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Doing integration in catchment management research: Insights into a dynamic learning process



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ABSTRACT

The promise of integrated research for addressing complex problems of sustainability such as catchment management has been widely recognised. However, the mechanisms for achieving integration in research have been the subject of few empirical studies. A major challenge of doing integrated research is how to combine and effectively manage diverse disciplinary perspectives and other knowledge/s in the generation of new knowledge for practice and policy change. We examined this challenge within a large catchment management research project in Australia's Murray Darling Basin and asked, 'What supports or enables integration in research?' Addressing this question requires an attention to integration as a dynamic process of knowledge production. We propose a model of this dynamic process which is characterised by a changing demand for integration in five different phases: (1) establishing the imperative for integration; (2) coordinating different disciplinary and other knowledge commitments; (3) consolidating arrangements for integration; (4) prioritising outputs from integration; and, (5) representing outputs of integration. For researchers and research managers this model can help identify the mechanisms required to support effective integration within research projects. We identify these mechanisms as sites and devices for integration that must be both *planned* (as part of the original integrated research design) and *emergent* (iteratively created and supported) in research projects.

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1. Introduction

Integrated research for improving catchment management is an important policy objective internationally (Bammer et al., 2005a,b; McCulloch, 2007; Orr et al., 2007; Luukkonen and Neveda, 2010; Fenemor et al., 2011b). Policy makers, research institutions and research funders increasingly recognise integrated research as a way of combining multiple perspectives and insights to address complex issues of sustainability

such as catchment management and climate change (Shackley and Wynne, 1995; Brouwer et al., 2005; Allen et al., 2011; Fenemor et al., 2011a). Integrated research is valued for its ability to: deal with complexity (i.e. multiple scales and interacting systems) (Morse et al., 2007; Mollinga, 2010); draw on the skills and knowledge of multiple professional practices (Gibbons et al., 1994); deal with and effectively harness differences between disciplines (Bammer, 2008); translate findings into widely accessible forms (Strang, 2009); add research capacity and insight (Jeffrey, 2003); solve societal

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problems (Maassen and Lieven, 2006); and produce research outputs with less uncertainty (Syme, 2005). Relatively few studies, however, have examined these claims with respect to how to ‘do [their emphasis] integrated research’ (Huutoniemi et al., 2010; Lang et al., 2012, p. 25; Gardner, 2013) including design principles for integrated research and lessons on what is required to support effective integrated research practice (Jeffrey, 2003; Pregernig, 2006; Bammer, 2008; Mollinga, 2010). Notable exceptions include recent studies in sustainability science and research policy on design practices and challenges of transdisciplinary research based on conceptual models derived from the literature (Luukkonen and Neveda, 2010; Lang et al., 2012; König et al., 2013). However, there remains a need for empirical studies on the method (Huutoniemi et al., 2010; Collier et al., 2011; Klein, 2012) by which integration in inter- and transdisciplinary research proceeds, as well as the mechanisms (Knorr-Cetina, 1982; Luukkonen and Neveda, 2010) which support this integration.

In this paper we report on an empirical study of integrated research from the perspective of participants in a large catchment management research project in Australia. This project was designed from the outset as an integrated research project and involved researchers from diverse disciplinary backgrounds and catchment stakeholders working together to address common research questions. The term ‘integration’ was used by the researchers in this project to describe how they worked together, and with farmers and water managers, to produce new knowledge to inform catchment management policy and practice. As participants in this same project, we (the authors) had an explicit, dual role of researching the integrated research in the project and, designing and facilitating aspects of integration with our co-researchers. This role gave us a unique perspective on ‘integration’ through an action research approach (Carr et al., 1986) to the question: what is required to support or enable effective integration in catchment management research?

Integration can be understood as a process of interdisciplinary (Haapasaari et al., 2012; Repko, 2012) or transdisciplinary knowledge making (Mattor et al., 2014) or what is also often called ‘integrated research’. Although integration is commonly conceptualised as a cognitive (Repko, 2012; Klein, 2012) and mutual or ‘extensive’ (Haapasaari et al., 2012) learning process, few studies inquire into how this learning proceeds and therefore how it can be best supported within integrated research. Our exploratory study conceptualises integration as a knowledge making and learning process. This paper adds to the theory of integrated knowledge making (or integration) within research collaborations by proposing that integration is supported by the planning and creation of heterogeneous knowledge practices in strategic mechanisms. It demonstrates how these mechanisms are performed in the everyday practices of negotiating and translating across researchers’ and practitioners’ diverse epistemic and ontological commitments including their different objects of inquiry, methods and concepts. From this analysis, a model of integration practice, characterised by different phases and changing ‘demands’ for integration is also proposed. Recognising integration as ‘demand-driven’ reveals the need to collectively perform and re-perform the ‘demand’ or imperative to integrate throughout the different phases of integration as

both *planned* (in the original integrated research project design) and *emergent* (in the everyday practices of integrated knowledge making). This model of integration practice can help guide research teams and research leaders in planning and conducting integrated research for addressing complex issues of sustainability such as catchment management.

2. Background

2.1. Knowledge integration in research

Catchment management research is an important case for examining integration in research as scholars and practitioners worldwide recognise the important challenge of understanding the interactions between economic, environmental, production and other uses and values of catchments as complex socio-ecological systems (Mostert et al., 2007; Pahl-Wostl and Kranz, 2010; Wallis et al., 2013). Integration in research has attracted the interest of scholars from a broad range of different fields including: sustainability science (Jerneck et al., 2011); social studies of science (Jeffrey, 2003; Mollinga, 2010); landscape sociology (Tress et al., 2003, 2005) and the dedicated scholarly areas of interdisciplinary studies (Bammer, 2008; Klein et al., 2010; Bammer, 2012a; Repko, 2012) and transdisciplinary studies. Within these traditions, there are many different ways to understand integration in research (Klein, 1996; Pohl et al., 2008; Klein et al., 2010; Luukkonen and Neveda, 2010), however for the purposes of this paper we focus on integration as a knowledge production and learning process to add to insights on how such learning can be best supported and to provide guidance on how research collaborations can be effectively managed in practice.

This is not to suggest that achieving effective integration is simply about integrated knowledge making alone: there are other factors impacting on success in integration including the wider socio-political context and the social relations of power in research. The many other important aspects of integration include: intellectual and ‘cultural’ aspects (Bauer, 1990); conceptual dimensions such as ‘paradigmatic assumptions’ (Gardner, 2013); evaluating the results or outcomes of integration (Roux et al., 2010); and the governance aspects of integrated research (Boon et al., 2014). While all these aspects are important to understanding and progressing integration in research, the aim of this paper is not to provide an exhaustive review of integration. It aims to address a recognised need for empirical research on the process dynamics (Pohl et al., 2008; Repko, 2012) of integration to support research teams and their collaborators in designing, conducting and representing the results of integrated research (Jeffrey, 2003; Luukkonen and Neveda, 2010; Mansilla, 2010).

Interdisciplinary scholars note that integration is central to the study of interdisciplinarity and is commonly conceptualised as a process of cognition and social activity (Klein, 2012; Repko, 2012). A conventional definition proposed by Repko (Ibid.) is:

... the cognitive process of critically evaluating disciplinary insights and creating common ground among them to construct a more comprehensive understanding. (Repko, 2012, p. 263)

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