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A Dynamic Framework of Path Dependence Mechanisms in E-STEM Education Reform: Evidence from the UK's Locked-in Curriculum

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Abstract

This article develops a dynamic theoretical framework to analyze path dependence mechanisms in E-STEM (Environmental-STEM) education reform, focusing on England's notable resistance to curriculum integration as a critical case study. By incorporating the critical juncture theory, we explore how principals and educational researchers can leverage policy windows to disrupt entrenched practices and break the cycles of stagnation. Combining historical institutionalism with critical policy sociology, we identify three interrelated mechanisms that sustain disciplinary dominance: (1) epistemic lock-in perpetuated by high-stakes assessment regimes, (2) institutional isomorphism in teacher professionalization that limits innovative practices, and (3) corporate-state symbiosis in educational publishing that prioritizes traditional content. Through a mixed-methods analysis of policy documents from 2010 to 2023 and assessment databases, we reveal how these mechanisms create an "iron triangle" that resists reform. Importantly, we highlight that path dependence operates not merely through inertia but through the active reproduction of vested interests, thereby contributing to education policy theory and offering actionable strategies for sustainable curriculum transformation.

Keywords: path dependence; E-STEM education; UK policy analysis; assessment regimes; institutional change