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Post-normal science and mathematics education in uncertain times: Educating future citizens for extended peer communities

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ABSTRACT

In this paper we argue that the academic fields of critical mathematics education and post-normal science are complementary and can provide mutual benefits for the future. Post-normal science promotes the idea of extended peer communities, through which citizens participate with knowledge and insights in urgent and complex societal issues with conflicting stakes. Meanwhile, critical mathematics education is a philosophy of mathematics education that includes attention to the central role of mathematics in a technological society, the effects of this role, and the need for epistemic dialogue in learning and teaching mathematics. We argue that a mathematics education based on these ideas can prepare students to participate in extended peer communities. We focus particularly on the uncertainty that characterises post-normal situations. Post-normal science distinguishes various characteristics of uncertainty and highlights its centrality to post-normal situations. A critical mathematics education should prepare citizens who are able to deal with the different ways in which uncertainty matters in such situations. We illustrate these ideas through brief descriptions of three classroom studies in which students discuss issues of uncertainty and risk.

1. Introduction

Contemporary society faces a range of complex and urgent challenges characterised by a high degree of uncertainty. Examples include climate change, global epidemics, and new technologies like genetically modified organisms. Funtowicz and Ravetz (1993) argue that such challenges require *post-normal science*. Post-normal science is distinguished from "normal" science, characterised as a kind of puzzle solving activity where scientists choose solvable problems and produce knowledge associated with a high level of certainty. The quality of this work is assured through a peer community that usually consists of other scientists. On issues where uncertainty and stakes are low (e.g. in terms of costs, impacts or risks), experts can feed decision makers with solutions based on a relatively value-free idea of science. Although there is an increased awareness of the limitations of science on complex issues, research suggests that the idea that policy should be informed by objective science is still strong (see, for example, Hauge et al., 2014; Hauge, 2011).

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