Available online at www.sciencedirect.com

SciVerse ScienceDirect

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

You say you want a revolution? Transforming education and capacity building in response to global change

Karen O'Brien [a,*], *Jonathan Reams* [b], *Anne Caspari* [c], *Andrew Dugmore* [d], *Maryam Faghihimani* [e], *Ioan Fazey* [f], *Heide Hackmann* [g], *David Manuel-Navarrete* [h], *John Marks* [i], *Riel Miller* [j], *Kari Raivio* [k], *Patricia Romero-Lankao* [l], *Hassan Virji* [m], *Coleen Vogel* [n], *Verena Winiwarter* [o]

[a] *Department of Sociology and Human Geography, University of Oslo, P.O. Box 1096 Blindern, 0317 Oslo, Norway*
[b] *Department of Adult Learning and Counseling, Norwegian University of Science and Technology, Trondheim, Norway*
[c] *Mindshift Integral, Generative Impact, Switzerland*
[d] *Institute of Geography and the Lived Environment, School of GeoSciences, University of Edinburgh, Scotland*
[e] *Sustainability Adviser, University of Oslo, Norway*
[f] *School of the Environment, University of Dundee, Scotland*
[g] *International Social Science Council, Paris, France*
[h] *School of Sustainability, Arizona State University, USA*
[i] *(formerly) European Science Foundation, Strasbourg, France*
[j] *UNESCO, Paris, France*
[k] *University of Helsinki, Finland*
[l] *Urban Futures, National Center for Atmospheric Research, Boulder, Colorado, USA*
[m] *International START Secretariat, Washington, DC, USA*
[n] *School of Public Leadership, University of Stellenbosch, South Africa*
[o] *Alpen-Adria-Universitaet Klagenfurt, Fakultaet fuer Interdisziplinaere Forschung und Fortbildung, Austria*

ARTICLE INFO

Article history:
Received 21 March 2012
Received in revised form
5 August 2012
Accepted 12 November 2012
Published on line 10 January 2013

Keywords:
Education
Capacity building
Global environmental change
Transformation

ABSTRACT

This paper considers the changes in education and capacity building that are needed in response to environmental and social challenges of the 21st Century. We argue that such changes will require more than adjustments in current educational systems, research funding strategies, and interdisciplinary collaborations. Instead, it calls for a deeper questioning of the assumptions and beliefs that frame both problems and solutions. We first discuss the challenges of transforming education and capacity building within five key arenas: interdisciplinary research; university education systems; primary and secondary education systems; researchers from the developing world; and the public at large and politicians. Our starting point is that any type of revolution that is proposed in response to global change is likely to reflect the educational perspectives and paradigms of those calling for the revolution. We differentiate between a circular revolution (as in the ''plan-do-check-act cycle'' often used in change management) versus an axial revolution (moving to a different way of thinking about the issues), arguing that the latter is a more appropriate response to the complex transdisciplinary challenges posed by global environmental change. We present some potential tools to promote an axial revolution, and consider the limits to this approach. We conclude that rather than promoting one large and ideologically homogenous revolution in education and capacity building, there is a need

* *Corresponding author*. Tel.: +47 22858480; fax: +47 22855253.
E-mail address: karen.obrien@sosgeo.uio.no (K. O'Brien).
1462-9011/$ – see front matter
http://dx.doi.org/10.1016/j.envsci.2012.11.011

for a revolution in the way that leaders working with education and capacity building *look at* systems and processes of change. From this perspective, transformative learning may not only be desirable, but critical in responding to the challenges posed by global environmental change.

"You say you want a revolution

Well, you know

We all want to change the world...

You say you got a real solution

Well, you know

We'd all love to see the plan...

The Beatles (1968)

1. Introduction

There is extensive scientific evidence that human-induced changes to the environment are threatening to "a safe operating space for humanity" (Rockström et al., 2009, p. 472) and that processes such as climate change could have dramatic consequences for humanity (UNDP, 2007/2008). Many consider that there is an urgent need to respond to global environmental challenges, and diverse solutions and approaches have been put forward, ranging from transformation of energy and agricultural systems to transformation of development paradigms, power relations, and values and worldviews (Beddoe et al., 2009; Crompton and Kasser, 2009; Leiserowitz et al., 2006). Underlying many of the arguments for transformative responses to global environmental change is a growing recognition that the complex environmental and social challenges of the 21st Century require a different approach to education and capacity building. In fact, it has been argued that nothing less than a 'revolution' in education and capacity building is needed to confront the challenges posed by global environmental change (RESCUE, 2009). Indeed, Albert Einstein is often attributed with the reminder that "we cannot solve our problems with the same thinking we used when we created them."

Transformative changes in education and capacity building can play a critical role in developing understandings and actions to address the complex, non-linear and potentially irreversible environmental changes associated with human activities (Sterling, 2001; Fazey, 2010). There are, for example, calls for transforming the current and dominant framing of knowledge from a "closed, uniform, linear and placeless system of insights and aptitudes" to an open knowledge system that brings in a holistic perspective to the dynamics of complex interactions of social-ecological systems (RESCUE, 2011, p. 26). This requires interdisciplinary and transdisciplinary approaches to both education and research, as well as the development of new capabilities, including humility and openness toward other systems of thought and sources of knowledge (RESCUE, 2011).

However, there are concerns that most universities and research institutes are limited in their delivery of the type of interdisciplinary knowledge needed to address environmental problems, and few have approached knowledge from a transdisciplinary perspective. Furthermore, they are not delivering as quickly as scientific findings suggest is necessary. The question is, what actions need to be taken? What kinds of capacities need to be built? What exactly does a revolution in education and capacity building entail? These are some of the questions that were addressed by the Working Group on "Toward a Revolution in Education and Capacity Building," which was part of the RESCUE project (Responding to Environmental and Social Challenges for our Unstable Earth), a Frontiers of Science initiative funded by the European Science Foundation (ESF) and European Cooperation in Science and Technology (COST). As a foresight project, a key emphasis was on the future of education, and in particular on moving from first-order changes that amount to "doing more of the same, but better" to second- or third-order changes that involve re-thinking systems by "seeing things differently" (Sterling, 2001, p. 28).

In this paper, we discuss the "revolution" in education and capacity building that is deemed necessary in response to urgent environmental and social challenges. We first argue that any type of revolution that is proposed in response to global change is likely to reflect the educational perspectives and paradigms of those calling for the revolution. Diverse attitudes toward a revolution were visible within the Working Group itself. We next explore the challenges of transforming education and capacity building within five key arenas. We differentiate between a circular revolution (doing similar things repeatedly) versus an "axial" revolution (moving to a different way of thinking about the issues). An axial revolution rests first and foremost on creating conditions for transformation through non-conventional tools and approaches that allow individuals (including academic staff, administrators, researchers and policy-makers) to question current assumptions and beliefs, whether about the future of education or the future of the planet. Finally, we consider some of the potential tools to promote an axial revolution in education and capacity building, including a "Futures Literacy" method for identifying creative solutions to the new challenges for education and capacity by revealing implicit assumptions about how we tend to think about the future.

It became clear through this work that one's anticipatory assumptions and beliefs shape decisions and actions, including the curriculum and agendas for education and capacity building. Addressing these assumptions can thus serve as an important point of departure for identifying creative and