

# Chapter 7

## Culturally Situated Design Tools: Generative Justice as a Foundation for STEM Diversity

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## **ABSTRACT**

*The “pipeline” model of STEM education conceives of underrepresentation by race, gender and class in terms of leaks that fail to deliver students to their destination in the science and technology workforce. But that model fails to consider the role of STEM in producing underrepresentation. This can only be solved by moving from the extractive approach of the pipeline model to a generative model in which the value produced by STEM students cycles back to their own communities. We report on our experience creating and evaluating Culturally Situated Design Tools. Using a framework of “generative justice”, we contrast the cyclic social damage, which reproduces underrepresentation with the potential for STEM education as a niche in the technosocial ecosystem that can address underrepresentation and causal factors.*

## **INTRODUCTION**

The “pipeline” model of STEM education envisions a stream of students entering the educational system, but because of “leaks” only a small percentage make it to the end. Low-income, female, and underrepresented ethnic groups leak out more than others, which “explains” their underrepresentation. This model has become so naturalized in STEM education that we no longer think of it as a model; it appears to be common sense. To think that the model itself is flawed may seem irrational. However scientists challenge models in search of better ones all the time.

Consider, for example, the origins of the pipeline model in the oil industry. If scientists and engineers approached the problem in the same way--the only solution to America’s rising fuel prices is to get more oil through the pipeline--we would be trapped forever in a world with accelerating global warming, middle-eastern petro-dictatorships, ocean oil spills, etc. Fortunately we now understand the importance of replacing these extractive industries with renewable energy. Biofuels based on waste products, for example, can suck up as much carbon in the plant growth part of the cycle as they release in the fuel part of the cycle. Similarly we must now replace an extractive approach to underrepresented students in STEM with a generative approach that embodies both social and environmental justice.

A common reaction to this view, especially from scientists and engineers, is that we are confusing two entirely different phenomena. Whatever our critique of the social and environmental damage caused by STEM may be, surely K-12 students are unaware of it. To the contrary, while underrepresented youth may not have the data or analytic tools to back up their intuition, few of those living poverty think they are inhabiting a system which treats them and their community in fair and just ways. Because they often lack the means to express this analytically, the reaction can appear irrational. In the case of underrepresented ethnic groups these include

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