Equitable Science Outcomes and School Organizational Conditions

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Abstract: This poster describes research at the school level that investigated systems factors associated with variation in equitable science outcomes. A mixed methods approach uncovered multiple associations between organizational features and demographically adjusted academic measures. Schoolwide surveys of faculty perspectives about leadership along with social network analyses revealed complexities with real-world applications. Findings highlight the need to attend to organizational contexts while studying learning.

Although academic disparities based on social class, and race levy considerable economic costs on individuals and communities (Auguste, Hancock, & Laboissiere, 2009) decades of research offer rich descriptions but few solutions (Bohrnstedt, et al. 2015; Fryer & Levitt, 2004). Within the learning sciences, outcome disparities are framed as equity or social justice and typically invoke individual identity development or within classroom social contexts (Bell, Van Horne, & Cheng, 2017; Tabak & Radinsky, 2014). Less common are studies attending to schoolwide and organizational influences on equitable outcomes (e.g., Naris & Vakil, 2017). Extending Lee's (2017) claim that learning science has been expanding beyond the purely cognitive, it is valuable to engage in deeper consideration of institutional factors for their influences on student academic outcomes.

Typically, achievement gaps are reported using large scale examination data. While some scholars contend such assessments remain at the fringe of learning sciences community interests (Roschelle, et al. 2011), the tests' presence, most notably in American schools, create influences that cannot be ignored. Because legislation requires test results to report outcomes disaggregated by various demographic categories, these reports are regular reminders that discrepancies in "learning" by race and social class exist within schools. Put another way, achievement gap severity is not a matter of uneven resource distribution between towns or districts; rather, schools with comparable demographic profiles generate widely varied results. Inequities correspond to conditions inside schools. This predicament suggests that learning research would benefit by drawing upon sociological frameworks. Individual students are embedded within peer groups, classrooms are constituted by multiple inter-relationships, and school level learning is shaped by complex interactions amongst adults and children. My research has revealed multiple institutional factors strongly associated with student outcomes and those suggest that equity agendas should more intentionally attend to organizational factors.

Methods

Data were gathered from 6 elementary schools within a single economically depressed district. To capture the organizational and leadership conditions within the schools, we administered a validated infrastructure survey containing eight distinct factors. Interviews were used to collect systems-level perspectives about the school science program. The school's lead administrator was asked to describe decision-making, community involvement, and equity considerations connected to the school's science programs. The designated lead science teacher of the building was interviewed to understand their role as a quasi-administrator who had daily contact with science teaching and learning. Finally, we "interviewed" the building to uncover what it would say about the presence of science education within the school; this took the form of a school tour led during which we sought to identify where formal and informal science instruction took place, where professional development activities occurred, where/when parents were able to participate in science activities, and the locations and accessibility of science instructional materials and equipment.

Findings

Findings revealed strong associations between multiple organizational factors and demographically adjusted science test scores. Except for "Other Teachers' Trustworthiness" which exhibited a ceiling effect, responses to the School Infrastructure survey uncovered seven other factors correlating with science residuals: *Collaborative Teacher Learning*, *Families as Educational Partners*, *Principal Dependability*, *Principal's Advocacy for Equity*, *Shared Decision-Making*, *Supports for Science Teaching*, and *Teacher Pride and Orderly Environment*. If one would allow that a science test score is a proxy for science learning, then this study's findings offer evidence that school conditions, climate, or culture contribute academic performance and educational success.

There were varying configurations and quantitative differences within schools for the various forms of advice-seeking. At the sites we visited, the more centralized advice-seeking arrangements placed the principal, a lead science teacher, and sometimes a third individual at the core. It was to these leaders to whom the teaching faculty went for advice. Schools with less privatized professional relationships were also sites where performance equities

were less severe. The below figure presents survey items from the factor *Collaborative Teacher Learning* and describes teacher actions that reduce the barriers separating teachers from one another. This is not to suggest that open collaboration was prevalent in the participating schools. In truth, the factors making up the *School Infrastructures* survey were highly reliable in part because there was such a range in ratings.

Items From the Collaborative Teacher Learning Subscale of the School Infrastructure Survey

Instructional coaching specific to science teaching is provided to teachers at this school.

Professional development has deepened my understanding of science-specific subject matter.

Professional development has strengthened collaborations around science instruction.

I have found value in visiting a colleague while he or she is teaching science.

Teachers at this school regularly meet to plan science lessons and activities.

Feedback from a colleague at this school has improved my science teaching.

I admire the instructional strategies my colleagues use when teaching science.

Implications

This research may encourage the learning science to elevate its regard for organizational influences. In circumstances where it is desirous to replicate and/or bring learning interventions to scale, it is advisable to give increased attention to factors typically relegated to the background: policy, administrators, climate, etc. The findings from our investigations show clear links between organizational conditions and students' academic outcomes. Less clear are the connections between instructional design and school infrastructure. Whether one views the resolution of achievement disparities as an educational imperative, there are intellectual and practical reasons to incorporate organizational considerations into learning studies. In many respects, the findings from this research project reinforces the value in looking at the nested nature of learning. The field is no longer content to investigate individual learning as if it is disconnected from other sources. Science learning is dialogic as individuals and groups influence one another (Southerland, Kittleson, Settlage, & Lanier, 2005). Taking into account institutional influences should become a less uncommon dimension of the learning sciences

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