© Academy of Management Learning & Education, 2014, Vol. 13, No. 4, 653–667. http://dx.doi.org/10.5465/amle.2012.0308

The Need for Design Thinking in Business Schools

ROY GLEN
CHRISTY SUCIU
CHRISTOPHER BAUGHN
Boise State University

The demands placed on today's organizations and their managers suggest that we have to develop pedagogies combining analytic reasoning with a more exploratory skill set that design practitioners have embraced and business schools have traditionally neglected. Design thinking is an iterative, exploratory process involving visualizing, experimenting, creating, and prototyping of models, and gathering feedback. It is a particularly apt method for addressing innovation and messy, ill-structured situations. We discuss key characteristics of design thinking, link design-thinking characteristics to recent studies of cognition, and note how the repertoire of skills and methods that embody design thinking can address deficits in business school education.

It is no secret that business schools are sending graduates into an increasingly complex and turbulent business environment without adequately developing their skills to adapt (Bennis & O'Toole, 2005; Dyer, Gregersen, & Christensen, 2011; Waddock & Lozano, 2013). This leaves those graduates ill-equipped to deal with uncertain situations where means–end relationships are unknown, and the ends to be sought are unclear. Sole reliance on analytic abilities instilled in business school education is proving insufficient for such challenges. Design thinking provides a much-needed approach for dealing with complex, ill-defined problems. As such, it can complement analytic perspectives and methods in preparing graduates for their careers.

Over the past decade, prominent calls have been made for managers to adopt a "design" perspective—to incorporate the cognitive processes employed by skilled designers as well as their methods, techniques, and sensibilities for solving problems (Boland & Collopy, 2004; Brown, 2008; Dunne & Martin, 2006; Martin, 2009). Many pioneering business schools have endorsed design thinking as they search for ways to help their students become more innovative (Beckman & Barry, 2007; Boni, Weingart, & Evenson, 2009; Kimbell, 2011; Liedtka & Ogilvie, 2011). If business schools are to adopt design thinking on a broader scale, however, several conditions must be in place. First, business schools would need to experience sufficient discomfort with the status quo to accommodate an approach which strongly contrasts with their prevailing ideology. Further, characteristics of design thinking would need to be sufficiently clarified beyond "what designers do" to provide a tangible alternative, and knowledge of these practices would need to be disseminated to a critical mass of those in the business school community. Design thinking would also need to be seen to be credible—both as a method of practical reasoning and as a means of addressing the unmet needs of business school students. Recently, advances have been made in all these areas. We explain why business schools should be uncomfortable with the status quo, describe the key characteristics of design thinking observed in studies of designers over several decades, and show how this approach has spread beyond the design field. We link design thinking to recent studies of human cognition, showing how design methods align with adaptive reasoning in real-world settings. We also discuss how and where design thinking can contribute to the business school curriculum and why it is useful to the long-term goal of educating our graduates for the challenges they will face throughout their careers.

DESIGN AND BUSNESS EDUCATION

Although the interest in bringing a design pedagogy into business schools would appear to be new, the distinguished scholar and business school administrator, Herbert Simon, argued for such integration over 4 decades ago (1967, 1996). Simon asserted that professional schools, including business, engineering, law, medicine, and architecture, are all primarily concerned with the process of design—devising courses of action aimed at changing existing situations into preferred ones (Simon, 1996: 111). These professions all concern "what ought to be," in contrast to pure science, which is concerned with explaining "what is." While the pure scientist employs analytic techniques in seeking the explicit and lawful underpinnings of phenomena, the professional practitioner is concerned with devising actions, processes or physical objects that effectively serve a specified purpose. While analysis entails dissecting phenomena into their component elements, the practitioner is engaged in synthesis, organizing those pieces into larger systems and ideas. As Simon noted, synthesis has been generally seen as an art—a process that is not fully explicit, involving intuition and judgment. Simon also observed that professional schools tended to embrace the "tough" scientific aspects of the curriculum at the expense of synthesis and design. He argued for a business curriculum that integrated both discipline-based science as well as practitioner orientation, incorporating both scientific analysis and design. He believed that this could be facilitated not only by the integration of discipline-oriented and practitioner-oriented curricula and faculty, but also by the development of a more thorough understanding of the design process itself. The design process could thereby be analyzed and taught in the same manner as the sciences (Simon, 1967).

"While analysis entails dissecting phenomena into their component elements, the practitioner is engaged in synthesis, organizing those pieces into larger systems and ideas."

The Analytic Side of Business Education

Examining the trajectory of business schools since the latter half of the 20th century clearly shows that the scientific and analytic components of the curriculum have dominated over synthesis and design. Skills such as forecasting, planning, rational decision making, and coordination, which had proven useful in WW II and were relevant to managing corporate postwar corporate enterprises, were seen as increasingly important components of a business education (Khurana & Spender, 2012). At that time, business schools were seen as lacking a firm rational, scientific, and quantitative foundation. Two major studies, one commissioned by the Ford Foundation (Gordon & Howell, 1959) and the other by the Carnegie Corporation (Pierson, 1959), portrayed collegiate business education as adrift, engaged in narrowly focused vocational training aimed at preparing students for a first job. The two studies noted the need for higher standards and greater development of rational-analytic problem-solving ability coupled with the analytic tools derived from the fundamental disciplines (Gordon & Howell, 1959; Pierson, 1959). As noted by Mintzberg (2004), these reports helped bring about a turning point in business education across the United States and then around the world. Business schools, in their quest to achieve academic legitimacy, incorporated the paradigm used by other academic disciplines such as the sciences and economics (Bennis & O'Toole, 2005; Clinebell & Clinebell, 2008; Simon, 1996).

Intertwined with this analytic perspective is the rational-analytic approach to decision making, which began to receive considerable emphasis in the 1960s and 70s (Keppner & Tregoe, 1965; Newell & Simon, 1972; Polya, 1957). The rational-analytic paradigm signified an important contribution, reflecting advancements made in artificial intelligence, as well as the work of Simon himself (Dorst, 2006). The paradigm emphasized cognitive planning, where thought proceeds action, the generation of alternatives proceeds choice, and the choices are based on an optimization process, matching alternatives to known goals (Gedenryd, 1998; Huber, 1980). The rational-analytic paradigm has proven itself to be of high value in the business curriculum. Analytic problem solving replaced vocational-style courses that relied on anecdotal accounts, and it enhanced the demand for business education. Important innovations in finance and operations research, including option pricing and risk management, linear programming models for constrained resource allocation, and queuing theory are examples of analytic procedures developed through business school research, taught in business schools, and imple-

mented in business practice (Zimmerman, 2001). The rational-analytic method is teachable and addresses a market need. Yet, as discussed below, the analytic approach can only take us so far.

Critiques of Business Schools' Analytic Emphasis

There have always been those who have viewed the rational-analytic approach as insufficient. Schön (1983), for example, saw technical rationality, based on explicit disciplinary knowledge, as suited for solving well-defined problems, but not at all adequate for the really important messy ill-defined problems that professionals often encounter in their work. "In the varied topography of professional practice, there is a high, hard ground where practitioners can make effective use of research-based theory and technique, and there is a swampy lowland where situations are confusing 'messes' incapable of technical solution" (Schön, 1983: 42). As Schön notes, the areas of greatest human concern are often to be found in the swamp (1983: 42). To deal with such an environment, professionals were seen as needing to develop repertoires of tacit knowledge derived through personal experiential learning, and reflection-in-action (Schön, 1983). March (1991) pointed out that rational calculative processes are effectively used to leverage existing knowledge for purposes of product refinement, production, and efficiency—a process he termed *exploitative learning*. However, March also noted that in the search for new entrepreneurial opportunities, exploratory learning is called for. Exploration involves flexibility, discovery, and innovation, requiring an adaptive feedback model. In a similar vein, Dyer, Gregersen, and Christensen (2011) differentiate the individual skills needed for "delivery" from those involved in discovery learning. Discovery skills include questioning, observing, experimenting, networking, and associative thinking.

Analytic overreliance directs attention to more well-defined and constrained problems, rather than messy, ill-defined conditions. The capabilities, tools, and perspectives in the traditional business approach may be more applicable to stable conditions than to times of discontinuity, when adaptation and entrepreneurship are called for. Business education must also foster divergent, imaginative styles of thinking (Baker & Baker, 2012; Leavitt, 1989; Schoemaker, 2008).

Critics of current practices in business education also have argued that business schools' overemphasis on rational analytics in teaching and research has come at the expense of the practical, yet open-ended issues that managers regularly encounter (Bennis & O'Toole, 2005; Waddock & Lozano, 2013). This undermines business schools' relevance to business practice and their ability to prepare students for career success (Clinebell & Clinebell, 2008; Pfeffer & Fong, 2002). Mintzberg (2004), further criticized business schools' approach of reducing management to problem solving, and of reducing problem solving to analysis. He proposed a framework depicting management practice as combining art, craft, and science. While the scientific aspect of management relies on systematic analysis, the "art" component deals with comprehensive synthesis based on creative insights and imagination. The "craft" aspect of management is based on practical experience, emphasizing iterative decision making and dynamic learning in the form of actions and experiments. The overemphasis on analytic calculation in business education, particularly MBA training, creates an imbalance that graduates carry into their careers (Mintzberg, 2004).

An overemphasis on analytic techniques also diverts attention away from less formally defined, but equally important considerations. The analytic approach may lead one to overweight knowledge based on available data that can be readily analyzed, blinding one to other perspectives. Further, business schools' drive to base all analysis on formal and abstract reasoning encourages students to become detached and disinterested actors rather than engaged practitioners. Several observers have noted that current business education does little to develop empathy or sensitivity to the experiences of others. Students thereby fail to appreciate the impact that business decisions have in people's lives (Baker & Baker, 2012; Ghoshal, 2005; Starkey & Tempest, 2009).

The Need for Practice Fields and Active Learning

At the heart of effective business education lies the need to synthesize knowledge of the functional business disciplines with the day-to-day challenges faced in practice. Business schools have been criticized for their overemphasis on lecture and case method at the expense of clinical training or learning by doing (Pfeffer & Fong, 2002; Rousseau & McCarthy, 2007). As noted by Leavitt (1989: 40), "business schools have been designed without practice fields." The importance of providing students with a clinical educational component in business education, coupled with opportunities to

solve complex problems, was also recognized by the authors of the study funded by the Ford Foundation in the 1950s—a study often cited as fostering the push from relevance in favor of analysis and academic rigor. The authors of the Ford Foundation study noted, "Didactic teaching by itself is not enough. The passive absorption of knowledge by the student can hardly be called education" (Gordon & Howell, 1959: 109). Studies supporting the effectiveness of active learning have been found in a wide variety of educational disciplines, including business schools (Hake, 1998; Hoellwarth & Moelter, 2011; Michael, 2006; Prince, 2004; Stewart, Houghton, & Rogers, 2012).

In Search of a Counterweight to Analytic Overreliance

While a great deal of consistency can be seen in the critiques regarding business schools' overreliance on analysis and their need for practice fields, we are still in need of pedagogy to address these problems, particularly when it comes to dealing with messy, ill-defined issues. Many action-learning methods are applied to aid retention and application of principles and analytic techniques to deal with the "high, hard ground" where research-based theory and technique can be deployed. Of course, business education does need to develop the ability to thrive in such terrain, but that is not enough. As so vividly portrayed by Schön (1983: 43), "there are those who choose the swampy lowlands. They deliberately involve themselves in messy but crucially important problems and, when asked to describe their methods of inquiry, they speak of experience, trial and error, intuition, and muddling through." In developing a pedagogy to deal with the "swampy lowlands," it is not sufficient to simply advise one to "muddle through" or "use your intuition." Schön (1983) saw a process of reflection-in-action—learning through doing, triggering new stimuli, and in turn, new reflections—as a means of dealing with such conditions.

Active experimentation and reflective observation while navigating through ill-structured situations can be observed in the process of design. Schön (1983: 76) has portrayed design as a "reflective conversation with the situation."

DESIGN THINKING

Design thinking describes cognitive processes designers have in common, across a wide range of design fields. The design fields from which these processes are taken are those more typically associated with professional designers than the broad range of professions that Simon (1996) listed. Schön (1983: 76) saw architecture as the "mother profession" of a growing family of design fields. Professional design has a long tradition of giving form to tangible material objects, and in a business context, has often been associated with crafting products and brands (Cooper, Junginger, & Lockwood, 2009). Yet design includes not only material objects, but also the design of symbolic and visual communications, activities, and organized services, and dealing with complex systems and environments (Buchanan, 1992). Studies of how designers think stem from observations of practices in such fields as product design, architecture, engineering, and urban design (Kimbell, 2011; Rowe, 1987). Much of the work in this area did not explicitly use the term "design thinking," but utilized such terms as design methods, cognitive strategies in design, and "designerly ways of knowing" (Cross, 1982; Lawson, 1979).

Design practice is now being applied to a broadening range of activity, moving from the product and graphic areas to the design of digital interactions, the design of service, and even to business strategy and social policy (Brown, 2009; Dunne & Martin, 2006; Liedtka, King, & Bennett, 2013; Moggridge, 2007). This has been accompanied by efforts to articulate design methods and tools in a clear way for those outside of the professional design field, particularly for business managers. Much of the work in codifying and diffusing design practice has been tied to the design consultancy, IDEO (Brown, 2008, 2009), and its relationship to the Stanford design school. Although not explicitly referencing empirical studies of design thinking, Brown and others have described design-thinking methods and tools, providing guidance for nondesigners (Brown, 2008, 2009; Kelley, 2001; Leidtka & Ogilvie, 2011; Martin, 2009). A core of common elements can be seen in the empirical research of designers and in the prescriptions for its application beyond the design studio.

Characteristics of Design Thinking

Studies conducted to understand the nature of design thinking have relied on such methods as observations, protocol studies, and interviews with designers (Cross, 2006). From a business school perspective, a fascinating aspect of the design-

thinking studies is their demonstration that in everyday problem-solving practice designers have diverged quite dramatically and significantly from the traditional rational problem-solving paradigm.

Exploration and Iteration

One deviation from the rational paradigm is that designers are often not able to completely define the problem prior to testing out solutions. Designers may redefine the initial goals and constraints of the problem-as-given over the course of solution generation, as understanding of the problem and definition of the solution coevolve (Akin, 1979; Cross, 2011; Hatchuel & Weil, 2009; Kolodner & Wills, 1996). This may, in part, reflect the nature of the problems that designers often contend with. Methods problems have been characterized as ill-defined, ill-structured, "wicked" problems (Buchanan, 1992; Cross, 1982). To the extent that this is so, problem formulation and design specification become intertwined as alternatives are explored with clients and users. In fact, designers may do this even if the initial problem could have been treated as well-defined (Cross, 2006, 2011; Thomas & Carroll, 1979).

Another deviation from the rational paradigm observed in designers is that a great deal of thought and planning does not always precede action. Action may frequently stimulate thought (Schön, 1983). Comparing the problem-solving strategies of designers with those of scientists, for example, Lawson (1979) found that scientists focused on the problem to discover the fundamental rule to be applied, while designers learned about the problem by trying out various solutions. This solution-focused strategy has been observed in architects, urban designers, and engineers (Cross, 1982). Proposed solutions may help clients further clarify the problem they want solved, as well as the relative importance of constraints such as price, performance, and ease of use. A rational-analytic model assumes that all these conditions are known a priori, while designers know that many iterations are needed before the issues are clarified.

As noted earlier, the rational model also holds that choices are based on optimization to known goals, and that such optimization can be performed on a calculative basis (Gedenryd, 1998; Huber, 1980). In a design context, however, this is not always possible. Although the design process may begin with some initial specifications, clients and customers often do not know what they want until they can see what they can get. This reinforces the solution-based, iterative nature of the design process.

"Although the design process may begin with some initial specifications, clients and customers often do not know what they want until they can see what they can get."

Attention to User Needs

Unlike the solution to a scientific problem, which can be judged in terms of correct or incorrect or true or false, design solutions are assessed in terms of better or worse, which is highly dependent on the specific context of use. The judge in this case is the customer or user, and the evaluation is based on preferred realities rather than objective truth (Cross, 1982; Owen, 2006). These preferred realities may involve emotionally resonant, as well as functional considerations (Fulton-Suri & Hendrix, 2010).

Design thinking has, therefore, been portrayed as a human-centered process incorporating insights and understandings of the needs and problems experienced by users (Brown, 2009; Lawson, 2006; Liedtka & Ogilvie, 2011). The designers' development of empathy for users allows them to shift their point of view to better imagine solutions that meet both expressed and unexpressed needs (Brown, 2008; Fraser, 2007; Junginger, 2007).

Observation

To understand user needs, design thinking often requires observation (Kelley, 2001). The fundamental principles underlying such observation come from ethnography. Such principles include conducting research in the users' natural setting, spending time with them, seeing the world through their eyes, separating one's own thoughts and assumptions from what one actually observes, and using exact quotes when possible (Beckman & Barry, 2007; Bucciarelli, 1972; Kawulich, 2005; Schensul, Schensul, & LeCompte, 1999). These principles are echoed in design-thinking guidelines, including those provided by the Stanford design school. Guidance, for example, is provided regarding interview preparation, nondirective interview

methods, and camera study (Bootcamp Bootleg, 2010).

Visualization and Prototyping

Rather than relying solely on traditional rational-analytic techniques, designers have employed other tools and methods. Designers frequently work visually, relying heavily on sketching and other means of transforming information into images that can be seen (Cross, 1982, 2006; Lawson, 2006). This allows more concrete interconnections of signs, things, actions, and thoughts. The sketches, blueprints, flowcharts, graphs, and three-dimensional models serve to overcome limitations of verbal or symbolic propositions (Buchanan, 1992). Initial sketches may be intentionally crude and unfinished, providing both a preliminary conception and invitation for further development (Boland, Collopy, Lyytinen, & Yoo, 2008; Cross, 2006). In addition to the creation of graphic images and models, visualization is also found in designers' substantial use of mental imagery and nonverbal thought (Göker, 1997). Designers' thoughts may not be easily reducible to words, since they are often expressed in object form (Ferguson, 1977, 1992). These observations support the role of intuition in the design process, which has been acknowledged by several observers (Boland et al., 2008; Collopy, 2004; Cross, 2006, 2011; Rowe, 1987).

Generating prototypes also serves a key role in the design process. Sketches, models and prototypes clarify the characteristics of the idea and make it more amenable to critical consideration and feedback. They serve as a logbook of the design process, and provide a stockpile of ideas (Dorner, 1999; Schön & Wiggins, 1992). Rapid generation of low-fidelity prototypes deepens the dialogue with potential users, thereby speeding up the learning cycles and further clarifying the nature of the problem to be solved (Mogeridge, 2007). One of IDEO's sayings, "fail early to succeed sooner" reflects the benefits provided by rapid prototyping (Brown, 2009: 17). Indeed, the entire design-thinking process is characterized by active learning and experimentation (Brown, 2008, 2009; Leidtka & Ogilvie, 2011).

Table 1 contrasts design thinking with the rational-analytic approach. This table reflects the observations discussed above, including contrasts between design thinking, science, and business orientations (Cross, 2006; Henn, 2010; Leidtka & Ogilvie, 2011). Although designers do employ analytic methods, the differences between the two domains are readily apparent when comparing design practice with the methods currently promoted through business school education. To aid business students in coping with complex, ill-structured situations and when creating new sources of value, a different paradigm is required.

TABLE 1
Comparison of Rational-Analytic and Design-Thinking Approaches

	Rational analytic	Design thinking
Problem formulation	Well-defined goal and constraints.	Goals and constraints uncovered during the design-thinking process.
Criteria	Objective definition of criteria, established before generation of alternatives.	Both objective and subjective criteria used to define design objectives, since the end user is the ultimate judge of efficacy.
Method	Planning and analysis—thought precedes action. Sequential process.	Iterative exploration of the design "space," where thinking and doing are intertwined.
Information-processing emphasis	Preference for objective formulations, especially verbal and quantitative.	Preference for visual and spatial representations, which evoke both objective and subjective insights.
Solution process	Ideally based on conscious, rational-logical reasoning process, which, over time, becomes formalized into a set of rules.	Solutions evolve as the result of interaction with users and the ongoing creation and refinement of possible solutions. Incorporates experience-based insights, judgment, and intuition.
Rationale	"Get it right." Reduce chances of failure though careful prior analysis.	Use rapid experimentation and prototyping to learn from early, inexpensive "failures."
Outcome	Solution optimizes predefined criteria to arrive at "best" answer.	Obtain "better" answer. Process may expose additional problems and solutions.

Design Thinking and Studies of Cognition

Design thinking's expansion into a broader arena of services, strategy and systems generates a need and opportunity for more empirical work in these areas, as well as greater dialogue between design-thinking practices and empirical design studies. Currently, there is little conversation between the practices being disseminated beyond the design field and the empirical studies on how designers work (Johansson-Skoldberg, Woodilla & Çetinkaya, 2013; Kimbell, 2011). At the same time, the empirical research on designer's methods, which was largely based on studies of product design, lack theoretical integration (Badke-Schaub, Roozenberg, & Cardoso, 2010). A dialogue between science and design, as Simon (1967) called for so long ago, is needed. The integration called for here rests on the development of general cognitive skills essential to the practical reasoning tasks confronted by managers working in the context of their day-to-day lives. Such a rationale can be presented, grounded in the field of cognitive science.

Cognition in Field Settings

Design-thinking practices can be linked to field studies of how decisions are made in real-life settings. Unlike laboratory studies of cognition, naturalistic studies may involve complex situations in which goals are ill-defined or changing. Domain practitioners, such as managers, fire fighters, and medical personnel, constitute the subjects of such studies rather than college students. A study of managers of engineering projects, for example, found that some began their designs before completely defining project objectives. The success of the R&D projects was not determined by the level of initial definition of the business and technical goals, but by the extent to which the goals could be defined over the life of the project (Klein & Rothman, 2008). Building on this, Klein and Rothman (2008: 26), contrast traditional management practice of management by objectives with a process of "management by discovery." While management by discovery does incorporate objectives and schedules, the objectives are expected to change based on learning. In a study of intelligence analysts, Klein (2011) identified two ways in which performance can be improved: by reducing mistakes, or by generating insights. Also of interest, Klein notes that the cognitive processes involved in each case are not only different; they are in tension with one another. Error reduction entails systematic analytic techniques and formalization of procedures to minimize variance. "Insight," Klein argues, involves pattern matching and associative reasoning, often building on tacit knowledge. Insight can also be generated by creating new observations to stimulate new patterns. Studies in the field of medical diagnostics provide complementary evidence. Based on such research, Rudolph, Morrison, and Carroll (2009) have developed a model of action-oriented problem solving that involves the interplay of acting and interpreting in generating diagnoses. In this iterative process, sensemaking prompts action, and the action provides cues for further sensemaking (Rudolph et al., 2009). This model of adaptive problem solving addresses the impact of speed of acting, alternative generation and feedback on decision processes—issues that could be readily applied to design-thinking studies.

Dual Process Models of Cognition

Studies of cognition in field settings and their fit with the design-thinking process can be appreciated through the perspective of dual process models of cognition. Current research in cognitive science supports the existence of two very distinct cognitive processes that are used in human reasoning. Cognitive psychologists have developed the convention of referring to the two cognitive processes as *System 1*—referring to fast, effortless cognitive processes that are automatic, and *System 2*—referring to the familiar conscious reasoning processes that are relatively slow, require high levels of attention and effort, and are constrained by the limits of working memory (Sloman, 1996; Stanovich & West, 2000). System 1 relies on pattern-recognition capabilities, identifying a typical configuration of signs, or similarity with situations encountered in the past. System 1 processes are highly dependent on contextual cues, particularly visual cues, as well as the affective state of the individual. System 1 has been described as "intuitive," "tacit," and "experiential." Since these processes are effortless, and require little cognitive cost, all our problem solving activities start there and most of them finish there as well. System 2, on the other hand, is characterized by analytic, rule-governed reasoning. This more controlled, deliberative process can serve to decontextualize and depersonalize problems. System 2 can serve as a

check on System 1 impressions, which can be subject to bias and errors (Kahneman, 2003, 2011; Stanovich & West, 2000). In addition, learning acquired through System 2, if accompanied by repeated practice over time, can become part of the intuitive, System 1 process (Croskerry, 2009).

In many ways, the educational implications of dual process research strengthen the argument for teaching rational-analytic reasoning. To the extent that intuitive reasoning is the source of error and bias, we must slow down and become more adept at using our rational checking process. Pedagogy would focus on instilling rigorously tested decision rules, which are stored in System 2. Good pedagogy also would provide sufficient practice to aid retention, beginning the transfer to the tacit System 1. However, this is not the end of the story. Improved reasoning can result not just from subjecting existing System 1 impressions to analysis, but by generating a variety of new impressions. That comes from sensory provocation—looking at more things, creating observations, evoking observations in new ways, and learning to be tentative while engaged in the process. The development of both System 1 and System 2 abilities is needed (Kahneman & Klein, 2009; Klein, 2011).

Design thinking can be seen as addressing the development of System 1 impressions, initially relaxing System 2 processes to allow new observations to occur and novel connections to be drawn between them. The designer is immersed in a field of tangible, visual, and sometimes emotionally evocative stimuli which can trigger intuitive, experiential System 1 impressions. Through prototyping, potential users are also provided with accessible stimuli. Design thinking provides opportunities for rapid feedback to serve as a check on those initial impressions. Although design thinking does entail analysis (Collopy, 2004; Martin, 2009; Razzouk & Shute, 2012), analysis is in greater balance with intuitive, and insight-producing processes than one finds in business schools.

BRINGING DESIGN THINKING INTO BUSINESS SCHOOLS

Design thinking has been presented as a way for organizations to achieve a balance between the tensions of exploration and exploitation that March (1991) called attention to (Martin, 2009). It has been presented as a source of business competitiveness, promoting innovation in new products and services as well as providing a means by which managers could create new alternatives in addressing a wide range of organizational issues (Brown, 2008; Dunne & Martin, 2006). These claims have generated considerable interest, not only in schools of design, engineering, and business, but in the broader educational domain as well (Beckman & Barry, 2007; Dym, Agoigno, Eris, Frey, & Leifer, 2005; Korn & Silverman, 2012; Razzouk & Shute, 2012).

Design Pedagogy in a Business School Setting

Rather than relying on formal lecture or other didactic practices, design-thinking instruction is student centered. Design-thinking pedagogy generally emphasizes project-based learning using student teams (Beckman & Barry, 2007; Dym et al., 2005). This reflects the common use of multidisciplinary, cross-functional teams in design-thinking practice. Multidisciplinary teams address project complexity, ensuring that technical, business, and human dimensions of a problem are all represented (Holloway, 2009; Kelley, 2001). Student teams—ideally, interdisciplinary—are typically provided with a "design challenge," which provides a general portrayal of the problem situation. The breadth and nature of this challenge will reflect the course in which the project takes place. The challenge, for example, may be brought to the class by businesses looking for a new approach to address a current problem, or may involve the development of a new product or service independent of an existing organization. The design challenge should allow opportunities for students to go out and directly observe potential users.

Students learn through active experimentation, where sketches, prototypes, and simulations are used to aid in sense making and build a conversation with the end user (Schön, 1987). Over the course of the project, students receive multiple opportunities for feedback and suggestions from end users, and where appropriate, from business executives, investors, suppliers and others who have an interest in the problem. Because such data are unusually rich, ambiguous, and often conflicting compared to the highly structured problems students are used to seeing in business classes, the students often experience a sense of shock and disorientation. It is precisely in this kind of situation, however, where the design-thinking process can make its greatest contribution to their development. By learning the methods of observation, visualization, and ideation, and applying them in a process of active exploration and feedback, stu-

dents gradually develop the confidence to work with such challenging and messy problems.

Design Thinking in the Curriculum

Design thinking can come into conversation with many business disciplines, informing and serving as a counterweight to the overly analytic approaches often applied to these areas. In each of the areas discussed below, problems have been noted over the years, and alternative approaches more consistent with design thinking have been recommended. Design thinking not only provides a coherent framework for nurturing these areas, but also contributes methods for doing so.

Design Thinking and Strategic Management

Simon's (1996) view of design as devising courses of actions to change existing situations into preferred ones can be applied to the development of business strategy. In contrast to viewing strategy as a design process, however, strategic theory and practice have overemphasized rational planning and analysis at the expense of exploratory learning. As noted by Golsby-Smith (2007: 24), "if strategy is in fact a design process, it has been using an incomplete toolkit." Strategy has long been portrayed as an explicit, purposeful plan that is formulated in advance of specific decisions. Strategic formulation and implementation are separated, with the implicit assumption that the strategy maker has all necessary information, and that the environment is sufficiently predictable to preclude the need for reformulation during implementation. Mintzberg (1978, 1996) pointed out, however, that where these conditions do not exist, strategy formation requires an adaptive learning process in which strategy emerges through the modification of intentions shaped by feedback. While Mintzberg (1994) labeled the top-down, planning-based approach as the "Design School," design thinking is actually very much in line with the flexible, adaptive approach he advocated (Liedtka, 2000). Design thinking encourages frequent testing and refining strategy early in the process. This provides an opportunity to gather feedback and uncover problems as the strategy unfolds, rather than waiting to assess the strategy after it is locked down and rolled out (Brown, 2005; Fraser, 2007).

Business strategy is often shaped by a culture that requires rigorous, quantitative analysis to prove that a proposed initiative will succeed. This undermines substantive innovation (Kotler & Rath, 1984; Liedtka & Ogilvie, 2011; Martin, 2007, 2009). Design thinking has been seen as a means of addressing the imbalance created by overly analytic approaches to strategic management, providing a cost-effective means of discovering unmet needs of potential users early in the strategic planning process. The process not only provides flexibility and adaptive learning, but early-stage prototyping provides the opportunity for some tangible evidence to be developed and communicated in support of potential breakthroughs (Brown, 2005; Fraser, 2007; Holloway, 2009).

Design Thinking and Entrepreneurship

Sara Sarasvathy, once a student of Herb Simon, found that successful entrepreneurs diverged from the rational-analytic model in that they did not rely on well-specified goals and extensive analytic projections. Instead, they engaged in a process of effectuation. *Effectuation* favors small actions, experimenting with a variety of strategies, and capitalizing on the surprises that arise in the process. Preferred options are those that create more options in the future. Effectuation manages risk by reducing the costs of failure, as failures are allowed to occur at earlier states and at lower levels of investment. Options that meet with success, on the other hand, are followed by larger investments (Sarasvathy, 2003).

Other authors also have adopted approaches to the business modeling stage, which show consistency with design-thinking perspectives (Blank & Dorf, 2012; Osterwalder & Pigneur, 2010; Ries, 2011). These approaches emphasize that business models should be prototyped and developed iteratively, since many of the initial business assumptions are likely to be wrong.

With this goal in mind, Osterwalder and Pigneur (2010) have developed a visual "canvas," which has been widely used to facilitate business model prototyping. Blank and Dorf (2012) have drawn on the business canvas approach to describe a step-by-step process for building a start-up business based on extensive assumption testing and iteration. The approach is well-illustrated by their frequent admonition that "the answer lies outside the building" (Blank & Dorf, 2012: 46).

The design-thinking approach complements both Sarasvathy's effectuation model and Blank's lean start-up approach. While they both eschew the traditional "plan-and-pitch" approach to entrepre-

neurship, neither gives any guidance to the aspiring entrepreneur as to how to develop useful ideas in the first place. Therefore, a design-thinking pedagogy provides a very useful front end to the new approaches to entrepreneurship, in giving students much more useful guidance on how to carry out a productive and user-centered ideation process.

Design Thinking and Information Technology

As with the field of entrepreneurship, other business disciplines have found sole reliance on extensive rational-calculative planning to be insufficient, and in need of more flexible, user-centered methods. The "agile software" movement, for example, has emerged as a robust alternative to the rational-analytic methodology. This also applies to Scrum methodology, an agile approach for managing software projects, which can be applied to other development projects as well (Halloway, 2009). There are many similarities between agile development and the iterative, user-centered methods seen in design thinking. These include emphasis on collaboration with customers, as well as utilizing a deliberately iterative process. The focus is on enhancing the ability to adapt and respond to emerging user requirements rather than reliance on traditional prediction and planning. Adaptation is facilitated by maximizing opportunities for feedback and by the creation of artifacts for inspection and development of shared understanding among team members (Beck, 2001; Leifer & Steinert, 2011; Schwaber & Sutherland, 2013).

Design Thinking and Marketing

Design thinking's emphasis on developing a deep understanding of the user would seem to mesh seamlessly with principles of marketing. Yet the teaching and practice of marketing have also fallen under the sway of analytic overreliance, with a bias toward quantitative methods. The real human beings creating "demand" are often subsumed in target markets segmented into demographic categories (Liedtka & Ogilvie, 2011). Clayton Christensen and his colleagues argued that the prevailing methods of product and customer segmentation taught in business schools and carried into company practice undermine the chances of successful new product innovation. They propose a model of marketing based on better understanding the job that the customer would "hire" the product to do. This perspective includes not only functional, but social and emotional dimensions of the job to be done (Christensen, Cook, & Hall, 2005). Observing potential users and what they are trying to get done in their lives can provide better insights than conventional market research. Christensen and colleagues' (2005: 78) advice to marketers to "turn off the computer, get out of the office, and observe" resonates well with the understanding that "the answer lies outside the building." It also resonates with design-thinking principles. Yet the business school curriculum falls short in teaching how to observe users of services and products, as well as how to use and test the insights evoked through such observation.

A Broader Role for Design Thinking in the Business Curriculum

The application of design thinking extends much further than the areas listed here. As an active learning method, the principles of design thinking resonate not only with Schön's (1983) principles of reflection-in-practice, but also with Kolb's (1984) widely used model of experiential learning. Kolb's model entails a cyclical process of active experimentation, concrete experience, reflective observation, and abstract conceptualization. Actions provide opportunities for observation and sense making, which in turn can be transformed to conceptual understanding through reflective observation. The conceptual understandings can complete the cycle by generating further active experimentation (Kolb, 1984). A design-thinking project offers students multiple opportunities to cycle through the processes of active experimentation, concrete experience, reflective observation, and abstract conceptualization. The iterative nature of design thinking also suggests that design teams will loop back to earlier phases in the process based on feedback from their actions and reflections (Beckman & Barry, 2007). This kind of dynamic evolution is much more typical of everyday managerial practice than the highly constrained "problem sets" used in a typical business school classroom, where the goal is to help the student comprehend the material and master preordained techniques.

Design thinking, as noted earlier, requires students to get out of the building, observe, and gather feedback. Research has found that teams showing higher levels of external activity are more effective than teams that spend much of the time talking to one another. Because externally oriented teams build relationships with stakeholders, they

are able to frame the problem more effectively at the outset. Further, the external networks prove to be invaluable when it comes to designing and implementing their proposed solutions (Ancona & Bresman, 2007). A business school pedagogy that incorporates such externally oriented activity in developing teamwork skills would help to set the stage for success in practice.

An additional general contribution of design thinking involves the important role of visualization. The demonstrated value of visual thinking in design points to an underdeveloped area in the business curriculum, which emphasizes numeracy and literacy (Henn, 2010). Well over 100 years ago, Francis Galton argued for the cultivating the "visualizing faculty" in developing a science of education. Yet many fields have regarded nonverbal thought to be inferior to verbal and mathematical constructions, and therefore, less rigorous and respectable to teach (Ferguson, 1977). The senses lose educational status beyond kindergarten (Arnheim, 1969: 3). Current research in human cognition, however, supports design practice in emphasizing the role of the nonverbal senses, particularly visual information in facilitating situational understanding and the development of adaptive intuitive responses (Reyna, 2008; Reyna & Brainerd, 2007).

The human-centered emphasis in design thinking directly connects students' problem-solving process to those who will be affected by their decision. While it may not make compassionate, socially responsible citizens of our students, design thinking's invitation to put oneself in others' shoes at least provides a nudge in the direction of empathy. Empathy and effective interaction with team members are also components of interpersonal competence. The use of interdisciplinary student teams in design-thinking projects has the potential to provide a practice field for cross-functional interactions in work situations. Design-thinking projects also may enhance the development of a better appreciation for the diversity of learning orientations exhibited by project team members (Beckman & Barry, 2007).

Design thinking should be offered at both the undergraduate and MBA levels in the curriculum. Although a single design-thinking class will by no means balance the heavily analytic approach to business education, the perspectives gained in such a course can provide a link to understanding streams of practice in several business fields which have attempted to employ a more exploratory, flexible approach to dealing with complex situations. An understanding of design thinking can help connect the dots among these practices, providing more counterweight to analytic dominance. Supplementing a design-thinking course with the incorporation of design-thinking perspectives in functional courses also provides opportunities for repeated practice. The development of observational skills, for example, may require multiple opportunities for practice over an extended period of time. Design-thinking projects also help signal the importance of active exploration to both undergraduates and MBA students. A key component of effective management involves the ability to learn from one's firsthand experience (Livingston, 1971; Mintzberg, 2004). Design thinking's strong bias for action requires this, developing the opportunity for students to become "authors" of their experiences, rather than simply passive "readers" (Golsby-Smith, 2007: 25). Students learn to become proactive problem solvers, who can confidently work on important but messy problems (Kelley & Kelley, 2012).

CONCLUSIONS

Business school graduates need to find ways to make decisions in complex situations where clear facts are scarce. They need to proceed in a proactive, diligent manner even when emotional tension is high, reports are conflicting, and the path to success is murky. The recommendations of the Ford and Carnegie reports and the evolution of business schools during the latter half of the 20th century reflected the belief that students' abilities to deal with increasingly complex environments over the course of their careers would be best addressed by providing a grounding in the fundamental disciplines from which business practices can be drawn, and by the application of such knowledge through systematic analysis. While valuable, this approach has proven to be insufficient. Yet, repeated evidence of this fact has not substantially altered business schools' analytic entrenchment, or opened the doors to alternative approaches to adaptive reasoning. Although the rational-analytic method is teachable and needed, it leaves practical reasoning in ill-structured situations as a continually unmet requirement for business schools. Design thinking addresses this need.

The design-thinking approach, we argue, represents a more general cognitive process facilitating adaptive reasoning. Although Simon's (1996) optimism that knowledge of human decision making and design would develop to the point that design could be taught as a science has not been realized,

recent studies in cognition point to processes and practices that can be seen as supportive of design-thinking methods. This provides a foundation and support for its wider dissemination beyond the design field as well as a basis for discourse across many business disciplines.

Design thinking facilitates learning at speed and low cost and serves to supplement the analytic component of business education with both the "art" (imaginative insights) and "craft" (learning through practical experience) dimensions that Mintzberg (2004) saw as essential to effective management. Design thinking offers a complement to, rather than a replacement of, the analytic tools and methods taught in business schools. An overemphasis on the "art" and the "craft" approaches at the expense of analysis leads to disorganized managing (Mintzberg, 2004). Similarly, an overreliance on design-thinking approaches at the expense of analysis would lead to considerable inefficiency in conditions where relevant data are available and means–end relationships are clear. In many ways the differences between the demands placed on designers and those placed on managers are not as stark as portrayed in the literature, and certainly not as different as the prevailing pedagogies would suggest. Both have to reconcile their innate intuitive thinking processes with the demands of rule-governed, rational approaches. Both must collaborate closely with others in social-cognitive processes as they engage with the world of the customer, client, and users. Design projects and businesses both evolve from immature to more structured mature states, with a corresponding shift from "discovery-based" learning to "delivery-based" learning. In "mature" environments, designers must act more like managers, in that the design challenge shifts from discovering a new design space to executing incremental improvements in efficiency, price, and ease of use. In the "immature" conditions, including innovation and the many open-ended situations that managers regularly encounter, managers must act more like designers. Business schools should prepare their students for both conditions.

REFERENCES

Akin, Ö. 1979. An exploration of the design process. ***Design Methods and Theories,*** 13: 115–119.

Ancona, D., & Bresman, H. 2007. ***X-teams: How to build teams that lead, innovate, and succeed.*** Boston, MA: Harvard Business School Publishing.

Arnheim, R. 1969. ***Visual thinking.*** Berkeley, CA: University of California Press.

Badke-Schaub, P., Roozenberg, N., & Cardoso, C. 2010. Design thinking: A paradigm on its way from dilution to meaningless? ***Proceedings of the 8th Design Thinking Research Symposium (DTRS8):*** 2039–2049, October 19–20, Sydney, Australia.

Baker, D. F., & Baker, S. J. 2012. To "catch the sparkling glow": A canvas for creativity in the management classroom. ***Academy of Management Learning & Education,*** 11: 704–721.

Beck, K. 2001. Manifesto for agile software development. Retrieved from http://agilemanifesto.org/. Accessed October 15, 2013.

Beckman, S. L., & Barry, M. 2007. Innovation as a learning process: Embedding design thinking. ***California Management Review,*** 50: 25–56.

Bennis, W. G., & O'Toole, J. 2005. How business schools lost their way. ***Harvard Business Review,*** 83: 96–104.

Blank, S., & Dorf, B. 2012. The startup owner's manual: The step-by-step guide for building a great company. Pescadero, CA: K. and S. Ranch Publishers.

Boland, R., & Collopy, F. 2004. ***Managing as designing.*** Stanford, CA: Stanford University Press.

Boland, R. J., Collopy, F., Lyytinen, K., & Yoo, Y. 2008. Managing as designing: Lessons for organization leaders from the design practice of Frank O. Gehry. ***Design Issues,*** 24: 10–25.

Boni, A., Weingart, L., & Evenson, S. 2009. Innovation in an academic setting: Designing and leading a business through market-focused, interdisciplinary teams. ***Academy of Management Learning & Education,*** 8: 407–417.

Bootcamp, Bootleg. 2010. Hasso Plattner Institute of Design at Stanford University. Retrieved from http://dschool.stanford.edu/wp-content/uploads/2011/03/BootcampBootleg2010v2SLIM.pdf. Accessed Jan. 14, 2013.

Brown, T. 2005. Strategy by design. ***Fast Company,*** 95: 52–54.

Brown, T. 2008. Design thinking. ***Harvard Business Review,*** 86: 84–92.

Brown, T. 2009. ***Change by design*** (1st ed.). New York: Harper and Collins.

Bucciarelli, L. 1972. An ethnographic perspective on engineering design. ***Design Studies,*** 9: 159–168.

Buchanan, R. 1992. Wicked problems in design thinking. ***Design Issues,*** 8: 5–21.

Christensen, C. M., Cook, S., & Hall, T. 2005. Marketing malpractice. ***Harvard Business Review:*** 74–83.

Clinebell, S. K., & Clinebell, J. M. 2008. The tension in business education between academic rigor and real-world relevance: The role of executive professors. ***Academy of Management Learning & Education,*** 7: 99–107.

Collopy, F. 2004. "I think with my hands": On balancing the analytic and intuitive in designing. In Boland, R. J. and Collopy, F., ***Managing as designing:*** 164–168. Palo Alto: Stanford University Press.

Cooper, R., Junginger, S., & Lockwood, T. 2009. Design thinking

and design management: A research and practice perspective. ***Design Management Review,*** 20: 47–55.

Croskerry, P. 2009. Clinical cognition and diagnostic error: Applications of a dual process model of reasoning. ***Advances in Health Sciences Education,*** 14: 27–35.

Cross, N. 1982. Designerly ways of knowing. ***Design Studies,*** 3: 221–227.

Cross, N. 2006. ***Designerly ways of knowing.*** Berlin: Springer.

Cross, N. 2011. ***Design thinking.*** New York: Berg.

Dorner, D. 1999. Approaching design thinking research. ***Design Studies,*** 20: 407–415.

Dorst, K. 2006. Design problems and paradoxes. ***Design Issues,*** 22: 4–16.

Dunne, D., & Martin, R. 2006. Design thinking and how it will change management education: An interview and discussion. ***Academy of Management Learning & Education,*** 5: 512–523.

Dyer, J., Gregersen, H., & Christensen, C. M. 2011. ***The innovator's DNA: Mastering the five skills of disruptive innovators.*** Boston, MA: Harvard Business Review Press.

Dym, C., Agogino, A., Eris, O., Frey, D., & Leifer, L. 2005. Engineering design thinking, teaching, and learning. ***Journal of Engineering Education,*** 94: 103–120.

Ferguson, E. S. 1977. The mind's eye: Non-verbal thought in technology. ***Science,*** 197: 827–836.

Ferguson, E. S. 1992. ***Engineering and the mind's eye.*** Cambridge, MA: MIT Press.

Fraser, H. 2007. The practice of breakthrough strategies by design. ***Journal of Business Strategy,*** 28: 66–74.

Fulton-Suri, F. J., & Hendrix, M. 2010. Developing design sensibilities. ***Rottman Magazine,*** Spring: 59–62.

Gedenryd, H. 1998. How designers work. Unpublished PhD Thesis. Lund, Sweden: Lund University.

Ghoshal, S. 2005. Bad management theories are destroying good management practices. ***Academy of Management Learning & Education,*** 4: 75–91.

Göker, M. H. 1997. The effects of experience during design problem solving. ***Design Studies,*** 18: 405–426.

Golsby-Smith, T. 2007. The second road of thought: How design offers strategy a new toolkit. ***Journal of Business Strategy,*** 28: 22–29.

Gordon, R. A., & Howell, J. E. 1959. ***Higher education for business.*** New York: Columbia University Press.

Hake, R. R. 1998. Interactive-engagement versus traditional methods: A six-thousand-student survery of mechanics test data for introductory physics courses. ***American Journal of Physics,*** 66: 64.

Hatchuel, A., & Weil, B. 2009. C–K design theory: An advanced formulation. ***Research in Engineering Design,*** 19: 181–192.

Henn, R. 2010. Aftermarkets: The messy yet refined logic of design. ***JCC,*** 37: 41–54.

Hoellwarth, C., & Moelter, M. J. 2011. The implications of a robust curriculum in introductory mechanics. ***American Journal of Physics,*** 79: 540.

Holloway, M. 2009. How tangible is your strategy? How design thinking can turn your strategy into reality. ***Journal of Business Strategy,*** 30: 50–56.

Huber, G. 1980. ***Managerial decision making.*** Glenview, IL: Scott, Foresman and Company.

Johansson-Skoldberg, U., Woodilla, J., & Çetinkaya, M. 2013. Design thinking: Past, present and possible futures. ***Creativity and Innovation Management,*** 22: 121–145.

Junginger, S. 2007. Learning to design: Giving purpose to heart, hand and mind. ***Journal of Business Strategy,*** 28: 59–65.

Kahneman, D. 2003. A perspective on judgment and choice: Mapping bounded rationality. ***American Psychologist,*** 58: 697–719.

Kahneman, D. 2011. ***Thinking, fast and slow.*** New York: Farrar, Straus and Giroux.

Kahneman, D., & Klein, G. 2009. Conditions for intuitive expertise: A failure to disagree. ***American Psychology,*** 64: 515–526.

Kawulich, B. 2005. Participant observation as a data collection method. ***FORUM: Qualitative Social Research,*** 6: 43. Retrieved from http://nbn-resolving.de/urn:nbn:de:0114-fqs0502430. Accessed October 11, 2012.

Kelley, T. 2001. ***The art of innovation: Lessons in creativity from IDEO, America's leading design firm.*** New York: Doubleday.

Kelley, T., & Kelley, D. 2012. Reclaim your creative confidence. ***Harvard Business Review,*** 90: 115–118.

Keppner, C. H., & Tregoe, B. J. 1965. ***The rational manager.*** New York: McGraw-Hill.

Khurana, R., & Spender, J. C. 2012. Herbert A. Simon on what ails business schools: More than "a problem in organizational design." ***Journal of Management Studies,*** 49: 619–639.

Kimbell, L. 2011. Rethinking design thinking: Part I. ***Design and Culture,*** 3: 285–306.

Klein, G. 2011. Critical thoughts about critical thinking. ***Theoretical Issues in Ergonomics Science,*** 12: 210–224.

Klein, G., & Rothman, J. 2008. New directions: Staying on course when your destination keeps changing. ***The Conference Board Review,*** 45: 24–27.

Kolb, D. A. 1984. ***Experiential learning: Experience as the source of learning and development.*** NJ: Prentice Hall.

Kolodner, J. L., & Wills, L. M. 1996. Powers of observation in creative design. ***Design Studies,*** 17: 385–416.

Korn, M., & Silverman, R. E. 2012. Forget B-School, D-school is hot. ***The Wall Street Journal.*** Retrieved from http://online.wsj.com/article/SB10001424052702303506404577446832178537716.html. Accessed January 15, 2013.

Kotler, P., & Rath, G. A. 1984. Design: A powerful but neglected strategic tool. ***Journal of Business Strategy,*** 5: 16–21.

Lawson, B. 1979. Cognitive strategies in architectural design. ***Ergonomics,*** 22: 59–68.

Lawson, B. 2006. ***How designers think: The design process demystified.*** Amsterdam: Elsevier.

Leavitt, H. J. 1989. Educating our MBSs: On teaching what we haven't taught. ***California Management Review,*** 31: 38–50.

Leifer, L., & Steinert, M. 2011. Dancing with ambiguity: Causality behavior, design thinking, and triple-loop-learning. ***Information Knowledge Systems Management,*** 10: 151–173.

Liedtka, J. 2000. In defense of strategy as design. ***California Management Review,*** 42: 8–30.

Liedtka, J., King, A., & Bennett, K. 2013. ***Solving problems with design thinking: Ten stories of what works.*** New York: Columbia Business School.

Liedtka, J., & Ogilvie, T. 2011. ***Designing for growth: A design thinking tool kit for managers.*** New York: Columbia Business School.

Livingston, J. S. 1971. Myth of the well-educated manager. ***Harvard Business Review:*** 79–89.

March, J. G. 1991. Exploration and exploitation in organizational learning. ***Organization Science,*** 2: 71–87.

Martin, R. 2007. Design and business: Why can't we be friends? ***Journal of Business Strategy,*** 28: 6–12.

Martin, R. 2009. ***The design of business: Why design thinking is the next competitive advantage.*** Cambridge, MA: Harvard Business Press.

Michael, J. 2006. Does active learning work? A review of the research. ***Journal of Engineering Education,*** 93: 223–231.

Mintzberg, H. 1978. Patterns in strategy formation. ***Management Science,*** 24: 934–948.

Mintzberg, H. 1994. ***The rise and fall of strategic planning.*** New York: Free Press.

Mintzberg, H. 1996. Learning 1, Planning 0. ***California Management Review,*** 38: 92–93.

Mintzberg, H. 2004. ***Managers not MBAs.*** San Francisco, CA: Berrett-Koehler Publishers.

Moggridge, B. 2007. ***Designing interactions.*** Cambridge, MA: MIT Press.

Newell, A., & Simon, H. 1972. ***Human problem solving.*** Englewood Cliffs, NJ: Prentice Hall.

Osterwalder, A., & Pigneur, Y. 2010. ***Business model generation.*** Hoboken, NJ: John Wiley.

Owen, C. 2006. Design thinking: Notes on its nature and use. ***Design Research Quarterly,*** 1: 16–26.

Pfeffer, J., & Fong, C. T. 2002. The end of business schools? Less success than meets the eye. ***Academy of Management Learning & Education,*** 1: 78–95.

Pierson, F. C. 1959. ***The education of American businessmen: A study of university-college programs in business administration.*** New York: McGraw-Hill.

Polya, M. 1957. ***How to solve it.*** New York: Doubleday.

Prince, M. 2004. Does active learning work? A review of the research. ***Journal of Engineering Education,*** 93: 223–232.

Razzouk, R., & Shute, V. 2012. What is design thinking and why is it important? ***Review of Educational Research,*** 82: 330–340.

Reyna, V. F. 2008. A theory of medical decision making and health: Fuzzy trace theory. ***Medical Decision Making,*** 28: 850–865.

Reyna, V. R., & Brainerd, C. J. 2007. The importance of mathematics in health and human judgment: Numeracy, risk communication, and medical decision making. ***Learning and Individual Differences,*** 17: 147–159.

Ries, E. 2011. ***The lean startup.*** New York: Crown Business.

Rousseau, D. M., & McCarthy, S. 2007. Educating managers from an evidence-based perspective. ***Academy of Management Learning & Education,*** 6: 84–101.

Rowe, P. 1987. ***Design thinking.*** Cambridge MA: MIT Press.

Rudolph, J. W., Morrison, J. B., & Carroll, J. S. 2009. The dynamics of action-oriented problem solving: Linking interpretation and choice. ***Academy of Management Review,*** 34: 733–756.

Sarasvathy, S. D. 2003. Entrepreneurship as a science of the artificial. ***Journal of Economic Psychology,*** 24: 203–220.

Schensul, S., Schensul, J., & LeCompte, M. 1999. ***Essential ethnographic methods: Observations, interviews, and questionnaires.*** Walnut Creek, CA: Alta Mira Press.

Schoemaker, P. 2008. The future challenges of business: Rethinking management education. ***California Management Review,*** 50: 119–139.

Schwaber, K., & Sutherland, J. 2013. ***The Scrum guide: The definitive guide to Scrum.*** Retrieved from https://www.scrum.org/Portals/0/Documents/Scrum%20Guides/Scrum_Guide.pdf. Accessed October 31, 2013.

Schön, D. 1983. ***The reflective practitioner.*** New York: Basic Books.

Schön, D. 1987. ***Educating the reflective practitioner.*** San Francisco: Jossey-Bass.

Schön, D., & Wiggins, G. 1992. Kinds of seeing and their functions in designing. ***Design Studies,*** 13: 135–156.

Simon, H. A. 1967. The business school: A problem in organizational design. ***Journal of Management Studies,*** 4: 1–6.

Simon, H. A. 1996. ***The sciences of the artificial*** (3rd ed.). Cambridge, MA: MIT Press.

Sloman, S. 1996. The empirical case for two systems of reasoning. ***Psychological Bulletin,*** 119: 3–22.

Stanovich, K., & West, R. 2000. Individual differences in reasoning: Implications for the rationality debate? ***Behavioral and Brain Sciences,*** 23: 645–726.

Starkey, K., & Tempest, S. 2009. The winter of our discontent: The design challenge for business schools. ***Academy of Management Learning & Education,*** 8: 576–586.

Stewart, A. C., Houghton, S. M., & Rogers, P. R. 2012. Instructional design, active learning, and student performance: Using a trading room to teach strategy. ***Journal of Management Education,*** 36: 753–776.

Thomas, J. C., & Carroll, J. M. 1979. The psychological study of design. ***Design Studies,*** 1: 5–11.

Waddock, S., & Lozano, J. M. 2013. Developing more holistic management education: Lessons learned from two programs. ***Academy of Management Learning & Education,*** 12: 265–284.

Zimmerman, J. L. 2001. Can American business schools survive?. Rochester: NY. ***Social Sciences Research Network.*** Retrieved from http://papers.ssrn.com/abstract=283112. Accessed Nov. 11, 2012.

Roy Glen (PhD Case Western Reserve University) is an Emeritus Faculty member at Boise State University. Glen coordinates an integrated executive MBA module incorporating design thinking and is actively involved in Boise's Angel Investing community. He serves on the executive committee of American Pharma Technologies, a rapidly growing medical technology company.

Christy Suciu (MBA Webster University) is a lecturer in the College of Business and Economics at Boise State University, teaching design thinking in the MBA programs. Suciu has served as a design-thinking consultant for major global companies. Her research interests include design thinking, innovation, and strategy.

Christopher Baughn, (PhD, Wayne State University) is a professor of management in the College of Business and Economics at Boise State University. Baughn's current research interests include conditions favoring entrepreneurship as well as cognitive processes involved in design thinking.