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Integrate the integrators! A call for establishing academic careers for integration experts

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Integration is often considered the core challenge and the defining characteristic of inter- and trans-disciplinary (ITD) research. Given its importance, it is surprising that the current system of higher education does not provide permanent positions for integration experts; i.e., experts who lead, administer, manage, monitor, assess, accompany, and/or advise others on integration within ITD projects or programs. Based on empirical results of an ITD 2019 Conference Workshop entitled "Is there a new profession of integration experts on the rise?" held in Gothenburg, Sweden, and our own experience in leading and studying ITD integration, the present article sheds light on the overarching question, "What are integration experts?", thus contributing to the emerging literature on integration and integration expertise. We use direct quotes from participants to substantiate workshop results and triangulate them with recent literature on ITD research as well as Science of Team Science (SciTS) and Science and Technology Studies (STS). We conclude our article by discussing possible unintended consequences of establishing academic careers for integration experts, and suggest four complementary ways to support them, while mitigating potentially negative consequences: (a) establishing an international Community of Practice (CoP) to foster peer-to-peer exchange among integration experts, create greater visibility, and develop ideas for transforming academic structures; (b) studying academic careers of integration experts to provide empirical evidence of "successful" examples and disclose different ways of establishing related academic positions; (c) funding respective positions and aligning metrics for ITD research to foster integration within ITD projects or programs; and (d) engaging in collaborative dialog with academic institutions and funding agencies to present empirical results and lessons learnt from (a) and (b) to support them in establishing and legitimating careers for integration experts. If academia is to be serious about addressing the most pressing environmental and societal problems of our time, it needs to integrate its integrators.

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Introduction

Meeting pressing environmental and societal challenges of our time requires inter- and trans-disciplinary (ITD) research that formulates "socially robust" responses by crossing boundaries of not only different scientific disciplines but also research, policy, and practice (Nowotny et al., 2001). Integration across such boundaries is widely regarded as the key challenge of ITD research (Bergmann et al., 2005; Klein, 2008b; Pohl et al., 2008; Huutoniemi, 2010; Jahn et al., 2012; Defila and Di Giulio, 2015). Yet, it is critical to the success or failure of ITD projects and programs (Defila et al., 2006; O'Rourke et al., 2016; Lux et al., 2019).

Notwithstanding multiple connotations of integration (O'Rourke et al., 2019; Pohl et al., 2021), in this article we treat integration as a process of combining a wide range of perspectives from different disciplines (i.e., *interdisciplinary* integration), as well as from research, policy, and practice (i.e., *transdisciplinary* integration). Doing so facilitates development of a more comprehensive understanding of complex problems while generating more promising solutions to deal with them (Hoffmann et al., 2017a). The concept thus involves linking and relating different perspectives to create a whole that is more than the sum of its parts (Lyall et al., 2011). We likewise refer to integration as outputs that emerge from integrative processes (O'Rourke et al., 2016). Such outputs can involve frameworks, concepts, methods, tools, or practices (Pohl et al., 2021). Finally, we regard integration as a multidimensional interactive process, which can incorporate cognitive, social, and emotional dimensions (Boix Mansilla et al., 2015; Pohl et al., 2021). Moreover, it can occur at different phases of an ideal-typical ITD research process (Jahn et al., 2012; Lang et al., 2012; Pohl et al., 2017; Hoffmann et al., 2019), and can yield "different types of integration in different contexts" (O'Rourke et al., 2016, p. 69) depending on the specific purpose, scale, and scope of ITD projects or programs (Klein, 2008b). Integration can also involve two, several, or all team members, in addition to being one-sided (i.e., an individual effort to integrate a perspective from another team member into one's own perspective) or mutual (i.e., a collaborative effort to integrate team members' different perspectives into a common perspective) (Pohl et al., 2021).

Given the importance of ITD integration, we call for establishing a new type of academic career for integration experts; i.e., experts who specialize in leading, administering, managing, monitoring, assessing, accompanying,[1] and/or advising others on integration within ITD projects or programs (Bammer, 2013; Bammer et al., 2020; Pohl et al., 2021; Rogga and Zscheischler, 2021). In order to explore the nature of integration experts we organized a workshop at the ITD 2019 Conference on "Joining forces for change" in Gothenburg, Sweden, attended by 47 participants and 8 workshop organizers. Participants were not required to be integration experts in order to attend the workshop, only to be interested in exploring the concept and joining the discussion. They represented different disciplines and fields (ranging from environmental sciences and environmental engineering to anthropology, philosophy, and economics), different geographic regions (ranging from Europe to Australia, North America, South America, and Africa), different academic institutions (ranging from research institutes to institutes of technology, traditional universities, and universities of applied sciences)[2], different academic positions (ranging from a vice president for research and directors of ITD centers and labs to professors, group leaders, postdocs, PhDs, and research assistants), as well as different organizations and networks including the Global Alliance for Inter- and Transdisciplinarity (ITD Alliance), the International Network for the Science of Team Science (INSciTS), the Network for Integration and Implementation Science (i2S), and the Association for Interdisciplinary Studies (AIS).

In organizing the workshop, we combined methods of "think-pair-share" (The Teacher Toolkit, 2021) and "world café" (The World Café, 2021) to engage workshop participants in group discussions. The former method required participants to first think individually about the question "How do you (or others) conceive your role regarding integration in ITD projects or programs?" (5 min), then to pair up with another participant to discuss that same question (20 min) and finally to share insights from their discussion with all other participants (15 min). A "world café" followed, requiring participants to divide into five small groups of around nine people each seated around a table and discuss for 20 min one of four subquestions specifically crafted for the purpose of the world café:

(1) What roles do integration experts assume?
(2) What motivates integration experts to assume their roles?
(3) What personal qualities and expertise do integration experts need to fulfill their roles?
(4) What career challenges do integration experts face in academia?

At the end of 20 min, each member of the group selected a different table to discuss another question. The two rounds of "world café" discussions were recorded in agreement with the participants and—together with sticky notes produced by participants during the workshop—were subsequently transcribed, codified, and analyzed using qualitative content analysis (Mayring, 2008).

In the present article, we summarize results of our ITD conference workshop around these four subquestions. To substantiate workshop results, we use direct quotes from participants who self-identified as integration experts (some group leaders, postdocs, PhDs, and research assistants) or supported integration experts in their academic careers (vice president for research, directors of ITD centers and labs, professors). We also triangulate such quotes with pertinent findings in recent literature on ITD research as well as Science of Team Science (SciTS) and Science and Technology Studies (STS). Building on these results and our own experiences in leading and studying ITD integration in research projects and programs, we then discuss possible unintended consequences of establishing academic careers for integration experts, and finally suggest four complementary ways to support their careers in order to achieve the full potential of ITD research.

What roles do integration experts assume?

Integration experts assume a wide range of different roles to enhance integration in ITD projects and programs. When asked about the diverse roles they take on, one workshop participant summarized the "world café" discussion at one of the four tables as follows:

> We're all bridging, translating, relating perspectives. We are generating new knowledge about the topic and the [integrative] process, (…) and coach people about the process. So, we generate new knowledge or help others to do it.

Another participant added:

> We take on many different roles at the same time, but that itself is a role.

To reiterate, drawing on both the literature and our own experience in leading and studying integration in ITD projects or

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Box 1: | The daily work of integration experts—the case of Wings

Wings (Water and sanitation innovations for non-grid solutions) is an ITD research program that strives to develop novel non-grid and resource-oriented water and sanitation systems that can function as viable alternatives to more conventional network-based systems. By integrating perspectives from different disciplines (e.g., process and environmental engineering, environmental health psychology, transition studies, urban planning, human geography) as well as from policy and practice, this strategic program aims to support sustainability transformations in the urban water sector. The two program leaders responsible for leading integration across different departments, projects, and disciplines used several methods and tools to strengthen integration within the program. They applied, for instance, the "Theory of Change" (ToC) tool to create a common vision among team members on sustainability transformations. Creating such vision enables, among others, joint planning of interventions to support sustainability transformations in the urban water sector as well as monitoring and assessing such transformations towards sustainability. It also enables regular reflection about integration in both theory and practice (cf., Deutsch et al., 2021).

To deal with emergent challenges in developing ToCs, program leaders alternated formal and informal interaction formats, ensured appropriate diversity in team composition, and explored diverging and potentially conflicting assumptions of team members about top-down versus bottom-up transformations in the sector. They not only facilitated the process of developing ToCs, but also linked and related the different disciplinary perspectives brought together—before and after each team workshop or meeting. Hence, they assumed both a service role (e.g., getting familiar with the ToC tool, adapting it to the specific program context, and facilitating the integrative ToC process) and a creative research role (e.g., digging into different disciplinary perspectives, identifying relevant gaps and critical connections, and linking them to the broader literature on sustainability transformations). Balancing these two roles resulted in a significantly higher workload than initially expected (cf., Deutsch et al., 2021).

Furthermore, throughout the whole process, program leaders applied a reflection tool providing integration experts with five questions about challenges they encountered in leading integration at cognitive, social, and emotional levels; the tool supports them in reflecting about potential strategies to address such challenges in subsequent workshops or meetings (Deutsch and Hoffmann, 2021). Using such tool, they recognized that a very heterogeneous group composition (social dimension) in terms of diverging and potentially conflicting assumptions (cognitive dimension) can cause a counterproductive discomfort zone (emotional dimension). They also realized that a very homogeneous group composition in terms of long-established relationships of trust, in turn, can create an "understimulating" comfort zone (Deutsch et al., 2021; Freeth and Caniglia, 2019, p. 254). Both social and cognitive dimensions can hinder integration across the program.

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programs we define integration experts as academics who lead, administer, manage, monitor, assess, accompany, and/or advise others on ITD integration, ideally from the outset to the end of an ITD project or program.

More precisely, integration experts have the following characteristics. They are:

- Bridge Builders, i.e., bringing different people together, establishing relations with, and building bridges among them (Lyall, 2019);
- Boundary Crossers, i.e., navigating social boundaries and successfully embedding within social groups that embody different perspectives to be integrated (Collins and Evans, 2007; Klein, 2021);
- Translators, i.e., discussing, reflecting on, and translating different perspectives and asking pertinent questions to render uncertainties and assumptions underlying such perspectives explicit (Collins and Evans, 2007; Deutsch et al., 2021; Hubbs et al., 2020);
- Catalysts, i.e., identifying potential tensions between different perspectives, leveraging potential synergies between them, and generating new knowledge by recognizing critical connections (Hendren and Ku, 2019; Deutsch et al., 2021);
- Facilitators, i.e., designing, planning, implementing, and facilitating integrative processes, assigning roles and responsibilities, and supporting generation of integrated outputs (Hoffmann et al., 2017a; Defila and Di Giulio, 2018; Lux et al., 2019);
- Contributors, i.e., providing own intellectual contributions to scholarship (Defila and Di Giulio, 2017; Lingo, 2018) by, for instance, linking theoretical concepts, co-creating integrative frameworks, or developing interdisciplinary methods (Bergmann et al., 2012);
- Mediators, i.e., recognizing power imbalances and interpersonal conflicts within and between different social groups (Oliver et al., 2019) and "deal(ing) with the implications as transparently, methodically, and consciously as possible" (MacMynowski, 2007);

- Advisors, i.e., providing opportunities for learning, practicing, and teaching integration (Hampton and Parker, 2011), as well as accompanying, supporting, or coaching others in leading integrative processes and reaching integrated outputs (Defila and Di Giulio, 2018);
- Evaluators, i.e., monitoring, assessing, and evaluating integrative processes and their integrated outputs (Pohl et al., 2010; Jahn and Keil, 2015).

In sum, we concur with participants quoted above that integration experts assume a range of different roles, while acknowledging the roles they assume change over time and depend on specific purposes, scales, and scopes of integration illustrated by the example of Wings in Box 1. We also note that some of these roles (e.g., advisors, evaluators) transcend existing roles and expertise of academics involved in ITD projects or programs. Furthermore, configurations differ by context. For example, a small team of academics including an integration expert, who complement each other with their respective expertise and who rely on each other with clear preferences for specific roles, might be preferable to a single individual who would assume such roles (Hoffmann et al., 2017a; Hölscher et al., 2021). Sharing these roles within a small team might also mitigate potentially negative consequences of assuming multiple roles simultaneously, further discussed below.

What motivates integration experts to assume their roles?
Addressing the most pressing environmental and societal problems requires ITD research that develops "socially robust" solutions by crossing boundaries and combining perspectives from different disciplines and fields, as well as research, policy, and practice. When asked about their motivation to work as integration experts in ITD projects or programs, several workshop participants emphasized their intrinsic motivation to "take ITD seriously" with a view to better "dealing with complex problems" and generating promising solutions (cf. Guimarães et al., 2019). Other participants emphasized their strong interest in "generating new knowledge out of the process and coaching people on that process" with a view to "solving complex problems," and

ultimately *"fostering societal change."* Additional participants, in turn, underlined their motivation to explore the breadth of a topic, instead of studying one single aspect of it in greater depth (cf., Lyall, 2019), while others yet stressed their interest in overcoming numerous hurdles on the way towards integration as sketched in the old Sesame Street television skit "Over! Under! Through!" (Fey, 2011)[3]. Referring to such hurdles, one participant remarked:

> What motivates me is the whole challenge of doing that. The whole conflictive moment when you are lost in the process, when you don't know where to run, when you explain what you want to do or how you envision the problem and the others do not understand. I think, for me, that's the main motivation, (…) all that thrilling moment of trying it. (…) It's the challenge of working it out that motivates me!

Referring to that "trilling" moment of overcoming numerous hurdles and finding creative solutions to the cognitive, social, and emotional challenges inherent in integration, another participant added:

> I like the moment after an integration process, when people say 'Yes, it was worth to do it'. It's the experience that we created something that is acknowledged (…) that motivates me for doing the next step.

Thus, integration experts tend to be motivated by putting the theoretical promises of ITD research into practice and making sure that ITD research actually contributes to solving complex problems and fostering societal change.

What personal qualities and expertise do integration experts need to fulfill their roles?

When asked about necessary personal qualities and expertise of integration experts, several workshop participants identified critical qualities such as openness, curiosity, creativity, sociability, persistence, and patience, as well as degrees of reflexivity, modesty, and humility. These findings echo essential traits of individuals embarking on ITD research by Augsburg (2014), Fam et al. (2017), Guimarães et al. (2019), and Evans and Cvitanovic (2018). Others added willingness to be vulnerable:

> In certain situations, you are extremely vulnerable—especially when you go out of your plate and you're in the plate of someone else.

Some participants also highlighted the ability to tolerate ambiguity and instability, while another emphasized other qualities, namely:

> … to remain optimistic and trustful in the process (…), i.e., to actually hold the trust, even though you are in a chaotic phase (…). It's trust and self-confidence in the process you designed.

In addition, others referred to the ability to *"see the big picture"* and to think holistically (O'Rourke et al., 2019), i.e., in a complex and interlinked manner (Augsburg, 2014; Uhl-Bien and Arena, 2017; Guimarães et al., 2019). Following Eigenbrode et al. (2017), we consider the following personal qualities key to leading integration: having a thick but not impermeable skin, finding humor in one's own mistakes, being flexible in one's own ideas, and being perseverant and unflappable in the face of numerous hurdles on the way towards integration.

Some workshop participants also referred to Collins and Evans (2007) when discussing different kinds of expertise integration experts require to successfully lead integration (cf., Defila and Di Giulio, 2015, 2017, 2019; Pohl et al., 2019; Bammer et al., 2020). Collins and Evans (2007) differentiated contributory expertise, i.e., expertise to contribute to research in a field, from interactional expertise, i.e., expertise to speak the language of a field without being able to contribute to it in-depth. Some participants rated the latter—interactional expertise—as particularly critical for leading integration, especially in large ITD research projects or programs. One argued:

> You need the ability to interact with others in a way that makes sense to them. You don't have to know their discipline [in-depth], but you have to be one of those that is able to interact in a way that they want to interact with you (…)—that's expertise.

Interactional expertise thus allows for meaningful interaction with, and often between, contributing experts (Sismonde, 2008). Building on Collins and Evans (2002), another workshop participant called referred expertise crucial, i.e., experience of contributory expertise in some field that is applied within another field (cf., Defila and Di Giulio, 2017). Referred expertise is particularly relevant in large ITD research projects or programs since integration experts will not possess contributory expertise in all fields to be integrated. According to this participant:

> You need to have contributory expertise in some field. But it does not need to be in the field that you are managing the integration process. But you must know how it feels to contribute to the debate in any field.

Based on our conceptual and empirical insights, then, we conclude integration experts require a range of personal qualities as well as interactional and referred expertise, but not necessarily contributory expertise in all fields to be integrated in order to successfully lead integration in ITD projects and programs. In addition to whatever other contributory expertise an integration expert might have, we argue following Collins and Sanders (2007, p. 639) that "a bundle of referred and other expertises simply becomes" contributory expertise in integration when practiced repeatedly.

Our conceptual and empirical insights notwithstanding, one workshop participant argued:

> What we experience as a challenge is balancing all these dispositions and skills, competencies and expertise, and determining how near or how distant you are from the topic that you are integrating or only helping to integrate. If you have no idea about the topic, you won't succeed—that's inexperience. If you are too near, you know what you want and you are not open enough. So, this balancing is a unique challenge for those that do it for 20 years or more.

Yet, it can be a challenge for integration experts to find suitable distance on a topic while earning respect from team members who may consider contributory expertise in a project's or a program's field to be critical to leading ITD integration; this challenge is further discussed below (cf., Collins and Sanders, 2007).

Following Collins and Evans (2007, p. 38), integration experts further require interactive and reflective abilities that both "turn latent interactional expertise into expressed interactional expertise." The former includes being able to establish relations with other people, to interact and to talk with them about their disciplines and fields, to seek out their diverse viewpoints (Salazar et al., 2019), to reflect on their subject matters, to translate their scientific thoughts and activities into the language of another discipline or field if possible, and to convey and explain such thoughts and activities in a way that is meaningful and useful for others. Reflective ability, in turn, "is not reflective ability *in*

something, it is just reflective ability" (Collins and Evans, 2007, p. 39, with emphasis by the authors). According to several workshop participants, reflective ability includes the ability to "*leave your ego at the door*" while recognizing that due to "siloed thinking" (Lyall, 2019, p. 60) inherent in university curricula, dropping egos:

> … proves challenging for many people on a personal level. Our institutions encourage us not to do that. It's like you move through the hierarchy through claiming authority, and that's like bringing your ego to the table. (…) Some people did [a] bachelor, master, [and] PhD in the same discipline or even institution, this is like endless years of education in a certain discipline. [Once] they are vested in their own discipline and achieve mastery, it can be difficult to leave the ego at the door, to be modest and humble and acknowledge other perspectives and [own] limits.

This statement also resonates with Lyall's (2019) doubts about whether ITD careers can still be launched once an academic has achieved disciplinary excellence. She further questioned whether such careers presuppose a process of socialization (or enculturation in terms of Collins and Evans (2007, p. 24)) within different social groups from early stages of their academic careers. Following Boix Mansilla et al. (2006, p. 73), who argue that for "people [who] are trained in deeply disciplinary ways, inter-disciplinary work becomes an unnatural act (…) and difficult to sustain," we contend integration experts should embrace ITD early on (Benson et al., 2015), instead of delaying ITD until disciplinary careers are firmly established (cf., Lyall, 2019). Acknowledging that disciplinary excellence does not preclude someone from becoming an integration expert and that some disciplines are more likely to link with ITD (e.g., environmental sciences, sustainability sciences) than others (e.g., mathematics),[4] training in ITD early on is particularly useful in building ability to understand the socially constructed nature of disciplines, to appreciate different disciplines and perspectives, to identify their strengths and weaknesses, and to recognize limitations of one's own field of study (Lattuca et al., 2012). This multi-layered ability is crucial for thinking (and acting) in an integrative manner. According to one participant, this ability involves understanding:

> … different ways of knowing from different fields and (disciplines). So, when you interact with a specialist in-depth and talk about one topic, you can then understand (…) the source of their concern.

Given inevitability of conflicts due to different and sometimes diverging perspectives, especially in heterogeneous ITD teams, integration experts also need the ability to deal with conflicts in a constructive way (Bennett and Gadlin, 2019), and to "recognize controversies caused by different disciplinary worldviews and distinguish them from those caused by dissenting opinions" (Defila and Di Giulio, 2017, p. 336). The latter ability includes being able to "recognize and acknowledge that there are other, often competing, perspectives on an issue or problem, and with that acknowledgement, there will be a certain level of pain that will only increase along with any increases of conflict" (Augsburg, 2014, p. 242). One workshop participant described how to deal with such kind of conflict:

> If there is a conflict between [two opposite views], that is where you can get creative tension to actually generate something that's emergent. (…) So, I think it's sometimes important to live the conflict instead of solving it right away, to sit with it for a little while, recognize it, accept it, and realize that it's not just some egos or disciplines fighting with each other, but that there is really a conflict.

So, we have to sometimes hold two opposite views in our head at the same time and not go crazy (cf., Crowley et al., 2016).

What career challenges do integration experts face in academia?

When asked about career challenges integration experts face in the current academic system, dominated by discipline-centered departmental structures and career paths, workshop participants reported challenges at both individual and institutional levels. Their responses indicated these two levels are strongly inter-related. One explained:

> The challenges I face (…) (are) very much about (…) people categorizing and classifying; particularly in very hierachical organizations, such as universities and governments, there is a bit of a box-ticking-mentality, it is like these are the criteria and if you don't fit neatly into a particular classification or category, people really don't know what to do with you.

Referring to lack of adequate evaluation criteria to assess academics who transcend conventional academic boundaries (Klein, 2008a), and bemoaning the aforementioned box-ticking-mentality, one participant also added:

> We found it difficult to find a specific box to explain our role in our context. (…) We discussed this tension between trying to get out of boxes, trying to put people in different boxes, and also at the same time trying to find a box for ourselves so that we can express to others what we are, what we do in our context.

Facing discipline-centered departmental structures and career paths, several workshop participants invoked a sense of "in-betweenness" (Kislov et al., 2017, p. 109). One workshop participant explained:

> When I look at myself as being an integration specialist I have a problem with "in-betweenness" (…). From a disciplinary background I am a geographer, this is in-betweenness at first level between natural and social sciences. Then I started with a research career and I came up with having more and more tasks that belongs to that integration specialists domain. (…) I have struggled to fulfill these multiple roles and [to plan] my own career in the current scientific system.

The last statement resonates with Lyall's (2013) observation that academics following an ITD route need to plan their academic careers more carefully and more strategically than their disciplinary counterparts who have more traditional career paths. Hence, they are less able to follow pre-defined paths (Lyall, 2019), a challenge several workshop participants affirmed. One described it thus:

> My journey has been a very long, winding, and emerging one and it is sort of massive vindication in a way of just a gut feeling and following a path that is not mapped at all. So I think the challenge is when there is no map and there is no path and you actually have to find your own way in the search.

The need to "*mold your own mold*" also echoes Lyall's (2019, p. 65) report that individuals embarking on ITD careers are often constrained to "carve out their own niche" in an academic system, which privileges disciplinary excellence over ITD excellence. Thus, they are often forced to adhere to the same academic values and conform to the same disciplinary standards as their

disciplinary colleagues in order to comply with academic career norms. However, fulfilling multiple roles, while being expected to exhibit both disciplinary *and* ITD excellence in order to earn a place in the academic system, proves extraordinarily challenging. Given such challenges, some integration experts continue to work in "an invisible maze" (Whitchurch, 2009, p. 408), or "in-between worlds" (Bielak et al., 2008, p. 207). As a result they often provide "invisible leadership from a supporting or administrative role," hold "responsibility without authority" (Hendren and Ku, 2019, pp. 369–370), inhabit "uncomfortable liminal spaces within their institutions," and experience "different impediments to their academic careers" (Lyall, 2019, p. 3). One participant expressed consequences of this limitation:

> I think I am in the worst situation. (…) I am an integrator. (…) I am all the things that we listed before. I'm doing an academic suicide, for pursuing this career (…). I would never gain a tenure track officially.

Participants' statements, then, reflect a persistent view that the current academic system mainly provides career opportunities to academics who have stayed within established boundaries of a given discipline (Nelson, 2011). In contrast, academics who pursue an ITD route and "work *across* and even *beyond* rather than simply *within* traditional academic disciplines" (Benson et al., 2015, p. 261, with emphasis by the authors) face job insecurity (cf., Rhoten and Parker, 2004; Lyall, 2019). Referring to this disparity, one participant lamented:

> We need much more integration experts [in our university], but we don't get them on a permanent job. (…) We don't get any long-term funding for those experts even though we're training them on the job. Then we lose them—those that are really good, and that's a great problem to us.

Owing to such impediments, more often than not integration experts leave the academic system to work outside academia (Zscheischler et al., 2017; Streit, 2020).[5] Accordingly, Zscheischler et al. (2017) observe a resulting erosion of ITD-specific expertise due to the loss by academic institutions of experienced integration experts.

In light of identified challenges, it is no surprise that integration experts who build their careers by leading, administering, managing, monitoring, assessing, accompanying, and/or advising others on integration are not yet fully established in the current academic system. Roles, responsibilities, and functions of integration experts are often poorly specified (Maag et al., 2018). Moreover, their expertise is often neither properly recognized and rewarded nor appropriately evaluated or assessed (Hendren and Ku, 2019; Lyall, 2019; Bammer et al., 2020). Drawing on our own experience and following Hendren and Ku (2019), we also found that integration experts are often miscategorized as merely coordinators or facilitators of integration or as merely administrators or managers of ITD projects or programs. Such miscategorization reduces their intellectual contributions to scholarship to a mere "service role" rather than an essential "research role" (Di Giulio and Defila, 2015; Viseu, 2015; Hendren and Ku, 2019; Deutsch et al., 2021). In line with Lingo (2018, p. 208), our findings indicate integration experts have more to offer than simply "guiding and eliciting creative ideas from others but also integrating differing contributions, perspectives, and interests—including their own." Their intellectual contributions materialize, for instance, in linking theoretical concepts, co-creating integrative frameworks, or developing interdisciplinary methods. Thus, they are an essential part of integration experts' role in knowledge production in diverse contexts. Such a role could be outsourced to an expert outside academia, but we argue that identifying the integrative potential of a particular ITD project or program requires appreciating and understanding the nature of the

disciplines and perspectives to be integrated (at least through interactional expertise). It also involves being creative in realizing that potential with a view to generating a more comprehensive understanding of complex problems and creating promising "socially robust" solutions. Hence, such a role is a creative research task, not merely performance of coordinative, facilitative, administrative, or managerial tasks. However, we join Lyall (2019) in questioning whether the current academic system with its discipline-based departmental structures and career paths is suitable to recognizing integration experts' crucial role in ITD research and, thus, to promote respective academic positions. Further echoing Golde and Gallagher (1999, p. 285), "this is not intended as a pessimistic lament." It is a call to action: to discuss and to develop concrete steps to counter challenges integration experts face and establish corresponding careers, thereby allowing the full potential of ITD research to unfold in the academic system.

Unintended consequences of establishing academic careers for integration experts

In recent years, scholars from a number of organizations and networks have started to push for new specialties, including a new discipline of Integration and Implementation Sciences (i2S) (Bammer, 2019). They do so by investigating the nature of cross-disciplinary integration (O'Rourke et al., 2016; O'Rourke et al., 2019; Pohl et al., 2021), analyzing challenges inherent to leading integration (Tress et al., 2007; Hoffmann et al., 2017a), exploring necessary expertise for addressing these challenges (Di Giulio and Defila, 2015; Defila and Di Giulio, 2017; Bammer et al., 2020), and compiling methods and tools that support overall integration and implementation (McDonald et al., 2009; Bergmann et al., 2012). Building on this literature, we acknowledge the need for further exploring, developing, and promoting academic careers of integration experts in all areas, while strengthening related personal qualities and expertise (Pohl et al., 2021). Such careers are critical, in colloquial terms, for closing the gap between "talking the talk but not walking the walk" (Åm, 2019, p. 171). This imperative means, as one workshop participant emphasized:

> … going beyond just tagging inter- and transdisciplinarity on papers, on proposals, on projects, but taking it seriously (…) from the start to the end. Also meaning, evaluating it, funding it, and making it valuable for careers.

Notwithstanding our call for establishing academic careers for integration experts to unfold the full potential of ITD research, we are aware that promoting such careers may entail possible unintended consequences, especially for academics leading integration across multiple boundaries. Without claiming to fully mirror all potentially negative consequences, we describe three possible consequences.

First, forcing integration experts to meet traditional standards of disciplinary excellence to attain promotion (Lyall, 2019), while leading integration in ITD projects or programs, is a demanding challenge that imposes a serious risk of physical and emotional exhaustion (cf., Oliver et al., 2019; Jaremka et al., 2020). This risk is even more pronounced when occupying liminal spaces and navigating possible identity conflicts associated with integration experts' "hybrid roles" (Croft et al., 2015, p. 380) of being a scholar *and* a leader (or assuming many different roles as one workshop participant noted). Accommodating these conflicts, integration experts risk being perceived neither as a "true" scholar nor as a "true" leader.[6] Yet, assuming both roles increases integration experts' awareness of discrepancies between conceptualizations of an ideal-typical ITD research process, on the one hand (Bergmann et al., 2012; Lang et al., 2012; Pohl et al., 2017; Hoffmann et al., 2019), and the reality of numerous and often insurmountable obstacles to integration, on the other.

Maneuvering such discrepancies between proposed theory and lived practice time and again only adds to the above mentioned risk of physical and emotional exhaustion.

Second, establishing academic careers for integration experts might lead to institutionalization of a new discipline of integration experts with its own professional standards such as graduate training, professorships, associations, conferences, and peer-reviewed journals (cf., Bammer (2017)). While "professionalization" is indeed favorable, forming a conventional discipline carries the risk that these experts withdraw into their own specialist's sphere and physical space, such as an institute or department, for instance. This formation might run counter to the process of enculturation within different social groups, which—according to Collins and Evans (2007, p. 24)—"is the only way to master an expertise, which is deeply laden with tacit knowledge." Inhabiting liminal spaces and moving between different social groups allow integration experts to further develop their personal qualities and interactional expertise, and to acquire valuable experiences in successfully navigating social boundaries and quickly adapting to new collaborative and integrative contexts.

Third, including integration experts in ITD projects or programs might entail that several or all team members re-delegate responsibility to realize the integrative potential of the project or program to integration experts, instead of engaging in a collaborative effort and enabling mutual learning among team members (Hoffmann et al., 2017b). In some cases, however, such integrative potential is best seen by experts from a particular discipline, field, or sector (cf., "integration by a leader" in Rossini and Porter (1979, p. 78)). Seeing such potential often implies a collaborative effort by the entire team, which, in turn, requires time and commitment from all involved, as well as degrees of reflexivity, modesty, and humility (i.e., to take a step back and recognize that one's own perspective is just one among many other perspectives). Withdrawing and disengaging from such collaborative effort, the team runs the risk of not fully unpacking the integrative potential of a project or program.

Ways to support integration experts in building their academic careers

Acknowledging possible unintended consequences of establishing academic careers for integration experts, we conclude this article by suggesting four complementary ways integration experts, on the one hand, and academic institutions and funding agencies, on the other, can promote such careers, while mitigating potentially negative consequences.

First, we propose establishing an international Community of Practice (CoP) of integration experts under auspices of the international ITD Alliance to foster peer-to-peer exchange among integration experts from different scientific communities and geographic regions, similar to INTEREACH, the Interdisciplinary Integration Research Careers Hub affiliated with the SciTS community in North America. Creating such a CoP would generate greater visibility for integration experts, while countering "potential feeling of intellectual homelessness" (Golde and Gallagher, 1999; Lyall et al., 2011, p. 80) reported by several workshop participants. Such a CoP would provide a safe and creative space for mutual learning beyond the boundaries of individual projects and programs and jointly producing a shared set of resources (such as materials and approaches) for addressing recurring challenges of ITD integration (Hoffmann et al., 2017a). It would also provide a space for developing joint visions and concrete steps for transforming academic structures that allows the full potential of ITD research—and thereby also integration experts—to unfold.

Second, we suggest studying academic careers of integration experts in greater depth, including cousin roles of Third Space

Professionals (Whitchurch, 2015), Research Development Professionals (Carter et al., 2019), Integration and Implementation Sciences Specialists (Bammer, 2013), Interdisciplinary Executive Scientists (Hendren and Ku, 2019), Boundary Spanners (Goodrich et al., 2020; Suhari et al., 2022), Knowledge Brokers (Maag et al., 2018), and ITD Project or Program Administrators and Managers (Di Giulio and Defila, 2015) such as Coordinators in the Horizon Europe Program. Studying such careers would reveal different pathways to becoming an integration expert and offer valuable insights into challenges and opportunities of hybrid roles, while unpacking competing demands of hybrid identities (Croft et al., 2015). Moreover, it would facilitate identification of best practices and successful examples of integration experts attaining permanent positions while disclosing different ways of supporting them in building careers at both individual and institutional levels. These examples would not only provide empirical evidence that integrating integrators in the current academic system is possible, but also offer valuable lessons for academic institutions and funding agencies willing to establish corresponding academic positions.

Third, considering that ITD integration cannot be assumed to "just" take place (Hölscher et al., 2021), we recommend that academic institutions and funding agencies, eager to address the most pressing environmental and societal problems of our time, make integration a more explicit requirement for ITD project or program funding, with appropriate criteria of evaluating their performance. Respective calls for project or program proposals should require ITD teams to explicitly design and intentionally support integration as part of ITD projects or programs (Schneider et al., 2019; Hölscher et al., 2021). The latter implies that academic institutions and funding agencies not only invest in ITD integration (by funding respective positions for integration experts as well as different collaborative and integrative formats such as retreats, workshops, and meetings), but also align metrics for ITD research, using integration across boundaries as quality criteria for ITD projects or programs (Pohl et al., 2010; Jahn and Keil, 2015).

Fourth and finally, we recommend integration experts participate more strongly in collaborative dialog with their academic institutions and funding agencies, by making use of results generated by our first and second suggestions. In addition to organizing a series of workshops and talks, such dialog includes presenting and discussing lessons learned from other academic institutions and funding agencies as well as joint visions and concrete steps developed by the CoP towards establishing permanent academic positions for integration experts. We thus urge engaging in mutual learning across academic institutions and funding agencies by inviting integration experts from other institutions or agencies to discuss best practices or successful examples. Such collaborative dialog would present an opportunity to further develop education and training courses for current and future integration experts, and to identify appropriate learning opportunities to acquire related expertise in ongoing projects or programs committed to leveraging the full potential of ITD research.

To put the matter succinctly by way of conclusion, in light of empirical findings from our ITD 2019 Conference Workshop, our literature review, and decades of experience in studying and leading ITD integration, the bottom line is clear: If academia is to be serious about contributing to solving pressing environmental and societal challenges of our time, it needs to integrate its integrators.

Data availability
The data analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

Notes

1 The term "accompany" refers to "accompanying research, inquiring the processes taking place and facilitating the production of integrated knowledge" as defined by Defila and Di Giulio (2018, p. 97).

2 Only one workshop participant represented a national science foundation.

3 The old Sesame Street television skit "Over! Under! Through!" suggests modeling your strategy if you have a difficult way ahead. Fey (2011) explained it taught concepts of "over," "under," and "through" by filming toddlers crawling around an abandoned construction.

4 Personal communication by Sebastian Rogga.

5 Integration experts leaving academia work, for instance, in consulting firms or non-academic research institutes such as the non-profit research institute SRI International or theHoward Hughes Medical Institute.

6 Referring to Maynard (2015), Oliver et al. (2019, p. 6) indicates that "co-productive researchers risk being regarded as an academic "lightweight", producing nothing of substance." This risk also applies to integration experts who often need to accomodate "competing demands of their hybrid identities" (Croft et al., 2015, p. 392).

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Competing interests

The authors declare no competing interests.

Ethical approval

The article incorporates comments from a workshop at an international conference. Participants were explicitly informed during the workshop that their comments might be used in a subsequent article to which they would be invited for possible co-authorship. For this reason, the organizers asked for permission to record the discussion, which was approved by all workshop participants. In addition, the workshop organizers gave the option of declining the use of any comments, but nobody choose to withdraw.

Informed consent

Workshop participants signed an attendance list indicating their agreement to be contacted in the future for writing the article and building a community of practice, listing only their names and email addresses. Twenty individuals decided to contribute to the article by critical reviewing both the submitted and re-submitted versions. Their names and roles appear under 'Contributors'.

Additional information

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