Crafting a Research Grant to Study the Influence of Elementary Science Specialists

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VEXATION

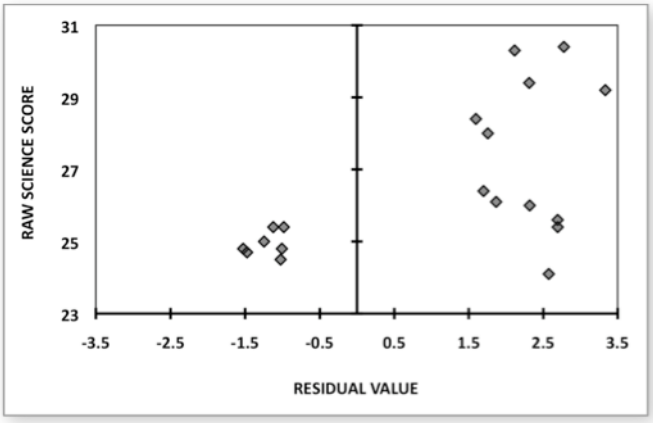
During my doctoral studies, I had a job as a part-time elementary science specialist. Twice each week, I'd visit a school to deliver science lessons to one fourth grade, two fifth grade, and two sixth grade classes. Science specialists were deployed throughout the district and were intended to provide support with the goal of improving children's science test scores. A few years later, as an assistant professor, I consulted in an urban school district that designated a Lead Science Teacher for each building, an initiative that was a by-product of a systemic initiative through NSF. I met many of these lead teachers across almost seventy different schools. Their dispositions and backgrounds were incredibly varied and the configurations of their responsibilities as elementary science specialists were equally diverse.

One person I was associated with remains a puzzle to me to this day. He had no formal science training and yet was willing to try anything. He began by pilot testing curriculum designed for early childhood and he then began presenting these modules to other teachers in the region. He had great interpersonal skills but was also perhaps the single worst writer as a graduate student I have ever met. He worked in a high poverty neighborhood school with an astonishingly transitory student population. Somehow, despite all of this, his school's science scores exceeded the district average. I suspect that the model of delivering science was what contributed to the success.

The school stayed very close to the district's scope and sequence using curriculum kits from EDC's *Insights*, Lawrence Hall of Science's *FOSS*, and a few Smithsonian *STC* modules. Every child had science two or three times each week, once in the science specialist's lab and the other times back in their regular classroom. I suspect the defining feature of the arrangement was this: the teacher brought his/her class to the science specialist and remained during the science lesson. On the surface, this helped build continuity between the lessons delivered by the two educators. But I also believe that the on-the-spot professional development, especially because it occurred with the very students assigned to the classroom teacher, was the secret ingredient. Everything else that took place was not all that unusual: tubs of science equipment, a fulltime instructor (without much formal science training), and a K-6 public school. Something impressive was going on that was intriguing.

What has been vexing me ever since is that I have not had the opportunity to pursue my hunch about the magical combination that contributed to the impressive science achievement. For one, this situation was pre-NCLB so when I moved out to another university, my new state did not have science standardized testing incentives or pressures. But as of this last academic year, all fifth graders in the state where I now reside must take a science test. This presents tantalizing possibilities including a way to compare buildings in terms of their science performance even as it elevates science to "must teach" status due to accountability. In the meantime, I was able to help shape our state's new science specialist credential which forced me to examine the empirical and policy bases of elementary science specialists. I found very little that carried much weight. In the process I have stumbled upon an area of considerable interest for funding agencies.

This past spring I conducted a graduate seminar that was a group research project. With help from an in-house statistician, I was able to identify school buildings that, after accounting for social class and student demographics, were outliers (Gladwell, 2008) according to their science test scores. In other words, after factoring in the percent of students qualifying for free/reduced price meals and the percent of children of color, we uncovered considerable variations in science achievement. This allowed me to identify WHAT schools were being successful with teaching science to non-mainstream students and compelled me to strive to uncover the HOW and WHY of this success. For sake of comparison, we were also able to identify schools that were doing a relatively poor job with these populations. This graphic displays only the outlying schools with under-performing buildings on the left and high-achieving schools on the right. We chose only those schools with a higher than median percent of low social status students because of my commitments to social justice and educational equity. In order to gain access to the schools, we only approached principals whose science test scores were above average. I couldn't fathom how to convince a principal with low scores to speak with us about their science program.



This was a pilot study. The graduate students visited the schools in pairs and interviewed principals using a protocol we had jointly developed around social capital. Our hunch was that principals that had networks of relationships (with college, peers, the community, etc.) would be more effective. Of course, the situation is more complex that can be unpacked with a single school visit. But I feel much smarter about the study and the contexts of elementary science teaching. Nevertheless, these efforts give me the fortitude to move forward with my pursuit of grant funding.

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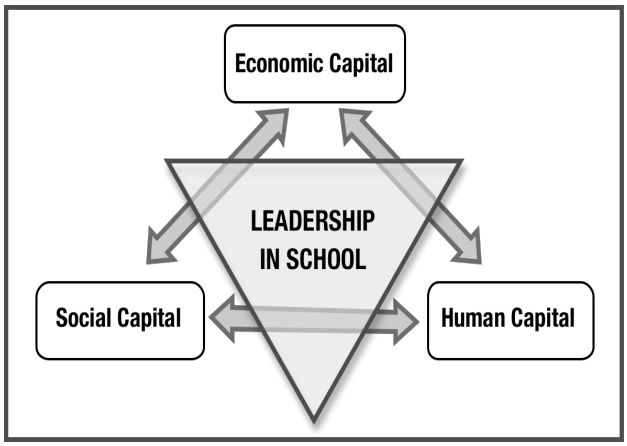
VENTURE

My aspiration is to submit a substantial grant proposal to NSF to take the work begun in New England and extend it to multiple cities around the nation. Because gaining access to schools is key, having local connections will increase the likelihood that I can entice school leaders to speak with me. Fortuitously, I have a colleague skilled with highly sophisticated statistical techniques who has agreed to be the Co-PI. Her quantitative expertise will complement my science education background and my experience with qualitative methods.

This research would be informed by the idea of social capital (e.g., Field, 2008) that has been nominated as a causal link between school leadership and student achievement (Halverson, 2003). Social capital describes the relationships within an organization, human capital describes the expertise embedded within the individuals, and economic capital describes both the monetary and material stuff owned by the organization. We have hypothesized that the leadership within a school is responsible for not only influencing the rise and fall of the three forms of capital but also for controlling how each influences the other. For example, a principal could use discretionary dollars to fund teacher study groups that might incorporate faculty from other schools and attract involvement from a local college. In this scenario, economic capital is deliberately invested to enhance human capital which has attendant influences on the social capital of the school, internally as well with external entities.



- ***Phase One***. We will use fifth grade science achievement data to identify schools that are performing above expectations after factoring in race/ethnicity, SES and English language learners. This will allow us to select outlier schools which would then be visited (by me and/or highly-qualified local research assistants) to uncover what practices could explain the students' success in science. In most instances, we have found that even though we target the building principal, it is almost inevitable that we have been introduced to other "leaders" in the school even though they may not hold a formal title. This ends up helping us access those who actually teach science in the school and becomes an indirect mechanism for discerning which form of "science specialist" may be in place within the schools (Jones & Edmunds, 2006; Schwartz & Gess-Newsome, 2008).
- ***Phase Two***. Having established interpersonal connections within the participating school districts (thereby creating our own social capital) this would open communication channels allowing us to classify which type of science specialist arrangement is in place within each school. In addition to follow-up visits to over-performing outlier schools, we would use hierarchical linear modeling to examine whether science specialists can be associated with student science achievement. Along the way, we might be fortunate enough to uncover school buildings that rely upon the mythical on-the-spot professional development that has beguiled me for several years. Furthermore, the HLM results should direct us to schools that are consistently over-performing, which would present fresh sites where extensive qualitative information might be gathered.

That is my vision for a three-year, one million dollar empirical study. I would like to believe that this could be couched as an education policy and systems study and would be appropriate as a Research and Evaluation on Education in Science and Engineering program. I am soliciting input on any and all dimensions: methodological, political, theoretical, and so on. I would like to believe that our pilot study work would be compelling and that we could demonstrate that we have sufficient technical expertise to carry out the project as designed. Beyond that, I worry about other components of the review process that I may not be attending to sufficiently. I am bracing myself for a polite rejection with an anticipated re-submission. Nevertheless, I would prefer to submit a proposal that has everything in it that it should … so even if it is not funded the first time, the feedback and critique will improve my understandings so the next submission would be fundably strong.