Geoforum 76 (2016) 164–175

Contents lists available at ScienceDirect

Geoforum

journal homepage: www.elsevier.com/locate/geoforum

Her beauty and her terror: A case study exploring the framing of water and extreme water events within formal education in Queensland, Australia and Saskatchewan, Canada

Dr. Ali Sammel

Griffith University, Gold Coast Campus, School of Education and Professional Studies, G30 3.37, Southport 4222, Australia

ARTICLE INFO

Article history:
Received 16 February 2016
Received in revised form 14 September 2016
Accepted 16 September 2016

Keywords:
Water
Extreme water events
Water education
Hydrosocial cycle
Curriculum-water education interface

ABSTRACT

The existence of freshwater is fundamental to all life on the planet. Water and society constantly shape and reshape each other. Historically and contemporarily, freshwater exists in dialectical relationship with societies. Despite this, most people seem to have an inadequate understanding of water. To explore this problem, this paper investigates how the concept of 'water' is constructed through the discursive practice of formal education in Queensland, Australia and Saskatchewan, Canada. A review of formal education curricula was chosen because schooling integrates students into a knowledge community focused on defined social and cultural knowledge. In other words, formal education shapes how individuals, communities and societies make sense of water. This analysis shows that water is constructed as a predominantly nature-based phenomenon and offered decontextualized. Understandings of extreme water events are virtually non-existent. This paper concludes with recommendations for future curriculum development, specifically ensuring that *what* is taught and *how* it is taught directly relates to the lives of the students and their community.

1. Introduction

Freshwater is fundamental for human health, agriculture, economic activity and critical for a functional ecosystem. It has no substitute. Globally, freshwater supplies are predicted to decrease (Bates et al., 2008) necessitating the need for freshwater to be understood as a limited resource, as currently not all freshwater use is renewable (Gleick and Palaniappan, 2010). Freshwater scarcity is a significant and growing problem globally: this includes the failure to meet basic human needs around safe water for drinking and sanitation, contamination of human and industrial wastes with freshwater systems and ecological disruptions leading to increased consequences associated with extreme water events such as floods and droughts (Bates et al., 2008; IPCC, 2014, 2012, 2001; WWAP, 2014). Issues of climate change (influencing long-standing water patterns) and increased human populations (as the Earth approaches eight billion people) exacerbate this problem (UNDESA, n.d.; UNESCO-IHP, 2014).

Globally, there needs to be an individual and shared sense of responsibility towards this vital problem (Sammel and McMartin, 2014; Schmidt, 2013). All people within a community, whether they are policy and decision makers, scientists, engineers, educators, or average voting community members, need to have a deep understanding of freshwater and extreme water events (Takao, 2016). Community members need to be knowledgeable and able to develop innovative responses and initiatives around water (Adikari and Yoshitani, 2009). To achieve this, citizens need to understand how social policies, political decisions and economic interests affect the equitable allocation of water (Global Water Partnership, 2000). This initiative should include how a community understands, plans for, and recovers from an increase in extreme water events brought about by climate change (Krause and Strang, 2016). All people need to be better informed in order to understand and engage in community conversations and to make insightful and responsive decisions and policies in relation to water and extreme water events. However, Linton and Budds (2014) argue that citizens have an inadequate understanding of freshwater or how social relations, power structures, technological interventions and social inequities are produced and sustained *through* water. Because schools provide some of our first understandings of water, it is evident we need to examine what government-mandated curricula specify that teachers should teach and what students should learn about water and extreme water events. To this end, this paper presents a case study of how the

E-mail address: a.sammel@griffith.edu.au

http://dx.doi.org/10.1016/j.geoforum.2016.09.015
0016-7185/

curricula mandated in two school systems, Queensland, Australia and Saskatchewan, Canada, formally frame the teaching and learning of water and extreme water events. The paper offers an analysis of these curricula to identify how water is contextualized and understood within two formal educational settings. Being clear about these patterns may add to discussions of how societies can strengthen the capacity of its citizens to plan for, and respond to issues associated with water and extreme water events. This paper identifies some assumptions inherent in these curricula and considers their possible impact. Recommendations for future development of curricula are advanced.

2. Literature review

2.1. Reframing understandings of water

Human systems have always had a highly complex and coevolving relationship with water (Bates et al., 2008; Di Baldassarre et al., 2013; Krause, 2014, 2016; Krause and Strang, 2016; Linton, 2014; Sammel and McMartin, 2014; Sivapalan et al., 2012). This long-term relationship has allowed water to shape societies while being shaped by societies (Brida et al., 2013; Wheater and Gober, 2015). The values, expectations and policies that have emerged from human's relationships with water illustrate the plurality of discourses and ideologies that influence how cultures engage with water (Strang, 2004, 2005). Within these discourses, certain ways of thinking about water have become dominant and have created and maintained ways of thinking and acting that over time have become considered 'normal' or 'commonsense'. These historically constructed ways of knowing and acting limit how people understand and think about water, and our relationship with it. Dominant or hegemonic social constructions of water interpret it as an object, or more specifically, a resource located within the natural environment, separate and distinct from human systems (Linton and Budds, 2014; Schmidt, 2013). Understanding water as a discrete 'natural' resource is socially convenient as it disentangles water from social interactions and consequences (Linton, 2008; Schmidt, 2014). Many authors advocate for challenging this understanding (Krause, 2014, 2016; Sivapalan et al., 2012; Takao, 2016). For example, Krause and Strang (2016) encourage the rethinking of our social relationship with water. They advise the point of identifying and challenging hegemonic understandings of water is to gain insight, and appreciate implications for policy and practice. Policies, this paper advocates, such as government mandated formal education curricula (which at its core is about the communication and reproduction of dominant ideologies to the next generation of a society) (Sammel, 2014). Analyzing the social construction of water within formal education curricula can enable the identification of water ideologies. With this knowledge, alternative understandings of water can be encourage with the aim of ensuring the next generation of citizens take seriously the intrinsic links between water and society, and are motivated, and have the skills to find dynamic and adaptive approaches to more effectively evolve this relationship. It is hoped that over time, water will be commonly viewed "as a generative and agentive co-constituent of relationships and meanings in [our] society" (Krause and Strang, 2016, p. 633).

Currently this understanding of water is not common. Schmidt (2014) suggests that when students are asked to imagine and draw the water cycle, certain uniform responses emerge. Students draw a big circle with arrows linking the different states of matter water exists in (rivers, clouds, etc.). What is absent in these drawings are people, cities, other species, etc. These students appear to comprehend the water cycle as a stand-alone natural process, separate from human activity. This emphasizes a social/natural dualism that apparently exists in societal perceptions about water. This dualism is deconstructed by researchers to reframe how water is understood (see Bakker, 2012; Di Baldassarre et al., 2013; Linton and Budds, 2014; Schmidt, 2013, 2014; Swyngedouw, 2006, 2009). They argue that 'water' and 'society' should no longer be categorized as two distinct entities but understood as part of complex interactions that influence not only the physical movement of water, but also its discursive construction and representation. The Intergovernmental Panel on Climate Change's (IPCC) technical report on climate change and water supports this understanding of water (Bates et al., 2008). It calls for holistic understandings of the complex social, economic, political, health and educational challenges associated with the changing water patterns brought about through climate change. It encourages an analysis of how societies view and value water with particular emphasis on enhanced preparation for, and mitigation against, the impact of extreme water events (i.e., floods and droughts).

2.2. Social constructions of water: hydrologic and hydrosocial cycles

Currently, hegemonic understandings of 'water' focus on the chemical properties of this compound and of how it interacts with the Earth's ecological systems (Gober and Wheater, 2014; Linton and Budds, 2014; Linton, 2014). This way of representing water is encapsulated within the term hydrologic cycle (or hydrological) (Schmidt, 2013, 2014). It emphasizes the circulation of water in relation to the Earth (Di Baldassarre et al., 2013). The hydrologic cycle is an important part of how people, governments and businesses presently make sense of water (Brida et al., 2013). Based on scientific and mathematical models of how this chemical compound moves in, through and around the Earth, the concept of hydrologic cycle is embodied as an abstract concept, independent of history or society (Strang, 2014, 2005, 2004; Wheater and Gober, 2015). This allows water to be understood as an independent resource to be owned, controlled and managed (Sivapalan et al., 2012). Linton and Budds (2014) adds that this construction of water is convenient for governmental and economic purposes as it supports:

> the notion that water was a discrete resource that could be exploited and manipulated without explicit regard for the complexity of relations between water and ecosystem functions and between water and human society. The hydrologic cycle fits nicely within this paradigm as a way of representing water as a pure hydrologic process, that is, as an epistemological tool for disentangling water from ecology and from human society (p. 113).

This construction of water offers those who 'manage' this 'chemical compound' the false belief that they can do so detached from social systems (Linton and Budds, 2014; Schmidt, 2013). Schmidt (2014) argues that dualistic understandings of water and society have aggravated this problem. The hydrologic cycle has historically depicted water as a 'natural force' within the nature/social dualism. He states, the "conceptual typology of modernity is what allows water, and non-human things in general, to be sorted to Nature" (p. 221). This categorization of water ignores the important interconnections between 'scientific' understandings and the very real economic demands of society (its need, use and consumption of water) (Wheater and Gober, 2015), and its deep Spiritual significance to many communities (Sammel, 2014).

Reflective of hydrologic cycle perspectives, dominant understandings of extreme water events are narrowly conceptualized by levels of precipitation within given regions that have resulted in shortages or excesses of atmospheric, surface or groundwater (Global Water Partnership, 2000; Krause, 2014, 2016). The