



Synthesis

Inclusive transdisciplinarity: embracing diverse ways of being and knowing through inner work

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ABSTRACT. Transdisciplinary research (TDR) aims to co-produce knowledge to address the complex challenges of unsustainability. Despite progress in articulating principles for successful co-production, Indigenous researchers have pointed out ongoing power imbalances. These disparities, partly stemming from unacknowledged ontological-epistemological inequalities, often perpetuate hidden hierarchies between researchers and participants. At the core of these power imbalances is the dominance in academia of certain ways of knowing (e.g., categorical, experimental, noun-based, substantialist) over others (e.g., relational, experiential, verb-based, idealist). This bias is formalized and reinforced by academic institutions and cultures, passed down and internalized through education and professionalization. Inclusive TDR needs to break this self-reinforcing cycle, but this requires making inner room for multiple perspectives on reality and existence. To explore how inner work may foster ontological pluralism and inclusive TDR, we held a workshop drawing lessons from three case studies of TDR from Malaysia, Botswana, and Ecuador. Participants' experiences were synthesized into a reflexive cycle of five inner shifts toward inclusive TDR. These shifts enhance the ability of researchers to engage with different ontologies beyond scientific materialism, and recognize their embeddedness in various kinds of relationships, extending their relational awareness to other beings, human and non-human, living and non-living. The proposed reflexive cycle seeks to cultivate capacities for co-production in TDR that are grounded in horizontally inclusive research practices that allow for more contextually relevant and impactful solutions to complex real-world problems.

Key Words: *co-production of knowledge; inner transformation; relationality; ontological diversity; onto-epistemological flexibility*

INTRODUCTION

Within sustainability science, transdisciplinary research (TDR) is a mode of research considered suitable for developing socially relevant solutions by facilitating co-production processes between academic and societal actors (Jahn et al. 2012, Lang et al. 2012). TDR serves as an umbrella term, encompassing various approaches to co-producing knowledge among different ways of knowing while being faced with the challenges of unequal power relations (Turnhout et al. 2020). The term co-production refers to knowledge not being exclusively produced by researchers but jointly with social actors, thus diversifying the ways we come to “know” something (Yua et al. 2022, Stirling et al. 2023).

TDR implies collaborations between academic and societal stakeholders to co-produce both knowledge and solutions together. Although it has been argued that TDR is relational by definition (McClure 2024), this position can be contested. Chilisa and Mertens (2021) point out that power relations between different knowledge holders participating in TDR are often unequally distributed, favoring those with academic backgrounds. Moreover, exchanges often take place as mere one-off events framed from a dominant non-relational onto-epistemology, thus leading to “extracting” knowledge as the main outcome of the collaboration (Igwe et al. 2022). This is not surprising given that scientific research has evolved in tandem with the priorities of economic and political elites, offering the knowledge and tools to optimize resource extraction (Turnhout 2024). One possible

solution might be to embrace relationality more strongly in TDR, particularly by those coming to TDR from Euro-Western academic backgrounds (Chilisa 2017, Manuel-Navarrete et al. 2021). We use the term “Euro-Western,” following Chilisa (2020) and Mignolo (2011), to describe research paradigms that favor Eurocentric epistemologies and power relations.

A growing body of TDR scholarship advocates ways of incorporating diverse knowledge systems and non-Western onto-epistemologies and methodologies (Chilisa 2020, Llanque Zonta et al. 2023, Reed et al. 2023). The abbreviation “onto-epistemologies” refers to contextually-specific ways of being, doing, relating, and knowing together. Perspectives rooted in relationality are essential for understanding Indigenous knowledge systems, as seen in the Canadian Mountain Assessment (McDowell et al. 2023) and Indigenous-based methods like Yarning circles (Walker et al. 2014). Integrating multiple evidence bases enhances ecosystem governance by combining diverse knowledges, offering a more inclusive framework (Tengö et al. 2014). Decolonizing research through relational perspectives, as Day et al. (2020) argue, involves reconciling how we relate to natural resources, fostering sustainable and just practices that respect Indigenous ontologies (Vásquez-Fernandez and Ahenakew 2020). The goal is not that everyone adopts Indigenous or relational onto-epistemologies, but rather building on them as a means to reflect on one's own onto-epistemological assumptions without falling onto either-or,

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or right-wrong dichotomies (Reano 2020). The process of decolonization aims at long-term, reciprocal relationships between knowledge holders. However, these relationships cannot be merely instrumental (i.e., at the service of external goals), they must also be personal, involving introspection into participants' inner-worlds to realize that we do not exist outside of our relations.

Failures in co-production are not just due to shortcomings in individual projects; they also result from systemic and institutional barriers. For example, research ethics board requirements and academic norms often favor linear, traditional methodologies, making it difficult for researchers to employ the flexible, relational approaches required for meaningful co-production (Lemos et al. 2018). Institutional incentives and funding models also tend to prioritize extractive knowledge production over collaborative, community-engaged research (Marshall et al. 2018). However, institutional barriers and incentives are also embedded in academic cultures that in turn condition the subjectivities and intentionality of researchers (Vásquez-Fernandez and Ahenakew 2020, Manuel-Navarrete et al. 2021). Therefore, inclusive TDR requires a dual transformation: changing both academic norms and institutional culture, while also fostering deep shifts in researchers' inner worlds and mindsets. This paper explores practices that may offer guidance for engaging in the latter. We asked ourselves: *How can we support TDR researchers in cultivating inner transformations that improve their relational capacities?*

Our main argument is that inner work is a key leverage point to help TDR researchers challenge their Euro-Western conditioning (Marshall et al. 2018, Ives et al. 2020), reversing their gaze (Searle and Muller 2019), or starting to embody and practice two-eyed seeing (Bartlett et al. 2012). All this points to embracing onto-epistemological pluralism, which we see as a precondition for engaging in truly inclusive TDR projects (Muller et al. 2019). In this vein, Manuel-Navarrete et al. (2021) examined the attitudes and intentions of a team of Ecuadorian biologists toward knowledge co-production with Indigenous communities during fieldwork. They found that those with less field experience held negative views on horizontal forms of co-production and did not recognize colonial biases in scientific practices even though they recognized these biases in Ecuadorian culture. These findings suggest that key barriers to inclusive co-production likely include disciplinary formal education, lack of diverse onto-epistemological perspectives in curricula, and productivist pressures to engage in extractive research (Manuel-Navarrete et al. 2021).

In sustainability science, inner work is often defined as the personal and transformative processes individuals undertake to cultivate the awareness, empathy, compassion, values, and capacities necessary for fostering meaningful interconnections, which are essential for collaborative efforts toward sustainability (Ives et al. 2020). In psychology, inner work has been defined as expanding our limited views of self toward a greater realization of what it is to be human (Welwood 1984). We propose that inner work can contribute to sustainability research by helping TDR researchers to revise entrenched ontologies and make room for diverse and often contradictory ontological claims (Chaves et al. 2016, Datta 2018, Vásquez-Fernandez and Ahenakew 2020). We

see inner work as a powerful lever for changing attitudes and intentions toward different forms of knowledge and assumptions about the nature of reality.

We begin by outlining the conceptual background that informs our understanding of inclusive TDR. We then introduce the three case studies that inform our findings, as well as the reflexive cycle to inclusive TDR. In the Discussion section, we present the challenges and solutions regarding relational aspects of co-production in each case study.

CONCEPTUAL BACKGROUND

Knowledge co-production in TDR

TDR as a mode of research responds to the need of combining different forms of knowledge to better address societal real-world problems. TDR emphasizes knowledge co-production and incorporates the viewpoints and interests of different societal actors, thus challenging traditional academic modes of knowledge production (Gibbons et al. 1994, Max-Neef 2005). Knowledge co-production serves as a key design principle of TDR and a main quality criterion (Jahn et al. 2012, Lang et al. 2012). However, there is no uniform definition of co-production, making it difficult for researchers to identify the conditions that support effective co-production (Yua et al. 2022).

In practice, implementing co-production requires reflexivity in order to recognize the different forms of knowledge and ontological or epistemological perspectives of participants (Nikulina et al. 2019, Horcea-Milcu et al. 2022). Popa et al. (2015) encourages researchers to move beyond rigid frameworks and instead engage in continuous reflexivity so that they can align with the evolving nature of real-world problems. There are several systematic approaches to help researchers engage in critical and reflexive processes of co-production. For instance, Norström et al. (2020:183) suggest that these processes should be (1) context-based, (2) pluralistic, (3) goal-oriented, and (4) interactive. Another widely cited example is the six modes of co-production for sustainability proposed by Chambers et al. (2021) as a heuristic tool for researchers and societal actors. The modes are: (1) researching solutions, (2) empowering voices, (3) brokering power, (4) reframing power, (5) navigating differences, and (6) reframing agency.

Systematic approaches for reflexive co-production emphasize the critical role of power imbalances inherent in collaborations between different social actors (Turnhout et al. 2020, Vincent et al. 2020, Minna et al. 2024). Muhl et al. (2023) highlight the role of researchers' motivations, identities, positionality, and values in power relations affecting co-production. However, a significant gap exists in understanding the inner worlds' dynamics within scientists who are expected to implement these guidelines. An underlying assumption is that researchers conventionally trained in extractive, non-relational modes of knowledge production, often based on substantialist onto-epistemologies, can seamlessly practice TDR and co-production without intentionally activating inner changes. This overlooks the reality that prevalent institutional barriers, academic disincentives, and ingrained mindsets must be consciously resisted, confronted, and eventually overridden, which may require inner qualities that are not conventionally included in academic training, such as, for instance, non-judgmental awareness, courage, resilience, or compassion.

This paper not only discusses overarching guiding principles but also offers a practice to cultivate the internal dimensions necessary for horizontal co-production in sustainability research. Central to this approach is the understanding that a disposition toward onto-epistemological diversity is an essential leverage point, which cannot be expected to arise naturally within the current contexts of TDR. Rather, these capacities must be intentionally fostered by researchers and supported by institutions (Manuel-Navarrete et al. 2019). Our focus here is on the former, with the aspiration that these intentional efforts will eventually inspire broader institutional transformation in research contexts.

Multi-science ways of knowing nature

Inclusive TDR recognizes that science is always culturally biased. Modern science and academia are no exception as they are historically rooted in Eurocentric cultures and in Western Educated Industrialized Rich and Democratic (WEIRD) populations (Gould et al. 2025). As a consequence, modern science privileges WEIRD psychological traits, including self-enhancement, overconfidence, or independence. It also prioritizes ways of knowing, such as analytical and noun-based thinking, where both knowledge and the known are treated as objects separate from the knower (Aikenhead and Ogawa 2007). WEIRD biases also support impersonal pro-sociality, such as trusting strangers and cooperating with anonymous individuals, which run opposite to relationality (Gould et al. 2025).

As Aikenhead and Ogawa (2007) argue, modern science arose in a specific sociopolitical context that emphasizes control over nature, linear time, and individualism. In contrast, verb-based, relational epistemologies rely on direct, experiential learning through observation, storytelling, and ritual, which foster a deep sense of place and relationship with the land as a process of “coming to know” (Aikenhead and Ogawa 2007:575). Relational ways of knowing are often associated with Indigenous groups and societies, but they are found in the sciences of many other cultures that have been differentially influenced by Western colonization and modernization, including a wide variety of Eastern, African, post-colonial, and post-development knowledge systems (West et al. 2024).

Inclusive TDR entails a “multi-science” approach that recognizes the legitimacy of a multiplicity of systems of knowledge and cosmologies, including Indigenous, neo-Indigenous, and non-Western epistemologies (Ogawa 2002). This is consistent with the growing interest in relational approaches within sustainability science (Nutton et al. 2020, West et al. 2020, Helne 2021). Additionally, as the global sustainability crisis can be understood as a relational crisis (Milgin et al. 2020, Whyte 2020), there is the need for sustainability science to learn from relational ontologies while acknowledging that the responsibility for our current predicament falls squarely on the predominance of non-relational ontologies (Goodchild 2021, Williams 2023). Yet in practice, much TDR continues to reflect the values and assumptions of WEIRD societies, which often leads to marginalizing or distorting other knowledge systems.

Gould et al. (2023) criticize what West et al. (2020) have deemed a “relational turn” for sustainability science, arguing it does not adequately include Indigenous scholars’ works and thus lacks “epistemological diversification” (Gould et al. 2023:1). Similar criticism is brought forward by Gallegos-Riofrio et al. (2022),

who point out the necessity to include Latin American scholarship when discussing the potential of relationality for sustainability science. This coincides with Indigenous scholars’ criticism of the still-dominant form of knowledge production, which often takes place in academic institutions in the Global North and draws on established methods characterized by an ongoing inequality, including processes of co-production that are often approached from transactional, utilitarian mindsets (Deloria et al. 2012, Milgin et al. 2020, Wehi et al. 2023).

Although there is no uniform definition of relationality, we understand it as a way of perceiving and knowing the world as rooted in a relational ontology. Relational ontologies entail ways of acting, living, and being that center community and kinship while being context-sensitive as well as in deep relationship and balance with the non-human world (Simpson 2014, Snow et al. 2016). They lead to understanding every part of the world as connected to everything else, providing an alternative view to the predominant substantialist worldview associated with the human-nature dichotomy and the assumption of humans’ superiority over nature (Kealiikanakaoleohaililani and Giardina 2016, Tynan 2021). We do not reject or claim any particular ontology for ourselves, but we argue that the persistence of non-relational onto-epistemological supremacy within academia in favor of substantialism and materialism justify excessively reductive forms of TDR that prioritize objectivity, competition, and abstraction over wisdom, care, and relational accountability, and that fall short of contributing to sustainability transformations (Nicolescu 2012, Rigolot 2022, Williams 2023). In turn, this supremacy supports and incentivizes extractive approaches to research and consolidates power asymmetries in knowledge production (Latulippe and Klenk 2020, Igwe et al. 2022).

We see onto-epistemological pluralism and the adoption of inclusive TDR as inextricably connected and mutually reinforcing. So: How can we end onto-epistemological supremacy? The obvious answer is by encouraging researchers to embrace and practice onto-epistemological diversity. However, this is a complex ask as it may require, amongst other things, breaking with supremacist habits and inertias, renouncing privileges, rebelling against the status quo, or developing capacities to engage in ontological politics (Chaves et al. 2016, Caniglia et al. 2021, Turnhout 2024). Overcoming these inertias is not only a methodological challenge (Mancilla Garcia et al. 2024), but also a deeply personal and cultural one. Western-trained researchers seeking to become more inclusive must develop the inner capacities necessary for authentic collaboration across difference. This is what the Inner Development Goals (IDGs) term “being” and “relating,” which include cultivating humility, listening, reflexivity, and openness to discomfort (Ankrah et al. 2023).

Our modest proposal is to examine inner work leading to inner shifts that could help diminish persistent onto-epistemological supremacist tendencies in TDR. Inclusive TDR acknowledges that no single onto-epistemology can capture the full extent of reality and that other beings access aspects of reality that lay beyond human cognition (Kimmerer 2013, Nicolescu 2014, Reid et al. 2024). Thus, relationships with non-human beings, such as for instance animal companions or microorganisms essential to

human life, may lead to revealing cognitive blind spots humans might overlook (Simpson 2014, Tàbara 2023). Extractive approaches are reductive and prioritize a singular, dominant way of knowing. In opposition, the radical inclusiveness we are advocating highlights that every onto-epistemology relies on culturally bounded and species-bounded protocols for observing reality and encoding the observations (Whyte et al. 2016, Mancilla Garcia et al. 2024).

Inclusive TDR requires inner work not only because it encourages researchers to be more self-reflexive and to recognize their own cultural biases. It also invites them to embrace the equal legitimacy and validity of every model of reality, while assessing each model's merits in the context of its own onto-epistemological framework. For instance, the Potawatomi people approach the act of harvesting as a sacred interaction rooted in gratitude, care, and the understanding that all beings are interconnected (Kimmerer 2013). This model is more useful to support sustainable and regenerative harvesting practices than to maximize short-term chrematistic profit. An important point, though, is that embracing onto-epistemological plurality does not imply that all claims should be treated as valid knowledge. Models that are self-referential and disconnected from direct observation or actual experience, such as conspiracy theories, are not useful and generally to be excluded from TDR.

Inner work for inclusive TDR

Inner work has been linked to wider systems transformations in the context of sustainability (Woiwode et al. 2021). It is also increasingly recognized as essential for advancing relational approaches, moving away from individualism and toward an extended self-awareness leading to a deeper sense of care and connectedness (Walsh et al. 2020, Artmann 2023).

Consciously exploring subjective dynamics, including emotions, thoughts, identities, and beliefs, may activate deeper leverage points, holding greater potential for transformation (Horlings 2015, Manuel-Navarrete and Pelling 2015). However, the dominance of substantialist-materialist ontologies supports the modern belief that consciousness and awareness emerge from brain activity (Kastrup 2019). From this assumption, the inward turn in sustainability can be misconstrued as reinforcing individualism and separation (e.g., Boda et al. 2022). Thankfully, Indigenous scholars understand that the inward movement does not take us to our brains (Wilson 2008, Kovach 2021). Instead, it links us back to our whole being, the planet and cosmos, and to realizing that we are our relationships (Manuel-Navarrete et al. 2024). Arguably, modern societies have stopped communicating and relating meaningfully with other beings (i.e., beyond extraction) because of the supremacy of substantialist and materialist ontologies (Kastrup 2019, Tassell-Matamua et al. 2023). In other words, although our materiality differentiates us, our internality unites us. Thus, inner, also referred to as inner-outer, transformations are often assumed in sustainability literature as means to relationally grounding TDR (Ives et al. 2020, West et al. 2020).

In alignment with these ideas, we propose a reflexive cycle consisting of five iterative inner work practices, leading to inner shifts, as a teaching and learning tool. This cycle is consistent with Ives et al.'s (2023) IMAGINE sustainability framework in several ways. First, the cycle engages Ives et al.'s proposed three inner

sustainability dimensions (namely, ontological, epistemological, and praxis). Each dimension contains two core characteristics of inner-outer transformations (Ives et al. 2023:2778): ontological dimension: "interdependence of inner/outer phenomena" and "multiple latent human potentials"; epistemological dimension: "expansion of knowledge systems" and "inclusion of diverse knowledges"; praxis dimension: "activation of inner dimensions" and "generation of transformative capacities." Second, the IMAGINE framework directly links to our suggestion of diversifying TDR ontologically as it also frames sustainability challenges as relational crises with deep roots that require solutions "grounded in an ontology of interdependence and human potential and supported by expansive knowledge systems" (Ives et al. 2023:2783).

Our reflexive cycle invites individuals to engage inner worlds with a specific focus on discovering the potential of ontological diversity. This aligns with West et al. (2020), who suggest that engaging relational ontologies holds the potential of initiating cognitive shifts, encouraging a deeper recognition of the interconnectedness between humans and nature, while also extending agency to non-human entities. These shifts represent crucial learning processes that move away from dualistic cosmologies.

RESEARCH APPROACH

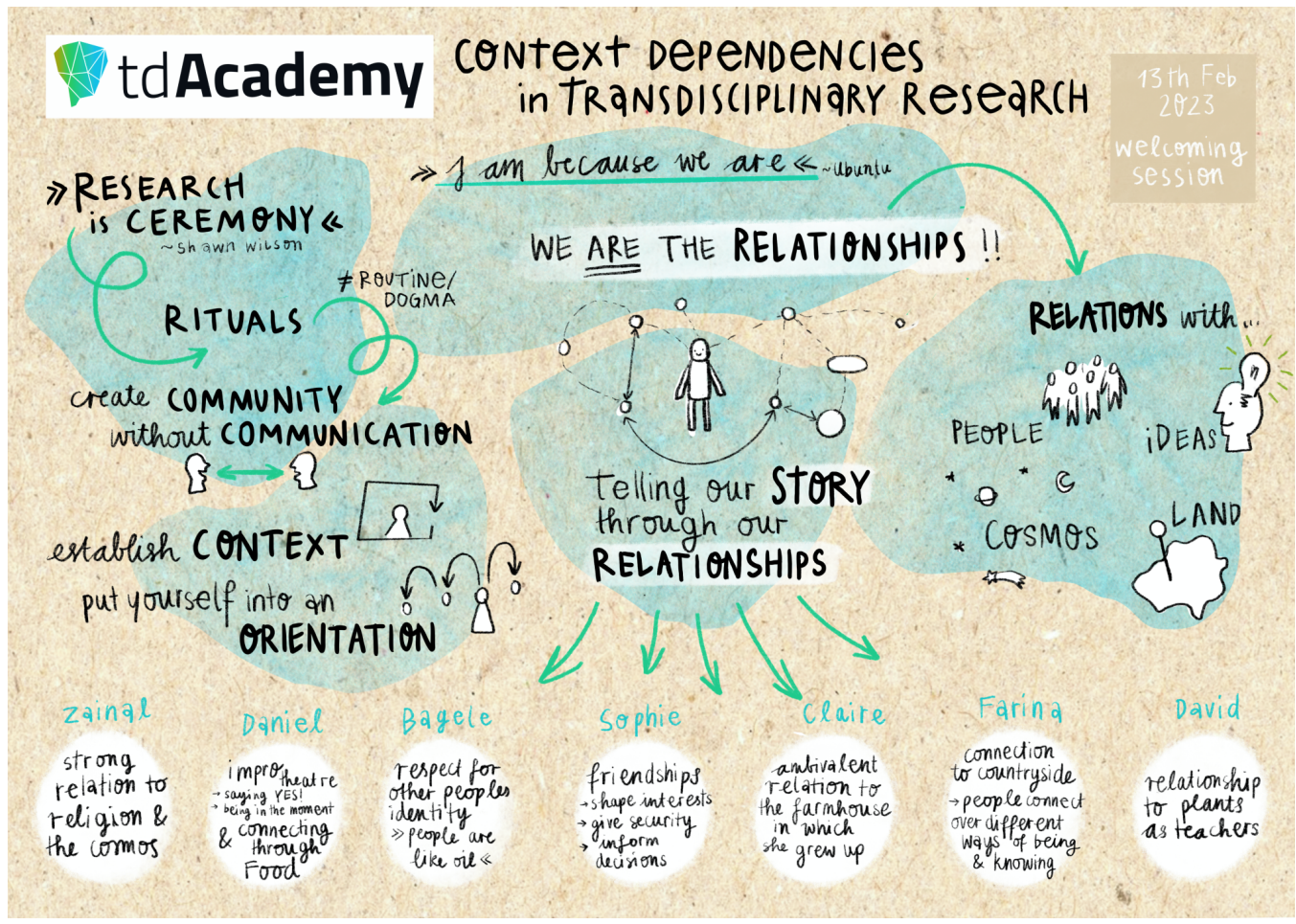
Our research explores ways of supporting Western-educated TDR researchers to cultivate inner work toward onto-epistemological flexibility. We organized a workshop focusing on three case studies, which we present in detail after outlining the workshop design. The results, the reflexive cycle, are presented in the subsequent section.

Context and positionality

A collaboration hosted by the tdAcademy project (Seidel 2022) brought together three German researchers specializing in TDR for sustainability, and three scholars based, respectively, in the Americas, Asia, and Africa, with experience in relational approaches to TDR. Drawing on Shawn Wilson's (2008) Indigenous research paradigm for reshaping co-production, we organized a five-day workshop at Leuphana University in Lüneburg, Germany, to explore how relationality could enhance context-sensitive TDR. Wilson (2008) emphasizes that knowledge is created through relationships, not just between people, but also with the environment, ancestors, and spiritual forces. This paradigm fosters mutual respect and interconnectedness, ensuring that research is not extractive but instead rooted in reciprocal, community-driven processes that honor multiple ways of knowing.

The visiting scholars presented case studies from Ecuador, Botswana, and Malaysia, offering diverse perspectives on relational approaches. One of the scholars, a member of the Bantu people, served as Principal Investigator on a TDR project in Botswana that emerged from a collaboration between North American and African universities. The Ecuadorian case was shared by a scholar originally from Europe, now based in North America, who has spent the last six years supporting a partnership with the Kichwa and Waorani people in Ecuador with the goal of co-producing sustainability solutions that generate income for rainforest defenders. The case from Malaysia was presented by

Fig. 1. Illustration of workshop design (all illustrations by Louisa Szymorek).



the Director of the Sejahtera Centre for Sustainability and Humanity at the International Islamic University of Malaysia, where "Sejahtera," an Indigenous Malay concept, refers to a state of balance, well-being, and prosperity. German researchers had limited experience working with Indigenous communities, but they valued onto-epistemological diversity and aimed to learn from those who had applied relational approaches in both teaching and research.

We acknowledge that the workshop was conducted within institutional settings that inherently uphold certain power asymmetries, such as its location within a Western academic context. Moreover, although this article reflects the collective contributions of all participants, the writing was led by Western-educated researchers, who had access to more time and institutional resources because of their positions at Western universities. As a result, this text is primarily addressed to non-Indigenous researchers who are genuinely interested in understanding how embracing diverse ontologies can enhance reflexivity within TDR.

Our reflexive cycle serves as a guide for Western-educated researchers, educators, and students who wish to advance horizontal forms of co-production in TDR by overcoming onto-epistemological supremacy through relational approaches.

Explorative workshop and the five inner shifts

The workshop did not aim to achieve any predetermined outcome. We began with a session to meet each other beyond our roles as academics and to create room for narrating significant relations in our lives. Other activities included a reflexive forest walk and a visit to a farmers' market as both conscious departures from the seminar room and exercises in relating to each other. Reflexive forest walks combined walking together in a forest with a mindful practice where we engaged with nature while simultaneously reflecting on our inner experiences and relationships.

Overall, participants reflected on their histories and positionalities as relational beings and shared them with the goal of developing collective understandings of inclusive TDR through inductive reasoning (Fig. 1). Inductive reasoning is a process of starting from a set of qualitative data to look for commonalities, patterns, and parallels (Denzin and Lincoln 1998, Ketokivi and Mantere 2010).

A key part was the presentation of the three TDR case studies. After each case presentation, we explored the meaning of context and the significance of relationality in each case through an iterative, inductive process. We enriched the discussions by presentations of a study on the role of context in TDR by the study's leader (Tolksdorf et al. 2025) and on TDR practitioners'

capacity-building, based on Seidel (2022). We used comparative case study (CCS) by focusing on a phenomenon of interest, approaches to co-production, which is considered across different temporal, spatial, and socio-political dimensions (Bartlett and Vavrus 2017). In this method, context is relationally constructed, meaning it is more than the geographic and socio-political frameworks. We also explored the case studies in a way that researchers' interpretations and reflections became part of the inquiry (Creswell 2014). To support capturing all voices, in addition to their recordings, parts of the workshop were accompanied by a graphic designer. This proved helpful for visualizing our creative thinking about the potential of inclusive TDR in Euro-Western academic settings.

Over the five days, we evolved emerging key themes into a reflexive cycle of five inner shifts toward inclusive TDR as most of us were interested in developing a tool to guide our TDR teaching and research activities. In the weeks following the workshop, participants proceeded with an iterative process of reflection and deeper engagement. During this process, the illustrations, case studies, and the minutes and notes from our workshop discussions served as data for subsequent analyses of how to best link this with the existing literature on onto-epistemological diversity, relationality, and inner transformations, and how to formulate the reflexive cycle in a way that becomes inviting and accessible to TD researchers and learners.

Case studies

Box 1:

Case study Ecuador: Partnership between Arizona State University and the Iyarina Center for Learning - David Manuel-Navarrete

Context: Researchers and students from Arizona State University (U.S.) have been collaborating with the Iyarina Center for Learning (Ecuador) to co-design and test bioeconomic innovations in the Ecuadorian Amazon toward generating local income, disincentivizing deforestation, supporting Indigenous biocultures, and encouraging academics and students to reconnect with social-ecological systems. In rainforests, bioeconomic innovations have the potential to sustainably combine agroforestry, aquaculture, tourism, education, native species silviculture, carbon sequestration, forest surveillance, forest foods, renewable energies, essential oils, medicines, healing practices, or cosmetics (Maximo et al. 2022). Bioeconomic innovations based on kinship relationships constitute the inner context of this case study (Tolksdorf et al. 2025). These models seek to counteract outer-context dynamics generated by colonial extractivism, and onto-epistemological imperialism. Previously, many projects that aimed to promote economic development and environmental protection insufficiently considered the outer contexts. These inner-outer dynamics have been central to this collaboration between universities and Indigenous people.

Onto-epistemologies: *Sumak Kawsay*, a term stemming from the Kichwa language, refers to an Indigenous relational ontology, originating in the Andean and Amazon regions, which internationally may be better known by its translation to Spanish as *Buen Vivir*. *Sumak Kawsay* emphasizes the importance of living in harmony with nature. *Sumak Kawsay* is a holistic approach promoting ideas of complementarity, relatedness, and

cooperation. It considers humans as part of nature, equal to all other parts of nature, and emphasizes the interdependence of all of these parts (Coral-Guerrero et al. 2021).

Partnership design and implementation: Iyarina Center for Learning promotes interpersonal relations between Indigenous and non-Indigenous to de-emphasize “us-versus-them” dichotomies and promote Indigenous knowledge and culture worldwide (Buzinde et al. 2020). Over 50 Kichwa and Waorani people are employed by the Center to create language and culture teaching materials and implement them in courses for English-speaking students. This contributes to Indigenous language and cultural revitalization. There are no more than 4000 speakers of Wao Tederó, a linguistic isolate not known to be related to any other language. Kichwa and Wao have been taught through the Center to hundreds of university students. Alumni generally report that learning the philosophy underlying Kichwa language has shaped not only their thinking, but also their ways of being in the world and ways of relating to non-humans (Gray and Manuel-Navarrete 2021).

The partnership's main hypothesis is that bioeconomic innovations must rely on personal relationships between locals and people at not-for-profit institutions (in our case, universities) based on reciprocity. We want to show how the power of universities, including the creativity and agency of their student bodies, can be leveraged to boost local biocultures. We also found evidence for what makes local partnerships with universities work: practicing horizontal knowledge co-production, decolonization, and network mutuality (Manuel-Navarrete et al. 2021).

Research activities and horizontal co-production: Two co-produced outputs of this collaboration are the scaling of higher education infrastructure to remote Waorani communities, and the co-design of a solar-powered canoe prototype. Sustainable river transportation is crucial to bioeconomic development in the Amazon. Educational-tourism activities enable knowledge co-production between American students and Kichwa and Waorani people. The canoe prototype promotes cultural resilience and local sharing economies, thus catering to local needs while disincentivizing the development of roads, logging, mining, and oil extraction.

Box 2:

Case study Malaysia: Compulsory community-based course *Usrah in Action* (Family in Action) - Zainal Abidin Bin Zanusi

Context: To operationalize TDR in the International Islamic University Malaysia (IIUM), the IIUM has introduced a compulsory course *Usrah in Action* (UIA), which requires all students to immerse themselves in the community, thus bringing together various stakeholders from multiple disciplines and backgrounds to develop mutual understanding about and solutions for sustainability-related local problems. The design of UIA is based on the concept of *Sejahtera*.

Onto-epistemologies: *Sejahtera* is rooted in the Malay Archipelago, the Southeast Asian region also called Nusantara. *Sejahtera* can be described as a balanced lifestyle summarized by

at least ten different elements, including spiritual, physiological, intellectual, cognitive, cultural, ethical, emotional, ecological, economic, and societal dimensions. All of these components must co-exist in a balanced manner to achieve an overall state of well-being that is lasting (sustainable) over generations (Abdul Razak et al. 2021).

Partnership design and implementation: In the context of UIA, instructors and students are first exposed to the concept of *Sejahtera* for them to appreciate its ontological meaning and especially its emphasis on the balance of different perspectives in building relationships. Each project needs to include at least three groups of stakeholders: community members, students, and instructors; the goal being to involve diverse groups from all areas of society, including, e.g., Indigenous peoples, marginalized populations, single mothers, youth, refugees, school students, and orphans.

Research design and horizontal co-production: Each project is developed on the basis of one semester of research in the identified community and is handed over to subsequent cohorts of students, so that long-term relationships with participating communities can be established. Community leaders serve as co-leads of the projects, ensuring co-production, and the representation of communities' needs in solution-development processes. The research design of the projects is supposed to reflect the need to understand the complexities of community issues that are not only contextual but very much dependent on the translational aspect among everyone involved. One example is a recent project carried out at an orphanage located in a suburban area of Gombak, where stakeholders reported the UIA approach has enabled them to better understand the very diverse perspectives on issues to be addressed because the participants were so diverse, ranging from children to caretakers and local authorities.

Box 3:

Case study Botswana: Building relationships between researchers from a U.S. university, the University of Botswana and local communities - Bagele Chilisa

Context: In 2007, the University of Botswana, in partnership with a university from the U.S., responded to a grant for HIV/STI/AIDS prevention. The researchers from the U.S. came from minority and less privileged groups in their country. Issues of culturally appropriate and relevant research were as important to them as to the researchers from Botswana. Thus, their dialogues on building relationships started with agreeing on a collaboration model that transformed hierarchical relationships that exist between the universities in the North and those in the South, academic institutions, and communities.

Onto-epistemologies: *Ubuntu* is associated with the Bantu (meaning "people") who live across almost one third of Africa. *Ubuntu* emphasizes the mutual interdependence of all living and non-living beings and their spiritual connectedness characterized by love and harmony. It centers on the importance of caring, sharing, and cooperation (Muwanga-Zake 2009), and the individual is defined through their relations to others including the natural environment.

Partnership design and implementation: The research team agreed to assign the role of principal investigator (PI) and other leadership roles to University of Botswana researchers to break the stereotype that expertise can only come from Northern universities (Chilisa 2005, Pryor et al. 2009). To integrate interests and create a composite understanding of HIV/AIDS prevention, various organizations working on this topic were brought together. From this it emerged that schools reached out to the majority of adolescents through the school curricula, churches played an important role in mitigating the impact of HIV among adolescents, and other organizations worked with adolescents living with HIV to encourage adherence to medication and prevent re-infection.

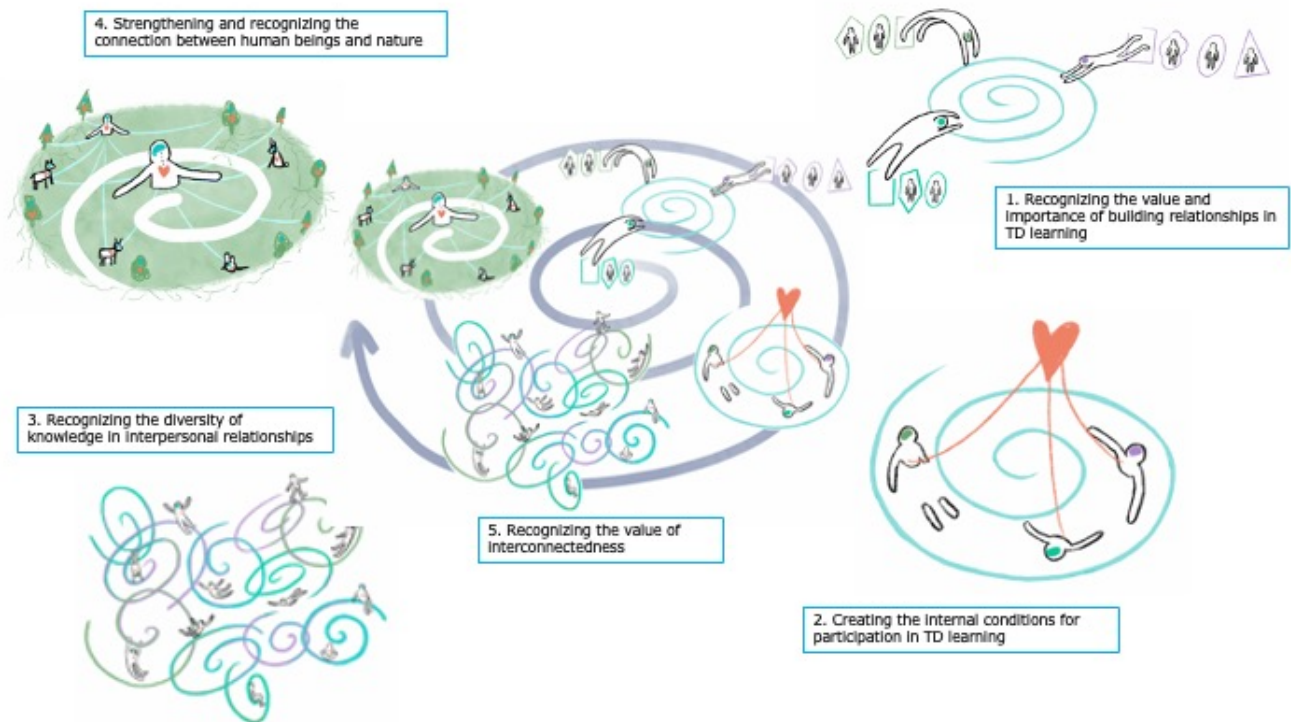
Research design and horizontal co-production: Based on these discussions, the research sought to address HIV/AIDS prevention and design intervention for school-based adolescents, church-going adolescents, and adolescents living with HIV/AIDS. This ensured that research questions would also address priorities set by the communities rather than being exclusively formulated by researchers. The research project had two advisory boards: an internal and an external one to bring together community and academic knowledge systems. The goal of this board was to serve as community theorists and contribute to decolonizing the research process by bringing in local Botswana worldviews and knowledge to ensure the research remained relevant and useful to local communities. The external advisory board consisted of intellectuals with expertise on global knowledge in intervention research from the U.S. and Southern Africa with the aim of serving the interest of the funders by bringing into the discussion the dimensions of rigor as understood by other interested parties.

Relational learnings: During the entire research process, the researchers took a deep dive to acknowledge, confront, and seek to reverse deep asymmetries of knowledge and power and colonial prejudices by mapping out stakeholders' relationships with knowledge structures, each other, and the environment or ecosystem. At the planning stage, this included finding relevant information (including institutional ethics review board guidelines, community ethics guidelines, or community values) likely to impact the research process, funder knowledge systems, each researcher's perspective on the multiple ways of knowing or paradigmatic perspectives, and stakeholders' interests and meaning making of the problem of study.

A REFLEXIVE CYCLE FOR FOSTERING INCLUSIVE TDR

The reflexive cycle consists of five iterative inner shifts seeking to foster inclusive TDR among researchers, practitioners, and other societal stakeholders from diverse backgrounds (Fig. 2). These shifts represent an iterative, cyclical process occurring in steps that loosely support and inform each other when continuously repeated, thus representing a relational cycle. Although we speak of a cycle, the shifts do not need to take place in a fixed order or build on each other. Below, we elaborate on the inner work supporting each shift by connecting them to our case studies and workshop findings.

Fig. 2. Reflexive cycle of four inner shifts integrated through a fifth holistic shift (in the middle).

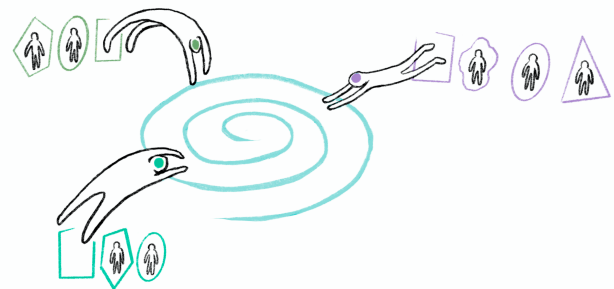


Recognizing the value of building relationships for inclusive TDR

A key shift in inclusive TDR involves “stepping down” from personal identifications and “jumping” into the shared context of a TDR process (Fig. 3). Participants come into the process from different angles and must be ready to face vulnerability, discomfort, and risks while avoiding the temptation of trying to control or completely know the TDR space (Haider et al. 2018). Although TDR researchers and practitioners are mostly aware of the importance of relationships within the TDR context, relationality is often foreign to people schooled in Euro-Western ways of knowing. The idea of opening to diverse onto-epistemologies may give rise to feelings of unease or even fear associated with facing and exposing oneself to the unknown.

As university-trained scientists, we are used to established conventions regarding which methods to use, and to evaluate what counts as knowledge (Mancilla Garcia et al. 2024). Overcoming these established ideas as well as opening to discovering new methods, bodies of knowledge, and ways of being requires inner work to build courage and the readiness to experience initial confusion. Though challenging, this inner work is a prerequisite of a transformative learning journey (Selby 2015). If we are serious about contributing to paradigm shifts toward inclusive TDR, it requires the (at times painful) process of leaving established ways of doing research behind, letting ourselves open up toward the new (Kovach 2021), and creating learning environments where all participants feel welcome and safe enough to enter processes that may be troubling or painful (Mälkki 2019, Singer-Brodowski 2022).

Fig. 3. Jumping into the unknown.



Although it may require courage and emotional intelligence, embracing the contradictions and instabilities that normally emerge from allowing a diversity of onto-epistemologies holds the potential to spark processes of un- and relearning from other, non-Western ways of perceiving reality and knowing and value systems. This is what we did during our workshop when we jumped into the first session, aiming to explore ourselves through relational aspects of our being, rather than solely encountering each other as independent learners in an academic workshop setting.

It also occurred in all three case studies; for instance, when U.S. students encountered Kichwa communities for the first time, it felt to many like jumping into local communities’ ways of life and

worldviews quite unprepared. Although this may initially be accompanied by stress, insecurity, and not-knowing, these kinds of experiences are a starting point for exploring one's own ontological and epistemological bias (Tuck and Yang 2012). Malaysian students, too, had to take a risk, or jump, when beginning to collaborate with students from other disciplines and community members in their project work for the first time, being ready to question and overcome existing concepts and prejudices.

Reflexive questions: What is my point of departure? What makes me feel uncomfortable when "jumping in" into the TDR experience? Why is that the case? Which kinds of feelings do I have about other participants? Why? What do I have to lose? What blind spots become visible?

Creating internal conditions for participating in TDR learning

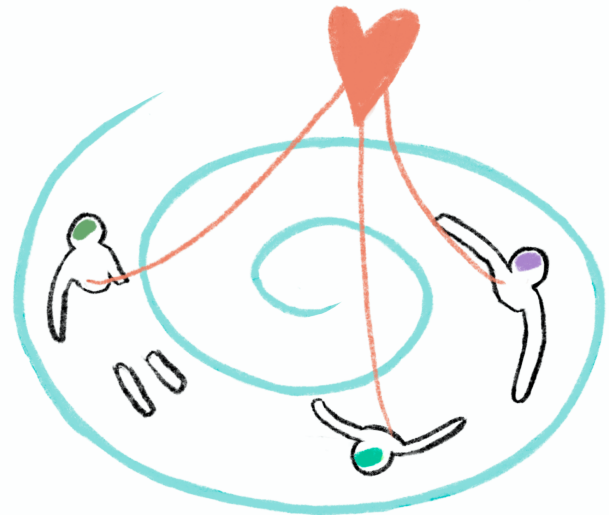
The second inner shift involves the realization of how the "I" relates to everything else, meaning we need to take a deep dive into our inner worlds to enable us to go beyond the supremacy of Euro-Western onto-epistemologies. This is intertwined with the first shift, as both depend on one another.

Shift two can manifest inner transformation and the embodiment of relational attitudes (Wamsler et al. 2021, Ives et al. 2023). We become aware of our inner values, needs, and beliefs and how these connect us as individuals with the society around us and inanimate nature (Fig. 4). These can be developed through transformative learning approaches, such as art-based and place-based pedagogies that seek to foster a sense of connection between inner and outer worlds (Pacini-Ketchabaw 2013, Burns 2015). This, too, requires a learning setting in which participants relate to each other and thus experience an engagement with inner worlds that is at first introspective but eventually serves to enhance our understanding of our entire lives as being made up of relations (Ives et al. 2023).

Engagement with inner worlds was visible in the Botswana case, where researchers socialized in Euro-Western contexts tended to describe themselves as individuals being trained in a certain discipline, whereas many individuals socialized in one of the Bantu societies in southern Africa would likely draw on the principles of the *Ubuntu* relational ontology and introduce themselves through their relations to other living and nonliving beings related to their home community. This is why in the workshop we consciously chose an exercise during which we introduced ourselves through the kinds of relations that form us as individuals, rather than solely through our academic resume. Especially for those among us who came from Euro-Western non-relational backgrounds, this was difficult at first, but proved valuable as we discovered how manifold the relations are that we navigate throughout our lives.

The Botswana case describes an event where researchers were taking a deep dive to acknowledge, confront, and seek to reverse deep asymmetries of knowledge and power and colonial prejudices by mapping out researchers' and societal stakeholders' relationships with knowledge structures, each other, and the environment or ecosystem. This included an awareness of how ethics review boards from academic funders are characterized by colonial structures, such as neglecting the voices and perspectives of those researched, and therefore the possibility that individual prejudice could undermine relational existence and accounting to all relations.

Fig. 4. Relational competency starts with the We.



Reflexive questions: Which kinds of relations have been forming me as a person? How do I relate to others: people, plants, animals, places, etc.? What elements, events, etc., have shaped my perception of relationships so far?

Recognizing the diversity of knowledge in interpersonal relationships

Shift 3 helps us recognize the diversity of knowledge in interpersonal relationships symbolized by the twirls that are situated differently while being connected with each other (Fig. 5). Inner work is needed to consciously reach out to others and recognize that there are different kinds of knowledge and knowledge systems, many of which are marginalized in today's academic landscape (Chilisa 2020). This links back to the first inner work/shift addressing researchers' uncertainty and unfamiliarity with non-traditional research approaches and the knowledge they generate. It also links to Gould et al.'s (2023) argument that a relational turn requires Western-trained researchers to more closely engage with Indigenous epistemologies, which directly translates into doing research differently and adds to our existing methodological tools.

The Botswana case shows how Western-trained researchers learned to combine academic methods (such as surveys) with Indigenous approaches to knowledge production (such as listening to stories told about local history). In the Malaysia case study, students are brought together with people from local communities to help them understand that sustainability problems need to be defined and solved together and through mutual understanding rather than through forming assumptions about specific groups without involving them.

Reflexive questions: Why do I consider relevant what I am proposing to work on? How can I take a step back and learn about others' perspectives on a certain topic or problem? What am I irritated about in the process, and why? How might stakeholders from other disciplines/contexts/social strata, etc., approach these processes of co-production?

Fig. 5. Questioning one's own onto-epistemological positionality as prerequisite for appreciating other's positionalities.



Strengthening the connection with all beings

Shift 4 strengthens the connection with all beings by replacing the instrumental and transactional approaches to sustainability science, which characterize nature as a means to narrowly-defined ends, and in turn create manifold externalities (Fig. 6). A core aspect of inclusive TDR is the accountability of researchers, practitioners, and other actors in TDR for all relationships that involve the non-human. Expanding our ability to engage with diverse onto-epistemologies makes it possible to recognize the dependencies and interdependencies between all beings, and to recognize that we all hold valid knowledge and developing emotional relationships. Milgin et al. (2020) argue that this promotes a holistic understanding of sustainability based on an ethics of care for all elements of the world. Furthermore, it helps recognize how sustainability problem definitions in co-production spaces are still often derived from Western-based scientific thought (Wehi et al. 2023).

Inner work holds the potential to help researchers to integrate in their inquiry insights from human history, stories, and participation in events, as well as visions and experiences of spiritual insight in their relations with non-humans (birds, animals, rivers, mountains). Spirituality and the sacred can be seen as a connection to the cosmos; therefore, any practice that strengthens connections or builds relationships is spiritual and ceremonial (Williams 2023). Recognizing spirituality allows researchers to explore the connections between the experience of the researcher and the researched on the one side, and with both the sacred and the practical aspects of research on the other side.

This was a constant theme in the Botswana case; for instance, when a local community refused to use a health facility that was planned for on an area of the community considered sacred ground. It would thus have been a mistake for researchers to ignore this and dismiss local actors as merely ignorant. Instead,

Fig. 6. Overcoming nature-culture dichotomy of modern Western ontologies, academic research and learning.



they took the concern seriously and the community was involved in finding an alternative site for the facility. Similarly, in Ecuador, it has been vital for researchers and other non-Indigenous stakeholders to understand the significance of the forest for Kichwa communities. Here, the forest is not just a collection of trees. Rather, it is part of everyone's existence. It is a teacher and the source of life, without which people can no longer exist.

Reflexive questions: How do I relate to my surroundings? Which living and non-living beings in my life have a special meaning to me and why?

Recognizing the cyclic nature of knowledge co-production

The fifth inner shift, which also forms the starting point for continuing the iterative reflexive cycle, highlights the long-term, circular, and repetitive process that may involve perplexity, resistance and even pain when one realizes that one needs to break away from linearity (Fig. 7). These are the characteristics of a transformative learning journey, which cannot be planned, but happens at its own pace (O'Brien et al. 2013, Walsh et al. 2020). The progression of TDR is a non-linear, chaotic, endless cycle with interruptions and the unpredictable back and forth between shifts.

Reflexive questions: In what way might my research benefit from fostering an attitude of inclusive TDR? What are one or two concrete starting points for initiating such a process within my own academic (or other) practice(s)?

DISCUSSION

We discuss how the five inner work practices and associated shifts relate to key theoretical aspects of relationality and inner transformation. Then we compare the central challenges of the three cases regarding each reflexive practice and the context-specific solutions. Finally, we critically summarize the main implications of our findings for inclusive TDR.

Aligning the five shifts with our conceptual background

We argue that known challenges to co-production in TDR, including ongoing unequal power relations between knowledge holders from different societal backgrounds, might be approached

A second example is the ongoing challenge of unequal power relations, present in all three cases, which often characterizes TDR contexts. In their exhaustive review, Turnhout et al. (2020) point out that even projects that consciously address power inequalities can only be effective to a limited extent given their embeddedness in wider contexts characterized by power imbalances. The example of the Botswana case study offers insights into one possible strategy to address this issue, while demonstrating the difficulties associated with a context characterized by unequal distributions of power. Even though Indigenous and Western-educated researchers had agreed to assign the role of PI to an Indigenous researcher, the co-production process still required ongoing and conscious actions to address unequal power dynamics within the research team, and between researchers and local communities. This included stakeholder mappings and constant negotiations and (self-)reflection within the research team, including openness to allow for the inclusion of Indigenous

Table 2. Comparative overview of challenges and their solutions regarding inclusive TDR in the case studies.

	Challenges from research and learning			Intentions and actions to address challenges		
	Ecuador	Malaysia	Botswana	Ecuador	Malaysia	Botswana
Relation-ality	American students socialized in “ego-culture” (cf. Escobar 2018)	Students socialized in in-group culture with prejudice toward other groups	American researchers socialized in “ego-culture” (cf. Escobar 2018)	Long-term relationship building through a boundary organization experienced in connecting U.S. academia and Indigenous people	Students engage with socio-cultural contexts of local communities to understand their onto-epistemology	Mapping out stakeholders’ relationships with existing knowledge structures
	Academic contexts are anti-relational (cf. Chilisa 2020)	Academic contexts promote disciplinary thinking, are anti-relational (cf. Chilisa 2020), difficulties for inter- and trans-disciplinary learning	Power asymmetries between researchers from different countries, and between researchers and community members (cf. Chilisa 2020)	Establishing clear protocols for interaction to avoid misunderstandings	Interdisciplinary student groups to foster understanding of different perspectives	Actively working with the knowledge about power asymmetries, e.g., by sharing power within the team, maintaining open and transparent, communication within the team and with community members
	Relationship building is difficult in intercultural contexts with huge income disparities and over time at distance (cf. Buzinde et al. 2020)			Fostering exchanges through social media allows relationship building after the in-person interaction	Students encouraged to engage with each other and with community members via social media	
Inner worlds	Lack of self-reflexive practices in education and science (cf. Lange 2018)	Self-reflexive practices not encouraged; challenging implementation of Ushah in Action (UIA)	Western understanding of illness as a purely medical problem, rather than one affecting the mind and spirituality, too (Ntseane and Chilisa 2012)	Pedagogies applied in this case study included tools and activities such as: –Journaling, –Sharing circles, –Conviviality, –Meditation, and –Immersion in nature	Pedagogies like reflective journaling and encouraging students to voice their reflections in class are mandatory elements of UIA	
	Emotions and spirituality are not seen as part of knowledge production (cf. Wamsler et al. 2021)	Emotions and spirituality are not seen as part of knowledge production: education defined as transmission of knowledge (cf. Wamsler et al. 2021)			Building the UIA curriculum emphasizing socio-emotional learning	
	Pressures to achieve tangible outcomes (cf. Manuel-Navarrete et al. 2021)	Community empowerment is not tangible enough as purpose of learning			To assess community empowerment using newly developed key- intangible-performance (KIP) vs. traditional Key Performance Index (KPI)	
Epistem-ology	Assumed superiority of Western scientific knowledge due to its ability to manipulate and control material processes (cf. Chilisa 2020)	Students’ perception of university education as equaling knowledge acquisition, preventing them from engaging more in-depth with other disciplines, and with knowledge production in non-academic settings (cf. Lange 2018)	Assumed superiority of Western scientific methods over seemingly non-traditional methods (cf. Chilisa 2020)	Appointing Indigenous knowledge-holders as instructors	Engaging community leaders and members as instructors to enhance students’ understanding of the value of co- produced knowledge	Employing and understanding local methods of knowledge transmission / production such as storytelling
				Emphasizing the strengths of non-Western knowledge systems to nurture sustainable relationships of care in all interactions	Involving community leaders as co-organizers of the project to strengthen the value of local knowledge and the visibility of local knowledge holders	Emphasizing the strengths of non-Western knowledge systems to nurture sustainable relationships of care in all interactions
Ontology	Materialist ontologies and objectification of nature strongly embedded in mainstream academia and Western cultures (cf. Kealiikanakaoleo-haililani and Giardina 2016)	Materialist ontologies shape students’ interpretations of local communities’ actions; neglecting contextual and local wisdom (cf. Gould et al. 2023)	Compartment alization and medicalization of problems instead of approaching the topic of HIV/AIDS from a relational perspective involving community and place (Ntseane and Chilisa 2012)	Immersive experiences: Being in the forest with Indigenous people as guides to the inner dimensions in nature enables questioning the objectification of nature	Immersive experiences: Students’ longer-term immersion and in-depth engagement with local communities for two semesters fosters understanding of local communities’ ontologies and their everyday lives	Immersive experience by means of a relational, community-based approach to help reframe the understanding of HIV/AIDS as a societal issue where medical aspects are but one part of a larger whole
Praxis (of inclusive TDR)	Western academic research defaults to linear research process (cf. Chilisa 2020)	Short-term thinking in community development prevents community involvement and solutions to be grounded in a sound understanding of local contexts (cf. Tolsdorf et al. 2025)	Western academic funding and research approaches favor hierarchical structures and power imbalances (cf. Chilisa 2020)	Creating opportunities for students’ and researchers’ recurring engagements with the same place and people	Involving local communities in planning and teaching of UIA courses as developing solutions requires prioritizing communities’ needs over expert approaches	Creating a team structure with an Indigenous (academically trained) researcher as PI
	Time and resource constraints imposed by efficiency and outcome-oriented ways of organizing education (cf. Manuel-Navarrete et al. 2021)	Decisions and solutions for community-based problems are developed by experts without engaging communities (cf. Norström et al. 2020)	Western researchers’ insufficient knowledge of local context, traditions, and values (cf. Sheremata et al. 2018)	Immersion to cultivate a sense of commitment to place	Immersion into communities and interdisciplinary student group work to foster understanding and appreciation of local contexts	Immersion to learn about local socio- cultural context early in the research process and continuously engage with local stakeholders to verify findings
				Educating students about the importance of processual approaches to engaging with others	Ensuring ongoing partnerships with community members as student cohorts pass on their project to the next cohort	

research paradigms. It has been suggested that Euro-Western trained researchers may find it difficult to embrace Indigenous methods and accept the quality of Indigenous knowledges (cf. Kovach 2021). Yet, without this readiness, a more equal approach to co-production may not be possible (Chilisa 2020).

Although the reflexive cycle may be applied to a variety of contexts, the idea to develop it emerged from the need to have a teaching aid helping learners to explore the meaning of relationality for their own learning and research practice. The Malaysia case presents the Ushah in Action (UIA) curriculum as

one recent effort to change higher education curricula in a way that they embrace principles of inter- and transdisciplinarity by drawing on local Indigenous ontologies such as *Sehjata* (Abdul Razak et al. 2021). Yet, even those students who were raised in Malaysian society experience this as challenging because contemporary formal education, influenced by Euro-Western non-relational rational and disciplinary thinking, has shaped their ideas about learning. UIA thus presents a challenge for many students because its emphasis on enhancing a relational attitude requires them to unlearn disciplinary thinking and established notions of knowledge production (cf. Woiwode et al. 2021). As with individual projects having limited impact when consciously addressing issues of power (see above), single curricular approaches such as UIA may only have a limited impact if the overarching values and goals of the education system do not correspond to this, i.e. are still not relational and focus on universalist metrics of quality and success (Sterling et al. 2018).

The case studies thus serve to illustrate possible starting points for inner work. Our reflexive cycle, aiming at inclusive TDR, seeks to engage with our relationship to all beings and the values we associate with them, and invites questioning the power relations in which we find ourselves, including overcoming disciplinary boundaries. There is much more to this, as the case studies show. For us, however, these were essential starting points for developing the reflexive cycle through which we want to connect to the work of scholars suggesting that transformation and decolonization need to go hand in hand (Gram-Hanssen et al. 2022), because both aim to overcome the negative consequences caused by colonialist and capitalist structures (Sultana 2022, Turnhout 2024). Our proposed reflexive cycle for inclusive TDR in teaching and research thus seeks to cultivate the kind of self-reflexivity that can lead to inner transformations that make room for embracing onto-epistemological diversity and making co-production more equal (Norström et al. 2020, Chambers et al. 2021).

The potential of inclusive TDR for learning and capacity-building

Inclusive TDR cannot be taught through purely cognitive approaches to learning (Wamsler et al. 2021, Ives et al. 2023). Cultivating onto-epistemological openness involves feeling and embodying our human-nature connectedness, and continuous reflection of how individuals are embedded in a variety of social and natural networks. Similarly, Gram-Hanssen et al. (2022), addressing non-Indigenous researchers, argue that fostering relationality in the context of sustainability transformation requires fostering an attitude of embodying relationality, and consciously seeking out one's own non-relational blind spots.

It is possible that this approach alienates rather than inspires those it is aimed at (that is, those coming from long and rigorous processes of Western-European conditioning). Furthermore, transformative learning generally involves enduring loss or distress (Mälkki 2019). Yet, as Indigenous researchers have argued time and again, alienation is what numerous Indigenous researchers, students, and research participants have been and still are experiencing when confronted with Western-European research that is based on knowledge extraction and continues to marginalize their Indigenous worldviews and knowledge systems (Gallegos-Riofrio et al. 2022, Yua et al. 2022, Wehi et al. 2023, Stirling et al. 2024). Moreover, given the ubiquity and pervasive supremacy of Euro-Western onto-epistemologies (Chilisa 2020),

achieving more inclusive approaches to co-production requires researchers to take both a step in and a step back (and out) to allow for more deep listening and meaningful engagement with marginalized onto-epistemologies (Kovach 2021, Gram-Hanssen et al. 2022).

We hope that our reflexive cycle becomes an ally to the multiple ongoing and emerging efforts by Indigenous scholars to help Western-trained scientists engage with a wider reality in more relational ways. For instance, David-Chavez et al. (2024) propose a relational science model for decolonizing research that emphasizes relational accountability, reciprocity, and relational ethics. Similarly, Stein et al. (2024) argue that Western-trained scientists need to unlearn exceptionalism and develop epistemic humility. Not only does this involve respecting differences in ways of knowing, but it also requires actively valuing and appreciating those differences, while humbly acknowledging that all human knowledge is inherently partial, context-dependent, and limited (Stein et al. 2024).

However, our proposal comes with limitations. First, we acknowledge that research processes continue to occur within systems that are essentially non-relational (Latulippe and Klenk 2020). While we are convinced that fostering reflective approaches to research that target researchers' inner worlds, seeking to engage them with relationality, individuals still are part of wider social networks and systems that may limit the impact of such transformative approaches (Lemos et al. 2018, Marshall et al. 2018). Second, as scientific research continues to take place in the context of unequal access to resources and career prospects (Chilisa 2020), engaging with marginalized approaches to knowledge production may entail professional risks. Third, we wish to reiterate that we are aware of the danger of turning inclusive TDR into a mere academic or policy buzzword, thus institutionalizing and taking away its transformative potential (Gallegos-Riofrio et al. 2022). This is related to the danger of merely appropriating Indigenous knowledge and methodologies that is generally associated with the colonial tradition of extractive research (Smith 1999, Thambinathan and Kinsella 2021).

CONCLUSION

Inclusive TDR requires not only continuous investments in deep listening and trust-building with non-academics, but also inner work toward onto-epistemological pluralism. When there is reciprocity between diverse ways of knowing and being, relationships can thrive despite the inevitable challenges, difficulties, and periods of inactivity (Buzinde et al. 2020). These relationships hold equal value to incommensurable contributions, emphasizing the importance of seeing knowledge as something that arises from interconnected relationships between "knowers." In this inclusive framework, TDR is co-produced through a dialogue with both animate and inanimate beings, recognizing their cognitive interdependence.

Our work aims to benefit those interested in promoting horizontal co-production and context-sensitive TDR, contributing to the decolonization of academic knowledge production (Stein et al. 2024). We argue that the global metacrisis of today is fundamentally relational and propose that inclusive TDR can contribute to the development of "better knowledge" (Reid et al. 2024, Turnhout 2024). However, we recognize that our reflexive

cycle is not a comprehensive solution but an invitation for researchers and educators to explore the potential of fostering inner work toward a more relational and pluralistic approach to knowledge. We encourage adapting and expanding upon our reflexive cycle, using it as an inward journey into the core of a fractal; the deeper one goes, the more one finds that each layer unfolds into infinite patterns of connection, revealing that the center of our being is intertwined with the totality of existence.

Author Contributions:

All authors participated in the workshop that generated the five shifts of the reflexive circle; BC, ZABS, DMN provided one case study each; CG, DMN, FT, TS and DJL conceptualized the first draft; CG wrote the first draft; all authors discussed and reviewed the first and subsequent drafts; DMN completed the three final versions of the manuscript and took responsibility for final editing. The first two authors contributed equally.

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Data Availability:

Data/code sharing is not applicable to this article because no the data analyzed are presented as case studies in the manuscript.

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