Received: 10 October 2024 | Accepted: 21 June 2025

DOI: 10.1002/pan3.70116

People and Nature

RESEARCH ARTICLE

The role of relational learning in knowledge co-production

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Funding information
Svenska Forskningsrådet Formas, Grant/Award Number: 2020-01614; HORIZON EUROPE Framework Programme, Grant/Award Number: 101056844

Handling Editor: Nibedita Mukherjee

Abstract

1. Learning, and how we learn, is integral for the governance of complex social-ecological systems. With the growing interest in knowledge co-production comes a need to further study how to better enable learning between different actors engaged in dialogue-based processes.
2. We use an empirical case of a workshop series centred on collaborative water and landscape governance on Öland, Sweden, to explore how a process partly designed for relating to others supported participating actors in their learning. Based on an analysis of reflection exercises and semi-structured interviews conducted with all 17 actors, we assessed learning outcomes using competencies in sustainability as the analytical lens. Competencies in sustainability allowed us to investigate how and why actors developed individual changes in perception and built and strengthened the skills and attitudes needed to deal with complex challenges in practice.
3. We provide empirical evidence that relational learning takes place in knowledge co-production processes and supports actors in competency development. The detailed accounts of changed understandings of the problem, pathways forward and especially other actors show that relational learning plays a key role in addressing misunderstandings and conflicts of interest, which could make collaborative governance arrangements more feasible. We found that a mix of discussion and interaction formats and activities specifically designed for relational learning create opportunities for engaging with plural understandings, perspectives, interests, norms and values. Hereby, actors need to draw on active listening, compassionate communication, collaborative and critical self-reflection skills as well as positive attitudes towards plurality. Different assessment approaches embedded in a process provide time for reflection and revisiting the learning.
4. We argue that designing for, supporting and tracing relational learning in knowledge co-production leverages dialogue-based processes as a suitable tool for nurturing collective action for addressing sustainability challenges in complex social-ecological systems.

KEYWORDS
assessment, competencies, Education for Sustainable Development, knowledge co-production, relational learning, social-ecological systems, transdisciplinary research

1 | INTRODUCTION

Learning plays an integral role in the governance of social-ecological systems, as complex circumstances and uncertainty require actors to draw on previous experiences and constantly re-evaluate knowledge and action options (Biggs et al., 2012; Cundill & Rodela, 2012; Pahl-Wostl, 2006; Walters, 1986). Within natural resource management, learning is often framed as a social process where individuals develop their understanding through engaging in active dialogue and collaborative decision-making with others. This social learning may then lead to changes within institutions or communities of practice (Armitage et al., 2008; Pahl-Wostl, 2009; Reed et al., 2010). However, several reviews of the literature point out that most studies lack conceptual clarity, a clear definition of social learning and a transparent discussion of methodological choices made to trace social learning processes (Ernst, 2019; Gerlak et al., 2018; Rodela et al., 2012).

Knowledge co-production, defined by Norström et al. (2020) as '[i]terative and collaborative processes involving diverse types of expertise, knowledge and actors to produce context-specific knowledge and pathways towards a sustainable future' (p. 183), picks up some of these threads as it represents a deliberate and targeted social learning process. In an in-depth review of 32 cases of knowledge co-production, Chambers et al. (2021) identify two main pathways to generate impact in multi-actor settings through learning from and with each other: by creating scientific knowledge products or by creating spaces for relating to others and engaging in change-making. However, misunderstandings and conflicts of interest between different actor groups present key obstacles in multi-actor settings, standing in the way of learning processes and taking collective action (Cabello, 2024; Caniglia et al., 2023; Chambers et al., 2022). Consequently, the field of knowledge co-production currently engages in an intensive exploration of formats and designs that are particularly effective for co-producing certain outcomes, but also fit situations characterized by misunderstandings and conflicts of interest. In addition, there is a need for more research on good practices for a rigorous and transparent assessment of what, how and why people learn in these processes. Apart from a few empirical contributions outlining the effects of design, facilitation and evaluation tools for changing actors' individual perception (e.g. Blackmore et al., 2016; Charli-Joseph et al., 2023; Seguin et al., 2021), most research does not offer clear conceptual and methodological guidance for how to advance the theory and practice of knowledge co-production regarding the evaluation of learning outcomes (Blackmore et al., 2016; Chambers et al., 2021; Johannessen et al., 2019; Seguin et al., 2021; Singer-Brodowski et al., 2018; Van Epp & Garside, 2019).

This study provides an in-depth, rigorous evaluation of a workshop series on collaborative water and landscape governance held on Öland, Sweden, conceived to investigate how a process partly designed for relating to others can support and influence what, how and why actors learn during knowledge co-production. To investigate and assess learning outcomes, we use competencies in sustainability as the analytical lens, as they centre on relational aspects in learning processes, allow us to draw attention to knowledge, skills and attitudes and serve as a generally relevant framework for tracing learning in knowledge co-production. We conclude by discussing relational learning as a branch of social learning that focuses on learning to relate to others to deal with plural understandings of the problem, pathways forward and other actors to collaboratively address sustainability challenges.

2 | THEORETICAL BACKGROUND

Building on ideas that individual learning takes place in a social context through dialogue and informal interactions (Bandura, 1977; Freire, 1970), Lee (1993) introduced the idea of social learning in natural resource management to refer to learning between resource managers, policy-makers and researchers in adaptive management to cope with uncertainty through experimentation and the creation of opportunities for change-making. Since then, the concept has been developed alongside approaches to govern complex social-ecological systems, such as collaborative management and adaptive co-management (Cundill & Rodela, 2012). Reed et al. (2010) define social learning as 'change in understanding that goes beyond the individual to become situated within wider social units or communities of practice through social interactions between actors within social networks' (p. 7). As this definition allows for understanding social learning as a two-step process consisting of (1) shifts in individual perception and (2) subsequent changes at the institutional or community level, different studies have followed up on individual changes (Baird et al., 2014; Lebel et al., 2010; Schauppenlehner-Kloyber & Penker, 2015) or institutional and community-level changes (Colvin et al., 2014; Ison et al., 2007), which explains the resulting lack of conceptual and methodological clarity around assessing social learning outcomes (Ernst, 2019; Gerlak et al., 2018; Rodela et al., 2012). Similarly, the systematic review of 100 empirical cases involving co-production processes by Wyborn et al. (2019) provides examples of studies reporting on actors' increased knowledge and awareness but also highlights research tracing changes in policy- and decision-making at multiple scales.

Zooming in on shifts in individual perception in knowledge co-production, studies by Blackmore et al. (2016), Charli-Joseph et al. (2023) and Seguin et al. (2021) provide examples of actors' improved understanding of the knowledge, needs, values, roles and

interests of others; the emergence of more systemic views; collective understandings; and agency, as well as the development of relationships and trust. These studies also offer promising entry points for studying learning based on their rigorous and transparent assessment of design, facilitation and evaluation tools.

2.1 | Relational learning

Building on this foundation, we propose the idea of relational learning as a branch of social learning that focuses on learning to relate to others to deal with plural understandings of the problem, pathways forward and other actor groups to collaboratively address sustainability challenges. We argue that this type of learning counteracts reducing people to holders of specific views ('stakes') or associating them with narrow sets of practice, which may lead to misunderstandings, conflicts or even polarization. Instead, relational learning requires actors to reflect on their own and others' perspectives and positions (Ligtermoet et al., 2025; Morrison & Chorba, 2015; Wells, 2015). To situate and contextualize such reflections as part of relational learning processes, actively working with place presents a promising entry point. Place, with its multiple ties to different identities, interests and livelihoods, can serve as a relational bridge for engaging with different perspectives, reframing one's own and the position of others and developing individual changes in perception. For example, Anderson and Harrison (2016) discuss places or landscapes as an extension of individual lifeworlds, through which actors can mobilize multiple articulations of value and meaning, but also trace the roots of certain ways of thinking and doing. Similarly, place-based practices allow actors to better understand how and why others mobilize care and agency to manage and govern landscapes (Anderson & Jones, 2009).

To support actors' relational learning in knowledge co-production processes, several studies provide insights on how to design opportunities for relating to others. Charli-Joseph et al. (2023) applied different exercises to explore values and meanings shared by the group of participating actors to reconcile tensions around land tenure and water use in Xochimilco, Mexico. They conducted a walking workshop to engage with place-based activities and others' perspectives and tried out a role-playing game to explore collective decision-making. Through observed changes in how actors perceive their own roles as well as individual and group capacities, and documented changes in actors' vision of a desirable future and pathways for achieving this vision, they concluded that group identity formation and alliance building took place. Blackmore et al. (2016) draw on several international case studies and synthesize that narratives and storytelling were central in learning processes for transforming water governance, as they allowed for exploring, sharing and challenging different individual understandings of the problem and pathways forward, and the emergence of a shared system understanding. With a similar focus on water governance, Seguin et al. (2021) showcase how participating actors built collective understandings of the problem and learned more about water and its management since the different participatory methods rendered actors' different values visible.

What these and similar studies (e.g. Bonatti et al., 2022; Ison et al., 2007; Souza et al., 2020) have in common is that they detail how and why facilitators draw on various discussion and interaction formats, such as conversations in small groups, pairs or sharing circles, and set aside enough time for engaging in meaning-making through sharing and exchanging knowledge, experiences and perspectives. Among the different participatory activities are mapping exercises to understand interrelationships and links in complex systems, storytelling to bring in history, memory or personal reflections, walking workshops for situating and rooting discussions in a specific context and role-playing games to encourage actors to actively take on different perspectives. Such participatory activities provide insights on how to design for relational learning, but also hint at entry points for assessing learning outcomes. Drawing on educational research, we introduce competencies in sustainability as a useful analytical lens to explore how and why actors develop individual changes in perception as well as the skills and attitudes to deal with plurality in practice and discuss methodological approaches for tracing these developments.

2.2 | Tracing relational learning processes through competencies in sustainability

The field of Education for Sustainable Development has developed and put forward key competencies in sustainability to prepare and support learners to engage in change-making (Brundiers et al., 2021; de Haan, 2010; Redman & Wiek, 2021; Rieckmann, 2012; Wiek et al., 2011, 2015). As no one learner can address sustainability challenges alone, competencies centre relational aspects in both their development and implementation process. Drawing on Wiek et al. (2011), we define competency as a 'functionally linked complex of knowledge, skills and attitudes that enable successful task performance and problem solving [...] with respect to real-world sustainability problems, challenges and opportunities' (p. 19). Competencies therefore bring together what we (1) need to know, (2) are able to do and (3) would be willing to do to effectively address sustainability challenges. We have selected systems-thinking, futures-thinking, values-thinking, strategies-thinking, interpersonal and implementation competency from the competency framework by Redman and Wiek (2021) for assessing learning outcomes. *Systems-thinking competency* focuses on understanding sustainability problems within a specific system, but also familiarizing oneself with complexity and the interrelated components or feedback loops (Brundiers et al., 2021; Wiek et al., 2011). Key skills include the ability to analyze interconnected systems across different scales (Annelin & Boström, 2023) and critical thinking (Rieckmann, 2012; Wals & Lenglet, 2016). *Futures-thinking competency* presents the ability to craft future sustainability visions, forecasts and scenarios. It involves thinking about what 'desirable futures' mean and creating space for a plurality of goals within these visions (Brundiers et al., 2021;

Redman & Wiek, 2021). Building and strengthening *values-thinking competency* requires actors to deal with a plurality of values. To deal with plurality, they need to work on their attitude of being open to different perspectives and learn to develop an understanding of others' values and how these values underpin decision-making processes (Wals & Lenglet, 2016). In conversations with others, actors might also renegotiate sustainability values according to changes in perspective (Redman & Wiek, 2021). *Strategies-thinking competency* focuses on generating ideas to alter the status quo, which requires working with contrasting visions and conflict in productive ways and, in some cases, reconciling conflicts of interest by thinking about how to create synergies (Wiek et al., 2011) and developing strategies to collaboratively affect change (Brundiers et al., 2021; Redman & Wiek, 2021). After developing different viable strategies, actors need to apply their decision-making skills to identify those strategies they want to translate into action. Building and strengthening *interpersonal competency* requires actors to recognize the value of meaningful collaboration and develop a positive attitude towards working within a diverse group (Wiek et al., 2011). Through enhancing their collaborative and communicative skills, actors can establish networks and develop a sense of belonging. Lastly, *implementation competency* refers to the translation of ideas into action (Brundiers et al., 2021; Redman & Wiek, 2021; Rieckmann, 2012), which requires actors to develop an understanding of how to affect change as a group (collective agency), how to support others in affecting change (proxy agency) and how to engage in change-making themselves (individual agency) (Bandura, 2006). Although bringing about change draws special attention to leadership and problem-solving skills, actors ultimately need to possess and draw on all competencies. Rieckmann (2012) reminds of the interconnectedness of competencies, with all competencies relying on and informing each other (Brundiers et al., 2021; Redman & Wiek, 2021; Wiek et al., 2011).

Based on a review of tools for assessing the development of competencies in sustainability, Redman et al. (2021) found that scaled self-assessments, reflective writing, case-based work or interviews feature prominently inside the 'traditional classroom' (formal educational settings). To capture what people know, are able to do and would be willing to do to address sustainability challenges, many studies included in the review combine several of these tools to assess changes in knowledge, skills and attitudes. As learners may perceive rating or articulating changes in perception as a challenge, one approach is to construct and tell stories to each other based on one's memory of specific activities, as illustrated by 'stories of value creation' developed by Wenger et al. (2011) to discuss meaningful activities, new insights gained and the application of new insights in the future. As a way to harvest such stories, the learning activity survey developed by King (2009) presents a quantitative entry point, and reflection exercises and interviews are examples of a qualitative approach to assess capabilities such as openness to new ideas or avoiding premature judgements, reflection on positionalities and perspectives and negotiation of shared meaning (Willink & Jacobs, 2011). Studies by Ensor and Harvey (2015) or Van Epp and Garside (2019) outline how to apply assessment tools outside the traditional classroom and follow-up on cognitive, normative and relational learning outcomes encompassing changes in knowledge, norms, values, belief systems and interpersonal dynamics. With our interest in competency development during knowledge co-production and the intent to embed the assessment in a larger process to avoid that actors feel like subjects under study, we will outline how we adapted and combined different assessment tools next.

3 | METHODS

We designed the knowledge co-production process on Öland to nurture collective action for change-making (Seiferth et al., 2024). After a baseline assessment and discussions with three key informants active in Öland's Water Council (Ölands Vattenråd) and the Water and Conservation Departments at the County Administrative Board (Länsstyrelsen Kalmar), we invited 17 actors to join the series of three workshops. We wanted actors to (1) represent different actor groups concerned with and knowledgeable about water and landscape governance on the island, (2) be interested in dialogue-based processes and collaborative projects and (3) have existing ties to other stakeholders to bridge social and organizational contexts. Among the 17 invited actors were farmers, representatives of environmental protection and cultural organizations, recreational fishers, as well as actors knowledgeable in administration and policy-making. Sixteen actors joined the first workshop, 15 the second workshop and 16 actors participated in the third workshop.

The three workshops took place between November 2022 and March 2023 and included different complementary activities, reflection exercises and follow-up interviews (see Figure 1; Appendix S1). At the beginning of the first workshop, we presented conditions for a good dialogue and agreed on a shared code of conduct to comply with ethical standards of knowledge co-production processes. All actors agreed to participate in research activities through signing an Informed Consent form. We then engaged with systems mapping to build a broad knowledge base of Öland as a complex social-ecological system. The second workshop centred on landscape stories, practices and perspectives through place-based encounters. During the third workshop, we brainstormed ideas for change-making through scenario thinking and strategies development. The different activities built on various discussion and interaction formats, such as discussion rounds as well as discussions in plenary, pairs or small groups. For small group discussions, we created groups consisting of actors with different or similar perspectives or let actors freely choose a group to allow for various actor constellations.

While we included some activities for supporting actors in mobilizing, articulating and connecting different types of knowledge (Seiferth et al., 2024), we intentionally designed others to nurture relational learning (see Figure 1). To illustrate, the 'Mood boards' activity at the beginning of the first workshop invited actors to engage with others' perspectives, interests and understandings of water issues on Öland.

	Activity	Description	Discussion and interaction/ reflection format	Relational learning opportunities
Workshop 1: *Social-ecological systems mapping*	 Mood boards	• Share positive and negative associations with water • Create shared problem formulation	• Discussion round • Discussions in plenary	• Engage with others' perspectives, interests, and understandings of the problem
	 Inventory of existing initiatives	• Create overview of existing initiatives to address problem	• Discussions in plenary	
	 Systems flowers	• Map actors, opportunities, and challenges around initiatives • Create system representations	• Discussions in small groups of 4-5 actors with shared interest in initiative • Group presentations followed by discussions in plenary	• Engage with others' perspectives, interests, and understandings of existing initiatives
	 Reflective postcards	• Formulate personal learning (What did I learn during the first workshop?)	• Individual reflection	
	Follow-up interviews with 7 actors			
Workshop 2: *Landscape stories, practices and perspectives*	 Place-based walks and talks	• Connect knowledge, values, perspectives, interests, and personal stories to place • Formulate and capture new insights about places visited through use of reflective diary and taking photos	• Walk and visit of three places with discussions in pairs, small groups, and plenary • Individual reflection	• Engage with others' values and meanings attached to places and explore place-based practices through storytelling and photo elicitation • Joint walking for relationship- and trust-building
	 Synergies mapping	• Think about synergies between different values, perspectives, and interests	• Discussions in small groups of 3-4 actors with different perspectives • Group presentations followed by discussions in plenary	
	 Seeds for good collaboration	• Collect positive aspects of collaboration	• Continuation of discussion in same groups as for Synergies mapping activity • Group presentations followed by discussions in plenary	
	 Circle, square, triangle	• Formulate personal learning (What are my three key take-aways? What did I really understand? What spins still around in my head?)	• Individual reflection	
Workshop 3: *Scenario thinking and strategies development*	 Three Horizons	• Create desirable future visions • Map seeds of desirable future visions visible in the present • Brainstorm what needs to change to enable emergence of future visions • Formulate ideas for personal change-making	• Discussions in small groups of 3-4 actors with similar perspectives • Group presentations followed by discussions in plenary • Individual reflection	• Engage with others' values and norms, which inform what a desirable future looks like • Revisit own and others' perspectives, interests, and understandings of the problem
	 Action steps for change	• Map changes in the landscape, values, norms, attitudes, and institutional practice	• Discussions in small groups of 3-4 actors with similar perspectives • Group presentations followed by discussions in plenary	
	 Strategies development	• Create strategies for navigating change towards desirable future visions	• Discussions in small groups of 3-4 actors with shared interest in strategy • Group presentations followed by discussions in plenary	• Create pathways forward based on plural perspectives, interests, norms, values, and understandings of the problem
	 Action step	• Formulate personal learning (What is a first step I can take?)	• Individual reflection	
	Follow-up interviews with all 17 actors			

FIGURE 1 Overview of activities, reflection exercises and follow-up interviews during the workshop series.

During the 'Place-based walks and talks' activity, we drew on the idea of places as relational bridges to surface plural values and meanings attached to multifunctional landscapes on the island. We asked certain actors to introduce the group to the sites visited and listened to stories about place-based practices. The joint walking also presented an opportunity for relationship- and trust-building as actors also had time to get to know each other on a more personal level.

To assess learning outcomes resulting from repeatedly relating to others during specifically designed activities, we invited actors to reflect on their own knowledge and that of others during and at the end

of the workshop series. Drawing on Searle et al. (2021) and different toolboxes, such as the ones by SessionLab (https://www.sessionlab.com) and Hyper Island (https://hyperisland.com), we designed different reflection exercises (see Figure 1). We invited actors to summarize their personal learning on 'Reflective postcards' at the end of the first workshop to harvest reflections. After the second workshop, we asked actors to share their three key take-aways, what they really understood, and what still spins around in their heads regarding water and landscape governance on the island with the help of a reflection exercise called 'Circle, square, triangle'. At the end of the third workshop, we invited actors to take stock of the discussions around interventions and strategies and write down a first step they would like to take to engage in change-making on an 'Action step' card.

In addition, we conducted semi-structured follow-up interviews with 7 participating actors after the first workshop (see Appendix S2) and all 17 actors after the third workshop (see Appendix S3). The interviews after the third workshop followed the approach of Wenger et al. (2011) in constructing a story of value creation. We included questions to trace experiences of actors throughout the workshop series with a special focus on activities, similar to the approach presented by King (2009). We were interested in the perceived outcomes of these activities, such as new insights gained about the problem or pathways forward, or skills and attitudes developed and asked about the perception of other actors at different times during the workshop series. For the qualitative analysis of both the reflection exercises and the interviews, we employed a deductive approach (Creswell & Creswell, 2018). We used the competencies in sustainability as propositions to code identified topics into categories. Although part of the framework of key competencies in sustainability, we left out intrapersonal competency as tracking actors' emotional development was beyond the scope of this study, and integration competency because it presents a meta competency and rather connects all other competencies (Redman & Wiek, 2021; Wiek et al., 2011). The categories were systematically reviewed and revised to create sub-categories and guide coding (see Appendix S4) before we identified and analyzed themes (Miles et al., 2020; Tracy, 2020).

4 | RESULTS

In the first part of the results section, we showcase how learning to relate to others supported actors in building and strengthening competencies in sustainability. The second part of the results section zooms in on the role of relational learning in developing changed understandings of other actors, which provides an entry point for addressing misunderstandings and conflicts of interest.

4.1 | Building and strengthening competencies

4.1.1 | Systems-thinking competency

Especially during the first workshop, actors had a chance to discuss the current state of Öland's water and landscape governance issues together. Through conversations with others, many actors realized that there exists a shared understanding of the problem within the group: 'the fact is that everyone had the same, the same starting point. We have a problem with water. And that is the most important thing. There is a lot of consensus' (P06).

In addition to acquiring an 'increased understanding of how complex it is' (P06), actor P10 mentioned that 'I have a broader and greater knowledge of Öland's water now than I had before. I have more, more stories, more examples, […] I have more of an expanded knowledge base to draw from'. Actor P13 provided a concrete example that 'I have learned more about water, about how, how the municipalities think about drinking water, […] I knew that we had—have—a shortage and that it is difficult and that we have built a desalination plant in Borgholm, but how the municipalities think and how serious it is now with […] drinking water, I had not really understood'. As the group consisted of actors working at or bridging different governance levels, some actors provided examples of how they began to understand the links between local problems and regional or national decision- and policy-making—an important skill for systems-thinking. Referring to the lengthy bureaucratic processes and administrative procedures on the regional level for implementing water management measures, actor P05 said 'what I really take away from this is that everyone has the same problem. It is this with processing times and permit assessments and such […], I thought that it was something that agriculture was particularly affected by, but I have learned that it is something that everyone is affected by'. Actors also made use of their critical thinking skills. They mentioned that their understanding of the problematic nature of current Swedish legislation concerning land drainage increased, which oftentimes stands in the way of wetland restoration efforts: 'there are still these drainage enterprises and water rights and lots and lots of things to deal with, and permit applications and so on, which are obviously very, very complicated, I understand. Administratively very cumbersome' (P10).

Some actors also shared that conversations with others provided new insights into the island's water and landscape governance issues, especially when it comes to viewing Öland as a complex dynamic system with interrelated system components, functions and feedback loops. To illustrate, some actors mentioned that they learned more about the connections between various landscape features and the interplay between nature and culture, especially during the site visits as part of the second workshop.

4.1.2 | Futures-thinking competency

Given the group's shared complex problem understanding, many actors mentioned that the process of jointly creating a vision for the island's future seemed fairly easy at the beginning, since everyone agreed on the importance of water, as illustrated by a quote from actor P06: 'there is no starting point for explaining why water is important, because there is no one, no County Administrative Board, no farmer, nobody who can say that this is not a very, very important issue'. Actor P13 remarked that 'there

is a common ground of wanting a living, somewhat healthy landscape, with water in it'. When actors were asked to further refine this overarching vision, they thought through, articulated and negotiated different agendas, dealt with the plurality of goals and critically reflected on if and how these are compatible. Reminding of potential tensions and conflicts of interest, which might arise in the process of creating space for different subgoals under a shared vision, actor P05 reflected that 'when you get down to specifically what has to be done, what and how, then I think we have many more goals that can clash'.

4.1.3 | Values-thinking competency

Thinking about desirable futures required actors to engage in normative discussions about values and ethical considerations, which links futures- and values-thinking. During the different activities of the workshop series, actors felt there were plenty of opportunities to understand and articulate their own values while comparing them with those of others through being open-minded. While actor P11 understood 'the different values of, in this case, water, that it can mean so much to different people', actor P01 revisited what he regards as important: 'I have learned a little from the others, checking in, like, what you think is important, like. So that you do not just sort of step on something that is important [for someone else]. And when it comes to us farmers, there is a lot that is not important, but some things are important, [...] certain fields, that you really get to cultivate them'. This quote also presents an example of internal processes for renegotiating sustainability values. He continued clarifying that while leading water off the fields for cultivating crops is crucial, woodlands can be under water: 'it is no problem to leave them [the woodlands] under water and if the pasture dries up a little later too, it is just an advantage. Keeping the water also means that it does not get so hot'.

Throughout the workshop series, actors also increased their understanding of how values underpin the governance of multifunctional landscapes. Zooming in on the different ways people work with and think about water on the island, actor P07 noted that 'everyone wants to preserve the special natural and cultural landscape of Öland, but there are different approaches. Those who live and work there take care of it by managing it, they have grazing animals, those who work with natural and cultural issues want to highlight those values'. Familiarizing themselves with different perspectives nurtured empathy and allowed actors to develop a better understanding for others' conditions and circumstances in relation to their work or engagement in interest organizations, as illustrated in Section 4.2.

4.1.4 | Strategies-thinking competency

During the interviews and the different reflection exercises, actors shared that familiarizing themselves with others' knowledge and perspective, creating a shared problem understanding and desirable future vision and negotiating which values to uphold laid the foundation for developing concrete ideas to address Öland's water and landscape governance issues towards the end of the workshop series. Actor P04 mentioned that 'I think I have seen many other solutions. There is, of course, no single solution to this; there are many different ones'. Similarly, P10 explained that 'I was not as aware of how to change the management regime in agriculture. There are probably many, many more solutions than what you think of immediately'. To accommodate actors' plural agendas, goals and values, the group developed four synergetic and collaborative strategies, which also set out to reconcile existing tensions and interest conflicts. Strategy 1 centred around restoring natural functions within Öland's water landscape, Strategy 2 focused on educating the general public about water issues on Öland, Strategy 3 included ideas on flexible drainage enterprises to allow for water retention in the landscape and Strategy 4 highlighted the role of farmers as sources of inspiration and farms as places for experimentation and sharing knowledge (Seiferth et al., 2024).

During the interviews, many revisited ideas related to the four strategies developed at the end of the third workshop. To illustrate, actor P13 shared the following about the strategy on educating about and raising awareness of water issues: 'We were thinking of a series of interviews with people who have relatives or have lived here for a long time and remember how the land was wetter in the past, about water memories. We thought of a concrete educational exhibition model at Himmelsberga, where both children and adults can play and see the different water levels on Öland and imagine how, or literally see, how the water flows on the island [...]. And a third part was to [...] work with invited artists who work in the landscape, perhaps with water, and also invite experts to talk to and create art with'.

Actor P19 added that he continued talking about this idea with actor P15 in one of the breaks: 'The water issue, for example, led us into discussions with P15 [...] about how we can work together to create a better understanding among the public of how water runoff works. So it is a concrete development of an idea that hopefully can lead to a workshop or something similar here at the museum in the future, which can tell us about what Öland has looked like historically and about drainage and how we could do it in the future and in that way showcase a current problem with an explanatory model and a historical understanding'.

4.1.5 | Interpersonal competency

In addition to developing concrete ideas to address Öland's water and landscape governance issues, recognizing the value of meaningful collaboration and knowing with whom to collaborate are precursors for translating strategies into action. Actor P05 shared that 'all the participants have come closer together. I think it was probably important for, very good for networking'. For some actors, the workshop series also

presented an opportunity to meet others they do not usually engage with: 'what was new, I think, was the representatives of civil society. It was fun that they were there, too. They were new people for me' (P02). Actors expressed that the workshops have made it easier to get in touch with others in the future: 'I have better contact with other actors, so it is probably faster, if I need help, I know who to contact' (P06). Actor P12 concluded that 'we are like a small family that can easily get in touch with each other I think'.

Linked to the idea of being a 'family', actor P14 reflected that 'it feels like the trust between the different groups has increased' and actor P13 shared that she feels 'a little more at home, a little safer after the workshop. A bit more secure in this group, in this network of different people working with water'. Regarding future interactions with others, actors developed some ideas for getting better in collaborating with and listening to others throughout the workshop series, thus developing their collaborative and communicative skills further: 'I will probably think about it a bit when I am in contact with both authorities and perhaps these other groups as well, and perhaps behave a bit differently. […] Maybe you should not be so harsh and say that this is how it is, but maybe you should say that we see it this way, a little softer' (P04). Actor P12 added that 'you have to listen to each other and then the perspectives become more legitimate, so to speak'. Actors also shared that the workshop series provided them with examples of how to manage conflicts and disagreements in constructive ways and understand and appreciate diverse viewpoints.

4.1.6 | Implementation competency

As the follow-up interviews took place after the first and third workshop, only a few actors shared that they have started to translate ideas for change-making into action. With a project course for students ahead of her, P13 mentioned that the workshop series inspired her to bring water issues into the classroom: 'the theme that was supposed to be about the sea, for me I will make it more about the water that goes from Öland to the sea. So there will be a slight change in direction'. Referring to a project proposal for translating the strategy on farmers as sources of inspiration and farms as places for experimentation into action, P14 said that 'it is already on my computer. So yes, yes, I have also sent it to the County Administrative Board, […] like a draft, or whatever you want to call it, about experiments with irrigation, and then I think I will add these pilot farms [Strategy 4] as a, as a subproject to it'.

While it was challenging to capture examples for taking immediate action, the interviews showed that actors developed an understanding of how to use collective, proxy and individual agency by providing different examples.

(Perceived) collective agency

Actors developed or increased their understanding of how they can collectively affect change as a group. During the interviews, they reflected on the importance of collaborating across different sectors: 'all of us living and working on Öland, how can we develop Öland in the best way? How can we secure water supply in the future? And it has to start now. And that you are part of it, agriculture, nature, tourism, all that, everyone is part of it and everyone must help' (P02). In their opinion, cross-sectoral collaboration is key to 'secure our future here on the island' (P04).

(Perceived) proxy agency

As specific activities were especially designed to mobilize, articulate and connect knowledge (Seiferth et al., 2024), the group noted that everyone 'came up with a lot of clever solutions that we could help each other with in terms of different projects' (P14). Different exercises invited actors to reflect on their own power and influence and how to best use them to advance a sustainability transition. In the interviews, some actors shared ideas on how they can influence others who have the necessary financial resources, time and mandate to act on their behalf. When it comes to supporting the strategy of raising awareness of Öland's water scarcity issues, actor P02 suggested to 'maybe be involved as a sounding board for sharing ideas and knowledge'. Actor P15 expressed that 'I cannot just sit and accept it, […] I have to try to influence in some way, and I do not want to go into politics yet, but I can try to influence others perhaps'. In his role in Öland's Water Council, P04 said that 'I will be able to help other farmers and landowners to deal more easily with the permit assessment and so on'.

(Perceived) individual agency

Actors articulated ideas for individual change-making, for example by sharing knowledge with others, initiating collaborations or implementing landscape-level interventions. Actor P05 expressed that 'perhaps in the Water Council, […] I can certainly bring some of what we have discussed and what we have learned. And even then, as I said, in discussions and conversations with colleagues, I can probably take it with me'. Similarly, actor P11 thought that 'I can take what we have discussed in the workshop with me, as well as raising it further within my channels, or with my colleagues'. The workshop series also strengthened actors' positive attitude towards collaboration: 'the workshop encouraged me, that you can do it and that it is good, also to work in the role you have, if you are an artist you can work with water in the way we do, to arrange, organize art projects or events around it' (P13). Actor P08 added that 'I have lots of projects going on. So it is not like I am going to start a lot of things now. But I may think a little differently and think more about the importance of various stakeholders being involved and being able to think and express their opinions early in the process'.

4.2 | Changed understandings of other actors

When exploring the multifunctionality of landscapes on Öland and developing ideas to improve governance processes during our workshop series, actors drew attention to their own knowledge gaps, familiarized themselves with others' knowledge and reflected on whose knowledge is important to address Öland's water and

landscape governance issues. In discussions with different people, actors were reminded that 'there is an enormous amount of knowledge about water. Yes, it is widely spread among all these people, and we have slightly different approaches and different specialist areas' (P04). Some actors, particularly those working for the authorities, appreciated that interest organizations and actors working in the cultural sector were part of the workshop series. Actor P11 stated that 'the municipality, landowners and the authority, the County Administrative Board, are three actors that I have worked quite closely with during these years', but that he gained 'new knowledge and perspectives from the cultural side, because those are the ones I have the least to do with'. As one example of perspectives gained from actors working in the cultural sector, he shared that 'you can use a museum, like Himmelsberga, as a space to raise awareness of an issue'.

Referring to local and experiential knowledge, actor P07, who works for the regional authority, acknowledged that 'many of the people who live and work on Öland possess knowledge that we are not even close to'. Similarly, actor P12 was reminded of the role of tacit and practical knowledge in addressing complex sustainability challenges during the workshop series: 'there are lots of skills and different knowledge […]. I know P05 [a farmer], I have known him for a couple of years at least. But quite often, unfortunately, he says in a slightly dismissive way that, well, I do not have any, I do not have any knowledge. […] And then I always reply that, yes, but you have another kind of knowledge, another kind of insight, another kind of experience, and practical experience that I do not have, which is just as valuable, at least, I say. And the, the, what should I say, the awareness that it is, that knowledge is not just academic or book knowledge, but there is other knowledge that is just as important, too. And we easily forget that, I think'.

The workshop series also surfaced similar, differing, or sometimes even clashing values, goals and aspirations. During the interviews, farmers and interest organizations referred to interest and ownership conflicts, especially around agriculture and wetland restoration, as well as the competition around access to water. Regarding the relationship between farmers and local and regional authorities, actors expressed frustration about the lack of trust and prevailing negative attitudes.

Throughout the workshop series, actors representing these groups had the chance to engage with diverse perspectives, which led to interesting changes in understanding. Drawing on discussions with actors representing interest organizations, actor P04, who is a farmer, referred to existing interest conflicts around land and water use and explained that 'many people are a bit, and maybe I am too sometimes, a bit afraid of them [interest organizations]. Because you think they have another, what should I say? That they are opposed to what we are doing'. As part of the workshop series, he understood that 'the interest groups, the Swedish Society for Nature Conservation and all those who, like them, they have a position that they unfortunately have not shown before. I have not seen it before, but now I have seen it, that they actually think that what we are doing is quite important and they are beginning to understand that they are very dependent on landowners and farmers as well, because it is largely us who manage this environment that they think is valuable and beautiful' (P04).

Actor P13, who is active in interest organizations on the island, shared an example of learning about and empathizing with others' reasoning: 'the kind of contradiction that you can sometimes feel between nature conservation and agriculture is […] partly due to a kind of defensive attitude, perhaps from both sides. But if you let go of that and somehow trust that you really both probably want the best for, the best for the landscape, then you can reason your way forward. And it happened, I think, when I talked to P04, […] I understood what he meant, that he meant that he could, for example, have high production, […] he could leave some pieces of land to be flooded or to become pasture instead or something, […] he also wants to go in the same direction as me' (P13). As another actor representing interest organizations, actor P10 reflected on a change in perspective after meeting farmers during the workshop and shared that he was 'pleasantly surprised' to hear farmers' openness towards doing things differently: 'I know that there are more farmers than I previously thought who are very open to thinking in new ways about water, water management. But it is not based on a prejudice about what farmers are like; it is just that I was not familiar with those people and their approach'.

Similar to representatives of interest organizations, local and regional authorities appreciated how farmers engage in landscape management. Actor P02 expressed that 'these farmers who were here, they have, well, a certain understanding that they have an impact and still want to do something, contribute as best as they can, for something good'. Similarly, actor P07 reflected that farmers 'look at the landscape and the values there in a different way than we do, and they know how to manage it'. He pointed out that 'it is not just a water perspective, but all the values' farmers seem to pay attention to. Actor P15 shared that 'I work a lot with agriculture and such, […] and I know many farmers privately. But I have, the biggest picture is that most only look after their own interests, because it is a business'. However, during the workshop series, she revisited her attitudes towards farmers and concluded that 'it was nice to hear that many were a bit innovative and open and think more broadly'.

When it comes to understanding others' conditions, actor P04 reflected that many 'had an insight into the fact that we have to produce food, and I think that has permeated all discussions really, that all we produce is food, food products. And most people actually seem to think it is quite important'. Actor P18, who works for the regional authority, shared that 'I have gained a better understanding of how farmers think about irrigation from their perspective' and actor P02 appreciated having 'learned more about the difficulties, and then the farmers' situation as well. So, understanding that it is difficult'. Actor P10 also developed a 'clearer understanding' of how farmers think strategically. He exemplified: 'P04's dam was very, I thought, represented the water issue in relation to agriculture. But also how […] many opportunities there were. Because I think that these irrigation dams, in some way, in terms of biodiversity and also in terms of appearance, are not a lot of fun, they are rather boring

places. But at the same time, I understand the necessity even more than before. Or well, not more than before, I understood that before, too. But I really understand the necessity, to have a viable agriculture on Öland, the water issue must be solved'.

5 | DISCUSSION

Our findings show that relational learning takes place in knowledge co-production processes and supports actors in building and strengthening competencies for addressing sustainability challenges. We also provide empirical evidence that actors change their understanding of others, which presents an entry point for addressing misunderstandings and conflicts of interest between different actors. We found that a mix of discussion and interaction formats and activities specifically designed for relational learning creates opportunities for engaging with plural understandings, perspectives, interests, norms and values. Different assessment approaches provide time for reflection and revisiting the learning, with a special focus on skills and attitudes developed to make better use of existing knowledge as well as ideas on how to apply the learning beyond the scope of a project.

5.1 | Discussion and interaction formats and specifically designed activities for relating to others

By combining active listening and compassionate communication with an attitude of open-mindedness, actors were able to appreciate and engage with similarities and differences in thinking about the problem, pathways forward and other actors. While there is value in surfacing shared understandings, we found that allowing actors to voice conflicting points of view is equally important: shared understandings can form a basis for aligned, collective action (Koskela & Paloniemi, 2023; Utter et al., 2021); conflicting points of view draw attention to areas for further negotiation and deliberation (cf. Cabello, 2024; Schusler et al., 2003). Especially when talking about negative associations with water on the island as part of the 'Mood boards' activity in the first workshop, we felt that photos presented a promising entry point for articulating root causes or symptoms of water scarcity on Öland and exploring plural understandings of the problem. In addition, actors shared personal anecdotes with each other to provide context to the photo, which nurtured processes of relating to others on a more personal level.

Moving from exploring plural understandings of the problem towards addressing misunderstandings and conflicts of interest in a productive way, the place-based walks and talks during our second workshop centred on different realities in terms of living in and working with the landscape and required actors to engage with personal stories loaded with values and emotions. Building on insights from visiting the three different places, actors turned conflicts of interest into opportunities for building synergies to improve the governance of Öland's multifunctional landscapes. To illustrate, the visit to the combined irrigation dam and wetland led to questioning the (perceived) incommensurability of agriculture and biodiversity conservation and exploring similar synergetic interventions in the landscape. In some cases, actors also thought through the strengths and weaknesses of their position and, if needed, modified it accordingly.

Different group work settings nurtured a positive attitude towards collaboration and allowed actors to practice collaborative teamwork. While grouping actors with similar perspectives and interests generated in-depth insights on agricultural practices, laws and regulations around land drainage, or the role of wetlands for biodiversity, grouping actors with different perspectives and interests supported the process of connecting knowledge, gaining complementary insights and identifying synergies for improved water and landscape governance. As a main outcome of the workshop series, actors proposed four strategies, which set out to achieve the shared vision of Öland as an island with water in the future while building on and accommodating plural understandings, perspectives, interests, norms and values. These strategies therefore combine the will to move towards a common goal, but also acknowledge the different possible pathways for taking action and implementing change-making. In addition to different group work settings, we conveyed discussions in plenary to harvest insights from group work and feed these into a shared understanding of the problem and pathways forward. We also found that discussions in pairs and spaces for informal interactions are crucial for engaging with others and vital for respectful relationships and the early stages of trust-building (cf. Langley et al., 2018; Schusler et al., 2003; Utter et al., 2021).

In addition to active listening, compassionate communication and collaborative skills, actors also needed to draw on critical self-reflection skills. Critical self-reflection skills are key for recognizing and questioning one's own perspectives, norms and values, which shape understandings of the problem, pathways forward and other actors. Drawing on these skills was crucial in discussions dominated by conflicting points of view to potentially identify incomplete or problematic perceptions and to update one's own frames of reference accordingly. The different reflection exercises throughout the workshop series provided opportunities for practicing critical self-reflection, but our findings also show that being open and transparent about one's own incomplete or problematic perceptions nurtures relationship- and trust-building.

We argue that the combination of active listening, compassionate communication, collaborative and critical self-reflection skills alongside positive attitudes towards plurality supports actors in learning to relate to others. Our results highlight that the different discussion and interaction formats and activities specifically designed for relational learning allowed actors to better understand others, but also themselves. Most actors engaged with others on a professional and personal level–especially through storytelling and photo elicitation during the 'Mood boards' or 'Place-based walks and talks' activities. Such activities also nurtured actors' willingness to receive other perspectives, but we also think that working with a code of conduct at the beginning of the workshop

series laid the foundation for respectful interactions and encounters at eye level.

Engaging in relational learning through drawing on different skills and attitudes is key for the development of competencies in sustainability, but competency development can also support actors in further building and strengthening these and other skills and attitudes such as analytical, critical thinking and decision-making skills as well as positive attitudes towards complexity. Through the comprehensive skill set and the willingness to understand, navigate and collaboratively address sustainability challenges, actors can make better use of existing knowledge and translate their ideas into action in the future.

5.2 | Assessment *as* learning

We used different assessment approaches to trace actors' relational learning throughout the knowledge co-production process. Aware of the tension between focusing on the needs and interests of actors and collecting data, we chose reflective entry points to avoid that actors feel like subjects under study. Assessment approaches required them to draw on their critical self-reflection skills and revisit changes in individual perception and the development of skills and attitudes, which fostered sense-making and an exploration of how to draw on the outcomes of the workshop series in the future. Moving from the assessment *of* learning, which fits well in educational settings, towards embracing the idea of assessment *as* learning (Earl, 2012), we regard assessment as an ongoing practice that informs and guides learning throughout a process, rather than merely a final measure of acquired knowledge, skills and attitudes at the end. While our findings show that research on knowledge co-production would benefit from paying more attention to creating reflection opportunities for actors, built-in reflection for those designing and facilitating dialogues remains essential to ensure responsiveness to actors' interests and needs (Caniglia et al., 2023; Chambers et al., 2021; Knickel et al., 2023; Moreno-Cely et al., 2021).

5.3 | Limitations

The findings of our study are context-specific, and we acknowledge that the group constellation of actors with an interest in collaborative projects and existing ties to other stakeholders mattered for achieving outcomes, such as building and strengthening interpersonal competency, which ultimately underpins the development of all other competencies. The decision to trace relational learning allowed for a discussion on how and why actors learn to relate to others in knowledge co-production but constrained an exploration of transformative or experiential learning experiences. Especially the 'Place-based walks and talks' activity during our second workshop presents an interesting entry point for discussing these two types of learning further. Using competencies in sustainability as our analytical lens helped us to engage with relational learning in a structured way. Similar to other studies, we document changes in the understanding of the problem, pathways forward and other actors, but add nuance to the discussion of cognitive, normative and relational outcomes (Baird et al., 2014; Lebel et al., 2010) through focusing on processes of connecting knowledges and developing the skills and attitudes to deal with plural understandings in practice. Actors' ideas for change-making, updated frames of reference and a reconsideration of values, beliefs and systemic structures link to triple-loop learning (Argyris & Schön, 1978; Pahl-Wostl, 2009), but translating these ideas into shifts in underlying governance structures on Öland and further shaping understandings of problems and pathways forward presents a collective effort beyond the group of actors involved in our workshop series. With our focus on changes in individual perception, we propose that future research on Öland follows up on subsequent changes at institutional and community level. Hereby, one could connect the discussion around social learning to integration competency as a meta competency connecting all other competencies for implementing change-making (Redman & Wiek, 2021; Wiek et al., 2011). Regarding our methodological choices for tracing relational learning, we found that reflection exercises and semi-structured interviews for constructing stories of value creation with a focus on specific activities present promising entry points, but articulating new insights gained and skills and attitudes developed all while providing concrete examples remained challenging for actors. Simply remembering activities from a workshop series spanning 5 months presented another difficulty, which one could address through working with a timeline including pictures of all activities to trigger memories as part of the interviewing process.

6 | CONCLUSION

With the goal to investigate what, how, and why actors learn throughout a series of three workshops around collaborative water and landscape governance on Öland, we provide empirical evidence that actors not only connect their knowledge and integrate new perspectives into their frames of reference but also develop active listening, compassionate communication, collaborative and critical self-reflection skills and positive attitudes towards plurality. We show that learning to relate to others through different discussion and interaction formats, specifically designed activities and assessment approaches supports actors in building and strengthening systems-thinking, futures-thinking, values-thinking, strategies-thinking, interpersonal and implementation competency. We argue that drawing on these competencies enables actors to engage in collaborative change-making to address sustainability challenges—within and beyond projects around water and landscape governance on Öland.

The detailed accounts of changed understandings of other actors show that relational learning plays a key role in addressing misunderstandings and conflicts of interest between different actors or actor groups. Reconciling such tensions can increase the likelihood

of actors collaborating with each other and lead to legitimate decision-making as well as the development of solutions inclusive of different knowledges, perspectives and values. To move towards improved governance of complex social-ecological systems, actors need to embed their learning in communities and institutions to update existing practices based on new ways of thinking, doing and being with others. Such community-level and institutional changes often take time to materialize wherefore longitudinal research is essential to assess the outcomes of knowledge co-production over time. Regarding the methodological implications of this study for designing, supporting and tracing relational learning, we call on researchers, practitioners and policy-makers to further test and develop the different discussion and interaction formats, specifically designed activities and assessment approaches to create opportunities for relating to others as part of dialogue-based processes in diverse contexts.

AUTHOR CONTRIBUTIONS

Carolin Seiferth, Erik Andersson and Maria Tengö conceived the ideas and designed the methodology. Carolin Seiferth collected and analyzed the data and led the writing of the manuscript. Erik Andersson and Maria Tengö contributed critically to the drafts and gave final approval for publication.

ACKNOWLEDGEMENTS

We would like to thank all participants for their valuable time, engagement and interest in sharing their knowledge and experiences during the workshops. We also thank Susanne Forslund, Carina Pålsson and Kristin Bertilius for their guidance, help and support throughout the process. We greatly appreciate the fieldwork support from Lisa Tengö and the support with transcribing the interviews by Cora Cunningham. We also thank Ölands Vattenråd for initial discussions on the project's framing. Thank you to Station Linné, Ölands Folkhögskola and the Öland landscape for hosting us. This research was funded by the Horizon Europe Framework Programme of the European Union through the research and innovation project 'ALFAwetlands—Wetland restoration for the future', grant agreement no. 101056844 and the Swedish Research Council Formas, project number 2020-01614.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

DATA AVAILABILITY STATEMENT

These data are not publicly available as they contain information that could compromise the privacy of participating actors but can be made available on request.

STATEMENT OF INCLUSION

We designed the transdisciplinary research project, and particularly the workshop series on Öland, with the help of three key informants who are active in the island's Water Council and several collaborative projects around water and landscape governance. Prior to and throughout the workshop series, we engaged in discussions with all participating actors to tailor the content of each workshop to their needs and interests, but also to implement their feedback and ideas for improvement. We presented initial research findings and summarized them in a report (written in Swedish), which we shared with all participating actors.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Appendix S1. Background information about Öland and workshop series.

Appendix S2. Follow-up interviews after Workshop 1.

Appendix S3. Follow-up interviews after Workshop 3.

Appendix S4. Codebook.

How to cite this article: Seiferth, C., Andersson, E., & Tengö, M. (2025). The role of relational learning in knowledge co-production. *People and Nature*, *00*, 1–14. https://doi.org/10.1002/pan3.70116