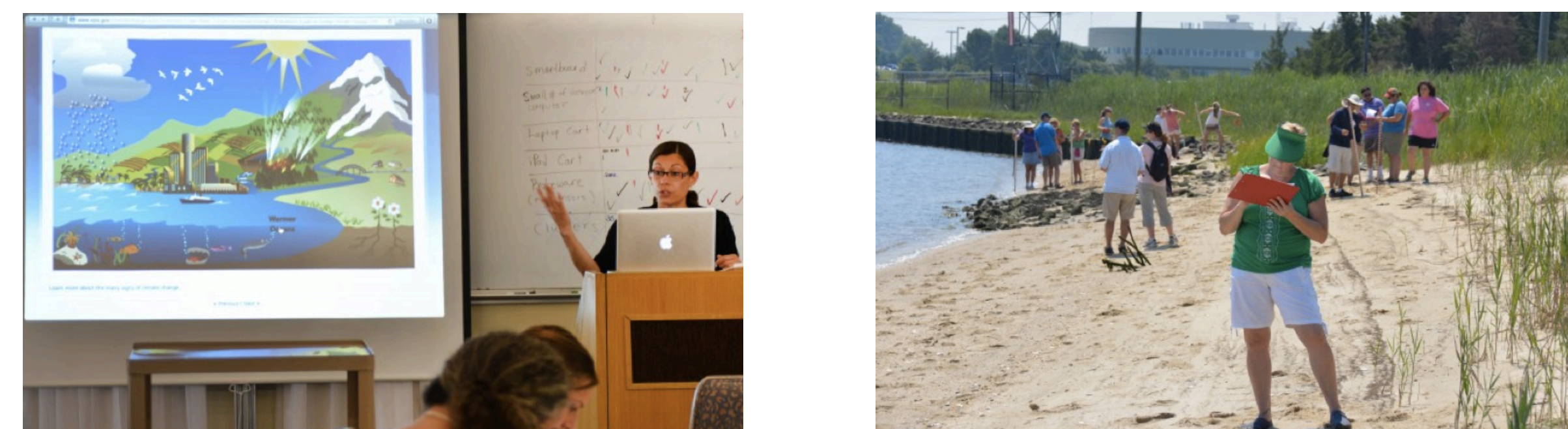
## Research questions

1. How do educators understand learning progressions and see the relevance of learning progressions to their teaching about climate change?
2. How does a *regional observations* approach to climate change education inform educators' thinking about how they will address climate change in their own teaching?

## Context and participants

Our study context was a weeklong professional development Climate Science Academy in summer 2013. Participants (N=28) were middle school (n=16), high school (n=6), higher education (n=2), and informal science educators (n=4) from Delaware and Maryland. Participants:

- Engaged with vetted classroom resources related to climate change,
- Examined NGSS components relevant to climate change
- Developed climate science learning segments to be implemented in their teaching contexts during the 2013-2014 school year.

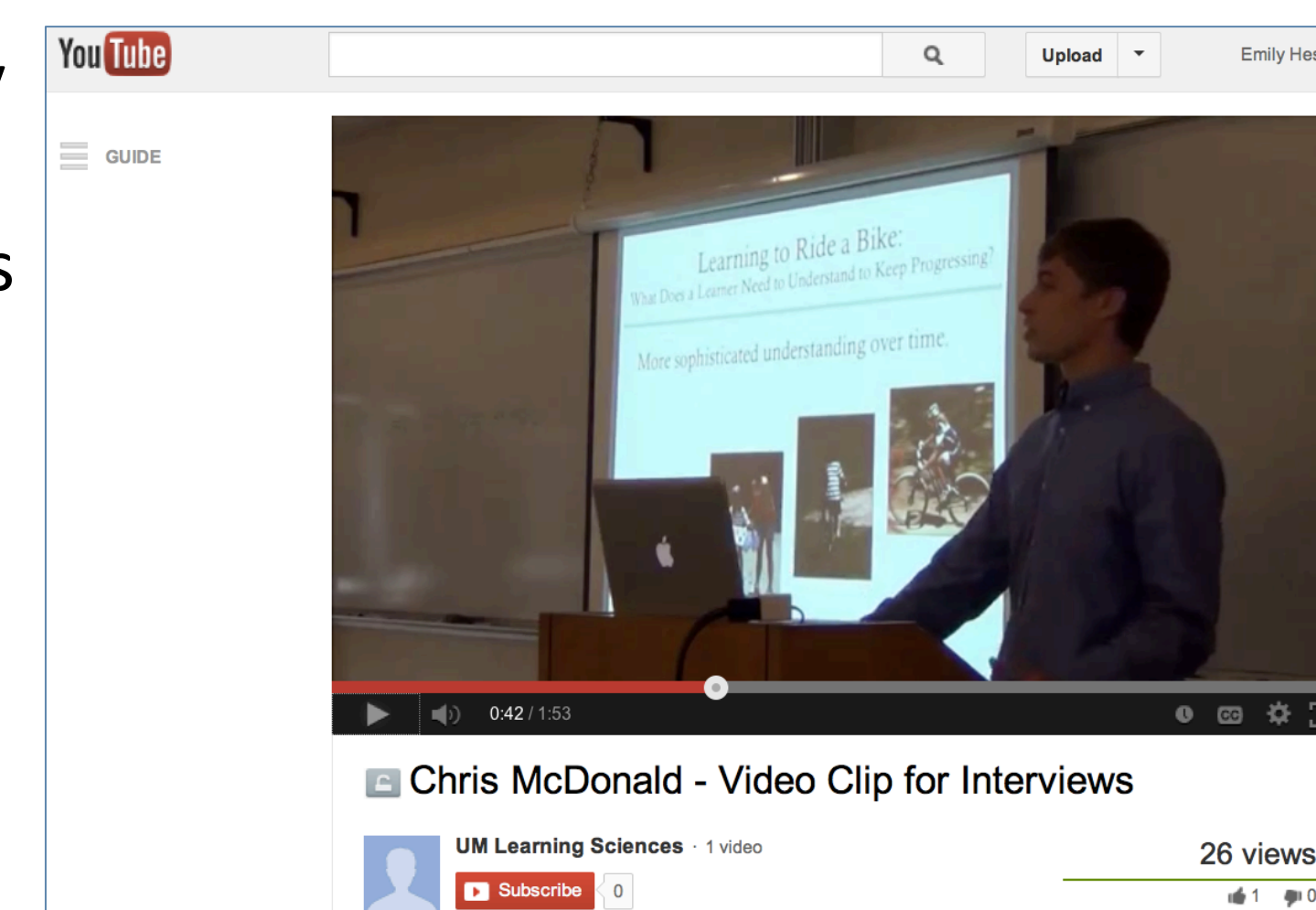


Participants were presented with an informational session on learning progressions and a draft hypothesized learning progression on sea level rise. They utilized the sea level rise learning progression as they developed their learning segments, and were asked to consider collecting information about their students' understanding of sea level rise. In this way, educators would take the role of co-researchers, helping to validate the learning progression.

## Methods

**Interviews.** During the interviews, participants watched brief video clips, recorded during academy sessions. Participants then responded to questions regarding their thinking about learning progressions and climate change education.

**Sample question:** *In the videotape selection from the Climate Science Academy, what did you learn about how learning progressions can guide your teaching about sea level rise, an example of a locally relevant effect of climate change?*



**Questionnaires.** Before and after the academy, participants answered items related to their perceptions of the climate change topics most relevant to learners in their teaching contexts. These items provided additional insight into our *regional observations* research question.

**Sample question:** *Does your geographic location influence how you approach teaching about climate change? For example, are certain topics more relevant or interesting for your students based on where they live? Please explain.*

## Data

We present preliminary data from three participants who provided insight into our research questions – an informal science educator, a pre-service high school science teacher, and an experienced middle school science teacher.

|  | Research question 1:<br>Learning progressions<br><i>Participants, by expertise (formal, nonformal) and experience, perceived learning progressions differently.</i>   | Research question 2:<br>Regional observations<br><i>Teaching context (urban, suburban) and existing practices may inform participants' thinking about regional observations.</i>  |
|--|---|---|
| Beatrice, Informal science educator (urban park)     | [Interview] <i>Learning progressions help identify targets for learning in terms of me developing programming... It will help refine the process of feedback. So are they actually learning? What are they learning? And how are they processing that?</i>  | [Interview] <i>I'm always right there on site [at the park] so I'm not interpreting polar ice by looking at polar bears... The point is that locally is always how I do my education...</i><br><br>[Questionnaire] <i>Climate change is currently focused (public understanding) on sea level rise, so many people don't understand/value the connection to our urban center.</i>   |
| Alison, Pre-service teacher (high school chemistry)  | [Interview] <i>I think you always need to have, like a baseline, and then you gain a little bit more knowledge, and then you can expand on that.</i><br><br><i>...I can't just tell [students] at the beginning, "Thermal expansion makes the sea rise." So we're doing activities, like, okay well we'll heat some water and you tell me if it rises in the tube, what do you think is going to happen? ...So we can then talk about, well how do you think that this is involved in our environments?</i> | [Interview] <i>I think it's a big thing that kids need to... link everything together because that's what's important and making it personal.</i><br><br><i>...at the end of the year they're like, 'we don't understand why we learn this this and this', and it kills me, but I was always like 'Because we have to.' ...If they came at the end and they linked everything together and realized why we did it? I just I think that would be awesome.</i><br><br>[Questionnaire] <i>Students relate to the factors affecting climate change and the negative results a city has.</i> |
| Richard, Experienced teacher (middle school science) | [Interview] <i>...We have to be cognizant that students come from a variety of levels.</i><br><br><i>...the learning progression allows us to sort of group them differently and look at them more as individual learners, or a group of learners, at a place rather than trying to, trying to put them on a different scale...It doesn't do so much labeling of the individuals, rather looking at the group and trying to move them along.</i>  | [Interview] <i>Talking about global climate change... you have to keep that in mind... many students may not have had much interaction with that.</i><br><br><i>And what little interaction they had... could have been directed through media, their own personal experiences and conversations</i><br><br>[Questionnaire] <i>Being in a suburban environment does not lend itself well to field experiences that could enhance the way students look at the impacts of climate change.</i>  |

## Future directions

We will study the implementation of participant-developed learning segments, attending to the benefits and challenges of incorporating learning progressions and regional observations into climate change education.



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