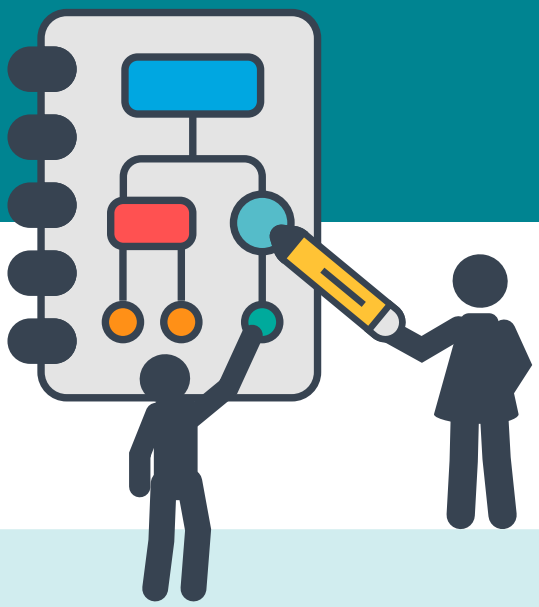

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Navigating terminology, concepts, and methods in inter- and transdisciplinary collaboration

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Effective inter- and transdisciplinary research depends on treating the reflection and discussion of terminology, concepts, and methods as core work, not a side task.

Introduction

The way researchers understand, name, and approach reality shapes the scientific knowledge they produce [1]. This, in turn, shapes the possibilities for collaboration across scientific disciplines. Naturally, scholars from disciplines as diverse as, for example, physics and sociology make different assumptions about the nature of the world they research (referred to as ontology) [2,3] and about what constitutes valuable knowledge (epistemology) [1,3]. These different

What did the SSH CENTRE project do?

SSH CENTRE (Social Sciences and Humanities for Climate, Energy aNd Transport Research Excellence) is a Horizon Europe project that focused on generating best practices for incorporating both Social Sciences and Humanities (SSH) and inter- and transdisciplinary research into the European Union's climate, energy, and mobility transition policy. The SSH CENTRE project deliberately created spaces for *epistemic experimentation* – i.e. structured collaborations that bridge different epistemic (knowledge) cultures to co-produce policy-relevant knowledge:

Interdisciplinary Collaborations for EU Policy Recommendations

The SSH CENTRE project facilitated nearly 30 novel collaborations between the SSH and STEM (Science, Technology, Engineering and Mathematics) disciplines, for strengthening European climate, energy, and mobility policy. These resulted in three edited books, whereby each Interdisciplinary Collaboration produced a chapter. For more see SSH CENTRE Interdisciplinary EU Policy Book Collection.

Transdisciplinary Knowledge Brokerage Initiative

The Knowledge Brokerage Initiative for sustainability transitions gathered 30 early- and mid-career SSH researchers working on themes of climate, energy, and mobility. These researchers actively engaged in accelerating the transition process towards a carbon-free society by working with six European cities on sustainability issues and brokering SSH knowledge. The researchers organised workshops and produced a range of reports that provided knowledge to support the cities' transitions. For more see Knowledge Brokerage Reports.

This Briefing Note is one of 10 that present the findings and recommendations from the evaluation of these epistemic experiments. For more, see the Introduction to the Briefing Note collection and the Formative Accompanying Research methodology.

assumptions manifest as distinct terminologies, concepts, and methods.

The challenge for inter- and transdisciplinary research is that differences in terminology, concepts, and methods are not just a matter of mere linguistic translation but reflect domain specificity – the tacit, practice-embedded ways disciplines construct and validate knowledge [4]. *Domain specificity* means that researchers' skills, terms, concepts, methods, and values are finely tuned to narrow problem spaces and are not easily transferable or comparable across disciplines [1].

This Briefing Note addresses the challenge of navigating terminology, concepts, and methods in inter- and transdisciplinary research. The literature insights show that managing these differences is not trivial and can undermine collaboration if left unaddressed. Empirical findings from the SSH CENTRE demonstrate how such obstacles can be worked through when supported by adequate effort, time, and openness to learning. The recommendations translate these insights into practical actions for individuals, projects, and funders.

Problem description and literature insights

In the literature evaluating inter- and transdisciplinary research, disciplines are metaphorically described as having their own languages or dialects – researchers from different disciplines are effectively "talking different scientific languages" [5]. Each discipline develops a **unique terminology**, which is necessary for the specific problems it investigates. However, this also creates barriers to understanding the broad, complex interdisciplinary research problems [6]. Further, seemingly shared terms have divergent meanings in different scientific fields whilst using the same word. This requires researchers to be prepared to recognize these "false friends" and discuss the different meanings.

Bracken and Oughton [7] distinguish three language forms that inter- and transdisciplinary researchers encounter when **negotiating common terminology**: dialects, metaphors, and articulation. *Dialects* refer to terminology with different meanings across disciplines. For example, "dynamic" is a term that a physical geographer may understand as referring to short-term geological variability, but may denote a longer-term societal change to a social scientist [7]. Secondly, *metaphors* are used among scholars to conceptualise complex ideas. They are shared so commonly within a speech community that it requires a certain reflexivity to recognise them; but metaphors can also work productively by offering a relatively empty term that researchers can fill with a new meaning. For example, Bracken and Oughton showcase the use of metaphor of "mapping" as a way of imagining multi-layered social-ecological relations [7]. A third form of terminology usage is through the process of *articulation*. This is a dialogic mode of explanation and understanding that requires trust, time, and openness. Conscious articulation leads researchers to reveal assumptions about terminology, allowing for collective reinterpretation and integration in inter- and transdisciplinary research, builds shared understanding through dialogue, and fosters trust among researchers.

Beyond language, researchers frequently clash over what counts as valid evidence and rigor [4]. **Presupposed hierarchies of knowledge** – often privileging quantitative, experimental designs – can delegitimize qualitative and interpretive approaches, producing friction over indicators, generalization, and standards of proof [8]. These are not merely technical disagreements but value-laden disputes about methodological and conceptual credibility. Particularly problematic are hierarchies that prioritize quantitative over qualitative measurements, where interpretive contributions may be dismissed as anecdotal or insufficiently rigorous, despite their essential role in understanding meaning and context [8]. Similar tensions are discussed in BN1 (Briefing Note 1), which shows how SSH contributions are often relegated to a subordinate, service role in inter- and transdisciplinary collaborations, and in BN4, which highlights how prevailing STEM-based evaluation metrics systematically disadvantage SSH and overlook the long-term nature of inter- and transdisciplinary knowledge integration.

Ultimately, successful navigation of terminological, conceptual, and methodological divides depends on the **capacities and wisdom of researchers**. One requirement is *epistemic reflexivity* – the ability to critically examine one's own disciplinary assumptions, methods, and values, and to recognize how these shape problem framing [9,10]. Within this series of Briefing Notes, BN9 addresses the practice of reflexivity in inter- and transdisciplinary collaborations in more detail. Closely related is *intellectual humility*, the recognition that one's own expertise is partial and that other forms of knowledge may be equally valid or necessary [8]. Finally, researchers need to cultivate *interactional expertise*: while it is unrealistic to expect contributory mastery of multiple fields, researchers can learn enough of the terminology, concepts, and methods of other disciplines to collaborate effectively [4]. However, all these requirements must be supported by time and budget at the project level, and enabled by funders through call texts that make such activities eligible and properly resourced.

Manifestation in the SSH CENTRE

Across the experiments in the SSH CENTRE, it is evident that establishing a common understanding of terminology, concepts, and methods necessitated a considerable investment of time and effort, especially at the outset.

With regard to the differences in terminology, these were not only evident between researchers from different disciplines (whether between STEM and SSH or between scientists from applied and formal research institutions), but also, in the case of transdisciplinary research, between researchers and stakeholders. The negotiation phase of the research – the early scoping and planning period when objectives, roles, and methods are agreed – required openness to learning. In this phase, participants had to gradually learn a new "language" outside their own area of expertise. Like acquiring a foreign language, it is not solely the meanings of words that need to be grasped, but also the cultural values and practices of disparate knowledge environments [11].

One such practice was academic writing. A notable distinction emerged in the writing practices between the SSH and STEM sciences. In the context of the SSH CENTRE

project, STEM scientists were used to more concise, hypothesis-driven texts. In contrast, SSH researchers underscored the significance of a more expansive, exploratory framework, often emphasising the necessity of incorporating a broad literature review.

Although all examples below come from the SSH CENTRE experiments, participants also drew on experiences from their earlier interdisciplinary work. A remark by one researcher illustrates how a term – such as "standardisation" – functions as a disciplinary dialect (see Bracken and Oughton's three language forms above [7]).

> *We were having a team meeting (…) and there was a mix of social scientists, me as the humanities kind of person, and then an engineer in the room. And we were talking about standardising models of energy communities. And the STEM guy [said]: "But why on earth would you want to do a project on this? This is very, very boring." And we thought, well, it's kind of cool that you have all these interesting things – like: "What about participation? How did you make sure people are involved in the right way? Or what would you do to make sure that you meet these standards?" And after a while of him being like that, thinking standardisation is boring and we're kind of confused, it turns out standardisation to him means like: what lengths will the pipe be, what voltage will this thing be? So, it's a very different kind of connotation surrounding what seems like normal language to each discipline.* (MECR2, Transdisciplinary Knowledge Brokerage Initiative)

This example underscores the need for conscious articulation where assumptions are made explicit and negotiated into shared definitions.

Methodological differences within the SSH CENTRE often meant that researchers had to abandon existing, "traditional" methods and develop novel, more inter- and transdisciplinary approaches. This was quite resource intensive. Despite its difficulty, researchers regarded the need to innovate as positive because it allowed them to address the research problem in a comprehensive and genuinely inter- and transdisciplinary manner. However, finding such approaches was not a trivial task. Research teams observed that when two different disciplinary methods were used, the collaborating researchers automatically tended to split along disciplinary boundaries. Another challenge pertained to the expectations and assumptions that others had regarding the methodologies of other disciplines, without knowing their actual capabilities.

> *The first thing that we needed was the time to set, to clarify the objectives, why we are doing what we are doing, and then, having gained this stage, we needed to clarify the language. (…) What is meant by this concept from SSH versus what is meant from the STEM perspective. And then, the methodology also took quite a lot of time, to be implemented and to be understood, and why we are doing this methodology and what can be the benefits that would be reaped from this methodology.* (FEXP2, Interdisciplinary Collaborations)

At the conceptual level, the sharpest contrasts emerged between the SSH and STEM disciplines, rather than between e.g. two SSH or two STEM fields. Researchers entered the collaborations with preconceived understandings about the other group of disciplines – sometimes sceptical of rigor, sometimes wary of reductionism – which were both challenged and, in some cases, reinforced during collaboration. One of the key areas of divergent conceptualisations of doing science related to what was considered scientific evidence and method between SSH and STEM. STEM researchers tended to focus on proving hypotheses and implementing testable solutions, while SSH researchers emphasized understanding complex human behaviour through multiple perspectives. Some STEM researchers initially viewed SSH approaches as lacking rigor, while some SSH researchers felt STEM researchers were overly reductive in their framing.

> *At the beginning, we knew that we came with our too wordy works and (…) the samples and interviews and [tried] to understand things (…). And they [STEM researchers] look at us, "How can you explain the world with 20 interviews or 200 answers? Come on, guys?" Okay! Because yes, you are not trying to prove it, we are just trying to understand and explain.* (FEXP2, Interdisciplinary Collaborations)

Several factors made negotiations of terminology, concepts, and methods more productive. Good leadership, project coordination, and role clarity (see BN7) provided structure and ensured that translation and integration work was shared rather than falling to one individual. Respect and openness to learn were essential, too:

> *I did learn quite a bit. And what [MEXP8] said about models and equations being useful, even though for me they're tough to understand often, but the one that we've included in the chapter, I think that's a useful way to understand information. So I think that was a learning experience for me and a learning process. Even though I still have a lot to understand.* (FECR3, Interdisciplinary Collaborations)

Openness to new forms of reasoning did not erase difficulty but reframed it as an opportunity to learn and supported the integration of interdisciplinary expertise between SSH and STEM disciplines. Finally, team members with previous inter- and transdisciplinary experience could draw on established practices and orient in such collaborations more effectively.

Recommendations at individual, project, and systemic levels

The literature and SSH CENTRE experiments show that integration improves when projects explicitly clarify and negotiate terminology, concepts, and methods well in advance, in an open and cooperative atmosphere, and use a variety of support mechanisms.

Recommendations at the individual/researcher level

- Name and translate dialects and metaphors: when a term feels "obvious," pause to articulate your meaning and invite others to share theirs; practice active listening to surface misunderstandings [7].
- Adopt a pluralist and reflexive stance toward methods: treat competing epistemic standards (quantitative/qualitative; positivism/constructivism) as productive

disturbances rather than problems. Make your assumptions explicit and stay open to revising them [9,12].

Recommendations at the project level

- Schedule early and recurring sessions to explain dialects and metaphors, agree on term meanings, and document decisions in a living shared lexicon – for an example of such lexicon, see [13].
- Employ boundary objects: boundary objects are shared artefacts – concepts, models, templates, maps, indicators, prototypes – that are structured yet flexible enough to mean slightly different things to each group, thereby reducing talking-past-each-other by anchoring discussion in something co-owned and revisable, rather than in one side's definitions [7,14].

Recommendations at the systemic/broader academia and funding level

- Legitimise pluralism in evaluation: signal that multiple epistemic standards and inquiry modes are acceptable (e.g., quantitative & interpretive & second-order analyses) and assess projects on how transparently they negotiated concepts/methods rather than on a single "gold standard."
- Require and fund explicit tasks/deliverables for epistemic reflection (e.g., shared lexicon, reflexivity workshops, boundary-object prototypes), with designated budget.
- Normalise boundary-object deliverables: accept boundary objects (e.g., constellation maps, shared indicators, co-developed scenarios) as legitimate outputs that demonstrate negotiated meaning across domains [14].

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