



NSF NCAR Convergence Science Program

What is convergence research?

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The National Science Foundation [defines convergence research](#) in the following way:

“Convergence research is a means of solving vexing research problems, especially those focusing on societal needs. It has two primary characteristics:

- It is driven by a specific and compelling problem, whether that problem arises from deep scientific questions or pressing societal needs.
- It shows deep integration across disciplines. Convergence research intentionally brings together intellectually diverse researchers to develop effective ways of communicating across disciplines. As experts from different disciplines pursue a common research challenge, their knowledge, theories, methods, data and research communities increasingly intermingle.

New frameworks, paradigms or even disciplines can emerge from convergence research, as research communities adopt common frameworks and a new scientific language. In this sense, convergence research is similar to transdisciplinary research, which is seen as the pinnacle of integration across disciplines.”

Other definitions of convergence research exist – including from National Academies reports (NASEM [2014](#), [2021](#)) and from scientists (Roco and Bainbridge [2013](#), Peek et al. [2020](#), Cullen et al. [2023](#), Sundstrom et al. [2023](#)) – all of which broadly correspond. Distilling NSF’s definition, convergence research has four key elements:

1. **Problem-driven (the “why”)**: It’s driven by a complex, important scientific and/or societal problem.
2. **People from widely varying expertise (the “who”)**: It involves people from disparate disciplines, sectors, roles, and experiences coming together to tackle the complex problem.
3. **Deep integration (the “how”)**: The team works together closely and regularly to co-develop and blend their ideas, knowledge, and practices.
4. **Novel outcomes (the “what”)**: It generates new, innovative ways of thinking, paths, solutions, and other outcomes that are not possible otherwise.

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There are other types of research, including disciplinary, multidisciplinary, interdisciplinary, and transdisciplinary. Definitions of these terms are not universally shared, and the terminology has evolved as the *practice* of research has changed to represent new approaches and as the *science* of convergence – and of team science more generally – is systematically studied (NASEM [2014](#), [2025](#)).

Broadly speaking, *disciplinary* research involves researchers from a single discipline who work alone or collaboratively. *Multidisciplinary* research involves researchers from two or more disciplines who focus on common or related questions or problems and who largely work in parallel and remain separate but who interact to leverage or transfer one another's knowledge, data, or tools. *Interdisciplinary* research integrates knowledge, data, tools, or methods from two or more disciplines that are focused on a given problem, but may not involve deep social and knowledge integration or develop novel frameworks. Historically, however, the term interdisciplinary has been used to describe some research that today could be considered as transdisciplinary or convergent (Rhoten [2004](#), Morss et al. [2018](#)). *Transdisciplinary research* and *convergence* research are often used interchangeably and align with NSF's definition provided above; definitions vary, however, with some specifying integration across sectors (academic, public, private) and others specifying end-user involvement. Excellent resources with definitions of the different types of research include: NASEM ([2014](#)), NASEM ([2021](#)), Peek et al. ([2020](#)), and Misra et al. ([2025](#)).

Casting back to the four elements distilled above (why, who, how, what), research that is not convergent (disciplinary, multidisciplinary, etc.) involves some of these elements. Importantly, the distinguishing characteristic of convergence research is that it necessarily involves all four elements.

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