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Thinking about data: Exploring the development of mental models for "data use" among teachers and school leaders

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ABSTRACT

This study aimed at understanding the development of mental models for data use among educators in a small school district located in Texas. Drawing from survey and interview data, the study was guided by three questions: (1) How do educators conceptualize "data" in relation to "evidence" or "information"?; (2) How do teachers and school leaders construe "data" or "data use"?; and (3) What factors affect mental models for data use? Findings indicated that educators approached decision-making from a range of mental models for data use, and that models seemed rooted in ways of thinking about "data" and "data use" that were influenced by formal training, modeling by leaders, social interaction with colleagues, and personal experience.

"The limits of my language mean the limits of my world."
-Wittgenstein

In *Tractatus Logico-Philosophicus*, Ludwig Wittgenstein considered how language—what we can and cannot name, define, and express—limits our thinking about the world in which we live and work. The words we use have power. They can shape and reshape concepts and the way we think about problems and the world around us, set the stage for constructive or destructive dialogue, and invite or exclude participation. They can convey threat or promise, despair or hope. They can inspire or discourage.

Words are no less powerful because they deal with educational policies and practices. For example, what do we mean when we talk about "data use"? Is educational data use a science or an art? Does it privilege test scores, or encourage the examination of many types of evidence? Is it focused on systemic improvement and accountability, or on informing instruction for the individual child? Does it disenfranchise teachers—turning teaching into a turnkey operation of test-remediate-retest—or does it empower teachers to engage in collaborative inquiry focused on helping students develop socially, emotionally, and academically? Because, as Wittgenstein suggested, language can limit or expand our ways of thinking about concepts, the answers teachers give to such questions may depend on the meanings they attach to the term "data use".

"Data-driven decision-making," (DDDM) or "data-informed decision making" (DIDM), is not a waning trend in the educational world. In most contexts, data use is on the rise, with school leaders and teachers pressed to make more frequent and formal uses of data (Mandinach, Honey, & Light, 2006; Mandinach & Jackson, 2012; Marsh, Pane, & Hamilton, 2006; Schildkamp, Karbautzki, Breiter, Marciniak, & Ronka, 2013; Staman, Visscher, & Luyten, 2013). In the United States, the past few decades have been marked by increased expectations for data use vis-à-vis accountability policies: The No Child Left Behind Act of 2001 (NCLB) is the most prominent lever in these efforts, but many states were actively engaged in accountability-driven uses of data prior to federal pressures (Beadie, 2004; Booher-Jennings, 2005; Vasquez Heilig & Darling-Hammond, 2008).

Despite increasing concerns about the misuse of standardized test data (Beadie, 2004; Booher-Jennings, 2005; Ravitch, 2010; Vasquez Heilig & Darling-Hammond, 2008), and the frequent findings that other forms of data (e.g., parental information, health information, or student interest inventories) are important to comprehensive school improvement efforts (Schildkamp et al., 2013; Schildkamp & Kuiper, 2010; Wayman, Cho, Jimerson, & Spikes, 2012), such data are used increasingly to rate schools, evaluate teachers, and determine college and career readiness (Marsh et al., 2006; Tucker, 2010). Thus, formal assessment data assume a place of prominence (for better or worse) in discussions about educational data use.

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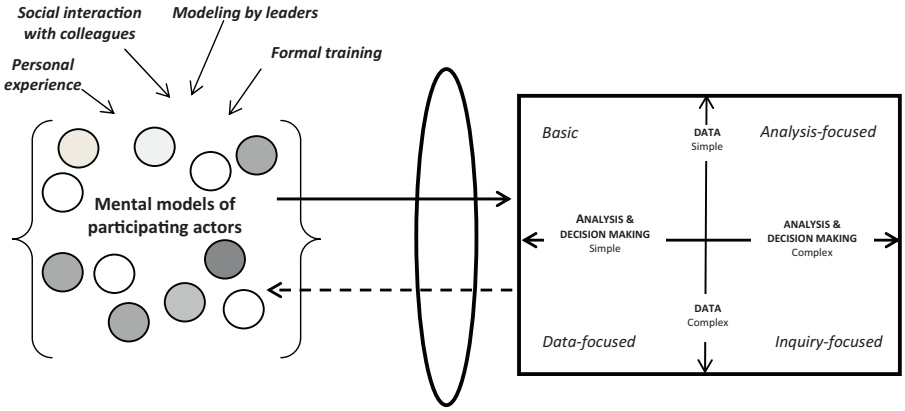

Fig. 1. A framework for considering mental models and educational data use.

The question is no longer "Will educators use data?" but "How can we help educators use multiple types of data *well*?" Researchers thus have begun to focus on how leaders may best support increased capacity for data use (e.g., Ikemoto & Marsh, 2007; Mandinach, 2012; Passey, 2013; Staman et al., 2013; Wayman & Stringfield, 2006). While educator capacity for data use is a critical piece of the school improvement puzzle (Ikemoto & Marsh, 2007; Mandinach, 2012; Marsh, 2012; Means, Chen, DeBarger, & Padilla, 2011), much research to date has focused on systemic strategies to support data use (e.g., Kerr, Marsh, Ikemoto, Darilek, & Barney, 2006; Schildkamp & Kuiper, 2010; Wayman, Cho et al., 2012). Others focus on the importance of co-constructing understandings around the desired outcomes or processes for using data (Park & Datnow, 2009; Wayman, Jimerson, & Cho, 2012). One recent study by Park, Daly, and Guerra (2013) focused on how leaders work to frame data use around continuous improvement efforts. However, few studies address precursors to data use—that is, those factors or experiences that may help shape beliefs around data use or impact whether educators consider data use as a promising practice. This study addresses this gap by focusing on how educators construe "data use".

To better understand how educators conceptualize data use, I conducted the present study with the purpose of examining the perspectives on data use that educators bring to the decision-making process. This work was guided by three questions:

(1) How do educators conceptualize "data" in relation to "evidence" or "information"?
(2) How do teachers and school leaders construe "data" or "data use"?
(3) What factors affect the development of mental models for data use?

Conceptual framework

Much research in the area of effective data use examines what leaders or teachers *do*: how they collaborate, what data they examine, which processes or protocols they follow. By contrast, the focus of this study was how educators developed ways of thinking about data use that then functioned as precursors to action. I thus approached the study from a perspective informed by the concept of mental models (Johnson-Laird, 1986, 2001; Senge, 2006) and the framework posited for DDDM by Ikemoto and Marsh (2007).

Fig. 1 illustrates this perspective. The framework acknowledges that actors possess mental models that comprise assumptions, definitions, and beliefs around a concept, and that subsequent actions or perceptions proceed from this framing (Johnson-Laird, 1986; Senge, 2006). Mental models are not static: They are either reified or reshaped when members of an organization are open to knowledge-sharing and to excavating the roots of their own perspectives. Therefore, the left side of the model highlights the diversity of mental models for data use that are at play in any collaborative educational endeavor.

The left side of the model also accounts for four factors involved in the development of those mental models. Studies suggest that the ways teachers think about and approach data use may be influenced by the ways teachers personally experience data use (Earl & Fullan, 2003; Jimerson & Wayman, 2011; Valli & Buese, 2007), as well as through social interactions (Daly, 2012; Young, 2006). Also, educators form conceptions around data use as they see and hear leaders making use of data (Anderson, Leithwood, & Strauss, 2010; Honig & Venkateswaran, 2012; Young, 2006) and conceptions may be further shaped through participation in formal professional learning (Kerr et al., 2006; Marsh, 2012; Wayman, Jimerson et al., 2012).

The right half of Fig. 1 makes use of Ikemoto and Marsh's (2007) "Framework for Simple versus Complex DDDM" to illustrate actual or considered uses of data. This framework highlights variation in data use by utilizing quadrants to represent alternative models for data use, depending on whether the data used are "simple or "complex" and whether the analysis and decision-making processes involved are simple or complex. The resulting models for data use are: (1) "Basic"; (2) "Analysis-focused"; (3) "Data-focused"; and (4) "Inquiry-focused".[1]

The framework in Fig. 1 illustrates some assumptions that frame this exploration into how educators think about data use. First, mental models for data use are always "under construction." As new stimuli, experiences, and knowledge are introduced into educators' frames of reference, mental models evolve. Second, the forces that shape and reshape mental models involve personal prior experience, formal training, social interaction with colleagues, and leader modeling. These influences can enrich ways of thinking about data use, so that teachers consider multiple forms of data in the context of continuous improvement, or they can restrict ways of thinking about data use, reifying standardized test scores and compliance reporting. Last, the ways in which educators use data may be influenced by their mental models. Thus, one role of school leaders is to help educators develop ways of considering data use that are sufficiently broad to allow nimble movement among quadrants as befits the problems at hand.

Terms

It is important to clarify how I define particular terms pertinent to this study. In line with Schildkamp and Kuiper (2010), I consider

[1] Ikemoto and Marsh (2007) provide several examples of types of data use that characterize each quadrant.