THE EFFECT OF DISTRUST ON COGNITIVE FLEXIBILITY AND KNOWLEDGE TRANSFER

A Dissertation

Presented to the Faculty of the Graduate School

of Cornell University

in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

by

Jessica Eve Federman

May 2014

THE EFFECT OF DISTRUST ON COGNITIVE FLEXIBILITY AND KNOWLEDGE TRANSFER

Jessica Eve Federman, Ph.D.

Cornell University 2014

In recent times, more attention in the management and educational psychology literature has been devoted to understanding how and why creative potential is not being achieved, despite the pressing need for innovative thinking and an increased capacity to transfer knowledge more adaptively. Scholars have argued that creativity and the capacity to use knowledge adaptively is often minimal, unless cognitive flexibility (Day & Goldstone, 2012), variability and cognitive incongruity is introduced (Hatano & Inagaki, 1992). Related to these ideas, recent research has demonstrated that distrust serves as a processing influence that enables individuals to think more flexibly and creatively (Mayer & Mussweiler, 2011). The goal of the current research was to investigate whether distrust effects the capacity to process information in more flexible ways, leading to an increase in knowledge transfer. Across three experimental studies, I primed a psychological mindset by having participants complete a scrambled sentence task made of words synonymous with distrust, trust, or neutral meaning. Study 1 measured the effect of distrust on the capacity to solve an immediate analogical transfer problem. Study 2 measured whether distrust aids in discrediting irrelevant information, when solving an immediate analogical transfer problem. Study 3 measured the effect of distrust on the capacity to solve an analogical transfer problem over a delay of time (4 days).

BIOGRAPHICAL SKETCH

Jessica E. Federman received her Ph.D. and M.S. in Human Resource Management in the School of Industrial and Labor Relations at Cornell University. She received her MBA and B.A. in Psychology from Binghamton University.

ACKOWLEDGMENTS

Whatif

מה אם
מתוך הספר "אור בעליית הגג" (1981)

אמש, כששכבתי חושב כאן,
כמה תהיות חלפו במוחי
וקיפצו וחגגו כל הלילה
ושר את שיר התהיות הנושן שלהן:
מה אם הייתי טיפש בבית הספר?
מה אם היו סוגרים את בריכת השחיה?
מה אם הייתי מוכה?
מה אם היו מרעילים את כוס השתיה שלי?
מה אם הייתי מתחיל לבכות?
מה אם הייתי חולה וגוסס?
מה אם הייתי נכשל בבחינה?
מה אם שיער ירוק היה צומח על החזה שלי?
מה אם אף אחד לא היה אוהב אותי?
מה אם ברק היה מכה בי?
מה אם לא הייתי גובה?
מה אם ראשי היה קטן?
מה אם הדג לא היה נושך?
מה אם הרוח תקרע את העפיפון שלי?
מה אם הם יתחילו מלחמה?
מה אם ההורים שלי יתגרשו?
מה אם האוטובוס יאחר?
מה אם השיניים שלי לא ייצמחו ישר?
מה אם המכנסיים שלי ייקרעו?
מה אם לעולם לא אלמד לרקוד?
הכל נראה בסדר, ואז
תהיות הלילה מתחילות שוב!

תודה:
לשל, על השנינות המצחיקה, מבריקה, ומעוררת ההשראה שלך, ועל היותך חבר ומורה מאז שאני זוכר.
ללואיס, איימי, לינדסי, ג'ון, ג'ני וקווין – החברים הכי טובים שלי – על הצחוקים הלא נגמרים בינינו.
ל די.ג', אליס, מרטי, שלי, פראן, שון, ארתורו, אנת'וני, קריסטינה וקריס – על הכנות, הכוונה ותמיכה.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

Psychological impressions of distrust and doubt have become common within and among organizations (Kramer, 1999; Lewicki, McAllister, & Bies, 1998). Distrust, the sense of uncertainty with a situation and an expectation that one needs to be on alert for change, is a mindset that many organizational leaders necessarily adopt. Competition in a global marketplace, technological advances, changing demographics, and the speed of information transfer are just some of the influences that make "change inevitable." Coincidently, one strategy engendered in the title of former Intel CEO, Andy Grove's book, "Only the Paranoid Survive...," underscores the value of instilling a sense of doubt into routine organizational actions and cognitions, in order to keep up with the rapid pace of change. As demonstrated by Intel's success in the microprocessor industry, a healthy dose of paranoia is presumed to make employees reflect on what they know and do not know.

Related to Grove's assertion that distrust is beneficial for learning and innovation, the current body of work explores the effect of distrust on using knowledge more adaptively and flexibly. While critical thinking is regarded as a valuable skill found in employees, there exists little guidance and empirical evidence from the management literature as to the conditions that enhance it. The current work examines distrust as a cognitive processing influence that facilitates adaptive thinking and knowledge transfer. I define a mindset of distrust in terms related to skepticism, in which one compares the fit and validity of new information with prior knowledge; yet differs to the extent that distrust also recursively adapts prior knowledge to fit new information by challenging the premises of what one assumes to be true. Quite different than a mindset of mistrust, in which individuals sense guise and deception within their social environment and thus tend to narrow attentional focus, distrust expands attentional focus and facilitates learning. Under a distrustful mindset, an

attentional shift takes place where cognitive flexibility is enhanced and information is processed and construed in broader and more adaptable terms. A more flexible lens for processing information leads individuals to clarify their own assumptions, better identify patterns between sources of information, and more effectively transfer knowledge.

Given the vast amount of theory and research developed on the concept of trust and learning, it may seem at odds to predict positive and adaptive effects of distrust on knowledge transfer. Yet, empirical findings in this domain indicate that individuals under distrustful mindsets engage in deeper reasoning processes and show more flexible, creative styles of thinking (Schul, Mayo, & Burnstein, 2004; Mayer & Mussweiler, 2011). Individuals with a distrustful mindset can transform information into different categorical schemes, think with a counterfactual lens and in non-routine ways, and apply sophisticated attributional considerations to incoming information that surpass conventional thought (Fein, 1996; Schul et. al., 2007). From a practical standpoint, because innovation is predicated on using non-routine measures for finding solutions, applying a skeptical mindset to routine cognitive and behavioral patterns can help channel the type of cognitive shift needed for effective and creative problem solving.

Critical Inquiry, Cognitive Incongruity, and Learning

Many learning scientists argue that fast-changing work environments require rethinking attitudes and approaches to learning and innovation to facilitate meaningful and productive performance (Bransford & Vye, 2008). There is an ever greater need for individuals to become self-directed, lifelong learners and to develop the capacity to *learn how to learn* to solve new problems. Innovation requires using existing knowledge adaptively and flexibly, as opposed to rigidly maintaining existing practices, routines, and knowledge. Individuals who question and think critically

about the role they have in dynamic environments are likely to benefit by using an open-minded perspective to prepare for changing conditions.

Hatano and Inagaki (1986) were among an early group of scholars who theorized about contextual conditions that influence an adaptive learning mindset and knowledge expertise. Hatano and Inagaki (1986) argued that when there is little variability in an environment, individuals are more likely to use their knowledge in routine and highly efficient ways. Under these conditions, individuals develop into "routine experts" as there exists little need or motivation to deeply understand one's source of knowledge, or have a critical understanding of what one is doing and why it is relevant. As a result of maintaining the same knowledge over time without adaptation, routine experts are less able to use their knowledge to solve new types of problems. In contrast, organizational contexts that consist of change and variability require a need for adaptive expertise. In these settings, non-routine work environments challenge individuals to learn the conceptual underpinnings of their knowledge. That is, if they are to solve new problems they are challenged to learn why and how their skill set is effective under particular conditions and are required to continuously learn and update their knowledge for it to be relevant. Adaptive experts, therefore, utilize a meta-cognitive and mastery goal orientation that guides them to become competent in what they know and to be able to apply their knowledge in novel ways.

Hatano and Ignaki (1986) explored the concept of adaptive expertise in their study of abacus masters and their capacity to solve novel problems. They differentiated expertise into two dimensions: routine expertise and adaptive expertise. Individuals labeled "adaptive experts," had a proficient skill set, yet also understood the meaning and nature of their work, so were capable of inventing new procedures for solving new problems. In contrast, Hatano and Ignaki (1986) found that routine

experts had developed a high, yet narrow procedural proficiency with their skill which enabled them to solve familiar problems very quickly and easily, but less able to solve novel problems. Hatano and Inagaki (1992) theorized about the conditions that promote adaptive expertise. They proposed that underlying an adaptive expert's skill proficiency is a psychological state of *cognitive incongruity;* the belief that one's current repertoire of skills and knowledge is inadequate or insufficient, thus requiring greater learning and inquiry. Hatano and Inagaki (1992) proposed that cognitive incongruity can be triggered when; (1) encountering a novel problem that cannot be solved with the knowledge available, or a prediction based on prior knowledge gets disconfirmed; (2) engaging in controversial discussion and debate; (3) the desire for learning is not motivated by extrinsic rewards; and (4) the surrounding environment and culture supports it.

Bransford and colleagues (2008) proposed that the ease with which a tacit schema gets misapplied to solve a novel problem may stem from over-reliance on a solution that gets regularly applied to existing, familiar problems. As situations become more routine and certain solutions become accepted, individuals do not see a need for using critical inquiry. Critical inquiry prompts individuals to question their assumptions and frame and reframe the way that problem statements are understood. This in turn can influence types of solutions generated (Getzels, 1979). According to the critical inquiry model developed by Argyris and Schön (1973), having an open-minded perspective to various forms of evidence, as well as having the freedom to search and deliberate enables the disruption of existing schemas. A mindset of this kind avoids adopting quick solutions based on a limited or superficial understanding of a problem statement. Instead, cognitive processes are devoted to a deep consideration of underlying conceptual dimensions and root causes.

In theory, using a mindset of critical inquiry and developing the cognitive skill sets of an adaptive expert corresponds with findings from research found on the relationships between distrustful mindsets, cognitive flexibility and creativity. As theorized by Schul and colleagues (2004) a trust mindset facilitates routine forms of thinking that direct attention toward maintaining the status quo. In contrast, a distrustful mindset promotes thinking about concepts in more flexible and atypical terms. The diverging effect that trust and distrust have on information processing appears to relate to the differences found in the environmental circumstances, learning experiences and solutions that routine and adaptive experts seek. By virtue of low variability in their environment and implicit trust in using existing knowledge to solve new problems, routine experts are less likely to find effective, novel solutions and levels of innovative and creative thinking are minimal. In contrast, adaptive experts likely utilize a distrustful mindset, which promotes critical inquiry and non-routine modes of thinking. In this mindset, tacit knowledge is more frequently brought to the surface, in which individuals are challenged to understand the "how" and "why" of their knowledge base. In this way, distrust serves as a psychological state that guides active learning processes and promotes an information processing shift for exploring more relevant sources of creative solutions. The following section elaborates on an issue of where routine expertise and trust may prove particularly dubious: the knowledge transfer process and failure to recognize when prior knowledge is relevant to solving a new problem that appears different on the surface but is actually structurally identical.

Surface Similarity and the Knowledge Transfer Problem

Whitehead (1929) labeled the term "inert knowledge" to describe situations where people have learned relevant knowledge and skills yet fail to spontaneously access this knowledge despite its relevance for problem solving. Examples include

poor transfer of skills and knowledge learned in the classroom to the outside world and work settings (Lave, 1988) and failure to retrieve and apply solutions to analogical reasoning problems (Gick & Holyoak, 1980; 1983).

Knowledge utilization is often assessed by comparing how well learners spontaneously transfer knowledge they possess or have recently acquired to a new problem context (Pea, 1987). Utilizing knowledge effectively requires developing a problem representation followed by stating and justifying solutions to the problem, often referred to in the literature as categorization and knowledge retrieval. When categorizing a problem, the problem solver links the problem statement contents to known problems or some comprehensive principle (Larkin, McDermott, Simon & Simon, 1980). Research has demonstrated that individuals effectively problem-solve when they transform or modify prior cases in order make them applicable to new problems. For instance, many transfer researchers have discussed an adaptation or "re-representation" phase during transfer, in which one or both of the representations involved is altered to make analogical mapping more consistent (e.g., Clement, 1988; Gentner & Colhoun, 2010). Knowledge retrieval is a process of comprehending and elaborating on information. It is thought to be goal-directed and guided by specific strategies such as seeking out additional information, examining inferences more closely, rebutting counterarguments, generating new inferences, making analogies, and developing problem-solving methods like problem decomposition.

Over the last several decades, the study of knowledge transfer has added to an understanding of the conditions under which individuals effectively apply their knowledge. One method that facilitates knowledge transfer is analogical reasoning (Gentner, 1983). Analogical reasoning is a process of recognizing the commonalities between a past situation x (source) and current situation y (target). Upon recognizing the similarities between source and target, one cognitively manipulates *x* to an

understanding of *y*. The success of "analogical mapping" requires: (1) that the thinker has a deep and flexible understanding of the source domain that is applicable to the target, and, (2) that there is no conversion problem between the conceptual schemes of the source and target domains (Pea, 1987).

The knowledge transfer literature has consistently revealed the strong influence of concrete surface similarities on analogical reasoning. That is, individuals have a much easier time mapping structural elements between cases when the surface details to cases are the same. (e.g., Anderson, Farrell, & Sauers, 1984; Ross, 1987; Salomon & Perkins, 1989). Otherwise, when the surface details between cases are different, despite sharing underlying information of which is structurally and configurationally fit, spontaneous transfer is difficult and unlikely. This is because attention is strongly guided toward finding commonalities among surface characteristics, despite being of limited benefit (Gick & Holyoak, 1980, 1983; Weisberg, DiCamillo, & Phillips, 1978). Thus, surface commonalities often impose a greater influence on knowledge transfer and superficially signal shared, analogous content, even when no true, structural fit may exist (Gentner, Ratterman, and Forbus, 1993).

The work of Gick and Holyoak (1980, 1983) demonstrated the robustness of recognition failure on analogical knowledge transfer. Using Duncker's (1945) classic "radiation problem," participants were told about a patient with an inoperable tumor in his stomach. There was a type of ray that could be used to treat the patient, but at intensities sufficient to destroy the tumor, too much healthy tissue would also be destroyed. At lower intensities, the ray would be harmless to healthy tissue but would not affect the tumor. Participants were asked to propose a solution that could destroy the tumor while also leaving healthy tissue intact. The solution involves a convergence approach, in which several low intensity rays are administered at once, from different angles, converging at the site of the tumor, thus creating a greater aggregate and

sufficient intensity. Participants have a very difficult time solving this problem. What is more interesting though is that presenting participants with a case example before solving the radiation problem, that differs in cover story yet bears structural similarity to the radiation problem, does little to improve performance. Participants have generally only been successful at solving the radiation problem when given an explicit cue to consider the relevance of a previously learned situation (e.g., "the story you read earlier might be relevant in solving this problem") (Catrambone & Holyoak, 1989).

Without such strong hints, however, recognition failure is more often the norm than the exception. In one of the more subtle experimental attempts to shift participants' attention to notice structural alignment between cases of information, Anolli, Antonietti, Crisafulli, and Cantoia (2001) interrupted participants during their attempts to solve Duncker's radiation problem with a request that they answer a relevant question about a previously seen, analogous problem. After completing the prompt, participants were then allowed to continue working on the radiation problem. Despite that the prompt should have hinted to individuals to look for commonalities between the sources of information, successful transfer was poor (5–10% of the time) and did not differ from the results of a control condition in which no analogous prior problem had been given.

In other work, researchers examined the likelihood of knowledge transfer if participants were to engage in similar kinds of cognitive processing during the learning and testing phases of the study. For example, in the testing phase of a study conducted by Perfetto, Bransford, & Franks (1983) participants were asked to solve insight puzzles, (e.g. "A man in the U.S. married 20 different women in the same town. All of them are still living and he has never divorced one of them, yet he has broken no law. Can you explain?)." Prior to the testing phase, participants were

presented with information that could help them solve the puzzle (e.g., reading the sentence "A minister marries several people each week."). However, individuals were generally unsuccessful at making the link and performance was poor. The researchers then presented the solution that matched how participants were processing the test puzzles—such as, "You can marry several people each week ...if you are a minister," and found that participants were much more likely to transfer their knowledge and solve the puzzles effectively (Lockhart, Lamon, & Gick, 1988).

In summary, past research has provided a strong and consistent picture of the role of similarity in transfer. While structural similarity serves as the basis for meaningful knowledge transfer, surface similarity between situations heavily influences whether transfer will actually occur. Unfortunately, the use of hints and cues utilized in much of these studies to improve knowledge transfer has little value for problem-solving in the real world. Thus, more contemporary research has been examining online factors, such as psychological states that can spontaneously influence information processing and facilitate knowledge transfer more effectively. In the following section I discuss several lines of research following this pursuit.

Mindset and Knowledge Transfer

A long line of research in the area of self-regulation has demonstrated the impact and significance that a psychological mindset can have on behavior. A psychological mindset increases the likelihood of changing behavior in a certain direction, due to the way that information is processed and construed. For example, Fujita and colleagues (2006) found that priming participants with high-level construals of a situation (abstract, central features of an situation) relative to low level construals (detailed, concrete details of a situation) led to decreased preferences for immediate over delayed outcomes, greater physical endurance, stronger intentions to exert self-control, and less positive evaluations of temptations that undermine self-control.

Studies are now emerging examining the effect that such psychological states have on encoding information and knowledge transfer. Recently, Bliznashki & Kokinov (2010) found that priming a mindset that tuned participants' attention toward thinking about information in relational terms subsequently led to processing other information in similar ways. For example, after attempting several items from the Raven Progressive Matrices test, which involves solving visual analogies based on structural relationships between a series of diagrams, participants were more likely to judge the similarities between new scenes based on underlying structural matches rather than surface matches.

Another way in which learners may influence their own encoding is in terms of the specific goals with which they approach a given task. Achievement goals, such as mastery versus performance goals have been shown to influence learning outcomes (Elliot, 1999; Pintrich, 2000). Whereas mastery goals relate to persistence, competency and a personalized agenda for long term learning and improvement, performance goals relate to short-term goals that demonstrate one's ability relative to others. Recent research has revealed effects of achievement goals on knowledge transfer. For example, Bereby-Meyer, Moran, and Unger-Aviram (2004) put groups of participants into either a performance or mastery condition to learn a negotiation task. Some participants were given instructions that emphasized performance goals, such as achieving error-free performance, whereas others received instructions that emphasized mastery goals of long-term persistence and understanding of content. An examination of performance on similar negotiation tasks revealed that both conditions experienced performance improvement. However, when the negotiation context changed, there was no significant difference between the performance-oriented condition and the control group, whereas those in the mastery-oriented condition reliably improved at the task.

Finally, there is evidence that the quantity and quality of explanations individuals generate when problem solving influences learning and knowledge transfer. The *self-explanation effect* has beneficial effects on learning and transfer because learners make inferences and become aware of the disparities between their own mental models and the ones presented by the examples (Chi, 2000). For example, Chi, Bassok, Lewis, Reimann, & Glaser (1989) found that students who generated rich descriptions and self-explained a problem statement were more successful at solving knowledge transfer problems. Self-explanation strategies included, explaining and justifying steps in an example problem, elaborating on conceptual relationships between subsequent actions, and consideration of goals and consequences. Renkl (1997) also found positive effects on knowledge transfer from the use of self-explanation methods and that self-explanation methods have lasting effects within individuals across situations.

Research examining the ways that learners can use a mindset to influence their encoding and transfer is in its infancy, despite being of great value. In the following section, I discuss how a distrusting mindset may serve as another mechanism for influencing knowledge transfer. Although possessing a trusting mindset is often equated to being beneficial for knowledge transfer, (such as, one can rely on using what has worked in the past), failure to use knowledge adaptively often happens when one only knows how to use their knowledge in familiar situations. As previously discussed, the literature on knowledge transfer has repeatedly shown that individuals are poor at transferring their knowledge because they look for similarity in surface characteristics between situations rather than underlying, structural similarity. However, if individuals were to loosen the contextual constraints of a problem statement and zero in on the central components, then the likelihood of finding a relevant solution should increase. It is worthy to ask whether a mindset can attenuate

the inert knowledge problem. Perhaps a trust mindset promotes a search for surface familiarity among information sources or elicits a simplified set of mental practices for processing information. For example, Hatano & Inagaki (1986) found that routine experts failed to develop adaptive learning skills to create new procedures for solving problems and had trouble using their knowledge to solve new problems. In contrast, adaptive experts consistently attempted new ways to use and understand their skill. Similar issues likely exist for a range of professionals who do their job very well by practicing their skill routinely, yet fail to see how they can use their skill under different conditions. Perhaps a mindset of distrust impacts the discovery of solutions and transfer, through a mechanism by which problem statements get reconstructed as a result of considering concepts in more flexible and adaptive terms.

The ubiquitous nature with which distrust is elicited in everyday life, particularly when change is on the horizon, is informative for advancing research in the area of knowledge transfer. Distrust is a state of mind that challenges individuals to question themselves before putting their resources into action. Similar to a mastery orientation, individuals in a distrustful mindset are more likely to question whether they are truly competent or need to revise how they are thinking about a problem or going to use a solution. In line with the self-explanation effect, individuals in a distrustful mindset compared to a trust mindset, are more likely to elaborate about what they know and whether they see a discrepancy between information that is given, what they understand and what is less understood. In the next section, I discuss the theoretical and empirical work on distrust and present my hypotheses that discuss the effect of distrust on the retrieval and transfer of knowledge.

Distrust, Cognitive Flexibility and Knowledge Transfer:

Distrust is defined as; (1) doubt of the honesty or reliability of something; (2) to regard with suspicion (Oxforddictionaries.com, 2014). Fein's definition of

suspicious mindsets, suggests that distrust represents a "dynamic state in which an individual actively entertains multiple, plausibly rival hypotheses about motives or genuineness of information" (1996, p. 1165). Distrust, similar in meaning to "doubt," "suspicion," and "skepticism," is a goal-oriented state where one seeks a validation of truth and greater transparency of information. A distrustful mindset can induce a critical reasoning process for interpreting and evaluating information (Halpern, 2003). In contrast to mistrust, which implies an interpersonal concern that others are deceptive and maliciously attempting to conceal information, distrust is often self-generated and/or triggered by variability in the environment, taking on a valence-free form of truth seeking. Rather than using a suspicious mindset toward understanding the intentions of others, one uses suspicious thinking inwardly, toward the self. That is, a distrustful mindset shifts attention to examine prior knowledge to avoid making mistakes and relying on biases that are often routinely accepted (Schul, Mayo, & Burnstein, 2004).

The meta-cognitive processes involved with examining prior knowledge and taking a learning stance toward self-knowledge mirrors views related to scientific inquiry. For example, Dewey (1933) regarded the value of using scientific inquiry and distrust in one's knowledge as an opportunity to (re)construct knowledge and to encourage an examination of information in relation to one's individualistic set of experiences and perspectives. According to Dewey, thinking critically requires making sense of things through questioning, debate, and reflection, particularly, on issues and concepts that have been accepted or assumed to be true based on common beliefs and explanations.

A number of scholars have argued that the human cognitive system has adapted to the psychological mindset of distrust by influencing information processing differently than a feeling of trust (Schul, Mayo & Burnstein, 2004; Cosmides & Toby,

2005). Individuals in a mindset of distrust sense that things may not be as they appear and that change or unpredictability is on the horizon (Kramer, 1999). Schul and colleagues argue that the feeling of distrust "is not the kind associated with outcomes that are inherently probabilistic, as in playing a slot machine or roulette. Rather, distrust reflects the receiver's theory about the truth" (Schul, Mayo, Burnstein, & Yahalom, 2007). When a state of trust is active, one accepts and believes in the available information. In contrast, when a state of distrust is active, one senses that the truth is being concealed and requires a search for non-routine or non-obvious alternative interpretations of the given information (Fein, 1996; Schul, Burnstein, & Bardi, 1996).

According to Schul and colleagues (2004) information processing follows a more adaptive strategy under conditions of distrust. Under a state of trust, information is processed as if it is true, bringing to mind 'routine' and prototypical concepts for how to think and behave. However, a state of distrust will spontaneously bring to mind a prototypical account of how to think and behave in accordance with routine and normative standards, yet also simultaneously prompt a counter or less typical view of the prototypical way to think and behave, thus preparing for the possibility that taking a perspective that is different and non-routine may be useful. The utility of processing information in non-prototypical and non-routine ways is that it stimulates individuals to question how they are interpreting the contextual framework of an information source. This may be particularly conducive for knowledge transfer due to the need for focusing on configurational details between sources of information, rather than on surface features for an effective mapping.

In an examination of the adaptive effects of distrust, Schul et. al., (2004) studied the associative links that became activated when participants processed information under a trusting versus distrusting stimulus. Schul et. al., (2004) found

that a prime word appearing under a stimulus of distrust triggered associations that were opposite the meaning of the target word (e.g., dark activated light). Conversely, a prime word appearing under a stimulus of trust triggered associations that were congruent (e.g., dark activated night). This work reinforced the notion that states of trust (versus distrust) differentially influence information processing and the generation of inferences (Cosmides & Toby, 2005). Further, this research set the foundation for examining the effect of distrust on using information more flexibly. If one is in a distrusting mindset, one is likely to probe more and also consider what might happen if the opposite is true and consider potential counter-scenarios. Counterfactual thinking, for example, has been shown to foster creativity (Markman, Lindberg, Kray, & Galinsky, 2007) and to be helpful in overcoming functional fixedness (Galinsky & Moskowitz, 2000) and set breaking, which are indicators of cognitive flexibility. Studies that have examined the counterfactual thinking effect, which mirrors the mindset of a state of distrust, have found that counterfactual thinking activates and increases cognitive flexibility such that individuals are less likely to show a confirmation bias and more likely to test the reverse direction of a given hypothesis, as well as come up with new uses of an object (Galinsky and Moskowitz, 2000).

Other research has demonstrated that a state of distrust inclines people to go beyond merely thinking about information to be true or untrue, but to consider how contextual information that frames central pieces of information may be misleading or irrelevant (Hilton et al., 1993). Individuals elaborate more when distrustful but also generate multiple interpretations of information to have a broader and more inclusive understanding of it (Hilton et al., 1993; Schul et al., 1996). The capacity to think about information in general and broader terms permits a more flexible interpretation

of problem statements and eases the process for retrieving relevant solutions and transferring knowledge (Clement, Mawby, &Giles, 1994).

More recently, studies have shown that distrust improves cognitive flexibility, which in turn enables creativity. For example, Mayer and Mussweiler (2011) demonstrated that participants in a distrustful mindset judged atypical exemplars of particular categories to be more inclusive of their category families, than individuals not in a distrustful mindset. In one study, Mayer and Mussweiler (2011) tested the effect of distrust on performance on a category inclusion task, as a measure of cognitive flexibility (Isen & Daubman, 1984; Rosch, 1975). A category inclusion task involves asking participants to rate the goodness of fit of several exemplars (e.g., chair, stool, telephone) to a superordinate category (e.g., furniture). Identifying highly and moderately typical exemplars (e.g., chair, stool) as good representatives of their category is not presumed to require cognitive flexibility (Isen & Daubman, 1984), because these exemplars are highly prototypical of the category. The extent to which atypical exemplars (e.g., telephone) are included in the category, however, requires having a looser and more open interpretation and, therefore, depends on having cognitive flexibility. Mayer and Mussweiler (2011), found that participants in a distrustful mindset gave higher typicality ratings to atypical exemplars, relative to participants primed by a trust mindset or in a neutral group. Thus, distrust enabled cognitive flexibility, which in turn influenced the ratings of atypical exemplars as being seen as inclusive to the superordinate category. Participants in the distrust mindset group were also faster at identifying atypical exemplars, relative to participants primed by a trust mindset and a neutral group. This work indicates that distrust facilitates a flexible mindset which enables individuals to think in more abstract ways. The capacity to re-represent information is important when problem solving because innovative solutions are often not readily obvious or visible. Rather,

individuals need to reconfigure and reconstruct information to more easily retrieve and generate effective solutions.

In contemporary times it has become ever more pressing to find interventions that promote learning and innovation in the face of organizational shift and change. Former Intel CEO Andrew Grove championed the idea of using a "paranoid" mindset to facilitate finding abstract solutions to conventional issues that depart from using common strategies that the competition may consider. For example, Grove's strategic plans for becoming a supplier of microprocessors was a function of comparing Intel's situation with the steel industry and Nucor's decision to operate its own steel mill to make steel products. Grove's skepticism of treating Intel's problems as a set of computer or electronic issues, led him to consider Intel's situation in a broader sense and look to an existing industry that achieved success experiencing similar threats and opportunities as Intel. As a result of rejecting the normative way of examining the problem, Grove considered Intel's situation on a more abstract level and considered the underlying strategy commonalities found between the steel and microprocessor industries. Steel and microprocessors are unrelated products, yet Intel could enter and grow the microprocessor industry as Nucor did with the steel industry. In an effort to design an innovative solution, Grove turned away from following what the competition was doing. His approach was radical, yet successful because he found insight from aligning the structural relationships found between two industries, rather than through product features.

Individuals with a distrustful mindset not only seek out multiple perspectives to reason with but they also reason about information more flexibly and deeply, thus finding structural and relational representations more compelling and meaningful. A distrusting mindset is one that probes more and considers what might happen if the opposite is true and consider potential counter-scenarios. Therefore, whereas in many

cases, routine forms of thinking predispose individuals to focus on irrelevant, surface features, in contrast distrust sensitizes attention toward noticing underlying relational similarities. Accordingly, I predict that distrust should help individuals bypass superficial features of a problem statement and extract relevant, relational properties.

Hypothesis 1: Participants in a distrustful mindset, relative to a neutral or trust mindset, will more accurately solve a problem, using knowledge transfer from a previously learned case that differs in cover story, but is configurationally relevant.

Hypothesis 2: Participants in a distrustful mindset, relative to a neutral mindset, will more accurately solve a problem, transferring knowledge from a distant but configurationally relevant analog case, versus a superficially similar, but non-analogous case.

Finally, the difficulty of transfer has been interpreted in terms of a dissociation between the kinds of similarity that governs access to long-term memory and the similarity that is used in evaluating and reasoning from a present analogical match (Gentner, Rattermann, & Forbus, 1993; Ross, 1989). The inert knowledge problem as mentioned earlier occurs when individuals fail to retrieve and apply knowledge from prior learning episodes to new situations. In this final study, I examine whether distrust facilitates retrieval of knowledge on tests of "far" transfer. This argument rests on the idea that because distrust improves abstract thinking and aids in the re-representation of information, individuals can better retrieve and match "source" and "target" concepts that in turn lead to analogical mapping and knowledge transfer. Distrust may be particularly helpful in maximizing the likelihood of retrieving analogous problems on tests of far transfer for several reasons. First, a distrusting mindset may encourage people to focus on the causal and relational aspects of the

problem statement rather than the superficial contextual elements of the problem. This is because a distrust mindset facilitates reasoning about information more deeply and comprehensively, where structural and relational representations are found to be compelling and meaningful. A state of distrust also influences information processing where information is encoded in more flexible and abstract, relational terms, which will facilitate retrieval access to relevant stored prior knowledge that share underlying similarities to a new problem statement.

Hypothesis 3: Participants in a distrustful mindset, relative to a neutral mindset, will more accurately solve a "far" transfer analogous problem case that takes place 4 days after encoding three mutually aligned analog cases.

In summary, prior work has demonstrated that a distrustful mindset is one that facilitates flexibility and non-routine cognition. The ability to break away from using prior approaches and conventional methods for solving novel problems is critical. However, even experts often fail to realize when a situation calls for a novel versus familiar solution to a problem. This issue highlights the key difference found between a routine expert and an adaptive expert. Adaptive experts will question their knowledge more frequently and attempt to use their knowledge in more flexible ways, to find relevant and novel solution interventions. As discussed with the inert knowledge problem, individuals must recognize when and where a solution is valid. This can often be very challenging because it requires ignoring surface details and instead uncovering a structural match between what may seem like very distant and unrelated domains of information. Most individuals however are inclined to find matches on the surface of information instead of its structural properties and often bypass information that seems unrelated on the surface. A mindset of distrust is beneficial in these areas because it disposes individuals to use their knowledge in different and non-routine ways. It improves the capacity to think abstractly and

enables flexibility in processing information, reconfiguring concepts and overcoming contextual barriers to make retrieval, analogical mapping and knowledge transfer more likely.

Distrust may serve as a critical "processing influence" on problem solving. Despite that it has yet to be studied it nonetheless has great potential for adding to our understanding. In particular, (a) distrust may serve a role in enhancing critical inquiry and using knowledge in more flexible ways to restructure concepts, increase retrieval of prior knowledge, and enhance analogical mapping (H1), (b) distrust may promote knowledge transfer by encouraging a stronger focus to structural properties as opposed to superficial details (H2), and (c) distrust promotes knowledge transfer by reconfiguring information found in "source" and "target" matches, increasing retrieval of prior knowledge, and in turn making "far transfer" applications of knowledge more likely (H3). I examine these arguments in three different studies of knowledge transfer, using tests of analogical problem solving.

Chapter 2

EXAMINING THE EFFECT OF DISTRUST ON KNOWLEDGE TRANSFER

STUDY 1

Study 1 was designed to investigate how implicit impressions of distrust affect a participant's capacity to solve an analogical transfer problem (see Appendix A-E for problem sets). I predicted that participants in a distrustful mindset, relative to a neutral or trust mindset, would more accurately solve an analog problem case, when provided with an initial solved analog case.

METHOD

Participants and Design

Participants were individuals from the United States who volunteered through a paid advertisement on Amazon Mechanical Turk (48% males, mean age of 29 years). The experiment had a 3 (distrust, trust, control mindset) x 1 (analogy problem) mixed design. Participants were paid $1.50 for their participation.

Experimental procedure

Upon giving study consent, participants were told that they would answer questions related to stories that they would be reading. Participants were randomly assigned to one of three priming conditions: distrust, trust, or neutral. Priming research is concerned with temporarily activating the internal mental states that mediate psychological processes (how people think, feel, behave differently than otherwise) in a passive and hidden manner (Bargh & Chartrand, 2000). This type of research focuses on the activating social knowledge structures without participants being aware of or attending to such influences (Bargh & Chartrand, 2000).

I manipulated distrust in a pure fashion ("mere state of distrust"; Schul et al., 2004, p. 669) that does not simultaneously involve additional social factors, such as, for example, decreased liking of a specific target. I also choose to manipulate distrust in a

subtle way because of the assumption that distrust is often automatically and implicitly prompted by external forces and is often outside peoples' awareness that they are using a distrusting mindset when processing information (Schul et al., 2004, 2007). To prime the distrust mindset outside of participants' awareness, I used a scrambled sentences task. The scrambled sentences task is a common priming procedure that gets widely used for concept activation in an unobtrusive manner (Bargh & Chartrand, 2000). Generally, priming stimuli in a scrambled sentences task are selected by consulting a thesaurus for close synonyms of the intended priming concept (Bargh & Chartrand, 2000). I used a pre-existing scrambled sentences task adapted from a past study that investigated the concepts of distrust, trust, and neutral on psychological behavior (conducted by Friesen & Sinclair, 2011) across all three studies. Instructions to the scrambled sentences priming task explicitly stated that, in each trial, five words would be presented in random order. Four out of the five words could form a meaningful sentence. Participants were asked to quickly form the correct sentence and to type it into the computer. Fifteen out of a total of 30 trials were identical for all three conditions. These trials did not contain prime words and were chosen to be unrelated to distrust and trust. In the control condition, the same was true for the remaining fifteen trials. In the distrust and the trust conditions, the remaining trials contained prime words closely related to distrust and trust, respectively. Appendix F shows examples of words that participants were primed with when performing the descrambling word exercise. Appendix G shows examples of the word fragments related to distrust that participants completed as a mindset priming manipulation check.

Dependent measure:

Next, participants read a source case analog that contained the convergence principle solution embedded in its text (adapted from Gick and Holyoak, 1983). The source

analog was *The General* (see Appendix A). To ensure encoding, participants were instructed to generate the critical insight to *The General*. The target problem used at test was the *Radiation* problem developed by Duncker (1945) (see Appendix B). At test, participants attempted the *Radiation* problem. At the conclusion of the study, a manipulation check of the priming procedure assessed whether participants were aware of the primes.

Manipulation check:

Differences in the completion of the word stems associated with distrust were counted and analyzed for significance among the mindset priming techniques, using GLM binary logistic regression. Diagnostic tests of the residuals revealed a normal distribution. A one-way between subjects ANOVA was conducted to compare the distrust mindset accessibility measure for distrust, neutral and trust mindset conditions. There was a significant effect of mindset on completion of the word stems having to do with words related to distrust at the $p<.05$ level for the three conditions [$F(2, 179) = 6.40$, $p = 0.001$]. Post hoc comparisons using the Tukey HSD test indicated that the mean score for the distrust condition ($M = 2.88$, $SD = .82$) was significantly different than the trust condition ($M = 2.24$, $SD = 1.03$) and the neutral condition ($M = 2.48$, $SD = 1.00$). However, the neutral condition and trust condition did not significantly differ from each other. Taken together, these results suggest that the distrust prime successfully activated the concept of distrust. Appendix G shows examples of the word fragments related to distrust that participants completed as a mindset priming manipulation check.

Scoring.

Two raters blind to condition scored whether each response solved the *Radiation* problem in terms of the convergence solution and discussed borderline cases with another rater to produce an agreed-upon scoring. The level of inter-rater agreement

was 98%. When more than one solution was written, participants were credited with the correct answer if it was among the proposed solutions. As in previous research using the convergence materials, a response was scored as a convergence solution if it captured the principle of a multiplicity of low-intensity rays acting in concert on the tumor. Solutions involving repetition over time rather than in parallel were not counted as convergence solutions. Responses such as "use a lot of low-intensity rays"—for which the application of rays at the same time and to the same area is only implied—were accepted (rejecting them produced a small overall reduction in solution rates that was evenly balanced across conditions).

RESULTS:

A chi-square test was performed and no relationship was found between distrust, trust, and a neutral mindset on analogical problem solving, x^2 (2, N = 89) = .088, p =.957.

Discussion

The results of Study 1 showed that individuals who experienced a subtle priming of distrust, trust, or a neutral mindset did not differ in their capacity to solve an analogous case. Although, the priming manipulation check indicated that the manipulation technique had been effective in putting individuals into a particular mindset, one reason participants may not have benefited from being in a distrustful mindset was because they had not encoded knowledge from the initial case well enough. Therefore, in Study 2, participants were given two analog cases, before attempting to solve the *Radiation* problem. Additionally, it was of value to see if participants could detect that the inclusion of a case (with surface similarity to the *Radiation* case) would be irrelevant and ineffective to solving the *Radiation* problem.

Chapter 3

EXAMINING THE EFFECT OF DISTRUST ON IRRELEVANT INFORMATION AND KNOWLEDGE TRANSFER

STUDY 2

Study 2 was designed to investigate how implicit impressions of distrust affect a participant's capacity to solve an analogical transfer problem (see Appendix A-F for problem sets). I predicted that participants in a distrustful mindset relative to a neutral mindset, would more accurately solve an analogous problem case. Participants were provided with the General case, as well as an additional solved analog case and a third case bearing superficial similarity to the Radiation problem, though not structurally similar.

METHOD

Participants and Design

Participants were individuals from the United States who volunteered through a paid advertisement on Amazon Mechanical Turk (46% males, mean age of 31 years). The experiment had a 2 (distrust, neutral mindset) x 1 (analogy problem) mixed design. Participants were paid $1.50 for their participation.

Experimental procedure

Upon giving study consent, participants were told that they would answer questions related to stories that they would be reading. Next, participants read the source analog case *The General* (see Appendix A). As in study 1, participants were instructed to generate the critical insight to *The General*, to ensure encoding of the convergence principle. Next, participants were randomly assigned to one of two priming conditions: distrust or neutral mindset. The same scrambled sentencing task was used from study 1 to prime participants' mindsets into either of these states.

Next, participants read two cases with solutions provided at the end of each case. Participants read *Mount Sinai* (see Appendix C), a case with superficial similarity to the *Radiation* problem, in that it was related to the medical domain, yet was non-analogous to the *Radiation* problem because it did not contain a convergence principle solution. The other case, titled *Red Adair* (see Appendix D)(Gick and Holyoak, 1983), utilized the convergence principle in its problem solution. These cases were presented in counter-balanced order. Participants were given the option to write notes about the cases.

Dependent measure:

The target problem used at test was the *Radiation* problem (see Appendix B) (Duncker, 1945). At the conclusion of the study, a manipulation check of the priming procedure assessed whether participants were aware of the primes.

Manipulation check:

Differences in the completion of the word stems associated with distrust were counted and analyzed for significance among the mindset priming techniques, using GLM binary logistic regression. Diagnostic tests of the residuals revealed a normal distribution. Regarding the distrust mindset accessibility measure, distrust-prime participants (M=3.19, SD =1.60) completed the word stems with more words having to do with distrust than neutral-prime participants (M=2.59, SD=1.04), t (124) =2.40, p =.018, suggesting that the distrust prime successfully activated the concept of distrust.

Scoring

Two raters blind to condition scored whether each response solved the *Radiation* problem in terms of the convergence solution and discussed borderline cases with another rater to produce an agreed-upon scoring. The level of inter-rater agreement was 97%.

RESULTS

A chi-square test was performed and no relationship was found between distrust and a neutral mindset on analogical problem solving, x^2 (1, N = 51) = .013, p =.910.

Discussion

The results of Study 2 showed that individuals who experienced a subtle priming of distrust or a neutral mindset did not differ on their capacity to solve an analogous case. Also, neither group borrowed information from the *Mount Sinai* case, suggesting that participants had some indication that it was of little help to solving the *Radiation* problem. Though, the manipulation check indicated that priming technique had been effective in putting individuals into a particular mindset, one reason participants may not have benefited from being in a distrustful mindset was because they had still not encoded knowledge from the initial case well enough. Therefore, in Study 3, participants were given three analog cases, before attempting to solve the *Radiation* problem, 4 days later.

Chapter 4

EXAMINING THE EFFECT OF DISTRUST ON FAR KNOWLEDGE TRANSFER

STUDY 3

Study 3 was designed to investigate how implicit impressions of distrust affect a participant's capacity to solve an analogical transfer problem in a test of far transfer (see Appendix A-D for problem sets). I predicted that participants in a distrustful mindset, relative to a neutral mindset, would more accurately solve an analog problem case, when provided with three initial solved analog cases.

METHOD

Participants and Design

Participants were individuals from the United States who volunteered through a paid advertisement on Amazon Mechanical Turk (51% males, mean age of 28 years). The experiment had a 2 (distrust, neutral mindset) x 1 (analogy problem) mixed design. Participants were paid $1.50 for their participation.

Experimental procedure

Upon giving study consent, participants were told that they would answer questions related to stories that they would be reading. Next, participants read three analog cases *The General*, *Red Adair* and *The Aquarium*, (Gick & Holyoak,1983; see Appendix A,D,E). *The General* and *Red Adair* utilized the convergence principle solution, which was embedded in each case. Participants were instructed to generate the critical insight to *The General* and *Red Adair*. Additionally, after reading the third case, *The Aquarium*, participants were told that the solution to this problem utilized the same solution principle found in *The General* and *Red Adair*. Thus, participants were asked to generate a solution to *The Aquarium* using the critical insight found in the other cases, to ensure encoding of the convergence principle. Four days later, participants were sent an email link to complete the study. Participants were randomly

assigned to one of two priming conditions: distrust or neutral mindset. The same scrambled sentencing task was used from study 1 to prime participants' mindsets into either of these states.

Dependent measure

The target problem used at test was the *Radiation* problem (Duncker, 1945). At the conclusion of the study, a manipulation check of the priming procedure assessed whether participants were aware of the primes.

Manipulation check

Differences in the completion of the word stems associated with distrust were counted and analyzed for significance among the mindset priming techniques, using GLM binary logistic regression. Diagnostic tests of the residuals revealed a normal distribution. Regarding the distrust mindset accessibility measure, distrust-prime participants (M=3.38, SD =1.45) completed the word stems with more words having to do with distrust than neutral-prime participants (M=2.59, SD=1.04), t (136) =3.47, p =.001, suggesting that the distrust prime successfully activated the concept of distrust.

Scoring

Two raters blind to condition scored whether each response solved the *Radiation* problem in terms of the convergence solution and discussed borderline cases with another rater to produce an agreed-upon scoring. The level of inter-rater agreement was 98%.

RESULTS

A chi-square test was performed and no relationship was found between distrust and a neutral mindset on analogical problem solving, x^2 (1, N = 52) = 1.56, p =.211.

Discussion

The results of Study 3 showed that individuals who experienced a subtle priming of a distrust or neutral mindset did not differ on their capacity to solve an analogous case.

Though, the manipulation check indicated that priming technique had been effective in putting individuals into a particular mindset, it is possible that the priming technique was not strong enough to bring about the desired effects of distrust in participants. A discussion about theoretical and methodological issues is presented in greater detail in the General Discussion section.

Chapter 5

GENERAL DISCUSSION

Competition in a global marketplace, technological advances, changing demographics, and the speed of information transfer are just some of the influences that make "change inevitable." Uncertainty about the future can naturally press leaders to reconsider their organization's strategic agenda and influence decisions on pivotal issues. In recent times, it has been argued that uncertainty possesses an upside; it can increase innovation through the psychological mindsets of distrust and doubt (Teece, 2007; Kramer, 2002; Lewicki, McAllister, & Bies, 1998). Distrust can been argued to be an important mediating factor in the uncertainty-innovation relationship because it shifts attention and heightens awareness of existing assumptions. Yet, because there is an inherent level of discomfort associated with uncertainty, it is often assumed that distrust in existing processes is a negative state of mind. The purpose of this research was to test whether a mindset of distrust has negative or positive influences on using knowledge adaptively.

In recent times, more attention in the management and educational psychology literature has been devoted to understanding how and why creative potential is not being achieved despite the pressing need for innovative thinking and the capacity to transfer knowledge more adaptively. Scholars have argued that creativity and the capacity to think adaptively does not thrive, unless variability and *cognitive incongruity* is introduced (Hatano & Inagaki, 1992). It has been recommended that experts should continuously try new applications of their knowledge and question the tacit underpinnings of their knowledge, to engage the creative process. More recent research has demonstrated that distrust serves as a processing influence that enables individuals to think more flexibly and creatively (Mayer & Mussweiler, 2011). Other research has found a positive link between abstract thinking and knowledge transfer

(Day & Goldstone, 2012). The goal of the current research was to investigate whether distrust effects the capacity of individuals to process information in more flexible ways, leading to an increased use of knowledge transfer.

In the three studies presented here I did not find support for my hypotheses. While the manipulation checks appeared to reflect that the priming technique had induced the intended mindsets of interest, the level of knowledge transfer that took place across between the treatment and control conditions was essentially equivalent across the studies.

THEORETICAL IMPLICATIONS

The results to these studies do not support the idea that distrust improves knowledge transfer. Recent research in psychology has examined distrust on measures of creativity, abstract thinking, and judgment. The current work leveraged previous findings that distrust has on cognitive flexibility and incorporated analogical problem solving as the primary test of knowledge transfer because this form of problem solving requires a flexible mindset to re-represent and map conceptual properties found between "source" and "target" components. It was anticipated that distrust would facilitate an information processing advantage in which information would be interpreted and applied in more flexible ways, leading to a more effective mapping process.

It is possible that the relationship between distrust and knowledge transfer did not reveal itself in the current set of studies for a number of methodical reasons. First, the tests to these studies were carried out online using Amazon Mechanical Turk, rather than taking place in a physical laboratory space where the experimenter could visually monitor the behavior of the participants. While Amazon Mechanical Turk is becoming a popular tool for collecting data, it is valuable to replicate studies conducted on Mechanical Turk using the traditional laboratory method as well, as one

cannot always be confident that participants will complete experimental procedures as they would in a laboratory setting (such as, without distractions or self-generated interruptions, which could influence the results to the study). Secondly, the current set of studies used a single type of priming procedure despite that there could be other ways to prime distrust in participants (Mussweiler & Mayer, 2011). It is not possible to know whether the procedure used in the current studies developed a sense of distrust in participants as saliently or powerfully as it potentially could. For example, having participants experience an act of distrust prior to completing the transfer task may bring out a more powerful influence on their cognition, which subsequently would reveal itself during test trials. In the future, it would be valuable to develop other priming methods of distrust to get at this issue and examine how different levels of distrust may have different effects on cognition. Third, it became apparent by study 3 that participants benefited by learning of the convergence principle through multiple examples. Therefore, the transfer task may have been challenging for participants because the convergence principle was still somewhat novel to them. Other work has demonstrated the importance of schema richness on analogical transfer and that gaining expertise of a concept helps individuals considerably improve their performance on knowledge transfer tasks, where contextual details have changed (Catrambone & Holyoak, 1989). Therefore, in future work, it is of value to examine the effect of distrust on a group of participants who share a baseline level of expertise with a task or skill. This will remove the complication of learning error and permit a stable foundation in which it will be easier to assess the effect that distrust has on transfer.

If the relationship between distrust and transfer is re-retested with some of these methodological considerations, perhaps the results will show transfer to be enhanced. Alternatively, another account for why distrust may benefit knowledge

transfer may exist with its propensity to drive information seeking. The need to validate and seek truth brings motivational and cognitive benefits that perpetuates learning. Krikelas' (1983) model on information seeking proposes that ''information seeking begins when someone perceives that the current state of knowledge is less than that needed to deal with some issue (or problem). The process ends when that perception no longer exists.'' This statement resonates with theorizing argued by Hatano and Inagaki (1992) that adaptive learning originates with a psychological state of *cognitive incongruity*, which is the belief that one's current understanding and knowledge of a skill is inadequate or insufficient, thus motivating greater information seeking.

It is not far-fetched to see that the need for information seeking should either influence or follow from a distrustful mindset, in which individuals pursue an active learning attitude to fulfill their goals. Past research indicates that transfer is enhanced when learners are actively involved in the learning process. For example, learning and transfer improves when learners compare sources of information (Kourilsky & Wittrock, 1987), when they actively generate solutions to a problem, (Needham & Begg, 1991), and when they engage in self-explanation (Ahn, Brewer, & Mooney, 1992). Research indicates that when learners use meta-cognitive strategies, such as organization, integration, and linking information to prior knowledge, transfer improves (Mayer, 1987). There appears to be a theoretical connection between distrust and active learning and the use of cognitive and motivational strategies toward the achievement of knowledge transfer. The present set of studies did not capture these variables of interest, though it seems relevant that strategies of this sort would mediate the learning processes taking place between distrust and knowledge transfer. In line with these considerations, developing the current theoretical framework to further specify mediating and moderating variables that strengthen the relationship

between distrust and knowledge transfer will prove valuable. For example, prior research has found the variable of timing to moderate important outcomes in stages of learning and creativity. It may be critical to develop a high enough level of expertise before a mindset of distrust is engaged.

Additionally, although I intended my manipulation technique of distrust to trigger an automatic mechanism for reconstructing knowledge, in reality it may not work so neatly. A mindset of distrust may naturally make information more flexible, yet the capacity to reconstruct information and organize it effectively for transfer may require additional skill. It is not clear whether people have a disposition for using distrust to problem-solve (trait position) or whether a distrustful mindset is developed as a skill or learned practice. This has implications for theorizing about distrust with regard to the variety of opinions and debates in different fields that exist on how and why people use knowledge more effectively in some situations than in others and why some people seem better at using their knowledge more adaptively than others. For example, much of the literature in educational psychology would liken distrust to critical thinking, which is a learned skill and used specifically for evaluating information. The argument of this camp is that any person is capable of using distrust to their benefit, however, because distrust is a skill, it requires practice and a set of strategies for its use. In contrast, scholars in applied psychology tend to take a trait perspective, and regard adaptive thinkers as individuals who likely have superior working memory skills and thus have an innate ability to manipulate information. According to this view, only certain people will ever be good at using distrust to their advantage.

PRACTICAL IMPLICATIONS

The propensity for distrust to influence learning and creativity has important implications for organizations. The stress of shift and change in organizations often

conjures up thoughts of doubt and uncertainty for employees. The threat of not knowing whether one's skills and abilities will still be relevant when changes go into effect, leaves employees questioning and reflecting on how they can use their skills more adaptively and successfully when existing organizational processes, jobs, and personnel change. To date, the most common response to employees who experience feelings of doubt when change is taking place is to ignore them. Leaders tend to focus on communicating the changes that will be taking place, which is a good thing, but overlook the psychological effect and reactions that change is having on employees. However, if a mindset of distrust is influencing employees to adapt their skills and facilitating serious consideration toward understanding how to use knowledge in different ways, such as, how one might do their job better when change takes place, then perhaps distrust is a valuable psychological state that prompts learning and development. Perhaps, management would benefit by investigating how distrust influences employee performance, not only from a motivational standpoint, but also from a cognitive, knowledge assessment perspective.

In addition to examining the effect of distrust on knowledge transfer at the individual level of analysis, future work should examine how distrust can be constructively developed and facilitated at the group and organizational level (Lewicki, et. al., 1998). In particular, it is relevant to understand the role that leaders play in managing impressions of distrust in group members and the effect this has on the type of knowledge that is exchanged. For example, although a mindset of distrust often connotes negativity in the academic literature, historically, organizations have been shown to develop a propensity for survival and innovation through cultures and learning climates founded on openness to change.

On a related note, much of past research on creativity has revealed that creativity is a risk-taking endeavor (Mayer & Mussweiler, 2011), which suggests that

individuals who possess distrusting mindsets may be less likely to speak up about their ideas because there could exist a penalty for deviating from "routine" ways of doing things. Therefore, leadership may largely play a role in creating a trusting environment, so that the context is a safe one for engaging in distrustful thinking. It is of value to know the leader strategies and tactics and/or leader behaviors and styles that encourage and promote the benefits of distrust in the work environment.

APPENDIX A

The General:

Instructions: Please read the following story carefully. Make sure you are familiar enough with it so that you could retell it in your own words. You may use the space below to summarize key points.

A small country was ruled from a strong fortress by a dictator. The fortress was situated in the middle of the country, surrounded by farms and villages. Many roads led to the fortress through the countryside. A rebel general vowed to capture the fortress. The general knew that an attack by his entire army would capture the fortress. He gathered his army at the head of one of the roads, ready to launch a full-scale direct attack. However, the general then learned that the dictator had planted mines on each of the roads. The mines were set so that small bodies of men could pass over them safely, since the dictator needed to move his own troops and workers to and from the fortress. However, any large force would detonate the mines. Not only would this blow up the road, but it would also destroy many neighboring villages. It seemed impossible to capture the fortress. However, the general devised a simple plan. He divided his army into small groups and dispatched each group to the head of a different road. When all was ready, he gave the signal and each group marched down a different road. Each group continued down its road to the fortress, so that the entire army arrived together at the fortress at the same time. In this way, the general captured the fortress and overthrew the dictator.

What critical insight allowed the problem in the story to be solved?

APPENDIX B

Radiation Problem:

Suppose you are a doctor faced with a patient who has a malignant tumor in his stomach. To operate on the patient is impossible, but unless the tumor is destroyed, the patient will die. A kind of ray, at a sufficiently high intensity, can destroy the tumor. Unfortunately, at this intensity the healthy tissue that the rays pass through on the way to the tumor will also be destroyed. At lower intensities the rays are harmless to healthy tissue, but will not affect the tumor. How can the rays be used to destroy the tumor without injuring the healthy tissue?

APPENDIX C

Mount Sinai:

Instructions: Please read the following story carefully. Make sure you are familiar enough with it so that you could retell it in your own words. You may use the space below to summarize key points.

The Mount Sinai Medical clinic is well known for helping patients who suffer from trauma injuries. In fact, many of today's trauma saving techniques were invented by physicians of the clinic. For example, the clinic performed one of the first treatment cases of thermal trauma, where intravenous fluids were given to a person who had an inadequate flow of blood to tissue. This practice has been beneficial in cases of isolated trauma or head injuries. They also found that if blood products are needed, a greater use of fresh frozen plasma and platelets to packed red blood cells can result in improved survival. The success of platelets has been attributed to the fact that they can prevent blood clotting disorder from developing. This is just one example of why Mount Sinai continues to annually win medical practice awards and receive substantial amounts of donations every year for improving the survival rates of trauma victims.

APPENDIX D

Red Adair:

Instructions: Please read the following story carefully. Make sure you are familiar enough with it so that you could retell it in your own words. You may use the space below to summarize key points.

An oil well in Saudi Arabia exploded and caught fire. The result was a blazing inferno that consumed an enormous quantity of oil each day. After initial efforts to extinguish it failed, famed firefighter Red Adair was called in. Red knew that the fire could be put out if a huge amount of fire retardant foam could be dumped on the base of the well. There was enough foam available at the site to do the job. However, there was no hose large enough to put all the foam on the fire fast enough. The small hoses that were available could not shoot the foam quickly enough to do any good. Red Adair knew just what to do. He stationed men in a circle all around the fire, with all of the available small hoses. When everyone was ready, all the hoses were opened up and the foam was directed at the fire from all directions. In this way a huge amount of foam quickly struck the source of the fire. The blaze was extinguished.

APPENDIX E

The Aquarium:

Instructions: Please read the following story carefully. Make sure you are familiar enough with it so that you could retell it in your own words. You may use the space below to summarize key points.

A major aquarium in a city on the East Coast decided to create a large aquarium display containing a replica of the sunken ocean liner the Titanic amid the sea environment of its resting place, which is deep in the Atlantic Ocean off the coast of Newfoundland. A professional aquarium designer was assigned to the project. She placed a small replica of the vessel in the center of a large tank, with a realistic sea bed. Then she added to the tank sea plants and fish of the sort that live in the Atlantic at the depth of the sunken Titanic. The display was virtually finished when the designer was confronted with a major problem she had failed to anticipate. In order to maintain the deep-water environment required by the fish and plants, the tank had to be kept quite dark, as the deep-water organisms were not adapted to light. However, if the tank was kept completely dark, people would not be able to see the small replica of the Titanic in the center of the tank, which, after all, was the main point of the exhibit. Putting lights inside the model of the wreck looked too artificial. The designer considered shining a powerful spotlight on the model of the vessel. However, if the spotlight was located inside the tank, it would raise the temperature of the water too high; and if it was located outside the tank, the bright beam seriously disrupted the feeding habits of some of the fish. So it looked like the display was going to have an embarrassing shortcoming.

What could be done to light the display? Write your solution below. Remember to use the same principles that were used in the stories you read.

APPENDIX F

Scrambled Sentence Test

Below you will find 30 word-groups consisting of five words each. Your task is to create **one** grammatically correct sentence for each group, using **four** out of the five words. For example, for the word group: ran outside talked today he there are several possible four-word sentences you could create from these five words. Some examples:

He talked outside today. He ran outside today. Today, he ran outside.

Any **one** of the above sentences would be an appropriate answer. Do not spend too much time on any one word-group, but complete the task as quickly as possible. Remember, you only need one sentence per word-group.

he trusts her others quickly	_____
cars dogs increase noise immediately	_____
they are feel mostly trusted	_____
he sings runs with strength	_____
she will believe easily tomorrow	_____
talk run to her quickly	_____
the truth is long remembered	_____
usually they eat well never	_____
he speaks sincerely there today	_____
light turn on switch the	_____
she depended on them occasion	_____
people stores are usually downtown	_____
they appeared unsuspicious today usually	_____
trains run stop at four	_____
he looked spoke with certainty	_____
birds airplanes fly sky high	_____
she will disclose it books	_____
calculate write large numbers slowly	_____
be trustworthy around others him	_____
write letters on paper hands	_____
we support you today usually	_____
he eventually normally brings food	_____
they mostly usually have integrity	_____
she was waiting running there	_____
he saw met their honesty	_____
they slept fell inside there	_____

she made them us safe _____

take pictures bark of trees _____

he can should trust others _____

never always eat the onion _____

APPENDIX G

Scrambled Sentence Test

Below you will find 30 word-groups consisting of five words each. Your task is to create **one** grammatically correct sentence for each group, using **four** out of the five words. For example, for the word group: ran outside talked today he there are several possible four-word sentences you could create from these five words. Some examples:

He talked outside today. He ran outside today. Today, he ran outside.

Any **one** of the above sentences would be an appropriate answer. Do not spend too much time on any one word-group, but complete the task as quickly as possible. Remember, you only need one sentence per word-group.

he distrusts her others quickly	_____
cars dogs increase noise immediately	_____
they are feel mostly mistrusted	_____
he sings runs with strength	_____
she will disbelieve easily tomorrow	_____
talk run to her quickly	_____
the lie is long remembered	_____
usually they eat well never	_____
he speaks hypocritically there today	_____
light turn on switch the	_____
she cheated on them occasion	_____
people stores are usually downtown	_____
they appeared suspicious today usually	_____
trains run stop at four	_____
he looked spoke with uncertainty	_____
birds airplanes fly sky high	_____
she will conceal it books	_____
calculate write large numbers slowly	_____
be skeptical around others him	_____
write letters on paper hands	_____
we suspect you today usually	_____
he eventually normally brings food	_____
they mostly usually have doubt	_____

she was waiting running there
he saw met their dishonesty
they slept fell inside there
she made them us wary
take pictures bark of trees
he can should mislead others
never always eat the onion

APPENDIX H

Scrambled Sentence Test

Below you will find 30 word-groups consisting of five words each. Your task is to create **one** grammatically correct sentence for each group, using **four** out of the five words. For example, for the word group: *ran outside talked today he* there are several possible four-word sentences you could create from these five words. Some examples:

He talked outside today. He ran outside today. Today, he ran outside.

Any **one** of the above sentences would be an appropriate answer. Do not spend too much time on any one word-group, but complete the task as quickly as possible. Remember, you only need one sentence per word-group.

he exercises her others quickly	_____
cars dogs increase noise immediately	_____
they are feel mostly soft	_____
he sings runs with strength	_____
she will see easily tomorrow	_____
talk run to her quickly	_____
the road is long remembered	_____
usually they eat well never	_____
he speaks rarely there today	_____
light turn on switch the	_____
she practiced on them occasion	_____
people stores are usually downtown	_____
they appeared normal today usually	_____
trains run stop at four	_____
he looked spoke with interest	_____
birds airplanes fly sky high	_____
she will send it books	_____
calculate write large numbers slowly	_____
be crowded around others him	_____
write letters on paper hands	_____
we lift you today usually	_____
he eventually normally brings food	_____
they mostly usually have desks	_____

she was waiting running there _____
he saw met their driver _____
they slept fell inside there _____
she made them us sandwiches _____
take pictures bark of trees _____
he can should touch others _____
never always eat the onion _____

APPENDIX I

DISTRUST MINDSET MANIPULATION CHECK

For the following words, please fill in the blanks by writing the word on the line.

(Example: p_n_il = pencil)

1	w a _	
2	f _ m _	
3	d i s t _ _ _ _	distrust
4	l i _	lie
5	b _ _ k	
6	d o u _ _	doubt
7	r _ p e	
8	f o _ e _ t	
9	c h e _ _	cheat/check
10	_ _ o n	
11	t r i _ _	trick
12	c r _ _ l	
13	p r _ _ _	prove/proof
14	d e c _ _ _ _	deceive
15	i n _ _ r e	
16	s u s p _ _ _	suspect
17	p r _ _ e	
18	s p e a _	
19	p h _ _ e	
20	r _ d e	

FIGURE 1
STUDY 1 RESULTS

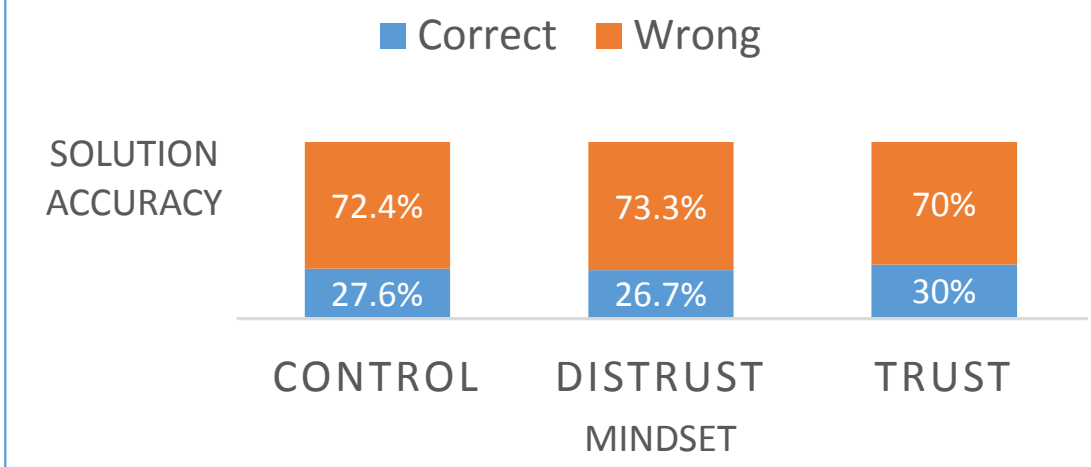


FIGURE 2
STUDY 2 RESULTS

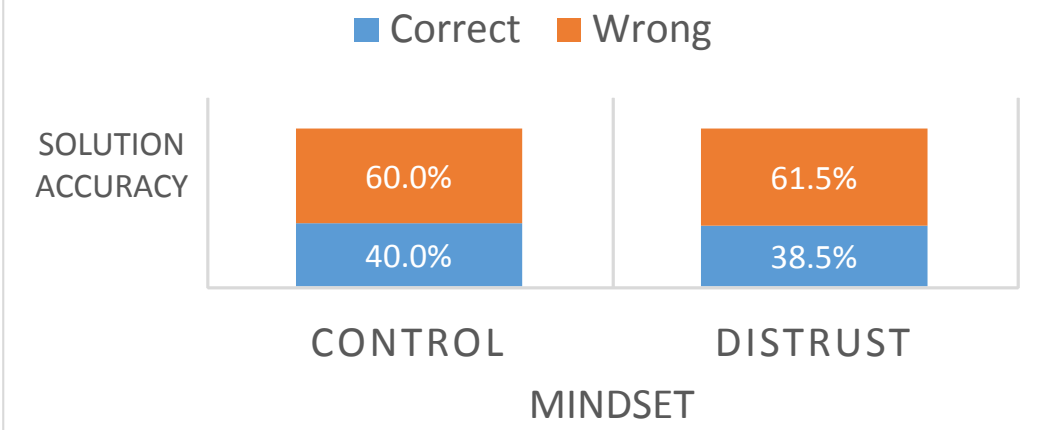
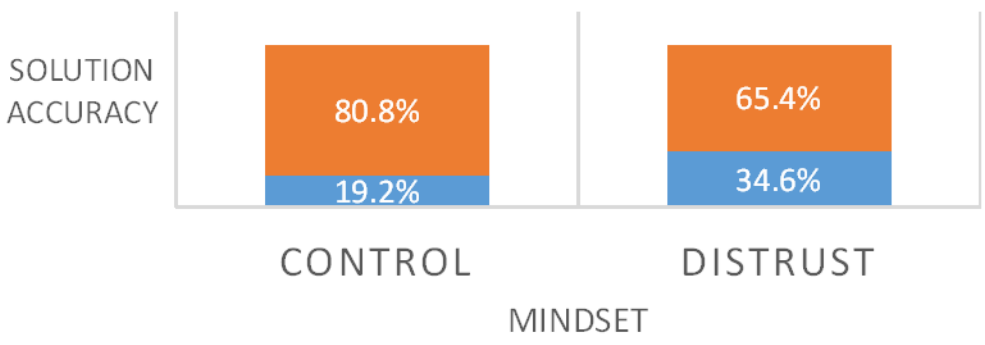


FIGURE 3
STUDY 3 RESULTS



REFERENCES

Ahn, W., Brewer, W. F., & Mooney, R. J. (1992). Schema acquisition from a single example. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 18,* 391-412

Anderson, J. R., Farrell, R., & Sauers, R. (1984). Learning to program in LISP. *Cognitive Science, 8*, 87–129.

Anolli, L., Antonietti, A., Crisafulli, L., & Cantoia, M. (2001). Accessing source information in analogical problem-solving. *The Quarterly Journal of Experimental Psychology Section A, 54*, 237–261.

Argyris, C., & Schön, D. A. (1978). *Organizational learning*. Reading, MA: Addison-Wesley.

Bargh, J.A. & Chartrand, T.L., (2000). The mind in the middle: A practical guide to priming and automaticity research. In H.T. Reis and C.M. Judd (Eds.), Handbook of research methods in social and personality psychology, New York: Cambridge University Press.

Bereby-Meyer, Y., & Kaplan, A. (2005).Motivational influences on transfer of problem-solving strategies. *Contemporary Educational Psychology, 30*, 1–22.

Bereby-Meyer, Y., Moran, S., & Unger-Aviram, E. (2004). When performance goals deter performance: Transfer of skills in integrative negotiations. *Organizational Behavior and Human Decision Processes, 93*, 142–154.

Bliznashki, S., & Kokinov, B. (2010). Relational versus attributional mode of problem solving? *Proceedings of the Thirty-Second Annual Conference of the Cognitive Science Society* (pp. 465–470). Portland, OR: Cognitive Science Society.

Bransford, J. D, & Vye, N. (2008). District reform and the learning sciences: Issues and opportunities. *American Journal of Education, 114*(4), 665–672.

Catrambone, R., & Holyoak, K. J. (1989). Overcoming contextual limitations on

problem-solving transfer. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *15*, 1147–1156.

Chi, M. T. H. (2000). Self-explaining expository texts: The dual processes of generating inferences and repairing mental models. In R. Glaser (Ed.), *Advances in instructional psychology* (pp. 161–238). Mahwah, NJ: Erlbaum.

Chi, M. T. H., Bassok, M., Lewis, M. W., Reimann, P., & Glaser, R. (1989). Self-explanations: How students study and use examples in learning to solve problems. *Cognitive Science*, *13*, 145–182.

Clement, J. (1988). Observed methods for generating analogies in scientific problem solving. *Cognitive Science*, *12*, 563–586.

Clement, C. A., Mawby, R.,& Giles,D. E. (1994). The effects of manifest relational similarity on analog retrieval. *Journal of Memory and Language*, *33*, 396–420.

Cosmides, L., & Tooby, J. (2005). Neurocognitve adaptations designed for social exchange. In Dunbar, K. B., I. (2001). The in vivo/in vitro approach to cognition: the case of analogy. *Trends in Cognitive Sciences*, *5*, 334–339.

Day, S. B., & Goldstone, R. L. (2012). The import of knowledge export: Connecting findings and theories of transfer of learning. *Educational Psychologist, 47* , 153-176.

Duncker, K. (1945). On problem-solving. *Psychological Monographs*, *58*, i-113.

Elliot, A. J. (1999). Approach and avoidance motivation and achievement goals. *Educational Psychologist*, *34*, 169–189.

Fein, S. (1996). Effects of suspicion on attributional thinking and the correspondence bias. *Journal of Personality and Social Psychology***,** *70*, 1164– 1184.

Fein, S., Hilton, J. L., & Miller, D. T. (1990). Suspicion of ulterior motivation and correspondence bias. *Journal of Personality and Social Psychology*, *58*, 753–764.

Fein, S., McCloskey, A. L., & Tomlinson, T. M. (1997). Can the jury disregard that information? The use of suspicion to reduce the prejudicial effects of pretrial and inadmissible testimony. *Personality and Social Psychology Bulletin, 23,* 1215– 1226.

Ferguson, R.W. (1994). MAGI: A model of analogy-based encoding using symmetry and regularity. In Proceedings of the Sixteenth Annual Conference on the Cognitive Science Society (pp. 283-288). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Friesen, J., & Sinclair, L. (2011). Distrust and simultaneous activation of multiple categories. *Social Psychological and Personality Science, 2,* 112-119.

Fujita, K., Trope, Y., Liberman, N., & Levin-Sagi, M. (2006). Construal levels and self-control. *Journal of Personality and Social Psychology*, 90, 351-367.

Galinsky, A. D., & Moskowitz, G. B. (2000). Counterfactuals as behavioral primes: Priming the simulation heuristic and consideration of alternatives. *Journal of Experimental Social Psychology, 36,* 384– 409.

Gentner, D. (1983). Structure-mapping: A theoretical framework for analogy. *Cognitive Science, 7,* 155–170.

Gentner, D., & Colhoun, J. (2010). Analogical processes in human thinking and learning. In B. Glatzeder, V. Goel, & A. von Maller (Vol. Eds.), *On Thinking: Vol. 2. Towards a Theory of Thinking,* pp 35-48. Berlin: Springer-Verlag.

Gentner, D., Rattermann, M. J., & Forbus, K. D. (1993). The roles of similarity in transfer: Separating retrievability from inferential soundness. *Cognitive Psychology, 25,* 524–575.

Getzels, J. W. (1979). Problem-Finding and Research in Educational Administration. In G. Immegart & W.L. Boyd (eds.*), Problem-finding in educational administration: Trends in research and theory.* Canada: DC Heath & Co.

Gick,M. L.,&Holyoak,K. J. (1980).Analogical problem solving. *Cognitive Psychology*, *12*, 306–355.

Gick, M. L., & Holyoak, K. J. (1983). Schema induction and analogical transfer. *Cognitive Psychology*, *15*, 1–38.

Grove, A.S. (1996). *Only the Paranoid Survive*. Doubleday

Hatano, G.,& Inagaki, K. (1986). Two courses of expertise. In H. Stevenson, H. Azuma,& K. Hakuta (Eds). *Child development and education in Japan* (pp. 262–272). New York, NY: Freeman.

Hatano G., & Inagaki, K. (1992). Desituating cognition through the construction of conceptual knowledge. In P. Light & G. Butterworth (Eds.), *Context and Cognition*: *Ways of knowing and learning*. (pp. 115-133). New York: Harvester.

Hilton, J. L., Fein, S., & Miller, D. T. (1993). Suspicion and dispositional inference. *Personality and Social Psychology Bulletin*, *19*, 501– 512.

Isen, A. M., & Daubman, K. A. (1984). The influence of affect on categorization. *Journal of Personality and Social Psychology***,** *47*, 1206– 1217.

Kourilsky, M., & Wittrock, M. C. (1987). Verbal and graphical strategies in the teaching of economics. *Teaching and Teacher Education,* 3, 1-12.

Kramer, R. M. (1998). Paranoid cognition in social systems: Thinking and acting in the shadow of doubt. *Personality and Social Psychology Review, 2*, 251– 275.

Kramer, R. M. (1999). Trust and distrust in organization: Emerging perspectives, enduring questions. Annual Review in Psychology, 50, 60–98.

Kramer, R. (2002) When paranoia makes sense. Harvard Business Review. vol. 80, no. 7, pp. 62–69.

Krikelas, J. (1983). Information seeking behaviour: Patterns and concepts. *Drexel Library Quarterly*, **19**(2), 5-20.

Lewicki, R., McAllister, D., & Bies, R. (1998). Trust and distrust: new relationships and realities. Academy of Management Review, 23(8), 438–458.

Lockhart, R. S., Lamon, M., & Gick, M. L. (1988). Conceptual transfer in simple insight problems. *Memory & Cognition*, *16*, 36–44.

Mayer, R.E. (1987). *Educational psychology: A cognitive approach.* Boston: Little, Brown, p. 214

Mayer, J., Mussweiler, T. (2011). Suspicious spirits, flexible minds: When distrust enhances creativity. Journal of Personality and Social Psychology, 101, 6, 1262-1277.

Mednick, S. A. (1962). The associative basis of the creative process. *Psychological Review, 69*, 220– 232.

Needham, D., & Begg, I. (1991). Problem-oriented training promotes spontaneous analogical transfer: Memory-oriented training promotes memory for training. *Memory and Cognition, 19,* 543–557.

Pea, R. D. (1987). Socializing the knowledge transfer problem. International Journal of Educational Research, 11, 639-663.

Pintrich, P. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. Pintrich & M. Zeidner (Eds.), *Handbook of self regulation* (pp. 452–502). London, UK: Academic.

Perfetto, G. A., Bransford, J. D., &Franks, J. J. (1983). Constraints on access in a problem solving context. *Memory & Cognition*, *11*, 24–31.

Renkl, A. (1997). Learning from worked-out examples: A study on individual differences. *Cognitive Science, 21,* 1-29.

Rosch, E. (1975). Cognitive representation of semantic categories," *Journal of Experimental Psychology 104, 3, 192-233.*

Ross, B. H. (1987). This is like that: The use of earlier problems and the separation of

similarity effects. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *13*, 629–639.

Ross, B. (1989). Remindings in learning and instruction. In S. Vosniadou& A. Ortony (Ed.), *Similarity and analogical reasoning* (pp. 438–469). New York, NY: Cambridge University Press.

Salomon, G., & Perkins, D. N. (1989). Rocky roads to transfer: Rethinking mechanism of a neglected phenomenon. *Educational Psychologist*, *24*, 113–142.

Schul, Y., Burnstein, E., & Bardi, A. (1996). Dealing with deceptions that are difficult to detect: Encoding and judgment as a function of preparing to receive invalid information. Journal of Experimental Social Psychology, 32, 228–253.

Schul, Y., Mayo, R., & Burnstein, E. (2004). Encoding under trust and distrust: The spontaneous activation of incongruent cognitions. Journal of Personality and Social Psychology, 86, 668–679.

Schul, Y., Mayo, R., Burnstein, E., & Yahalom, N. (2007). How people cope with uncertainty due to chance or deception. Journal of Experimental Social Psychology, 43, 91–103.

Schul, Y., Mayo, R., & Burnstein, E. (2008). The value of distrust. *Journal of Experimental Social Psychology*, *44*, 1293– 1302, *12*, 563–586.

Teece, D.J. (2007). "Explicating dynamic capabilities: the nature and microfoundations of sustainable enterprise performance", *Strategic Management Journal*, 28,(13), 1319- 1350.

Weisberg, R. W., DiCamillo, M., & Phillips, D. (1978). Transferring old associations to new problems: Anon-automatic process. *Journal of Verbal Learning & Verbal Behavior*, *17*, 219–228.

Whitehead, A.N. (1929). *The aims of education*. New York, NY: Macmillan.