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Review of *A Framework for Sustainable Thinking*: Is QL for Citizenship Even Possible?

Abstract

Van Antwerp and Heun's *A Framework for Sustainability Thinking* offers an extensive collection of data related to sustainability with an emphasis on energy. Intended for a primary audience of undergraduate students, the authors set the data in the context of the IPARX identity which notes that impacts (I) are the product of population (P), affluence (A), resource intensity of economic activity (R), and impact of the resources (X). In addition to being a useful text for seminars focused on sustainability and energy use, the book provides a context for contemplating the roles of expertise vs. general quantitative literacy when addressing major questions of citizenship.

Keywords

quantitative literacy, sustainability, environment, expertise

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Cover Page Footnote

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Several years ago, Erickson (2016) offered a provocative critique of the numeracy movement. Drawing on an analysis of ballot measures, he argued that quantitative literacy (QL) could not prepare citizens for useful engagement with significant public problems because “the contextualized knowledge necessary to evaluate [them] goes beyond anything that might reasonably be expected of a citizen” (3). As an alternative, he suggested in the abstract to his article that a “reasoned dependence on the knowledge of others” in which the citizen’s task is to evaluate potential sources of expertise rather than directly engaging in analysis. Erickson’s claim generated a reply from Hamman (2017) who countered that QL in the public domain was powerful precisely because it empowered citizens to “be savvy consumers of mathematics, not ... creators of it” (1).¹

This critical debate came to mind as I read *A Framework for Sustainability Thinking: A Student’s Introduction to Global Sustainability Challenges* (hereafter, *A Framework*) by Jeremy Van Antwerp and Matthew Kuperus Heun. Where Erickson (2016; 2017) and Hamman (2017) consider the necessity of expertise from a theoretical perspective, Van Antwerp and Heun offer a practical basis for contemplating the feasibility of the vision articulated by the National Numeracy Network (and explicitly supported by *Numeracy*): “a society in which all citizens possess the power and habit of mind to search out quantitative information, critique it, reflect upon it, and apply it in their public, personal and professional lives” (Madison and Steen 2008, 6).

Indeed, questions of sustainability offer a nearly ideal context for pondering Erickson’s hypothesis. After all, it is difficult to imagine a QL-relevant public problem of greater salience than the ability to sustain life on the planet. If QL doesn’t prove useful for a problem such as this, then Erickson scores a huge rhetorical point. Sustainability policy also exemplifies the challenges of expertise at the root of Erickson’s critique because the issue’s complexity draws on so many expertises that no one could hope to be master of all. In particular, no one would argue that a full understanding of sustainability is possible without deep insights from all the natural sciences. And given the available policies and their intersections with human behavior, who would doubt complete mastery of the topic would call on significant content from most if not all of the social sciences and ethics? I’d go even further, arguing healthy sustainability policies are impossible without a deep understanding of what it is to be human, which means that a comprehensive command of the issue also calls for expertise in the arts and humanities. Given that no one person can command expertise sufficient to the question at hand, what if anything does QL offer to those who wish to act as informed citizens?

¹ See also Erickson’s (2017) reply.

Contribution to Sustainability Studies

Before returning to these larger questions of our discipline, let me describe the more direct contribution of the book as a sustainability primer. In the preface, the authors describe their intended audience for the book as “anyone who is interested in sustainability” (xxi). While they imagine that it might be read in connection with a college seminar, they also note its potential use in a book club. This choice of audience naturally affects the goals of the book. Specifically, such an audience will not be transformed into experts with a single book. Instead, the authors set out to arm the reader with basic facts and figures, provide an “explanatory framework” for thinking about sustainability, offer thought-provoking discussion questions, and inspire future research. The audience also limits the breadth and depth of the treatment; at 252 pages, the text seems appropriately brief for the intended reader.

The first section of *A Framework* introduces the reader to the IPARX identity: Environmental impact (I) is the product of population (P), affluence (A), resource intensity of economic activity (R), and the impact of resources (X). While the authors take up questions of sustainability generally, they continually return to a case study of energy use and carbon emissions. The authors devote a brief (roughly 15-page) chapter to each element of the identity, using numerous graphs to explore trends in and causes for changes in each over time. Freed from limitations related with print media, the authors make good use of vibrant color so that the many visuals are easy to read and digest.

These chapters exemplify Steen’s (2004, 9) view of QL: “sophisticated reasoning with elementary mathematics more ... than elementary reasoning with sophisticated mathematics.” I don’t recall seeing mathematics more advanced than products of ratios or discussion of exponential growth. (The latter is unpacked through a story at the very opening of chapter 1.) While the authors don’t cite Gaze (2020), it was difficult not to read the opening six chapters as a paean to that QL textbook’s championing of proportional reasoning.

At times the book’s brevity led to uneven coverage. For example, nuclear-sourced electricity warranted only 107 words (plus 155 more in two end-of-chapter questions). Without arguing that nuclear power is or is not a useful component of a carbon-free (or -reduced) future, this treatment seems far too limited. For example, direct air capture of CO₂ is given more space despite the authors acknowledging that the technology has not “been proven to work at scale” (104). By contrast, we know how to make nuclear energy with, presently, a relatively modest carbon footprint (Sathaye et al. 2011).

The second section of *A Framework* applies the lessons of the IPARX identity to four large areas of human activity where we face sustainability challenges: households, transportation, agriculture, and land use. Again, chapters average about 15 pages. Given the breadth of these topics, the reader cannot expect a

comprehensive treatment of relevant choices to energy use and carbon emissions, much less to the broader topic of sustainability. But the chapters lead students to a basic understanding of some of the larger challenges society faces. For example, in discussing sustainability challenges of households, the authors discuss size and location of homes, heating and cooling, hygiene, and lighting. These do seem to capture the larger aspects of household choice (recalling that food and transportation are the subjects of their own chapters). One might argue that the section is missing a chapter related to work—both industrial production and the increasingly energy-intensive service industry. However, I suspect that wherever the authors drew the line one could argue something had been left out.

The book concludes with a two-chapter section concerning collective and individual actions in response to sustainability challenges. Once more, the authors call upon the IPARX framework to organize their exposition.

For each chapter, the authors include roughly five pages of discussion questions and project/research prompts. Most of the questions nudge (or sometimes shove!) readers to connect the empirical content of the chapter to personal values in a way that supports potential individual change. For example, in the chapter on population one of the questions points to Malthus's connection between later marriage and lower population growth. The discussion question asks readers to articulate their understanding of the purpose of family and consider how these purposes intersect with trends toward wider geographic dispersion in ways that affect sustainability. Obviously, such questions are subjective, normative, and qualitative. Equally obviously, answering such questions for oneself can play an empirically large role in an individual response to sustainability (the subject of the concluding chapter of the book). I could easily imagine using some of the end-of-chapter questions as a vehicle for dinner conversation with my children as they grapple with issues at the intersection of values, personal choice, and public policy.

In all, I believe the book achieves its stated goals. The work is rich with basic, useful quantitative information (particularly in the first six chapters). The argument serves as a wonderful example of Steen's argument that one can contemplate sophisticated ideas with the most basic of mathematical tools if armed with relevant data. Given its audience-dictated length, the treatment is sometimes uneven (more on this below). But I would argue that for its purpose, *A Framework* is far more effective than the more complete Intergovernmental Panel on Climate Change Sixth Assessment Report which clocks in at 3,675 pages.

For its content, I would recommend the book for consideration in QL seminars or other college-level seminars aimed at basic citizenship questions of sustainability.

Contribution to Our Thinking About QL

Perhaps unsurprisingly, the reflections *A Framework* provoked in me concerning the role of expertise in QL grew from my identity as an economist. I was disappointed by the very brief mention of carbon taxation as a tool to promote sustainability and wished the book had emphasized questions of intertemporal substitution—that is, asking whether we are better off to impose costs on the present or to adapt to consequences in the future. I think nearly all economists would respond similarly: these authors (a chemical and mechanical engineer, respectively) simply did not exhibit expertise in the aspects of sustainability policy that are closely connected to my field.

I suppose this conclusion is true, but it is very partial. After all, I lack the authors' expertise in chemical and mechanical engineering relevant to sustainability. And both the authors and I lack expertise in the facets of this issue that call upon political science, sociology, psychology, philosophy, humanities, and more. So, there is plenty lack of expertise to go around.

And so we arrive at the question posed by Erickson (2016): does QL empower us for sound citizenship concerning sustainability (or immigration or macroeconomic responses to inflation or gun control or pandemic response or any other policy), or does it just show us that policy questions of this magnitude and complexity demand expertise which we must find in another?

Reading *A Framework*, I found myself convinced that QL does empower effective citizenship. First, the complexity of sustainability only proves that relying on experts is ultimately fruitless for most important policy questions. It isn't possible to be expert in all fields implicated by sustainability—literally no one possesses all of the called for expertises. So, seeking some expert who will make up my mind for me isn't a possibility.

But does QL offer anything toward a solution? My reading of *A Framework* leads me to answer “yes, and in several ways.” First, many times QL suffices even without narrow disciplinary expertise. For example, I am not expert enough to build a solar farm, but I don't need that expertise to ponder whether it is possible to address sustainability challenges through renewable energy investments alone. The basic arithmetic (combined with tremendous data) offered up by Van Antwerp and Heun serves to guide my thinking.

Second, because complex problems often touch on multiple expertises, the citizen is often called on to synthesize information from multiple experts. When costs and benefits surrounding the problem at hand involve quantitative elements, QL is essential in combining insights from multiple sources. Of course, the need for synthesis alone does not rule out the role for expertise. One might imagine a meta-expert possessing skill in synthesizing others' expertise to guide my way.

However, *A Framework* points to two reasons why such meta-expertise is no substitute for the citizen's own QL. First, many of the actions required by citizenship take hold at the individual level. Indeed, many of the discussion questions of *A Framework*, not to mention the book's entire final chapter, point to the importance of individual decision making. Personal-level decision-making involves information only the individual citizen knows. What is the value of visiting my grandmother? How important is it to me to live outside the city center? No meta-expert can answer these questions because the expert lacks necessary information about the individual's circumstances. Second, as seen in the discussion questions, such decisions often (usually, even) involve ethical issues that invoke the individual's values—considerations that one cannot simply outsource to another.

Realizing the limits of expertise and the role of QL in my role as citizen led me to a second observation. While the book provoked some predictable objections from an economist reading policy-relevant work by STEM authors, the bigger picture is that our disciplinary differences, while important for our narrow discipline-specific research agendas, are of second order when contemplating complex problems such as sustainability. While I would have written a different sustainability primer had I been the author, at a deeper level our books would have looked very similar. Both books would contend with the same basic data (and lack thereof). Both books would run into the proportional reasoning embedded in the IPARX identity. Both books would identify the same four broad “buckets” of potential policy responses—one for each element of PARX. And both books would ultimately conclude that this is a very complex problem such that there is no single objectively “correct” set of optimal policies, only value-informed trade-offs constrained by basic facts.

Of course, some may disagree with me—they may instead agree with Erickson (2016) and conclude that the complexity of issues like sustainability reach beyond the grasp of the lay person such that QL offers little aid in citizenship. Interestingly, those readers will also find this book worthy of consideration for a college seminar. After all, there would seem to be no better environment for students to consider the power and limitations of QL versus expertise than in the messy context of a complex and real challenge like sustainability.

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