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And the rest of the On-Ramps Writing Team**



ON-RAMPS
to more effective teaching in tectonics

Quick-start guides to help faculty get up to speed in effective strategies for actively engaging students in the classroom to improve learning

Read fronts and backs below, download as pdfs, or view web pages at *Teach the Earth*: serc.carleton.edu/teachearth/index.html

Why On-Ramps?

The context

The landscape of college and university teaching in the geosciences has changed over the past 20 years. Faculty now spend less time lecturing and more time actively engaging students in the classroom, and active engagement is more common in geosciences classrooms than it is in biology, chemistry, or physics.

- *Teach the Earth* and *On the Cutting Edge* have literally thousands of web pages about how to more actively engage geoscience students. But what if you don't know where to start, or you don't have a lot of time?
- On-Ramps are designed to be catalysts to take you up to highway speed, with advice and resources to help you actively engage students effectively in the classroom.

Why focus on active learning?

It dawned on me about two weeks into the first year that it was not teaching that was taking place in the classroom, but learning.

Pop star Sting, reflecting upon his early career as a teacher
NSF 96-139, Shaping the Future: New Expectations for Undergraduate Education in Science, Mathematics, Engineering and Technology

We cannot do our students' learning for them, and cognitive science research over several decades has demonstrated that:

- **Exposure does not equal learning.**
- People learn when they are actively engaged in building knowledge and when they apply what they know to problem-solving.

As you enter a classroom, ask yourself this question: "If there were no students in the classroom, could I do what I am planning to do?" If the answer to the question is yes, don't do it.

General Ruben Cubero, Dean of the Faculty
United States Air Force Academy
Novak et al., 1999, Just-in-Time Teaching
Education in Science, Mathematics, Engineering and Technology

- **What we do in the classroom matters.** If we care about student learning, we need to create environments in the classroom that promote student learning.
- The key is to actively engage students. Student-centered teaching methods, such as those in these On-Ramps, are well documented to be effective in improving student learning.

Writing & disseminating On-Ramps

- In April of 2019, an international team of passionate educators from across the spectrum of the broad field of tectonics gathered at Wesleyan University for an NSF-funded writing soirée.
- Over the course of three days, we wrote the initial eight On-Ramps. Members of the writing team will continue to be involved in developing additional On-Ramps, and we hope that faculty in other areas of the geosciences will take the idea and develop On-Ramps in their own fields.
- On-Ramps will reside on the website *Teach the Earth*, managed by the National Association of Geoscience Teachers (NAGT), and will be linked from a variety of other web sites.

Do you want to incorporate more active learning in your classes but aren't sure where to start? Are you looking for new strategies to try or fresh ideas for techniques that you already use?

What's in each On-Ramp

- **A simple example** with a teaching-classroom scenario
- **Rationale and benefits** for both you and your students
- **Tips for success** with in-the-trenches advice for effective implementation
- **Additional examples** of a variety of tectonics-related topics to serve as catalysts for your own courses
- **Additional on-line resources** with links to activities, implementation details, and the research basis



We chose a dual format for the On-Ramps – both pdfs and web pages – to broaden the reach.

What courses do On-Ramps include examples for?

On-Ramps include examples from courses across the subdisciplines that regularly address tectonic problems, including **structural geology, tectonic geomorphology, plate tectonics, geophysics, regional tectonics, neotectonics, and tectonics-related hazards.**

What if I don't teach tectonics?

- **Don't despair!**
- The strategies, rationale, and tips for implementation on the first page of each On-Ramp are applicable to courses in all fields.
- The examples on page two of each On-Ramp provide inspiration and good ideas that you can adapt for the topics in your own courses and for your own students.

Why On-Ramps in Tectonics?



- In 2018, the tectonics community presented a vision document to NSF on the challenges and opportunities for research in tectonics. In the section addressing the vision, the document points toward the need to recruit and educate a diverse and rigorously trained work force.
- The vision document suggests developing a tectonics educator's onramp to facilitate practical implementation of best practices in geoscience education.
- Our project owes its inspiration to this report and to a request from lead authors Kate Huntington and Keith Klepeis to spearhead the first phase of development.

**Our fabulous On-Ramps Writing Team



Standing from left to right: Anne Egger (Central Washington University), **Sean Fox** (SERC, Carleton College), **Kim Blisniuk** (San Jose State University), **Sara Mana** (Salem State University), **Barbara Tewksbury** (Hamilton College), **Phillip Resor** (Wesleyan University), **Cailey Condit** (University of Washington), **Christine Regalla** (Boston University), **Kendra Murray** (Idaho State University), **Beth Pratt-Sitaula** (UNAVCO), **Jennifer Wenner** (University of Wisconsin, Oshkosh), and **Kyle Fredrick** (California University of Pennsylvania).
And contributing remotely: Carolyn Tewksbury-Christle (ETH Zürich), **Florian Fusseis** (University of Edinburgh), and **Jamie Kirkpatrick** (McGill University).

If you would like to help disseminate the On-Ramps via your web site, program, department, or meeting, please contact us!

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Available On-Ramps

The Intro to On-Ramps explains the structure and purpose of the individual On-Ramps

Individual On-Ramps each focus on a specific effective strategy for actively engaging students in the classroom

Use the QR code to download a pdf of an individual On-Ramp

What are On-Ramps?



Lead authors: Barbara Tewksbury & Phillip Resor

Interactive lecture



Lead authors: Phillip Resor & Barbara Tewksbury

Brainstorming



Lead authors: Barbara Tewksbury & Phillip Resor

Concept sketches



Lead authors: Jamie Kirkpatrick & Carolyn Tewksbury-Christle

Jigsaws



Lead authors: Barbara Tewksbury & Kim Blisniuk

Compelling discussions



Lead authors: Beth Pratt-Sitaula & Sara Mana

Quantitative skill-building



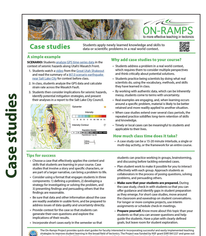
Lead authors: Kyle Fredrick & Cailey Condit

A just-in-time approach



Lead authors: Anne Egger & Christine Regalla

Case studies



Lead authors: Phillip Resor & Kendra Murray

Re-thinking coverage & linearity



Lead authors: Barbara Tewksbury & Florian Fusseis

Future On-Ramps

We will be writing additional On-Ramps over the course of the year, and all will be available from the On-Ramps web site (QR code below or on any of the pdfs).

If you have suggestions for future On-Ramps, please let us know!

We also hope that other disciplines in the geosciences will take up the baton and write On-Ramps for their own communities!

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