Advancing Atmospheric Science Education Research (ASER): Reflections on a 3-Day Workshop

Developing Expertise and Building Collaborations to Advance Atmospheric Science Education Research (ASER)

This material is based upon work supported by the National Science Foundation under Grant No. (AGS-2224006).

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University of Nebraska – Lincoln

AMS Annual Meeting
33rd Conference on Education
Baltimore, MD
February 1st, 2024

Zachary James Handlos — Georgia Institute of Technology
Peggy McNeal — Towson University
Kathy Quardokus-Fisher — University of Notre Dame
Anne Lammes — University of Nebraska - Lincoln

Donna Charlevoix

Call for research-based approach to teaching & learning (Charlevoix 2008)

History of ASER

Donna Charlevoix

"Community of Practice"

EARTH EDUCATORS' RENDEZVOUS
MADISON, WI JULY 18-22, 2016

Call for research-based approach to teaching & learning (Charlevoix 2008)

Todd Ellis

Cindy Shellito

Donna Charlevoix

Dawn Kopacz

Lindsay C. Maudlin

Wendilyn J. Flynn

Todd Ellis

Rebecca Batchelor

Kathy Quardokus Fisher

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Swarndeep Gill

Lindsay C. Maudlin

Zachary J. Handlos

Dawn Kopacz

Adam Hirsch

Wendilyn J. Flynn

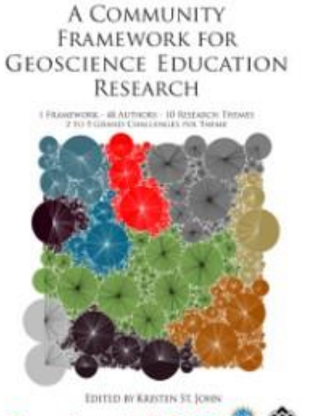
Peggy McNeal

Daphne LaDue

Cody Kirkpatrick

Dawn Kopacz

Involvement in & Perception of ASER (IPASER) Survey (Kopacz et al. 2021)



Cervato et al. 2018

AMS Ad Hoc Committee on ASER & IPASER Survey - Recommendations

Please describe your most valuable professional development (training) opportunity related to teaching & learning.

Themes	Training (%)	Professional development (%)
Longer term	75.8	62.7
Internal	49.5	38.6
External	18.9	28.1
Graduate school	29.8	2.6
Informal	23.5	20.2

Develop longer-term training & professional development, including at the graduate level

(Kopacz et al. 2021; NRC 2012)

Peggy McNeal

Wendi Flynn
Cody Kirkpatrick
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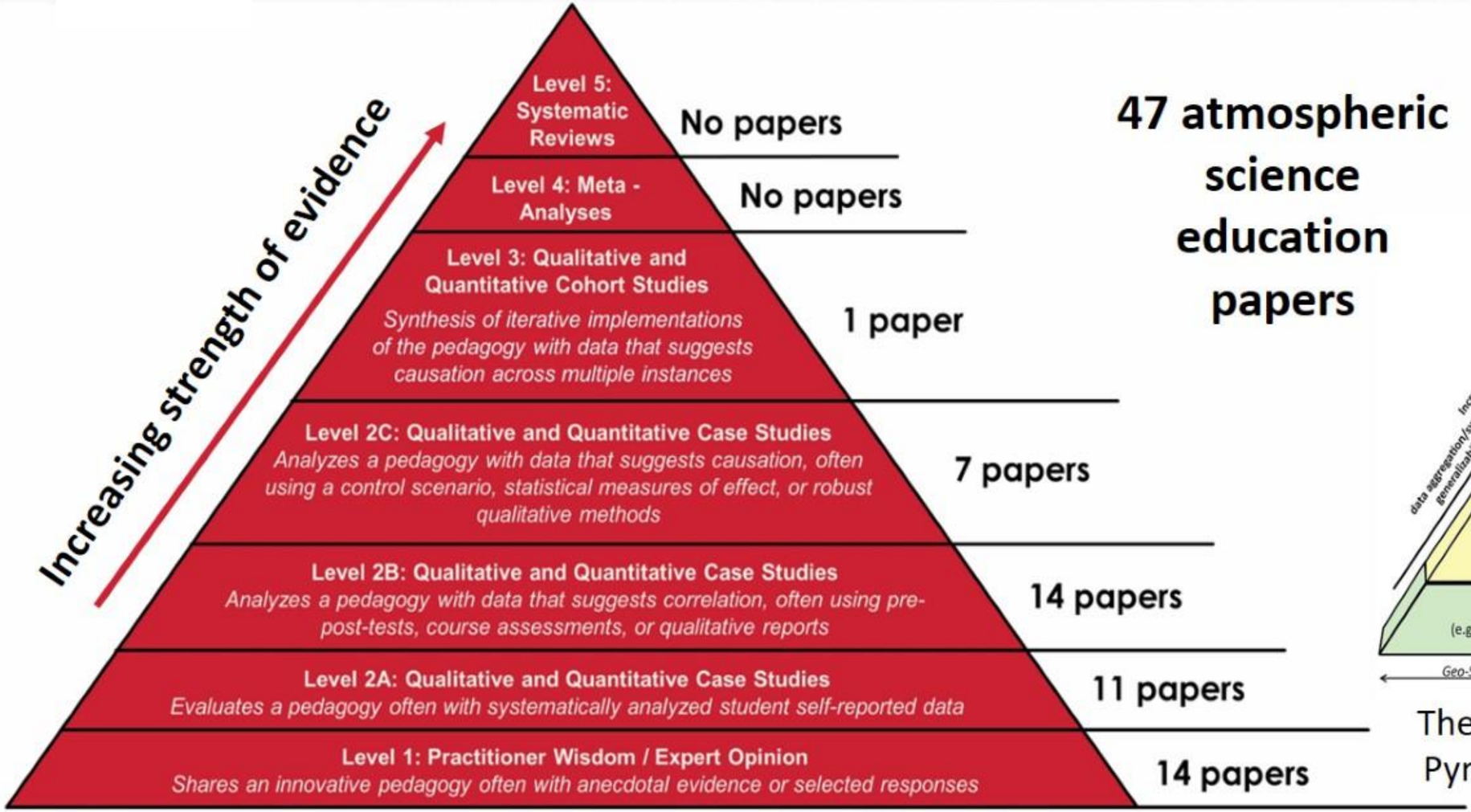
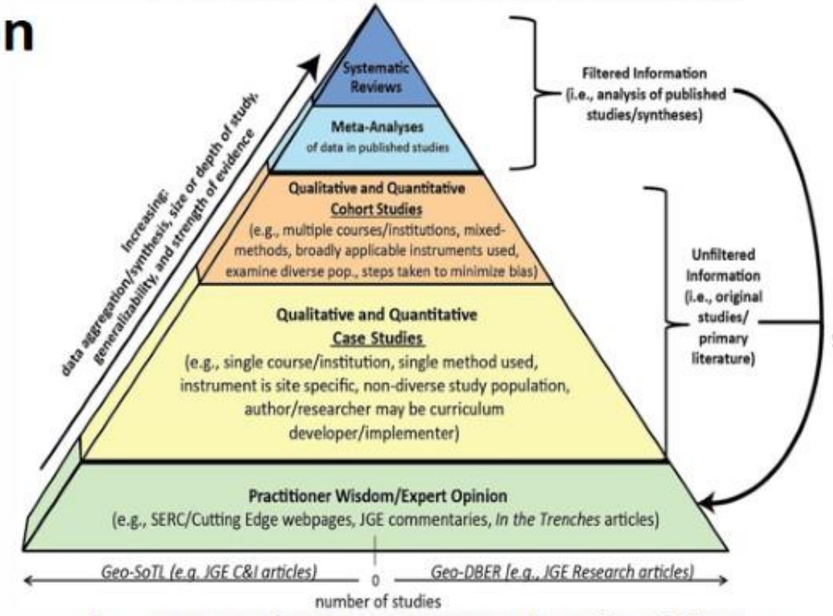
Daphne LaDue
Lindsay C. Maudlin

State of ASER

Systematic review of the atmospheric science education literature (McNeal et al. 2022)



47 atmospheric science education papers



The Geoscience Strength of Evidence Pyramid (St. John and McNeal 2017)

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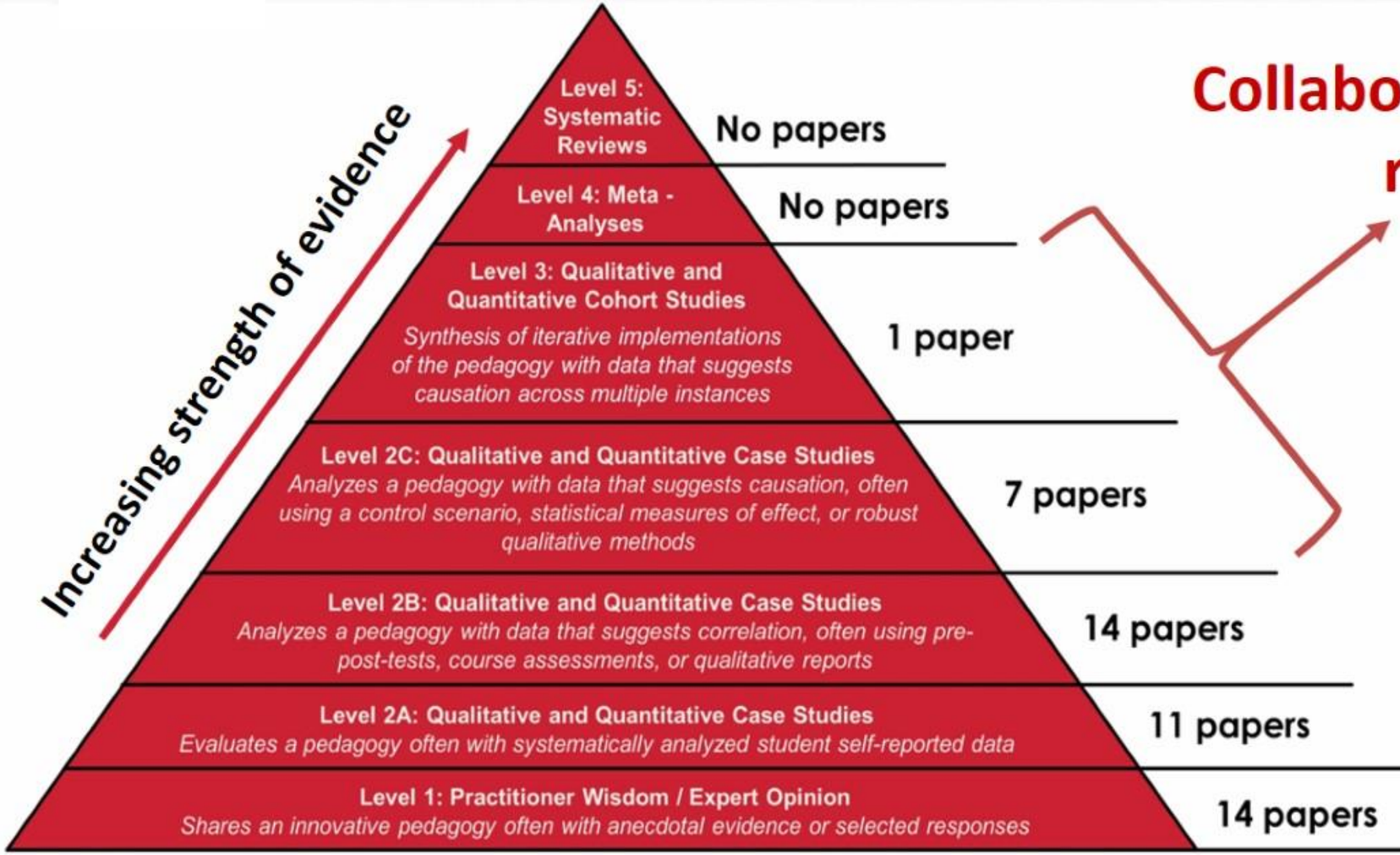
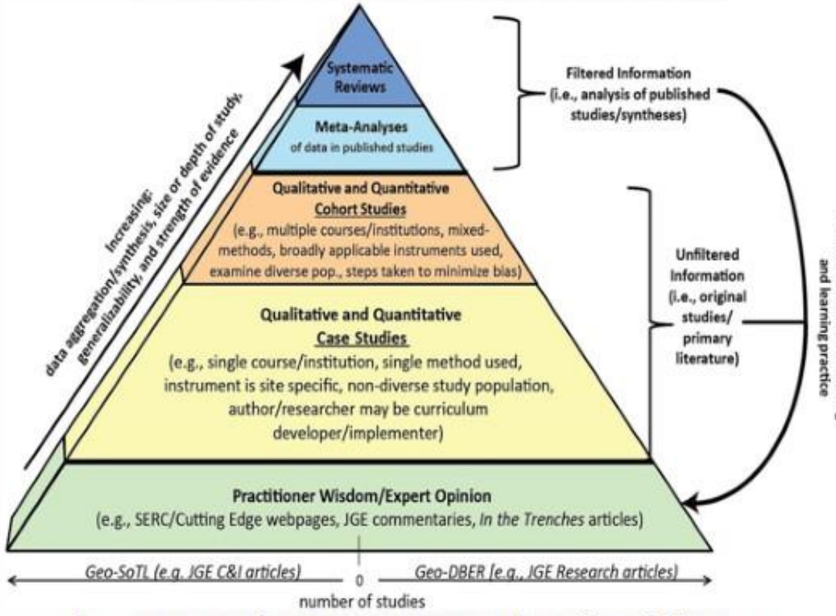


Collaborations with education research experts



The Geoscience Strength of Evidence Pyramid (St. John and McNeal 2017)

Developing Expertise & Building Collaborations

- Discipline-based education research (DBER) requires expertise in the discipline AND in education research
- Most atmospheric scientists are not professionally trained in education research

→ Collaborations & professional development experiences can be an important pathway for newcomers

Developing Expertise and Building Collaborations to Advance Atmospheric Science Education Research (ASER)

Professional Development Workshop

Purpose

- Enhance the education research skills of atmospheric science educators through training provided by education research mentors.
- Build collaborations between education research mentors, current ASER scholars, and atmospheric science educators that will lead to well-designed education research projects with concrete goals and deadlines.

Topics Include

- Introduction to Education Research including the Scholarship of Teaching and Learning (SoTL)
- Introduction to Qualitative Methods
- Introduction to Statistical Analysis for Social Science Research
- Research Design
- Theoretical Frameworks
- Funding Your Research

Goals

- Develop collaborative projects with other attendees
- Receive targeted feedback on the project that your team develops
- Become more involved in the ASER community

Minneapolis, MN

May 22-24, 2023

Keynote Speaker:
Dr. Kim Kastens
Special Research Scientist at Lamont-Doherty Earth Observatory of Columbia University

Apply by Jan. 18, 2023!

Click Here

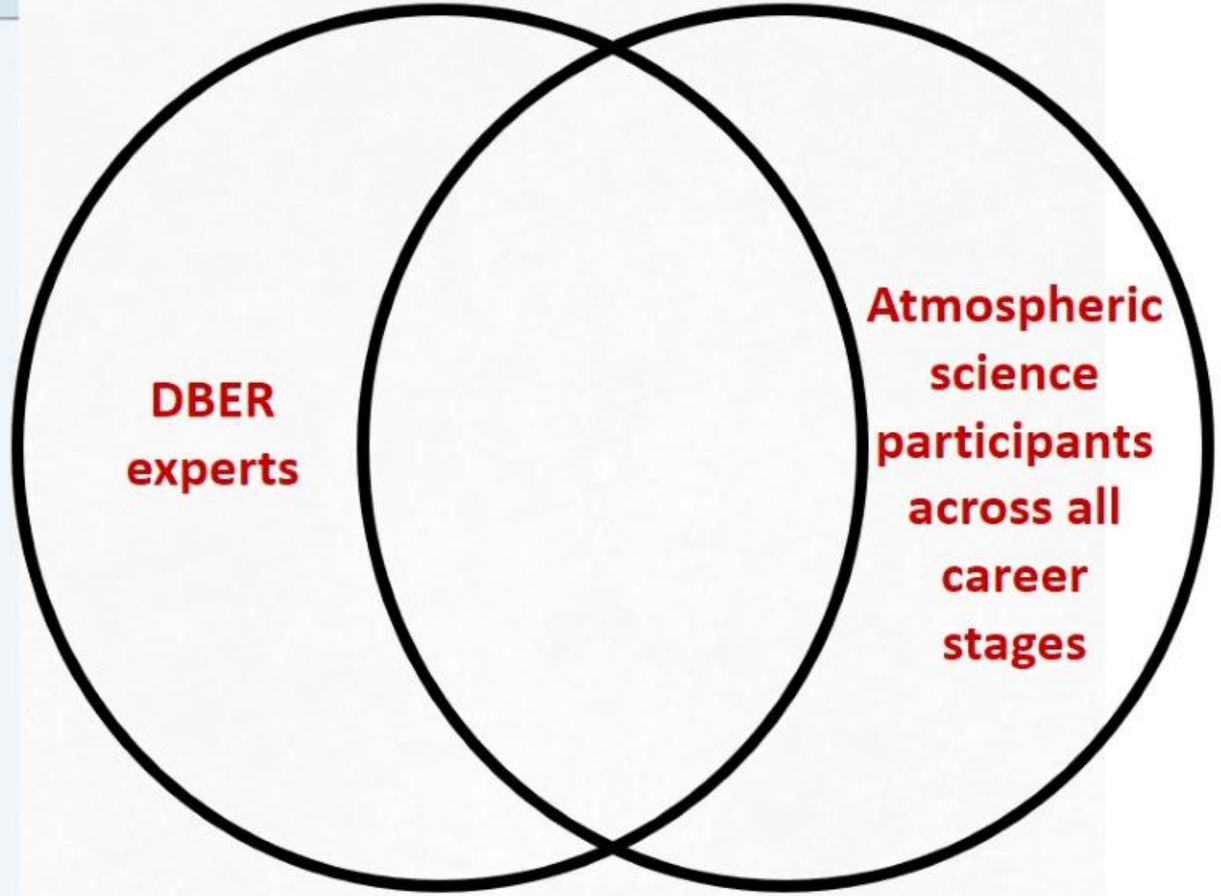
Organizers:
Dawn Kopacz
University of Nebraska-Lincoln

Zachary J. Handlos
Georgia Institute of Technology

Peggy McNeal
Towson University

Kathy Quardokus Fisher
Florida International University

ASER Workshop



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ASER

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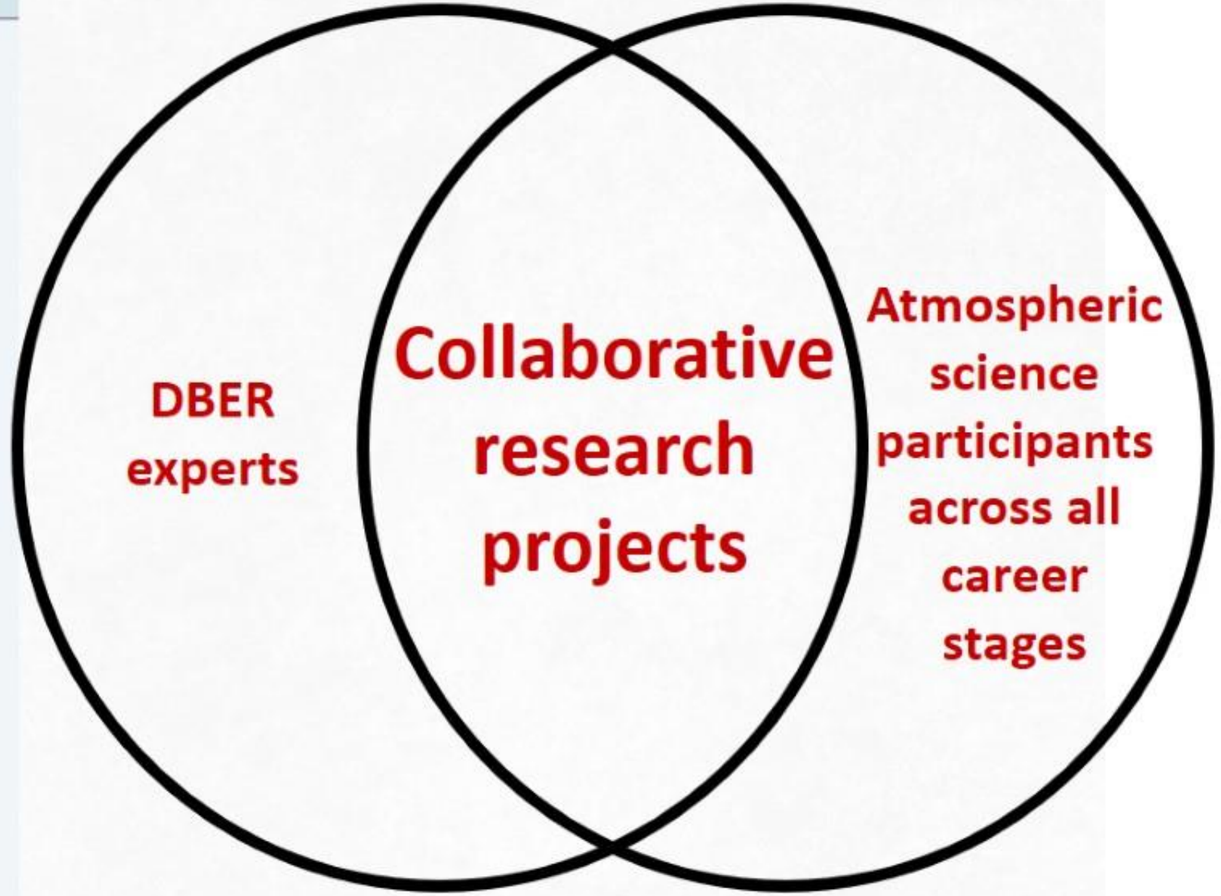

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ASER Workshop

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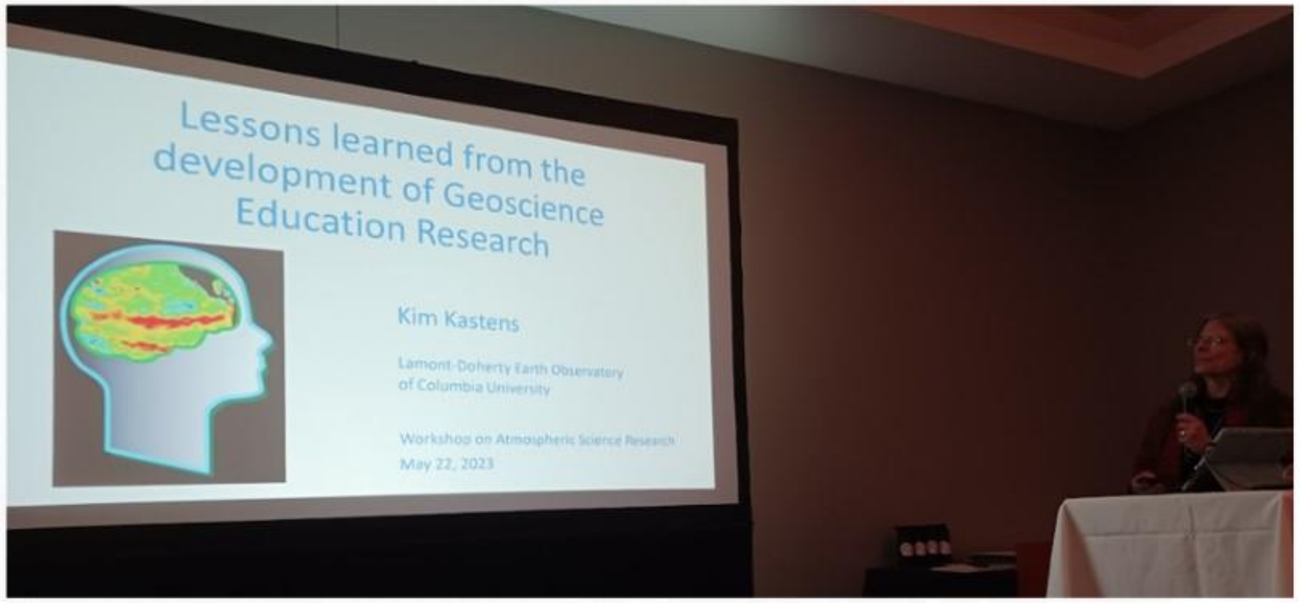
Kim Kastens
Lamont-Doherty Earth Observatory of Columbia University

Workshop leadership team:

Dawn Kopacz
Zachary Handlos
Peggy McNeal
Kathy Quardokus-Fisher
Anne Lammes



ASER Workshop

5 Education Research Mentors

- Education Research Design
- Qualitative Methods
- Quantitative Methods
- Theoretical Frameworks
- Publishing & Funding Your Research

Dr. Laura Lukes

Dr. Heather Petcovic

Dr. Darryl Reano

Dr. Julie Sexton

Dr. Doug Czajka

Theoretical Frameworks

Prepared by Laura Lukes, PhD May 2023 for the Atmospheric Science Education Research (ASER) Workshop, Minneapolis, Minnesota.

Disclaimer: There isn't consensus around theoretical frameworks. Here's one definition: 'a set of theoretical assumptions that explain the relationships among a set of phenomena' (Camp, 2001)

Developing a theoretical framework in DBER

- Familiarize yourself with the major paradigms of educational research (there are many, let's go with positivist, interpretivist/constructivist, critical, and pragmatic—paradigms connect epistemologies with research practices) and situate yourself as a researcher [Use Kivunja & Kuyini 2017, p. 30-38]
  - This will guide your research Q's, methods (data collection & analysis/interpretations), and conclusions
  - But also how you discuss prior research/findings in literature review—what paradigms were used in these studies to make sense of the phenomenon?
  - You need to be able to articulate your general set of beliefs that underpin your research methods (this is essential in qualitative and mixed research methods)

Publishing and Funding your Atmospheric Science Education Research

Developing Expertise and Building Collaborations to Advance Atmospheric Science Education Research (ASER) Workshop, May 22-24, 2023

Compiled and presented by Heather Petcovic, Western Michigan University, with contributions from Alison Jolley, Research Editor, Journal of Geoscience Education

heather.petcovic@wmich.edu

Part 1: Publishing your Research

Congratulations on having completed your ASER study. Now what? Your work is not complete until you share it with peers and colleagues (and other researchers cite you). But where should you publish your study? And how can you set your paper up to successfully navigate the peer review process?

Resources provided by mentors

Education Research Design Handbook

Education Research Design Handbook
Julie Sexton

Table of Contents

ASER Workshop

21 Total Participants:

- 4 graduate students
- 6 early career
- 8* middle career
- 3 late career

*2 middle career participants regretfully could not attend due to personal reasons

Summary of Research Themes in Community Framework

St. John, K. (Ed.) (2018). *A Community Framework for Geoscience Education Research*. National Association of Geoscience Teachers. Retrieved from https://doi.org/10.25885/ger_framework/15

Conceptual Understanding: Functional and integrated knowledge of atmospheric science. Includes student ideas and their development, disciplinary standards of knowledge, and how to teach them

Teacher Education: Preparation and ongoing education for K12 teachers. Includes content coursework, pedagogy coursework, clinical experience, alternative pathways, K12 partnerships, standards, certifications, accreditation

Societal Problems: Challenges that impact people and have an atmospheric science component (e.g., environmental social justice, severe weather communication). Includes integration of challenges in lessons, student understanding and motivation

Access and Success: The ability of students and professionals to join and thrive in the atmospheric science community. Includes impact of intersectionality on experiences, inclusiveness, equity and diversity

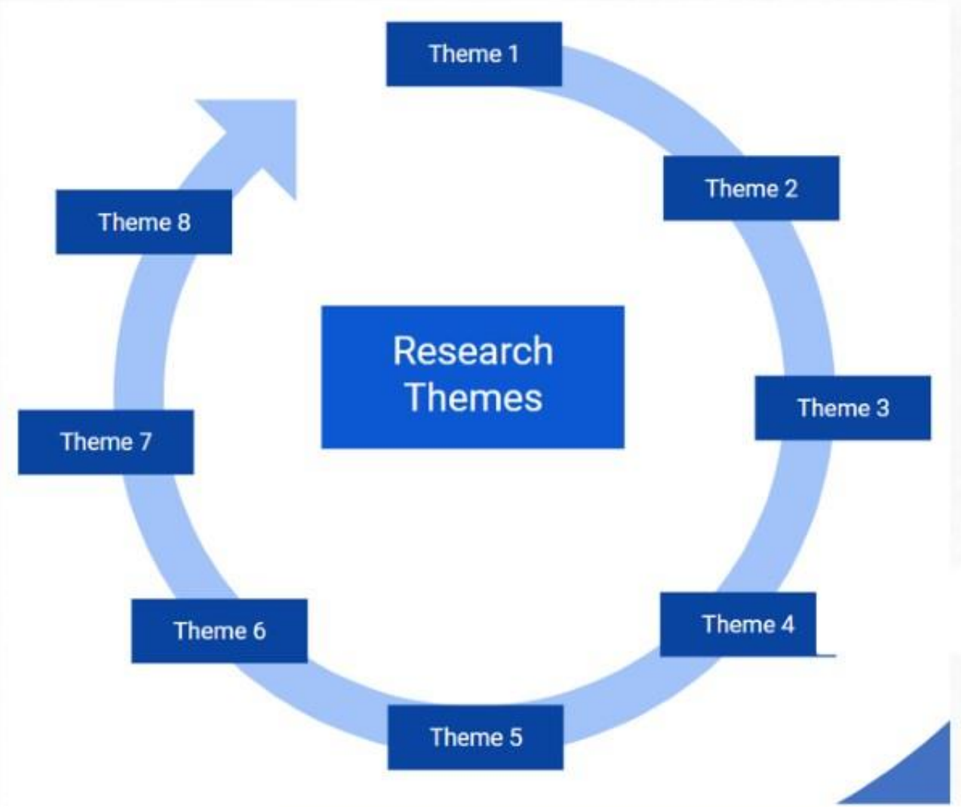
Cognitive Aspects: Habits of minds and ways of thinking that occur when acquiring or using knowledge. This includes quantitative knowledge, problem finding and solving and use of models

Instructional Strategies: Methods, strategies, and settings for teaching atmospheric science. This includes informal and formal learning, lesson and course design, technologies, and pedagogy

Metacognition and Affect: Mental processes and emotions that impact learning. This includes self-regulation, attitudes, beliefs, self-reflection and motivation

Institutional Change and Professional Development: The analysis of people and structures that impact atmospheric science education and how to promote change within them. This includes: individual learning, community learning and change, and professional development

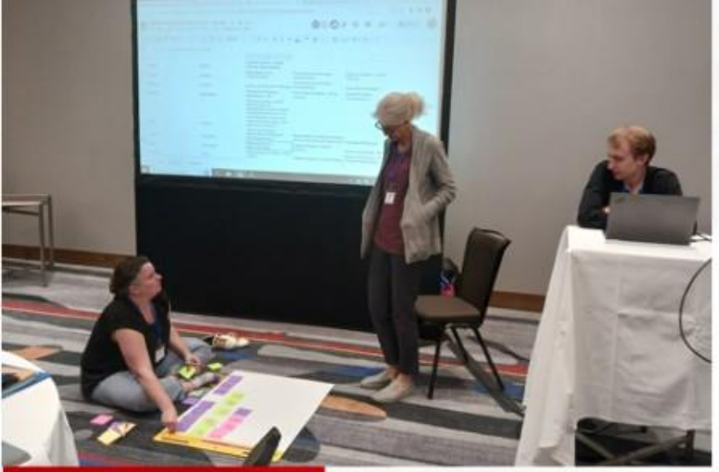
Day 1



Round 1 Brainstorm research questions ideas
24 minutes

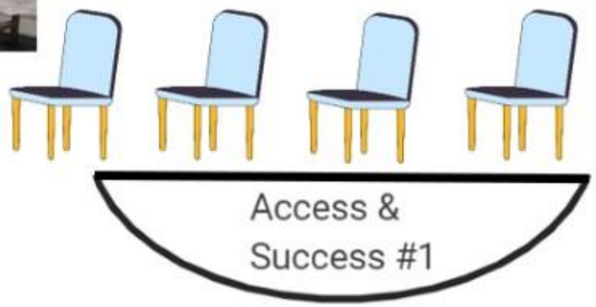
Round 2 Read questions and possibly add more
16 minutes

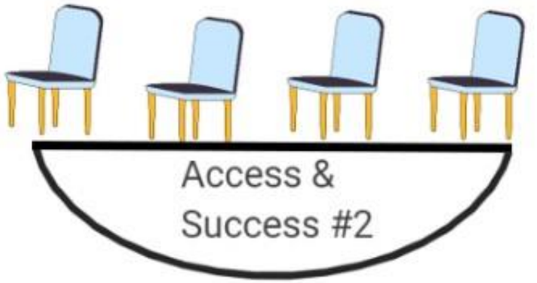
Round 3 Place your name on your top 3 questions of interest
5 minutes

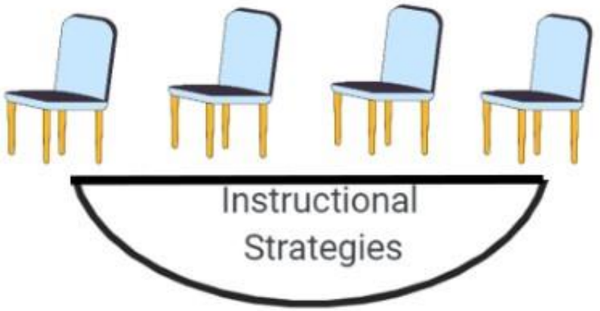


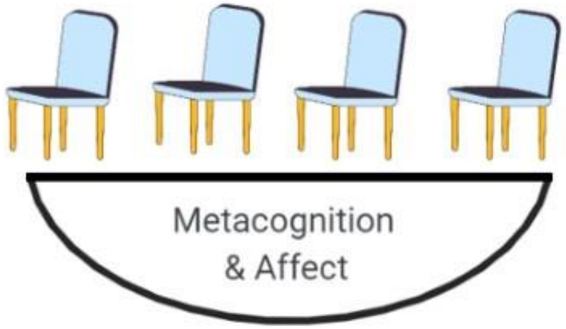
Day 1

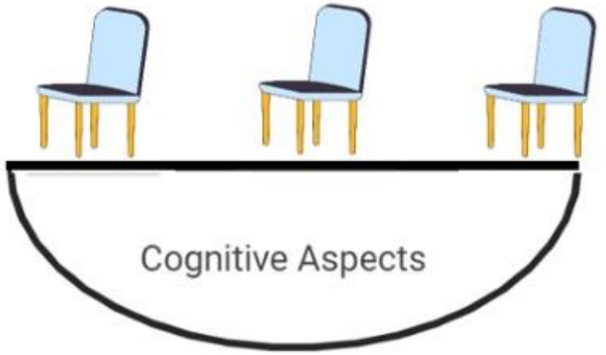
Research Groups











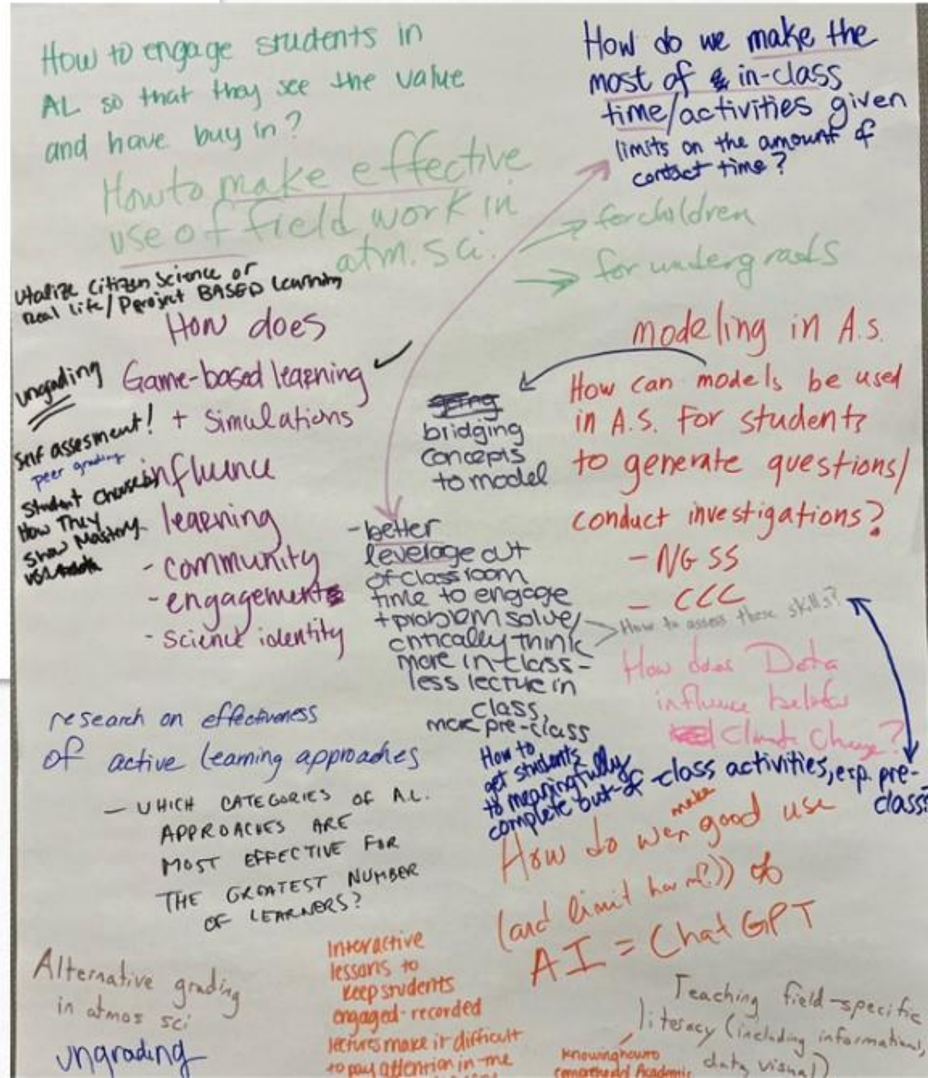
Day 2

Research Planning Worksheet

Discussing Your Goals (9 - 10 AM)

Use this worksheet as a guide during Tuesday's small groups sessions to help you outline key information about your group's research topic.

- Review the poster from yesterday's Gallery Walk for your group's assigned theme (see Day 2 Materials - Gallery Walk Photos on Google Drive). What observations from yesterday's Gallery Walk activity were most interesting to you and your group?



Jigsaw Professional Learning

Day 2

1	2	3	4	5
Choose Topics	Attend Topic 1	Switch!	Attend Topic 2	Group Work: Drafting Research Questions
8 minutes	40 minutes	2 minutes	40 minutes	Next Session

Education Research Design
Qualitative Methods
Quantitative Methods
Theoretical Frameworks
Publishing & Funding Your Research

Day 2

Research Planning Worksheet

Developing Research Question(s) **(11:45 AM - 12:30 PM)**

- Review your notes from the earlier workshop sessions and reflect on discussions with your group. As a group, draft one or more research questions below. You are encouraged to use the mentors for consultation, discussion, and feedback.

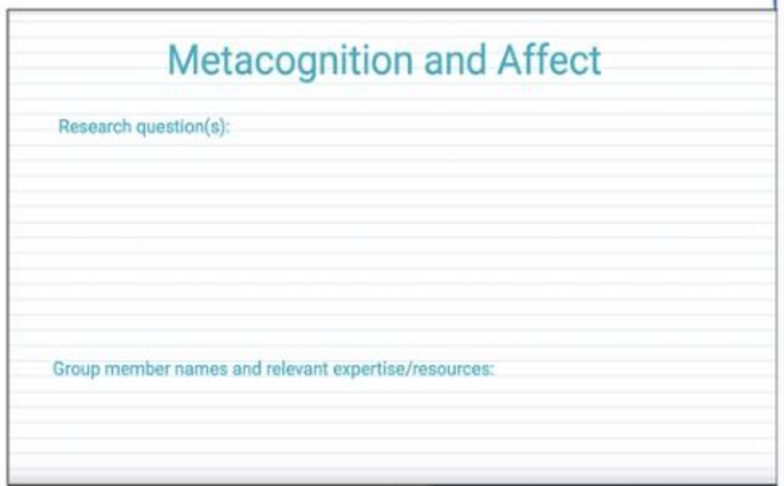
ASER

Drafting Research Questions

(45 minutes)

This afternoon, you will build on a research question and develop project ideas.

- Generate ideas for research questions with your group.
  - Please use the mentors for consultation, discussion, and feedback.
- Enter your preliminary research questions in the Drafting Research Questions Jamboard
- You can access this Jamboard in the Day 2 Materials folder



Individual Work Time

- Visit the Drafting Research Questions Jamboard slide
- Review each group's slide; Add questions/comments
  - What types of data will they need to collect?
  - Does the group have the necessary expertise/resources?
  - What additional expertise/resources will they need?
- A few minutes before 1pm, take some time to review your group's feedback

Day 2

Research Planning Worksheet

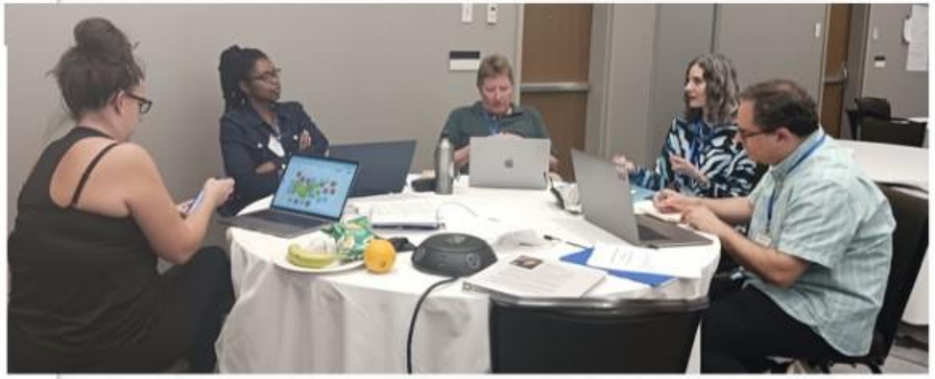
Literature Review & Assessment (1:30 - 3:00 PM)

- Search the Internet for any literature relevant to your research question(s). Make note of any resources that you have found. Record key information from each resource that pertains to your research question(s).

Research Planning Worksheet

Develop Action Plan (3:15 - 4:45 PM)

Develop an action plan for investigating your research questions. Here are discussion questions to consider creating your action plan:



Day 3

Share your journey (so far)

- Research theme and theoretical framework
- Expected methods
- Research questions
- Areas for feedback

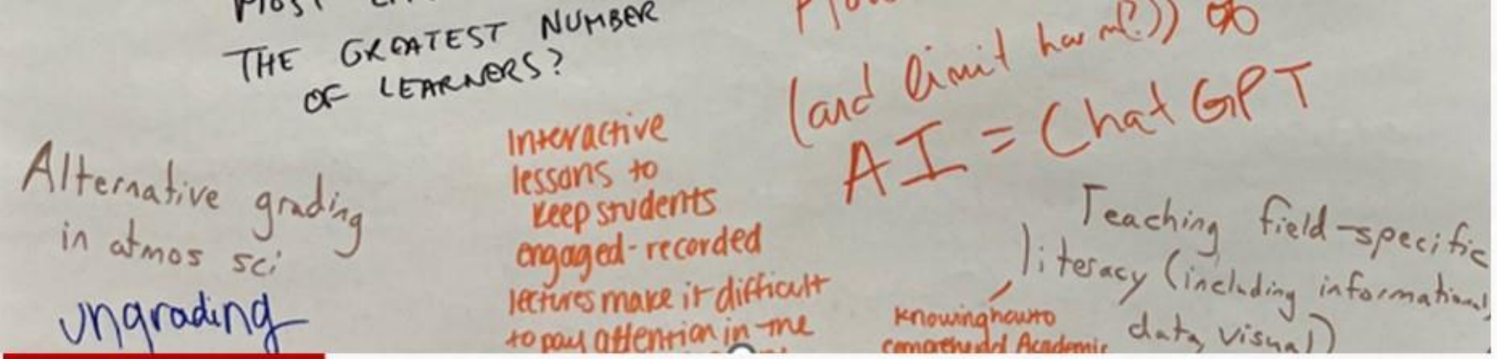
Funding Your Research Panel: Questions

What are ways to stay informed on updates to funding programs?

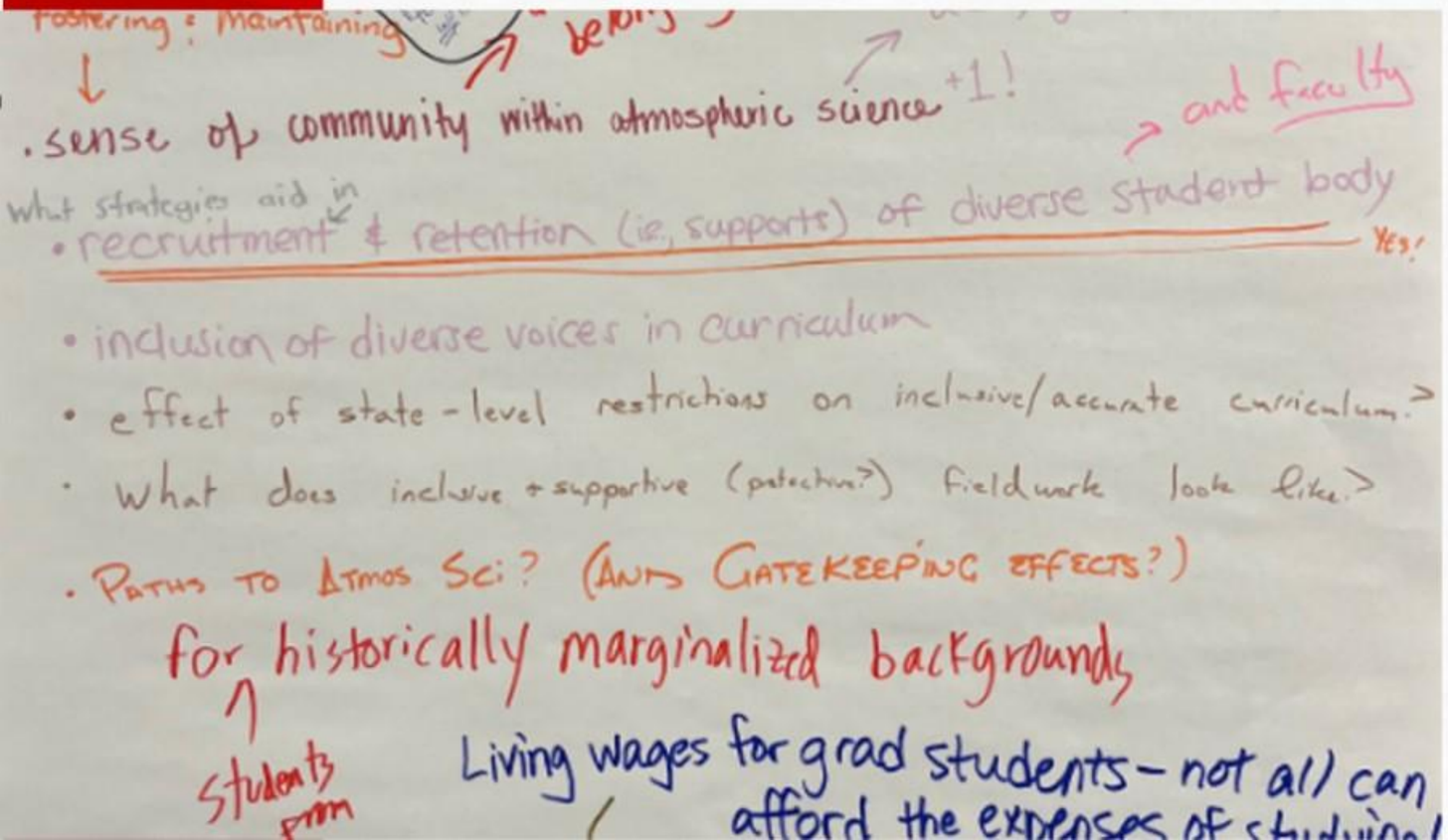
How do you get funding without prior publications/funding?

How challenging is it to acquire education research funding with NSF while already engaged on other science research (with NSF)?

What are some funding sources specifically for graduate students or post docs related to education research?



"What is Ungrading?" (5.1)



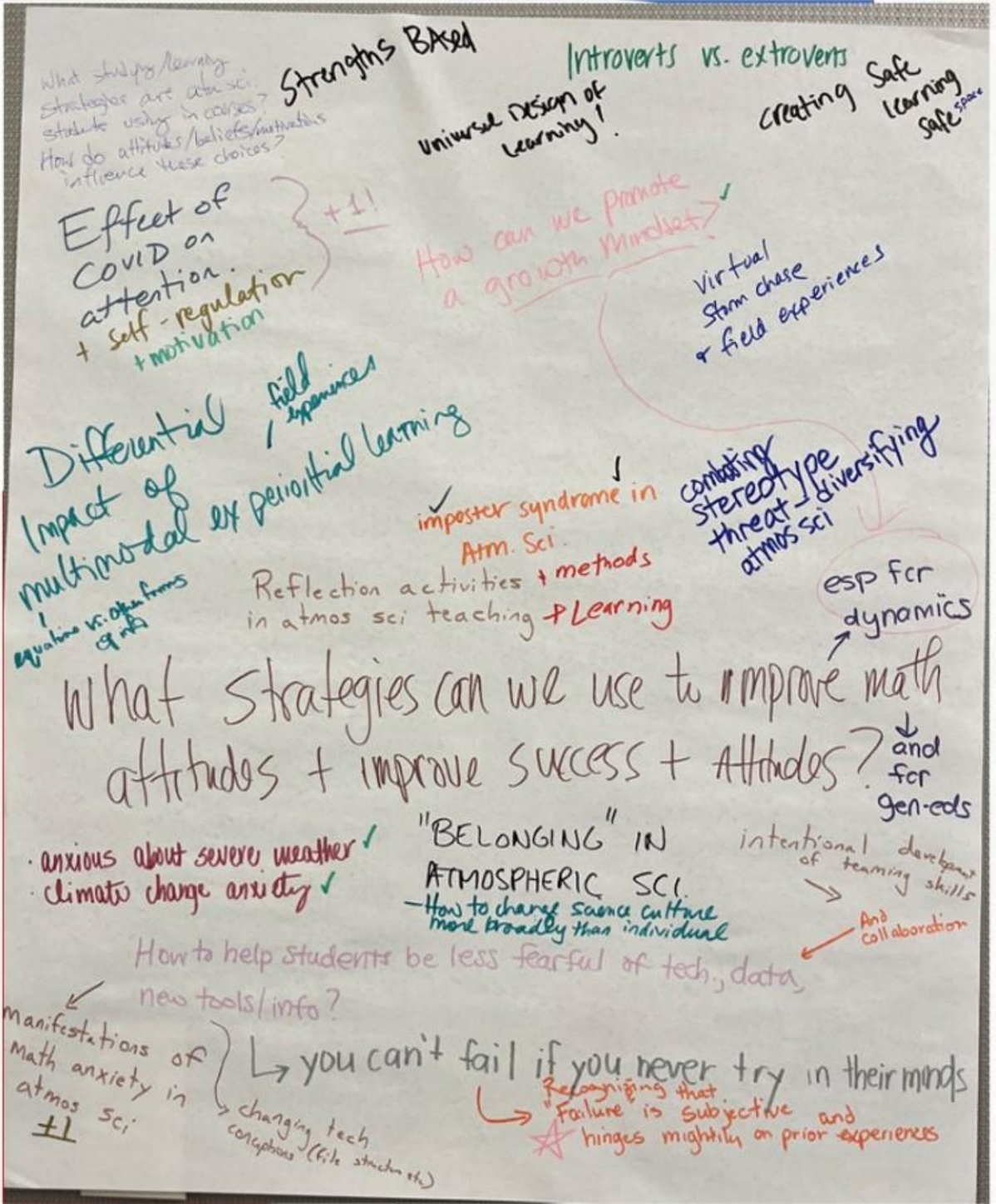
ASER Projects

"Case Study Analysis of "Ungrading" within an Atmospheric Dynamics Course" (5.2)

"Non-traditional On-ramps to Meteorology: Engaging with Incarcerated Youth" (1.1)

"Assessing the Barriers to Retention in Atmospheric Science Undergraduate Programs" (7.4)

"The Atmospheric Science Pathway Experience from Two Year to Four Year Colleges and Universities" (11.2)



ASER Projects

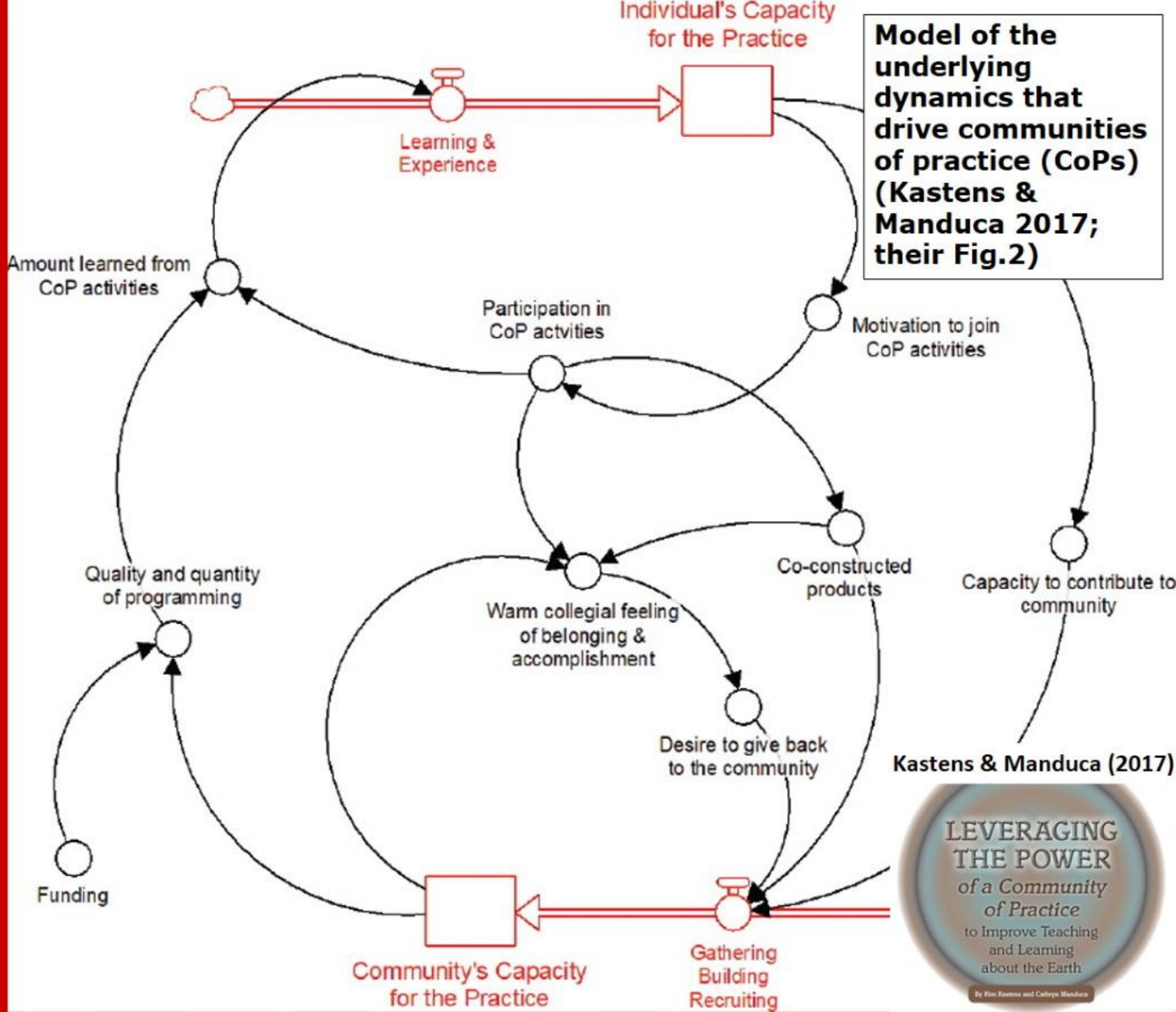
"Thinking About Thinking: How is Metacognitive Development Fostered in Undergraduate Atmospheric Science Programs?" (15.3)

Wendilyn Flynn

TODAY at 2:15pm!

Important factors that drive growth in CoPs:

- "Mutual reinforcement of individuals and the community"
- Recruit new members
- Foster lasting collaborations amongst community members
- Quality programming that leads to individual learning and leadership opportunities



Model of the underlying dynamics that drive communities of practice (CoPs) (Kastens & Manduca 2017; their Fig.2)

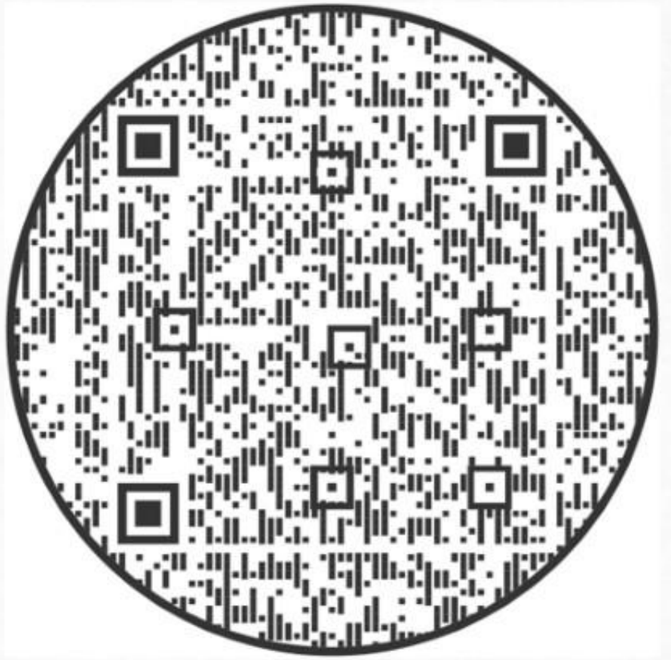
Kastens & Manduca (2017)

What's next?

- Collaborate with each other, but also with education researchers on project design, structure, and methods
- Funding for ASER projects

Interested? Want to get involved?

→We encourage you to lead an ASER project or event!



Join the ASER listserv!

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Thank you!!

Any questions??

References

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