JAMES S. McDONNELL FOUNDATION

**Translational Research at the Intersection of Cognitive Science and Education: Background and Motivation**

During 2016, the James S. McDonnell Foundation (JSMF) convened a study panel to help JSMF identify potential funding opportunities at the intersection of cognitive science and education. As a component of its activities, JSMF requested that the study panel survey the current landscape of educationally relevant research that would make it possible for JSMF to 1) build on its prior investments in cognitive science and psychology research and the applications of such research to student learning, 2) encourage researchers to take a more direct and active role in the effort to translate research findings into K-12 educational practice, and 3) be responsive to the JSMF Directors' concerns about the translational gap characterizing the flow of knowledge between academia and practioners.

The study panel, chaired by Mitchel Nathan (University of Wisconsin-Madison) and Bethany Rittle-Johnson (Vanderbilt University), was comprised of six experts representing different perspectives including that of an experienced high school teacher. In the course of its deliberations the study panel consulted with a wide range of external experts from multiple sectors within academia and education, including Deans of Schools of Education.

Questions JSMF asked the study panel to consider included:

- What factors account for the seemingly impermeable barrier dividing academic research on learning and cognition from a strong and consistent influence on the design and implementation of and effective and sustainable educational interventions?
- Why does the knowledge emerging from existing educational practices and the real-world constraints of the environments in which most student learning occur rarely feedback into the scope of academic cognitive and learning research?
- In light of the significant public and private funding available for education are there overlooked opportunities where a modest investment could meaningfully contribute to the building of a community of scholars whose investigations would collectively contribute to the translation between cognitive science research and education practices?

The first order of business was for the study panel to develop a framework by which they could evaluate the potential programmatic topics. The consensus of the study panel was that any new JSMF programmatic investment should be characterized by these criteria:

- Relevant for an effective 21st century learner in childhood and adolescence,
- High potential to bridge from research to educational practices while also advancing basic cognitive science and educational research,
- Cross-cutting impact across subject areas and across ages,
- Backed by a respected body of controlled laboratory research and a rich body of authentic field research
- Likely to advance the field with small-to-mid-sized grants

In addition, it was agreed a JSMF program should produce knowledge and tools making a collective contribution to the community of investigators and adding to the cumulative body of education research and practice.

**Recommendations**

A summary of the principal points raised in the study panel report to JSMF is provided in this summary report. The study panel identified an exciting and important opportunity for a new JSMF program that builds on our prior investments in cognition and educational practice, confronts an important but under-recognized barrier to changing educational practices, and gains leverage from programs supported by large public and private funders that touch on this topic but do not address it explicitly.

The study panel discussed a number of possible programmatic directions, converging on the idea that fulfilled all the essential criteria. The study panel concluded that systemic (or even local) education reform efforts to change classroom practices based on evidence cannot succeed without a scientific understanding of teaching and teachers as learners. It was felt that the key to unlocking educational innovations more broadly was an understanding of how teacher's learn and change their practice. From this discussion emerged the idea that a fruitful direction for a new JSMF funding initiative would be needs-driven educational research that identifies the malleable factors that promote and support teachers learning to improve their practice.

Despite the numerous and ever growing lists of recommended evidence-based practices that teachers are encouraged to adopt such as those identified in What Works Clearinghouse Practice Guides from the U.S. Department of Education (ies.ed.gov/ncee/wwc/) and the Core Practice Consortium (corepracticeconsortium.com/), practice change remains slow and uneven. In part, this is not surprising because little is empirically known (since little research is carried out) on how teachers view, interpret, or work to improve their use of such practices. In the study panel discussions there emerged a common agreement that research on teacher learning and teacher change was a largely overlooked component of the many efforts attempting to "reform" education. Indeed, a new book on the topic, *Effective Teaching and Successful Learning* (2016) noted "there are too many guides and 'cookbooks' that indiscriminately propagate…dozens of techniques and strategies" without concern for how teachers understand, select, and take up these techniques. Research that builds from a cognitive science perspective on teachers as learners – including a focus on the cognitive constraints that guide teacher thinking and change in attitudes, knowledge, skills and behaviors – and carefully considers aspects of cognition (e.g., attention, working memory, expertise, etc.) could better explain teachers' learning and change, particularly as it relates to adopting evidence-based practices in classroom contexts.

The study panel further identified *teachers learning to facilitate communication in the classroom* (e.g., student explanations, collaborative discussion) as the initial pilot topic for a focused call for proposals advancing both theory and practice and meeting the criteria

the panel established for this initiative. The topic -- teachers learning to facilitate communication in the classroom -- fulfills the criteria detailed above and it is widely identified as an evidence-based practice for improving classroom instruction that is sparsely utilized (corepracticeconsortium.com/core-practice). The term "communication" in this context does not just refer to verbal communication but refers to the many ways information can be transmitted including gestures, documents, demonstrations and digital media.

**Key Methodological Perspective: Scale-Down Research**

The JSMF program is encouraging potential applicant teams to incorporate a methodological perspective, "scale-down" that addresses several of the reasons traditional cognitive science-based "scale-up" research may not enjoy translational success. Scale-up approaches typically start in the laboratory studying learning phenomena in controlled environments at fine-grained time scales. Scale-down approaches are rooted firmly in the learning context, operate in real-time, and are constrained by the conditions of the local environment. The scale-down approach is well suited to the topic of teachers learning to facilitate communication in the classroom and will be facilitated by creating a network of research teams.

A scale-down approach builds on methodological perspectives that focus more on the critical role of the *learning context* in order to make educational innovation and improvement viable at scale (e.g. McDonald, Keesler, Kauffman, & Schneider, 2006; Penuel et al., 2011). Scale-down is offered as an alternative to "scale-up" approaches that have traditionally been defined in terms of the breadth of dissemination and level of fidelity of an innovation (RAND, 2004). In cognitive science, scale-up approaches tend to start with the study of learning phenomena at fine-grained time scales, such as the biological or cognitive phenomena, and then advocate for adoption of interventions based on these studies at larger time scales at the rational, sociocultural, and organizational levels. Successful application of research-based interventions from smaller to larger time scales is rare, as many contextual intrusions that fall outside of the original, lab-based context serve as barriers for successful translation to authentic learning settings (Penuel et al., 2011). This prior focus on scale-up approaches may be one reason that academic research has often failed to translate to effective educational policies and practices. The scale-down approach can readily be applied to the focal area of the inaugural call for proposals: teachers learning to facilitate communication in the classroom.

There are many case studies of expert teachers facilitating communication within classrooms (i.e., system-level observations) that can serve as a starting point for the kind of research envisioned by JSMF (Ball, 1993; Hiebert et al., 2003; Lampert, 1990; Stein et al., 2008; Webb et al., 2014). Contrasting such case studies with classroom observations of typical teachers facilitating the same communicative practice can form the starting point for scale-down research that seeks to understand *why* typical U.S. classroom teachers have difficulties facilitating high-quality discussions and *methods* for helping teachers learn to use

the practice more effectively.

**Impact**

JSMF anticipates that the potential impact of research on this topic could be substantial for a number of reasons.

- *First, research on the science of teaching could shift the larger field of research by promoting new merges between cognitive science and teacher change. This is no small feat. This new initiative could create a community of scholars that contribute in new ways to the translation between cognitive science research and education practices and shift the direction of the field at large. JSMF had a similarly large impact when they initially funded research that merged cognitive science and student learning.*
- *Second, this research agenda has high potential to invoke widespread change in teachers and teacher practices. Teachers are "super spreaders" of educational reform as each teacher reaches between 10 - 1,000 students every year. Thus, impacting many teachers has the potential to have a substantial impact on student outcomes.*
- *Third, the research could continue to inform reform-based efforts in education. The Common Core State Standards include recommendations that reflect the results of basic cognitive research. Pushing cognitive science in new and exciting directions toward the science of teaching has the potential to produce the type of results that get incorporated into reform-based practices and standards.*
- *Finally, this research agenda has high potential for impact because it focuses on already established "evidence-based" practices that teachers often know they should be doing. This greatly increases teacher buy in. The result of this new research program will not just be an additional practice or strategy that gets tacked on a list of recommended practices for teachers (a "piling on" of new recommendations for teachers who are already lacking in time and resources), but rather classroom-based discoveries about how teachers learn to use an existing, evidence-based practices within their complex systems.*

JSMF is committed to encouraging an ethos of open science and data-sharing contributing to the building of cumulative knowledge.

**Outcomes**

The study panel suggested that JSMF monitor the program's outcomes by tracking the scholarly publications appearing in and cited by both the cognitive science and educational research literatures, the presentations and activities that involve teachers and other education stakeholders, the degree to which teachers and students directly participate in the research and directly benefit from it, and the ability of the research findings to influence policy documents, curricular standards, and practice guides.

**Summary**

The anticipated outcomes from this new JSMF funding initiative are twofold. The program should lead to refined theories of teachers as learners that include: understanding the cognitive demands of practice change, identification of motivational incentives and disincentives that could either inhibit of enhance teacher learning, and best practices for making systematic improvements in teachers' instructional practices. The program grants should also produce well-articulated and documented approaches for improving uptake and use of evidence-based practices by teachers.

It is important to underscore that while the study of teachers as learners will overlap with and could inform the study of adult learners more broadly, the study panel expressed the strong opinion that teaching has unique intellectual and professional demands meriting dedicated research.

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