



## What are On-Ramps?

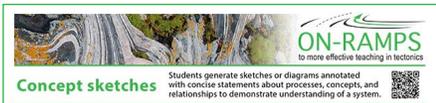
On-Ramps are quick-start guides to help you get up to speed in effective strategies for actively engaging students in the classroom to improve learning.

### 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.

## What's in each On-Ramp?



**Concept sketches**  
Students generate sketches or diagrams annotated with concise statements about processes, concepts, and relationships to demonstrate understanding of a system.

**A simple example**  
The next topic in your tectonics course is arc volcanism. As pre-class homework, have each student draw a sketch that illustrates their current knowledge about the origin, magma and the processes leading to arc volcanism. Then, have students draw a simple labelled cross-section, highlighting key components but also short concept sketches describing what processes occur and where, what adults are formed, and how both relate to the nature of high arc volcanism. Have students submit concept sketches before class so that you learn where students have misconceptions and gaps in knowledge that need to be addressed.

**Why add concept sketches to your course?**

- Constructing concept sketches helps students move from low-level to graduate seminars move beyond mastery of terminology to higher-level thinking about concepts, processes, and products.
- Concept sketches require students to translate what they have learned into their own diagrams and concept captions, promoting information transfer from short- to long-term memory and consolidating understanding.
- Concept sketches provide an opportunity for students to develop and practice 3D spatial thinking and sketching skills – both are important for geologists.
- Concept sketches can enhance all steps of the learning cycle from engagement to exploration, explanation, elaboration, and evaluation.
- Concept sketches paint concise visual pictures that can be graded more quickly than written descriptions and that provide a clearer picture of student thinking than written answers, which can be paraphrased from a text source.

**How much class time does it take?**

- Allow at least 15-20 minutes for in-class sketch construction. Peer review takes a similar amount of time.

**Additional examples** of a variety of tectonics-related topics to serve as catalysts for your own courses

- **Pre-class preparation and post-class synthesis:** Because concept sketches facilitate integrating and synthesizing knowledge, they are a great tool for preparing students ahead of class (e.g., having students summarize assigned reading as concept sketches) or for reflection after a class meeting (e.g., asking follow-up questions and having students review/critique their own concept sketches in the context of what they have just learned in class).
- **Integration with field sketches:** Field sketches typically focus on detailed description and feature identification. Combine those with information from maps, cross sections, reports, and other field data into an overarching concept sketch that summarizes the processes and relationships as well as features.
- **Preparation and wrap-up for discussion:** To prepare students to discuss journal articles, have students create concept sketches of the key figures in the papers. If students can prepare good concept sketches, they will be well prepared for discussion. Following discussion, have students develop a group sketch as a community resource for recording understanding and further questions.
- **In a research seminar:** Use group concept sketches to develop ideas for future research and strategies for addressing those ideas.

## On-Ramp topics

- [Interactive lectures](#)
- [Brainstorming](#)
- [Concept sketches](#)
- [Jigsaws](#)
- [Compelling discussions](#)
- [Quantitative skill-building](#)
- [A just-in-time approach](#)
- [Case studies](#)
- [Rethinking coverage & linearity](#)
- [Gallery Walk](#)
- [Flipping the classroom](#)
- [Designing effective courses](#)

**A simple example with a tectonics-related classroom scenario**

**Rationale and benefits for both you and your students**

**Tips for success with in-the-trenches advice for effective implementation**

**Additional on-line resources with links to activities, implementation details, and the research basis**

**A word about adapting vs. adopting**  
The resources listed here have been adapted from courses in topics other than tectonics. They are not meant to be copied and pasted into your course, but rather to inspire and provide ideas for your own courses and your own students.

Research paper on concept sketches:  
Johnson, J.K., & Reynolds, S.J. (2008). Concept sketches: using visual and artistic generalization to enhance learning, discussion, and assessment in geology courses. *Journal of Geoscience Education*, 53, no. 1, p. 89-95.

[onramps/index.html](http://onramps/index.html)

- Gallery Walk
- Flipping the Classroom
- Beyond the Granary of coverage
- Designing effective courses

## Why is active learning so important?

*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](#)

- **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.

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.

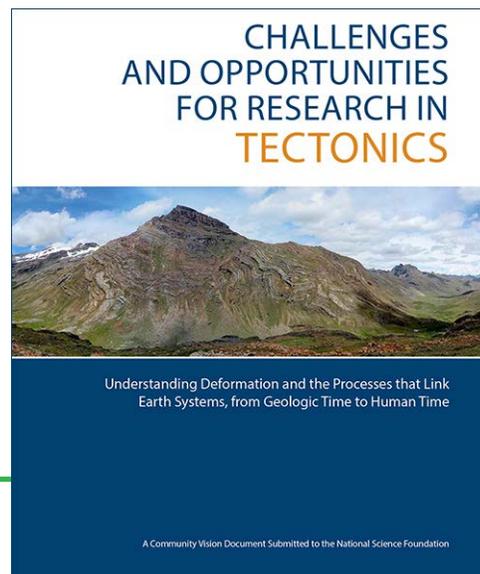
*As you enter a classroom, ask yourself this question: "If there were no students in the classroom, could I do what I am planning to do?" If the answer to the question is yes, don't do it.*

General Ruben Cubero, Dean of the Faculty United States Air Force Academy  
Novak et al., 1999, [Just-in-Time Teaching](#)



## Why On-Ramps in Tectonics?

- In 2018, the tectonics community presented a vision document to the National Science Foundation on the [challenges and opportunities for research in tectonics](#). In the section on achieving the vision, the document points toward the need to recruit and educate a diverse and rigorously trained work force.
- The vision document recommends facilitating practical implementation of best practices in geoscience education and suggests development of a tectonics educator's onramp.
- 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.



## Writing and disseminating the 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 as well.
- We chose a dual format for the On-Ramps – both pdfs and web pages – to broaden the reach.
- On-Ramps will reside on the website [Teach the Earth](#), managed by the [National Association of Geoscience Teachers](#), and will be linked to from a variety of other web sites. If you would like to help disseminate the On-Ramps via your web site or program, please contact one of the project leads (see footer).



**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*).

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**Graphics:** Logo - C. Tewksbury-Christle; banner photo - C. Gerbi.

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