

An engineering design approach to improve math and science education in Ytabo, Dominican Republic

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ABSTRACT

Despite numerous policy initiatives and billions of dollars spent in recent decades, the levels of math, science and language skills remain dangerously low in most countries in the world, particularly in developing countries like the Dominican Republic and in less advantaged communities worldwide. This constraint scientific, technological and socio-economic advancement in developing countries and can reduce the pace of such development in advanced nations like the United States. Ineffectual math and science education hinder the ability of poor nations to lift themselves from poverty. The rationale for the failure of major educational reforms is that they are grounded on ideology rather than ‘knowledge’ generated by educational research and that research-based policies will improve educational practice. However, complexity is a broader and richer explanation for the failure. Educational systems are human systems thus intrinsically complex. The components – teachers, learners, families, community environments, school environments, school management, government agencies, and union organizations – interact in complicated ways and their interactions are dynamics, difficult to understand and predict. Hence, global policies based on generalization of predictive research will not produce the desired improvement since educational systems are neither deterministically nor stochastically predictable. Complexity limits model completeness, a necessary requirement for model accuracy and resolution. Only short-run localized or process-specific solutions can be optimal in this environment. Consequently, problem-solving research - as practice in engineering and materials sciences – rather than predictive research can be more effective and improve the usability of the results for decision-making. The goal of these modes of inquiry is to search for good, context-sensitive solutions that work in practice, rather than for generalizable knowledge about practice. Following a problem-solving approach coupled with a system view educational research has the potential to offer significant practical benefits for developing countries that can help them address educational challenges in the 21st century and propel scientific and technological advances. MACILE, which stands for Matemáticas, Ciencias y Lenguaje

(Mathematics, Sciences and Language), follows this approach to design solutions that can improve the state of math and science education in Ytabo, Dominican Republic. The purpose of this work is to present an overview of the program and its potential policies implications. Another objective is to examine the role of engineering design methods and engineering in general in improving the effectiveness and efficiency of education systems.

Key words: education systems, complexity, engineering design, MACILE, Dominican Republic