POOR ROOTS AND WEAK STEM: POTENTIAL ISSUES IN STEM LEADERSHIP PROGRAMS

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STEM Education and Leadership: A Mathematics and Science Partnership Approach

by Chris Merrill and Jenny Daugherty

In continuing response to the No Child Left Behind (NCLB) Act of 2001, the United States (U.S.) Department of Education releases an annual appropriation of 180 million dollars for Mathematics and Science Partnerships (MSP), whose "overarching goal … is to increase students' achievement in mathematics and science by increasing teachers' content knowledge and pedagogical skills" (Merrill & Daugherty, 2010, 23). In their article, Merrill and Daugherty hail the MSP funded science, technology, engineering and mathematics (STEM) Education and Leadership Program at Illinois State University (ISU) as an example of the direction that many MSP funded STEM programs should take to address the needs of students and teachers. However, as this paper will discuss, the authors seem to ignore some fundamental flaws in the leadership model of U.S. government funded MSP projects, which create issues in initiatives such as ISU's STEM Education and Leadership Program from their outset through preset restrictions and regulations, and this can hinder the intended promotion of STEM careers.

Though they provide funding necessary to start and sustain programs, MSP initiatives are unfortunately tied to U.S. government's promulgation of panic and fear surrounding the imminent need for an increase in student success rates in STEM subjects, which has been part of political rhetoric in the U.S. for at least the past decade (Committee on Science, Engineering,and Public Policy (U.S.) & Committee on Prospering in the Global Economy of the 21st Century (U.S.), 2007, 3; Kuenzi, Matthews, Mangan, & LIBRARY OF CONGRESS WASHINGTON DC CONGRESSIONAL RESEARCH SERVICE, 2006, 1). While there is truth to the poor performance of American students in STEM subjects, the danger here is the sense of paranoia that is created when rhetoric of political documents, newspaper articles, and even scholarly journals sound the alarm for urgent reform in STEM education (Cuban, 2010, 1125). Though Leithwood wrote specifically about teacher practices, the advocacy for improvement in STEM

achievement most certainly adheres to his definition of a "bandwagon" (Leithwood, 2008, 72-73). STEM has a champion (the US government though its NCLB Act of 2001), and disciples (such as Apple Education and Khan Academy), who, it can be argued, are as attracted to the promotion of STEM subjects as they are to the money to be made from this promotion. One could argue that STEM is also a slogan that "'signifies' something we all agree is a good thing" (Leithwood, 2008, 72). The problem with "bandwagons" and "slogans" is that they simplify issues and are not usually sustainable, then become a target of skepticism when they fall out of favour. The issues with MSP projects that I will discuss, which are symptomatic of the flaws in the U.S. government's approach to STEM reform, will likely cause STEM initiatives to be ineffective. This ineffectiveness, combined with the generalized urgency generated over the past decade by media and politicians, will cause the general public to lose faith in all such programs, which will undermine the efforts of any STEM projects that are actually achieving suitable results in the interests of students and teachers.

One example of an issue with MSP funding restrictions is the goal of MSP initiatives to "promote strong teaching skills through access to expertise of mathematicians, scientists, and engineers and their technologies and resources" (Merrill & Daugherty, 2010, 23). It has long been true that the quality of teaching at higher education institutions has been overshadowed by the priority for research excellence, and instruction has not been highly emphasized or rigorously evaluated until recent years (HâNard, OECD iLibrary, Organisation for Economic Co-operation and Development, & Institutional Management in Higher Education, 2010, 9; Institutional Management in Higher Education, 2010, 3). It is difficult, then, to accept that mathematicians, scientists, and engineers have "expertise" in pedagogy that should be sought by teachers. It is also unlikely that a partnership between these groups of professionals will help to improve

subject-specific understandings useful for teachers since most STEM concepts that a professor has to share are likely well beyond the level of difficulty required by elementary or secondary school curricula. It should be said that part of the MSP includes plans to consult with faculties of education in universities to guide the MSP-required action research process, and it should also be mentioned that teaching quality has been given more of an emphasis in post-secondary institutions in the past ten years in the U.S. However, the potential to gain from such a partnership in terms of subject knowledge or pedagogical practice is minimal, especially considering that most professors outside of faculties of education are not required to enroll in teacher training or have classroom experience as a prerequisite for their positions. Add to this that MSP programs require that partnerships be formed with schools from high-risk school districts, and you potentially have very little common ground as a basis for partnerships between teachers in struggling schools and professors with, likely, comparably privileged backgrounds.

Beyond partnership issues are risks that come from the simple fact that MSP initiatives are driven by government funding (Merrill & Daugherty, 2010, 22), a hazard seemingly ignored by Merrill and Daugherty that can jeopardize the MSP goal to utilize and improve teacher leadership. As Hargreaves and Fink state, "sustainable leadership must have an activist dimension" (Hargreaves & Fink, 2004, 12), which can be perceived as absent by colleagues when one is accepting funds and thus adhering to restrictions and requirements from the government, whose aims and interests are not wholly educational. One must remember that "leadership is always context bound" (Foster & Smyth, 1989, 29), and so a teacher who is a member of a partnership through an MSP project will teach in the context of the funding they receive and the restrictions they are held to. It is possible, for instance, that the leadership of a teacher participant in an MSP may be viewed by fellow colleagues as transactional – that the

participant is trying to "climb the ladder" to a new position of authority within the school or district by using the partnership to heighten their profile (Foster & Smyth, 1989, 28). These colleagues may feel that the participant wishes to claim agency for colleague involvement in the MSP to legitimize claims to a promotion of some kind, whether real or imaginary, and the colleagues may resist involvement so as not to take part in this "transaction." Similarly, suspicion of participant ethics may arise surrounding conflicting choices teacher leaders may face as they try to comply with MSP regulations. While requirements are necessary to provide structure, it is possible that parents and colleagues may come to believe that the practitioner's ethics are compromised by MSP restrictions, and this perception can undermine the ethical element that must be present for effective leadership (Foster & Smyth, 1989, 37). The aforementioned issues may not guarantee failure, but it is alarming that Merrill and Daugherty do not acknowledge these potential problems.

The effectiveness of MSP initiatives could also be in jeopardy due to the goal-driven bureaucratic-managerial model of leadership on which they seem to be based (Foster & Smyth, 1989, 30). The bureaucratic-managerial model is flawed as leadership and management are confused and "translated into the needs of bureaucracy", and the problem with management is that it "never really knows whether the decisions made have had the effects intended" (Foster & Smyth, 1989, 31-32). The previously mentioned goals of MSP projects, and the NCLB Act, are evidence that improved student achievement is the ultimate aim of these projects, which may cause educationally sound elements to be ignored. We can see this potential in MSP projects, which target teachers who are "not-highly qualified" and who have less than ten years of teaching experience (Merrill & Daugherty, 2010, 23). This fulfills the MSP aim to improve teacher pedagogy by targeting teachers who have not fully developed these skills. However, this

conflicts with the MSP directive to foster teacher leadership, which assumes agency on the part of the teacher to enact change. With little experience or qualifications as their basis for judgment, these teachers will be challenged to command the respect of their older and much more experienced colleagues. While there is no guarantee that this will go wrong is every case, the goals of supporting teacher leadership and improving teacher education seem to in conflict, hindering the intended positive effect of MSP.

I do not want to give the impression that MSP projects are rife with inherent problems. For example, the action research required by MSP programs can certainly be of benefit as it will give teachers a source of information from which to adjust and refine their plans and learn more about their students and their own teaching. MSP programs also work in K-12 classrooms, and recent research has shown that children are learning to suppress their problem solving intuition earlier and earlier in their school careers **Jung p 50 (add this reference to RefWorks). These are two examples of some ways that research is being used to inform the creation of such programs. However, there are some substantial flaws that still need to be dealt with in order to gain the improvement that we should truly seek: an improvement in all areas of student learning, including STEM.

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