MIS Quarterly

RESEARCH ARTICLE

MINDFULNESS IN INFORMATION TECHNOLOGY USE: DEFINITIONS, DISTINCTIONS, AND A NEW MEASURE[1]

Jason Bennett Thatcher
Department of Information Systems, Statistics and Management Science, Culverhouse College of Business, University of Alabama, Tuscaloosa, AL 35487 U.S.A. {that@cba.ua.edu}
and Technology, Innovation Management, and Entrepreneurship Research Group, Information Technology University–Copenhagen, Copenhagen, DENMARK {that@itu.dk}

Ryan T. Wright
McIntire School of Commerce, University of Virginia, Charlottesville, VA 22903 U.S.A. {rtwright@virginia.edu}

Heshan Sun
Division of Management Information Systems, Price College of Business, University of Oklahoma, Norman, OK 73019 U.S.A. {sunheshan@gmail.com}

Thomas J. Zagenczyk
Department of Management, College of Business, Clemson University, Clemson, SC 29631 U.S.A. {thomasj@g.clemson.edu}

Richard Klein
Information Systems & Business Analytics, Florida International University, Miami, FL 33199 U.S.A. {rklein@fiu.edu}

Mindfulness is an important emerging topic. Individual mindfulness in IT use has not been studied systematically. Through three programmatic empirical studies, this paper develops a scale for IT mindfulness and tests its utility in the post-adoption system use context. Study 1 develops a measure of IT mindfulness and evaluates its validity and reliability. Study 2 employs a laboratory experiment to examine whether IT mindfulness can be manipulated and whether its influence is consistent across technological contexts. Study 3 places IT mindfulness in a nomological network and tests the construct's utility for predicting more active system use (e.g., trying to innovate and deep structure usage) as well as more automatic system use (e.g., continuance intention). Our primary contribution includes the development and validation of a scale for IT mindfulness. In addition, we demonstrate that IT mindfulness (1) differs from important existing concepts such as cognitive absorption, (2) can be manipulated, (3) more closely relates to active system use than automatic system use, and (4) provides more predictive power within the IS context than general trait mindfulness.

Keywords: Trait mindfulness, IT mindfulness, measures, replication, multidimensional constructs, traits, trying to innovate, deep structure use, continuance intention

[1]Rajiv Kohli was the accepting senior editor for this paper. Andrew Burton-Jones served as the associate editor.

The appendices for this paper are located in the "Online Supplements" section of the *MIS Quarterly*'s website (http://www.misq.org).

Introduction

Mindfulness refers to an individual's continuous scrutiny and refinement of expectations based on new experiences, appreciation of subtleties, and identification of novel aspects of context that can improve foresight and functioning (Langer 1989). Research finds that mindfulness positively relates to good health (Christopher et al. 2006; Shapiro et al. 2008) and high quality interpersonal relationships (Brown et al. 2007). Organizational researchers also have found positive links from mindfulness to group decision-making (Fiol and O'Connor 2003), learning (Levinthal and Rerup 2006; Rerup 2005), quality of attention (Weick and Sutcliffe 2006), and safety (Vogus and Sutcliffe 2007). Mindfulness has attracted growing interest among researchers from various perspectives, given its proven benefits to individuals and organizations.

Connections from mindfulness to information technology (IT) use have recently attracted attention in popular culture. A *TIME* magazine cover story proclaimed the growth of "The Mindful Revolution," asserting that mindfulness might help individuals navigate technology thus "making digital technology work for us—not the other way around" (Pickert 2014). In a similar vein, *The Economist* (2013) asserts that top business schools embrace mindfulness by weaving the concept into their curriculum and studying the relevance of mindfulness to managing organizations and IT use. This same article implies that mindfulness can help users overcome inappropriate or addictive IT use, by helping individuals "unplug and chill out" from their use of social networking sites.

Despite practice based reports of mindfulness's relationship to technology use, an Information Systems (IS) research agenda on IT mindfulness has yet to emerge. A search of major academic journal databases (JSTOR, PUBPsych, EBSCO, Google Scholar, and the AIS eLibrary) found that research uses different definitions and levels of analysis to examine mindfulness in general, and IT mindfulness in particular (Table 1).

Our search revealed that IS research most often studies mindfulness at the organizational level, espousing the view that "greater mindfulness among decision makers changes the way in which mechanisms for environment scanning and information processing are used" (Fichman 2004 p. 338). Specifically, IS research suggests that mindfulness relates positively to (1) organizational IT innovation (Fichman 2004), (2) IS reliability (Butler and Gray 2006), and (3) high-quality managerial decision-making (Carlo et al. 2012; Swanson and Ramiller 2004).

Our review of the literature hinted at the promise of IT mindfulness for extending our understanding of how individuals extract value from IT (Roberts et al. 2007). For example, Sun and colleagues demonstrate that IT mindfulness affects adoption decisions. To realize the full potential of IT mindfulness in IS research, Sun and his colleagues call for systematic development of a scale for IT mindfulness suitable for studying users' post-adoption systems use (Sun 2011; Sun and Fang 2010; Sun et al. 2016). This call echoes recommendations found in Weick and Sutcliffe's (2006) research in organizational behavior, along with Langer's (1989) work in psychology, which underscore the importance of developing domain-specific individual-level measures of mindfulness.

Accordingly, this paper systematically develops the concept of IT mindfulness at the individual level. We begin by conceptualizing IT mindfulness, describing its dimensions and interrelationships, and distinguishing it from similar concepts in the IS literature. Then, through three programmatic studies, we develop, validate, and demonstrate the value of our proposed scale for IT mindfulness. Collectively, our three studies result in a useful tool for measuring individual level IT mindfulness and provide initial evidence that IT mindfulness holds significant promise to inform future IS research.

Defining IT Mindfulness as a Dynamic IT-Specific Trait

Mindfulness has been conceived as the essence of engagement (Langer 1989, 1997). Psychologists argue that mindfulness shapes how individuals interact with their environment (Bishop et al. 2004; Dane 2011). Mindfulness enables people to "distinguish between wholesome and unwholesome, beneficial and unbeneficial tendencies" (Wallace 2006 p. 61). Langer (1989, 1997) maintains that when individuals feel a heightened state of involvement or presence in the moment (i.e., being mindful), they are more likely to detect changes in their environment as well as corresponding opportunities for action (Langer and Moldoveanu 2000). This connection to the present moment enables individuals to constantly create new ways of categorizing change as a means to understand the present and future implications of their actions (Langer 1997).

We view IT mindfulness as an overarching mental mindset driven by individual awareness of the context, and openness to, value-adding applications of IT. Specifically, we define IT mindfulness as *a dynamic IT-specific trait, evident when working with IT, whereby the user focuses on the present, pays attention to detail, exhibits a willingness to consider*

Table 1. Summary of Empirical Work on Mindfulness

Level of Analysis	Discipline	Definition	Author(s)
Individual	Education	"Reflects a voluntary state of mind, and connects among motivation, cognition, and learning" (p. 623)	Salomon and Globerson 1987
Individual	MIS	"… continuous scrutiny and refinement of expectations based on new experiences, appreciation of the subtleties of context, and identification of novel aspects of context that can improve foresight and functioning" (p. 1)	Roberts et al. 2007
Individual	MIS	"Mindfulness is a state of alertness and lively awareness" (p. 2)	Sun and Fang 2010
Individual	Psychology	"Mindfulness involves intentionally bringing one's attention to the internal and external experiences occurring in the present moment" (p. 125)	Baer 2003
Individual	Psychology	"Mindfulness can be defined, in part, as the self-regulation of attention, which involves sustained attention, attention switching, and the inhibition of elaborative processing" (p. 233)	Bishop et al. 2004
Individual	Psychology	"Aware of thoughts and feelings and to relate them in a wider, decentered perspective" (p. 616)	Teasdale et al. 2000
Individual	Social Psychology	"… can be best understood as the process of drawing novel distinctions" (p. 1)	Langer and Moldoveanu 2000
Organizational	Management	"… involves encoding ambiguous outcomes in ways that influence learning, and encoding stimuli in ways that match context with a repertoire of routines" (p. 514)	Weick and Sutcliffe 2006
Organizational	MIS	"Mindfulness based approaches hold that individuals' and organizations' ability to achieve reliable performance in changing environments depends on how they think: how they gather information, how they perceive the world around them, and whether they are able to change their perspective to reflect the situation at hand" (p. 214)	Butler and Gray 2006
Organizational	MIS	"… the heedful interrelations of activities among social actors—which, if carefully and richly configured, can 'both increase the comprehension of complexity and loosen tight coupling' (Weick et al. 1999, p. 105)" (p. 687)	Carlo et al. 2004
Organizational	MIS	An organization innovates mindfully to the extent that it attends to the innovation with reasoning grounded in its own facts and specifics (p. 320)	Fichman 2004
Organizational	MIS	"Mindfulness, at its roots, is a psychological notion that reflects upon the cognitive qualities of the individual" (p. 555)	Swanson and Ramiller 2004
Organizational	MIS	"A mindful individual is cognizant of different situations and emergent contexts that surround him/her and is prepared to adapt to (and/or use) them for achieving the desired results" (p. 203)	Teo et al. 2011
Organizational	MIS	"Mindfulness is a state of being alert and aware" (p. 435)	Wong et al. 2009
Organizational	Organization Science	"Mindfulness is fundamentally a heightened awareness of and enhanced attention to current experience or present reality" (p. 84)	Thomas 2006

other uses, and expresses genuine interest in investigating IT features and failures. We contend that IT mindfulness exerts a relatively enduring, consistent effect on user behaviors with a given technology.

While the effects of IT mindfulness are relatively enduring, we conceptualize the construct as somewhat malleable: it may be changed through training. Therefore, our conceptualization of IT mindfulness is consistent with research on personality traits. Specifically, traits have been thought of as a three-level hierarchy (i.e., broad, stable, and dynamic), based on breadth and stability (Allport, 1961; Davis and Yi 2012).

(1) At the first tier, ***broad, or cardinal, traits*** capture context-independent predispositions to act. Such broad traits tend to remain stable and shape individual decisions across situations (Allport 1961; Ryckman 2012). For example, biological considerations motivated the five-factor model of personality traits that consists of (1) agreeableness, (2) conscientiousness, (3) extraversion, (4) neuroticism, and (5) openness to experience (McCrae and Costa 2008). Absent a cathartic event (Boyce et al. 2015; Lockenhoff et al. 2009), these broad traits are widely believed to be "set" once an individual reaches 30 years of age (Costa and McCrae 1994). Further, given the distal relationship of broad traits with specific domains, they often exhibit a smaller influence on individual behavior than more situation-specific antecedents. Thus, domain- and context-specific factors mediate the effects of broad traits on behavior (Davis and Yi 2012; Motowildo et al. 1997; Thatcher and Perrewe 2002). IS research has employed broad traits, such as neuroticism and cynicism, to predict beliefs about technology use (Thatcher and Perrewe 2002) and IT professionals' behavior (Ply et al. 2012).

(2) At the central tier, ***stable, IT-specific traits*** capture domain-specific predispositions to act across situations (Thatcher and Perrewe 2002). While specific to IT, this class of traits is thought to be stable and to exert a consistent influence across technology-related situations (Davis and Yi 2012). IS research has shown that stable, IT-specific traits—such as personal innovativeness in IT (PIIT) (Agarwal and Prasad 1998) and computer playfulness (Webster and Martocchio 1992)—can predict diverse outcomes such as user acceptance of technology (Venkatesh et al. 2003), e-learning (Barnett et al. 2015) and e-commerce use (McKnight et al. 2002).

(3) At the secondary tier, ***dynamic, IT-specific traits*** capture more malleable predispositions to act in specific situations (Davis and Yi 2012). While relatively enduring, this class of traits are thought to be malleable, because they reflect not only dispositions to act, but also the gradual accumulation of individual experiences with technology (Thatcher and Perrewe 2002, p. 383). Examples of dynamic IT-specific traits include computer self-efficacy and computer anxiety (Davis and Yi 2012). Research has found that such dynamic IT-specific traits predict technology user behavior within diverse technology adoption and use contexts including the factory floor, financial services, and accounting, as well as technologies from mainframe to desktop software applications (Venkatesh and Bala 2008). Because they are dynamic traits, training, role modeling, and other activities might cultivate the growth of secondary tier traits. Thus they represent opportunities for managerial intervention (Compeau and Higgins 1995; Venkatesh and Bala 2008).

We contend that IT mindfulness constitutes a secondary dynamic, IT-specific trait as the construct has a narrower *breadth of impact* than broad traits and is more *malleable* than conceptually similar IT-specific traits.

(1) ***Breadth of impact***: Where broad traits affect behavior across situations, domain-specific central and secondary traits should exert greater influence within narrowly defined contexts (Allport 1961; Allport 1966; Langer 2014). Research in specific contexts (e.g., personal health, interpersonal relationships, or classroom settings) finds domain specific mindfulness a powerful predictor of behavior (Langer and Moldoveanu 2000). Although a few studies (e.g., Roberts et al. 2007; Sun 2011; Sun and Fang 2010) have posited the concept of IT mindfulness, none have explicitly examined the construct's breadth of impact. Recognizing the importance of the breadth of impact IT mindfulness offers the opportunity to render actionable advice for designing technologies (Hevner et al. 2004; Hong et al. 2014).

(2) ***Malleability***: Whereas broad or stable IT-specific traits are enduring, IT mindfulness may be altered as a result of behavioral interventions. Langer and her colleagues note that relatively simple training can result in enduring changes in domain-specific mindfulness (Langer et al. 1989; Lieberman and Langer 1997). For example, in a field experiment, Jensen et al. (2013) found that IT security training elevates users' mindfulness about phishing to higher levels; furthermore, such elevated levels of mindfulness persisted for up to 30 days after participants received training. Recognizing that IT mindfulness may be malleable, offers opportunities for developing guidelines for how training can lead to users reaping greater value from IT.

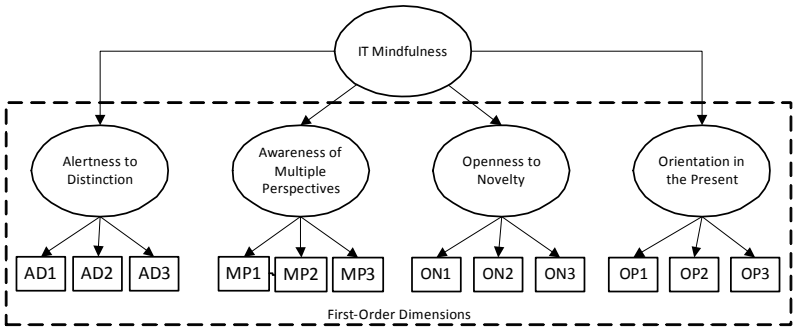

Figure 1. A Superordinate Second-Order Conceptualization of IT Mindfulness

Dimensions of IT Mindfulness

Consistent with Langer's (1997, 2014) work, we view IT mindfulness as a superordinate, second-order construct composed of four reflective, first-order dimensions: (1) alertness to distinction, (2) awareness of multiple perspectives, (3) openness to novelty, and (4) orientation in the present (see Figure 1) (Edwards 2001; Law and Wong 1999; Polites et al. 2012).

(1) *Alertness to distinction* refers to the degree to which a user understands not only the capabilities of IT applications, but also the context in which IT applications will prove useful. When alert to distinction, users note the discrepancies between their use of the system and its potential. They actively resolve such discrepancies through generating new ways for using the system (Langer 1989). A more IT mindful user will quickly recognize the difference between the capabilities of old and new features of a system.

(2) *Awareness of multiple perspectives* refers to the extent to which a user identifies different points of view regarding how one might use a system and understands the distinct value of each potential use. A user who employs multiple perspectives holds greater potential to create innovative solutions to problems and opportunities found in their environment (Langer 1989). A more IT mindful user may recognize different potential applications of feature-sets that even go beyond the intention of designers or the desires of employing organizations (Sun 2012).

(3) *Openness to novelty* refers to users' willingness to explore new features or potentials of a system. More IT mindful users are open to considering a greater number of applications of a specific system. A user can manifest this openness by demonstrating curiosity, experimentation, and flexibility in his/her interaction with the system's features. Consider a communications system. Less IT mindful users rely on familiar features, such as "voice." In contrast, more IT mindful users likely experiment with bundling familiar features (voice and text) with less familiar features (video, screen sharing, and virtual reality), and thereby increase productivity (Dennis et al. 2008).

(4) *Orientation in the present* refers to the degree to which a user becomes involved in a specific and current context. Being IT mindful means users focus on the present and their system use varies in response to different contexts (Sternberg 2000). For example, users may vary their use of emojis when conducting personal, as opposed to professional, correspondence. Such sensitivity to their context results from more IT mindful message senders attending to the "big picture" and understanding the signals that emojis send message recipients (e.g., familiarity, emotion, etc.) (Stark and Crawford 2015).

We expect that users with higher levels of IT mindfulness will report higher levels of alertness to distinction, awareness of multiple perspectives, openness to novelty, and orientation in the present. Consistent with a Type I, superordinate construct (Jarvis et al. 2003), we specify each first-order dimension as reflective (i.e., their items covary and are interchangeable). While the dimension's indicators may covary, each dimension of IT mindfulness has a distinct, noninterchangeable conceptual underpinning (Rindskopf and Rose 1988). Consequently, one cannot assume that a change in IT mindfulness results in the same degree of change across all of the construct's dimensions (Edwards 2001; Polites et al. 2012). Therefore, operationalizing IT mindfulness requires capturing all four dimensions, as a construct comprised of one, two, or three of the dimensions would require a different conceptual development (Kim et al. 2010).

Discriminating IT Mindfulness from Related Concepts

IT mindfulness is distinct from similar concepts such as cognitive absorption, computer playfulness, flow, IT habit, personal innovativeness in IT (PIIT), as well as trait mindfulness and mindlessness (see Table 2). By way of examples, consider congnitive absorption, PIIT, and trait mindfulness. IT mindfulness differs from cognitive absorption, a variable that captures the user's deep involvement with IT (Agarwal and Karahanna 2000). While both constructs emphasize the present moment, they differ in terms of focus and stability. First, cognitively absorbed users highly focus on performing a single task, or narrowly defined set of tasks, to accomplish a desired outcome, leading them to be somewhat oblivious to their immediate context (Csikszentmihalyi 1990). In contrast, an IT mindful user continually scans the context to identify new opportunities to create novel categories for using IT that enable completing tasks (Langer 1997; Langer and Moldoveanu 2000). Second, where cognitive absorption refers to a *state* of immersion in a moment, IT mindfulness constitutes a dynamic *trait* that expands beyond the current moment and impacts future behavior (Wittmann et al. 2014). Hence, while cognitive absorption offers an explanation for user interaction with the system at a specific point in time, IT mindfulness helps to explain how users' awareness of the present can change their present and future interactions with the system.

Similarly, IT mindfulness and PIIT differ in their focus and stability. IT mindfulness focuses on the immediate task context, whereas PIIT represents a "the willingness of an individual to try out any new information technology" (Agarwal and Prasad 1998, p. 206). Moreover, IT mindfulness is by definition a dynamic, secondary trait and thus is more amenable to change than PIIT, which is a stable, domain-specific trait (Agarwal and Karahanna 2000; Davis and Yi 2012; Thatcher and Perrewe 2002). Notably, openness to novelty, a dimension of IT mindfulness, shares conceptual underpinnings with PIIT. Specifically, they both capture a person's willingness to try out a technology's features. Yet, they differ with respect to their focus (i.e., specific technology versus a domain) and stability (i.e., dynamic versus stable). In short, IT mindfulness and PIIT, while related, represent distinct concepts.

Finally, while IT mindfulness shares the dimensionality of trait mindfulness, the constructs differ in their focus. Trait mindfulness refers to one's propensity to exhibit mindfulness *broadly*, across situations and time (Langer and Moldoveanu 2000). A person with a high level of trait mindfulness would likely demonstrate a tendency to be mindful whether at work, home, or play. In contrast, domain-specific IT mindfulness directs attention to a *specific* situation and/or range of behaviors (Langer 2014). Hence, while one might be generally mindful, one might not necessarily demonstrate high levels of IT mindfulness in the specific system use context, and thus miss new opportunities to apply the system in the workplace. Given the domain-specific nature of IT mindfulness, we anticipate the construct will demonstrate greater predictive power than broad trait mindfulness with respect to IT-specific beliefs and behaviors.

The Development and Validation of a Scale for IT Mindfulness

To develop and validate a scale of IT mindfulness, we conducted three empirical studies (see Figure 2). In Study 1, we generate items for our IT mindfulness scale. We assess their validity and reliability using datasets collected from students at three public universities in the United States. We also test whether IT mindfulness differs from cognitive absorption. In Study 2, we evaluate the manipulation validity of our IT mindfulness in a laboratory experiment across two different technological contexts. We further test how IT mindfulness discriminates from three related constructs: IS creativity, PIIT, and computer playfulness. In Study 3, we examine the scale's utility by evaluating it in a nomological network of three post-adoption system use constructs: trying to innovate, deep structure usage, and continuance intention. We examine how IT mindfulness explains these factors beyond what can be explained by trait mindfulness.

Collectively, the three studies rigorously validate our scale of IT mindfulness in different technological contexts, using multiple methods and subjects, in different theoretical relationships, and in both long and short forms. Although each study uses a relatively simple system and context for use, their simplicity affords an opportunity to focus on scale development and validation. In the following pages, we present each study's main procedure and major findings. In the appendices, we provide more detailed explanations of each study's method and data analysis.

Pilot and Study 1: Item Generation and Initial Testing

Study 1 served to generate our IT mindfulness scale items as well as evaulate their content, discriminant, and convergent validity. We followed a multistep procedure to develop the scale (Churchill 1979; Straub et al. 2004). First, we reviewed mindfulness research (Langer 1989, 1997; Langer and Moldoveanu 2000; Sternberg 2000). We identified Langer's (2004)[2] measure as an archetypal mindfulness measure. Then,

[2]Please note that Langer (2004) requires authors to pay licensing fees to use her measure. Consequently, readers must purchase copies of the measure directly from Langer.

Table 2. Distinguishing IT Mindfulness from Similar Concepts

Construct	Description	IT Focus	IT Outcomes	Examples
IT Mindfulness	*A Secondary Dynamic IT-Specific Trait*: A way of approaching technology such that individuals are aware of, and open to, value-added use of the system.	Wide focus on the system at hand.	Both personal and organizational improvements.	This research
Cognitive Absorption	*A State*: Represents a situational intrinsic motivator whereby users focus remains narrow.	Narrowly focused on the system at hand.	Narrowly focused on the task at hand.	Agarwal and Karahanna 2000
Computer Playfulness	*A Stable IT-Specific Trait*: A user's tendency to interact with the system in a spontaneous, creative, and imaginative way.	Broadly focused on system use.	Mostly focused on personal improvements.	Magni et al. 2010; Venkatesh 1999; Venkatesh 2000
Flow	*A State*: The creation of a pleasurable feeling that users feel when they interact with a system with total involvement.	Narrowly focused on the system at hand.	Narrowly focused on the task at hand.	Csikszentmihalyi 1990
IT Habit	*A Stable IT-specific Trait*: Automatic behavior developed in the past to elicit a certain response given a certain condition.	Narrowly focused on the system at hand: people form different habits of using different systems.	Narrowly focused on the task at hand.	Limayem et al. 2007
Personal Innovativeness in IT (PIIT)	*A Stable IT-Specific Trait*: The willingness of users to try any new system.	Broadly focused system use.	Mostly focused on personal improvements.	Agarwal and Prasad 1998; Yi et al. 2006
Non IT Related Constructs				
Mindfulness	*Is a Broad Trait*: A persistent state of mind in which one pays attention to the present moment.	Not specifically related to the use of the system.	Not specifically related to the use of the system.	Langer 1997; Langer and Moldoveanu 2000
Mindlessness	*Is a Broad Trait*: Thoughts that have little to do with the present moment or activity.	Not specifically related to the use of the system.	Not specifically related to the use of the system.	Dane 2011; Sternberg 2000

we crafted an initial set of six items for each dimension. In doing so, we took great care to be faithful to the word choice of the original Langer instrument. For example, our "Alertness to Distinction" items use the same action words as Langer's original items (e.g., novelty, creativity, and effectiveness). At the same time, we made sure that the items were IT specific.

To pilot this instrument, six IS and Organizational Behavior academics participated in a card-sorting procedure to map items to dimensions (Moore and Benbasat 1991). We then modified some items to improve clarity and deleted some items that failed to map to a dimension. A second card sorting confirmed 12 items mapped to their corresponding dimensions of IT mindfulness (see Table 3).

A matching exercise supported that the refined IT mindfulness scale maps well to Langer's mindfulness scale. Some 79 MBA students completed the term-matching exercise. We found that 87.21% of the participants correctly mapped our IT mindfulness items to Langer's original scale of trait mindfulness. No two pairs of items had a match rate less than 80%. Based on established metrics for inter-rater reliability (Cicchetti and Sparrow 1981; Landis and Koch 1977), the results of this matching exercise provided evidence that participants viewed the IT mindfulness and Langer's mindfulness items as very similar.

We designed Study 1 to test the convergent, discriminant, predictive, and content validity of the items generated through the pilot study. To evaluate convergent and discriminant validity, we employed a two-step factor analysis. First, using data collected from 288 business students enrolled in IS classes at two universities, we estimated a principal components analysis (PCA) with a varimax rotation. Second, using data collected from 316 business students enrolled at a third

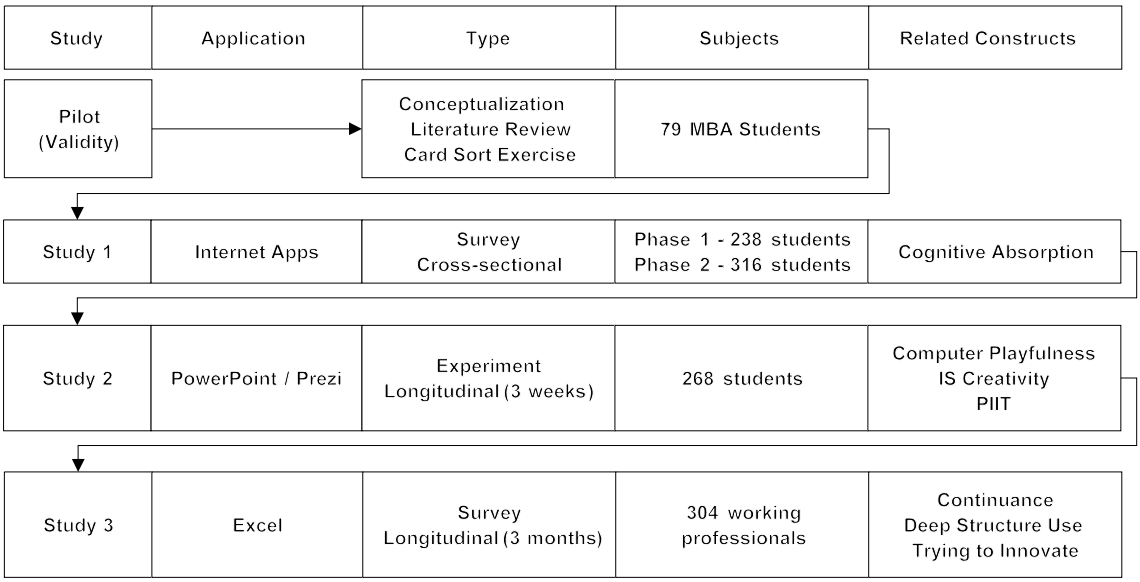

Figure 2. Summary of the Three Studies

Table 3. IT Mindfulness Instrument[a]

Alertness to Distinction (AD)	
AD1	I find it easy to create new and effective ways of using <the systems>.
AD2	I am very creative when using <the system>.
AD3	I make many novel contributions to my work-related tasks through the use of <the system>.
Awareness of Multiple Perspectives (MP)	
MP1	I am often open to learning new ways of using <the system>.
MP2	I have an open mind about new ways of using <the system>.
MP3[b]	I use <the system> in many different ways to support my work.
Openness to Novelty (ON)	
OP1	I like to investigate different ways of using <the system>.
OP2	I am very curious about different ways of using <the system>.
OP3	I like to figure out different ways of using <the system>.
Orientation in the Present (OP)	
ON1	I like to investigate different ways of using <the system>.
ON2	I am very curious about different ways of using <the system>.
ON3	I like to figure out different ways of using <the system>.

[a]For more information about item generation, convergent and discriminant validity, please see Appendix A.
[b] MP3 was dropped due to low item loadings.

Table 4. Second-Order Model Comparisons for IT Mindfulness

Model	X^2, df	CFI	RMSEA
M1. Unidimensional (1st order factor)	722.66, 44	0.70	0.221
M2. Four freely correlated (1st order factors)	99.70, 38	0.97	0.072
M3. Second-order construct	105.22, 40	0.97	0.072

public university, we estimated a confirmatory factor analysis (CFA) to confirm the scale's dimensionality and second-order factor structure. To evaluate predictive and content validity, we used structural equation modeling.

Results

Our factor analysis confirmed the discriminant and convergent validity as well as the factor structure of our scale. An initial PCA resulted in one item (MP3) loading at less than 0.404. After dropping MP3, a subsequent PCA suggested the remaining 11 items loaded on the appropriate dimensions. Subsequent CFAs of the initial 12-item and reduced 11-item scales further supported dropping the MP3 item.

To assess the second-order conceptualization, we estimated three models: (M1) unidimensional, (M2) four freely correlated factors, and (M3) a second-order model. Our comparison of models suggests that M3, the second-order model that treats IT mindfulness as a second-order construct with four reflective first-order factors, best describes the relationships in our data (Boomsma 2000; Gefen et al. 2000; Grover et al. 2002) (see Table 4). We also estimated a series of chi-square difference tests that confirmed the discriminant validity of the IT mindfulness dimensions. Further, we checked for multicollinearity. With the highest variance-inflation factor value equal to 3.2 for ON2 below the prescribed 3.3 threshold (Diamantopoulos and Siguaw 2006), multicollinearity does not appear a significant concern (Cohen et al. 2003). Details of these analyses can be found in Appendix A.

Structural equation modeling was used to evaluate discriminant and predictive validity. We estimated structural models that confirmed IT mindfulness and cognitive absorption related differently to perceived usefulness and perceived ease of use. Appendix A presents the logic behind these hypothesized relationships and more detail on our tests of predictive validity.

Overall, Study 1 yielded an 11-item scale of IT mindfulness and provided initial evidence of the scale's reliability as well as convergent, disciriminant, predictive, and content validity.

Study 2: Manipulation Validity, External Validity, and Discriminant Validity of IT Mindfulness

To further evaluate the validity of our IT mindfulness scale, Study 2 (1) assessed the dynamic nature of IT mindfulness by examining whether it can be manipulated; (2) evaluated the scale's external validity across different technological contexts; and (3) further examined the scale's discriminant validity by empirically distinguishing IT mindfulness from such concepts as computer playfulness (Webster and Martocchio 1992), IS creativity (Tiwana and McLean 2005), and PIIT (Agarwal and Prasad 1998). Appendix B has more details regarding Study 2.

To assess manipulation validity, we used Langer's (1989) priming techniques (i.e., absolute or conditional instructions) to empirically examine whether IT mindfulness changed with task and technology. Langer's work suggests that the absolute instructions result in lower mindfulness, while conditional instructions yield greater mindfulness. We designed a 2 by 2 experiment that crossed a type of task conditions (e.g., absolute or conditional) with two different types of presentation software (i.e., PowerPoint or Prezi). We asked our subjects to develop a "visual resume." In the absolute condition, we provided specific requirements, including using a template as well as required color, pictures, content, and number of slides. For the conditional instruction, we provided much broader instructions, simply specifying a technology and rubric for evaluation, thereby affording opportunities to explore novel ways to present content. In total, 268 subjects completed the experiment and provided supplemental data on computer playfulness, IS creativity, and PIIT. We detail information about the priming techniques, experimental procedure, post-experiment surveys, and subjects in Appendix B.

Results

Study 2 yielded three important findings. First, ANOVA analyses revealed the dynamic nature of IT mindfulness, as theorized. We effectively manipulated IT mindfulness, using conditional and absolute instructions. Subjects who received conditional instructions about using a technology (PowerPoint or Prezi) had higher levels of IT mindfulness than those who received absolute instructions. This confirms our conceptualization of IT mindfulness as a secondary dynamic trait that is amenable to change. Second, ANCOVA analysis showed that IT mindfulness operates in a similar manner across desktop (PowerPoint) and cloud-based (Prezi) applications, providing additional evidence of external validity. Third, tests of convergent and discriminant validity confirmed that IT mindfulness is distinct from computer playfulness, IS creativity, and PIIT. This further clarifies the scope of IT mindfulness. Moreover, Study 2 confirmed Study 1's findings with respect to discriminant and convergent validity. Appendix B provides detailed statistics.

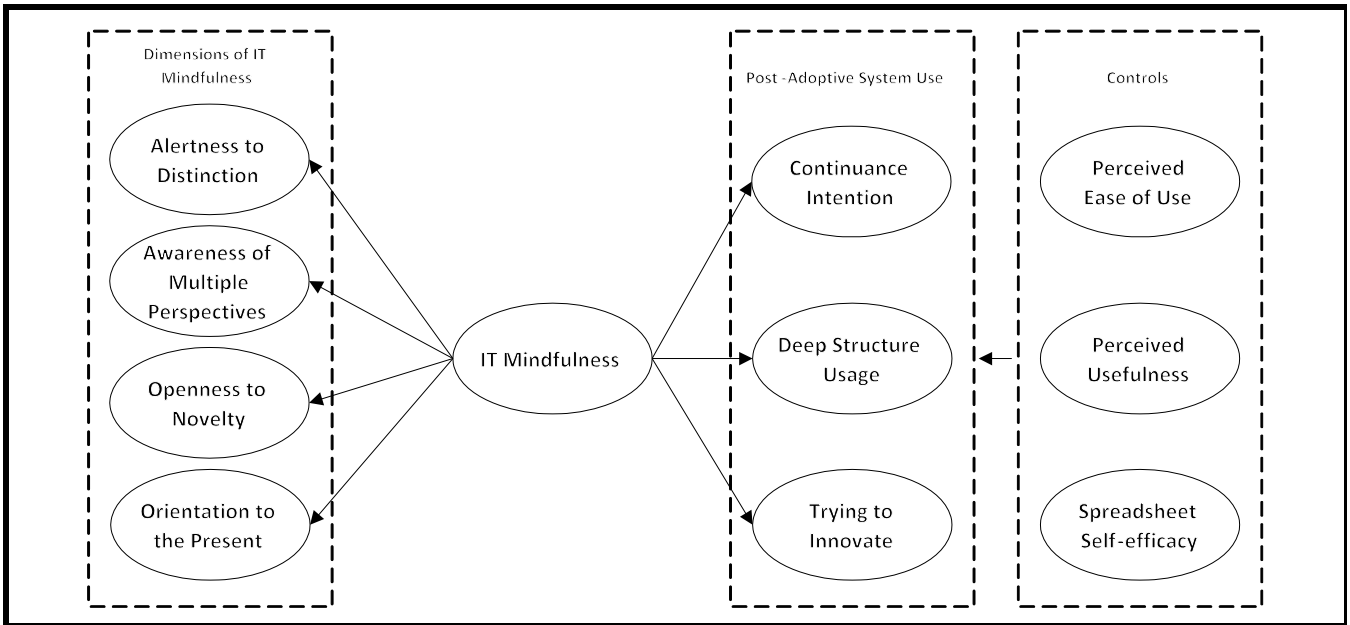

Figure 3. IT Mindfulness Research Model

Study 3: Utility of the New Scale of IT Mindfulness

In Study 3, we focused on evaluating the predictive validity of the new IT mindfulness scale vis-á-vis post-adoption systems use. Specifically, we examined the relationship from IT mindfulness to three important system use constructs: (1) continuance intention (Bhattacherjee 2001), (2) deep structure usage (Burton-Jones and Straub 2006), and (3) trying to innovate (Ahuja and Thatcher 2005). Figure 3 depicts the structural model tested in our third study. Also, we evaluated the relative predictive power of the IT mindfulness scale vis-á-vis Langer's existing scale of trait mindfulness.

Consistent with dual-process theories of human cognition (Epstein 1994; Evans 2008; Louis and Sutton 1991; Sloman 1996), two "modes" of use, more active and more automatic, can be used to characterize post-adoptive system use (Kim et al. 2005; Limayem et al. 2007). More active system use entails a person consciously reflecting upon and, if necessary, modifying how they use the system (Barki et al. 2007; Burton-Jones and Straub 2006; Hsieh et al. 2011; Sun 2012). More automatic, or habitual, system use describes a person using the system in a largely unconscious way without deliberate evaluations and decision-making regarding their use (Kim et al. 2005; Limayem et al. 2008). Hence, we find an examination of system use constructs essential to further evaluating the predictive validity of IT mindfulness.

We operationalized systems use using three established constructs (i.e., continuance intentions, deep structure usage, and trying to innovate). Drawing upon modes of use, we represent more *active* system use by deep structure usage and trying to innovate. Deep structure usage refers to the "use of features in the IS that support the underlying structure of the task" (Burton-Jones and Straub 2006, p. 236). Engagement in deep structure use requires an acute user awareness of how potential use of a class of features supports completion of an underlying task (Burton-Jones and Straub 2006). Trying to innovate refers to a "user's goal of finding new uses of existing workplace information technologies" (Ahuja and Thatcher 2005, p. 431). This construct reflects a person's beliefs about their context and their ability to accomplish a task. Focusing on the more *automatic* system use mode, we employ continuance intention, defined as whether an individual plans to use a familiar technology in the future.

We argue that IT mindfulness by nature should be more closely related to more active system use than to more automatic system use. Mindfulness necessitates active rather than passive thinking (Limayem et al. 2007; Louis and Sutton 1991). IT mindful users do not restrict themselves to pre-committed ways of using a system and thus will likely adapt their system use to the environment (Butler and Gray 2006; Swanson and Ramiller 2004). IT mindful users will exhibit a greater likelihood to scan the task environment in relation to the system (Fiol and O'Connor 2003). As a result, IT mindful users are likely to be aware of system features, or feature

groups, relevant to a given task, thereby forming a larger "action repertoire" (Levinthal and Rerup 2006). Such an expanded action repertoire will empower users to adapt and innovate with their system use. Prior research has demonstrated that mindfulness can help people apply knowledge more flexibly in novel situations (Langer et al. 1989). Therefore, we believe that IT mindful users are more likely to detect a greater number of opportunities for innovativing with system use and report achieving deeper usage of a familiar system. In contrast, we argue that IT mindfulness will demonstrate a weaker relationship with individuals' automatic system use, as represented by continuance intention. The rationale is that continuance intention derives to a greater extent from current use (Kim et al. 2005; Limayem et al. 2007)—a distinct sphere of activity from awareness of opportunities for change or engagement in more nuanced use.

To evaluate the utility of the new IT mindfulness scale, we compare domain-specific mindfulness to trait mindfulness (Langer 1989) with respect to how each is related to these three system use constructs. Prior research suggests that general trait variables should exhibit a smaller influence on user beliefs and behavior than more domain-specific variables (Davis and Yi 2012; Webster and Martocchio 1992).

Moreover, we control for the three constructs tied to system use by including perceived ease of use, perceived usefulness, and application self-efficacy in our analyses.

Method

To assess our model, we analyzed panel data collected from working adults who use Microsoft Excel as part of their daily work. MarketTools, a survey research firm, collected the data at two points in time with a three-month interval between Time 1 (T1) and Time 2 (T2). MarketTools invited 455 individuals to participate in the study. Some 304 working adults provided usable responses to the first and second surveys, yielding a 67% list-wise response rate. To evaluate and compare realtionships, we used structural equation modeling and dominance analaysis. Appendix C presents sample characteristics and study details.

To operationalize constructs, we used existing measures. At T1, we measured perceived usefulness and ease of use with items adapted from Davis (1989), while sourcing items for spreadsheet self-efficacy are from Marakas et al. (2007). We also employed Langer's (2004) trait mindfulness scale. At T2, we adapted continuance intention from Bhattacherjee (2001) and used Burton-Jones and Straub's (2006) deep structure usage measures. Further, we adaopted items for trying to innovate from Ahuja and Thatcher (2005).

Results

Appendix C reports the statistics for the measurement model, confirming the validity and reliability of all measures. To test our structural model, we used Mplus 7.21. To ensure the robustness of our estimates to non-normality (Hu et al. 1992), we used scaled chi-square statistics (Satorra and Bentler 1988) and corresponding robust fit estimates provided by Mplus. Figure 4 presents standardized parameters for our second-order factor model.

The results supported the stuctural model. IT mindfulness has a significant effect on deep structure usage ($\beta = 0.40$, $p < .001$) and trying to innovate ($\beta = 0.52$, $p < .001$), but not on continuance intention. This confirms our arguments specific to the relevance of IT mindfulness to active system use but not automatic system use. Moreover, we used hierarchical regression to examine the predictive power of IT mindfulness and trait mindfulness. The results showed that IT mindfulness and trait mindfulness empirically discriminate (see Table C4 in Appendix C). Moreover, dominance analysis (Azen and Budescu 2003) suggest that IT mindfulness outperformed trait mindfulness in predicting our systems use constructs (see Table C5 in Appendix C). This supports our contention that IT mindfulness and general trait mindfulness constitute distinct constructs with IT mindfulness adding explanatory power to our understanding of post-adoption IT use.

Discussion

This research conceptualizes IT mindfulness, and then develops a scale for measuring it. Each of our three studies addresses unique elements of our definition and measure of the validity of IT mindfulness. Specifically, we distinguish IT mindfulness from similar concepts such as a state variable, cognitive absorption, in Study 1, stable IT-specific traits (i.e., computer playfulness, IS creativity, and PIIT) in Study 2, and broad trait mindfulness in Study 3. Moreover, our results demonstrate that IT mindfulness is amenable to change through manipulation, as demonstrated in our training experiment in Study 2. Finally, our results show that IT mindfulness explains additional variance in deep structure usage and trying to innovate, while trait mindfulness does not influence trying to innovate. These findings jointly confirm that IT mindfulness is distinct, manipulable, and dynamic, while also possessing greater explanatory power within the domain of IT than general trait mindfulness.

Our multi-study design, in which each study examined the IT mindfulness scale from different perspectives with necessary replications, should inspire confidence in our results. The fact that each study supported our superordinate second-order

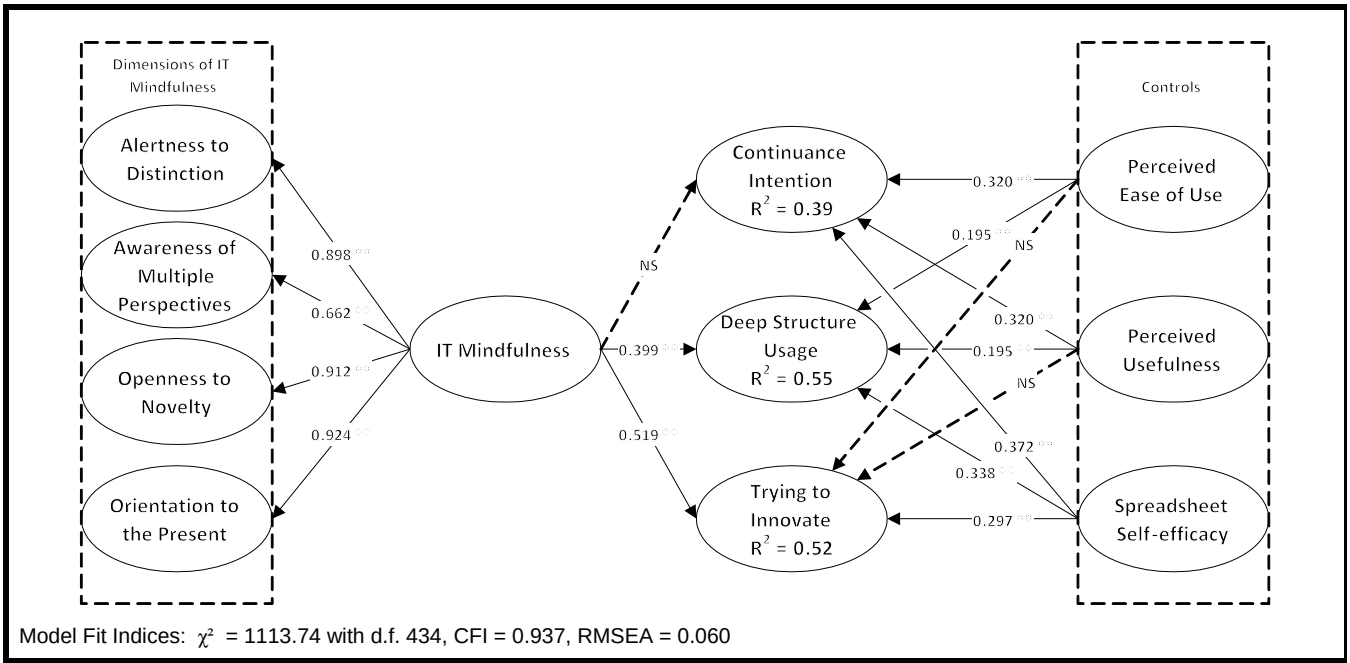

Figure 4. Results of Model Testing

conceptualization of IT mindfulness demonstrates the robustness of our theoretical and operational definitions of this new construct and illustrates the utility of our findings to future research.

Findings from this research contribute to the broader literature on mindfulness as well as scholarship within the IS community. With respect to the growing body of mindfulness research, our results suggest that domain-specific mindfulness measures offer greater explanatory power than broad mindfulness measures. We also illustrate the utility of dominance analysis in confirming this intuition regarding domain-specific vis-á-vis broad measures of mindfulness. These findings imply that researchers should consider developing domain-focused measures when seeking to use mindfulness to explain context or object-specific behaviors and illustrate a method for confirming their utility.

Usability often presents challenges in the presence of long-form measurements (for details, see Smith et al. 2012). Therefore, we validated a short-form measure of the IT mindfulness construct, following the procedure outlined by Smith et al. (2012).[3] We found that a four-item measure of IT mindfulness (using items AD2, MP1, ON3, and OP3) provides reasonable predictive power without losing significant reliability (Appendix D). This short form measure offers a parsimonious means for researchers to further explore the implications of IT mindfulness for technology use.

Limitations

Like any empirical study, the studies reported in this paper have limitations associated with the methods and the sample selection process. By triangulating across studies, we overcame these limitations to create a useful measure. Further, while we examine IT mindfulness using different technologies and populations, we did not examine IT mindfulness in the broader context of complex social systems or more sophisticated technologies. Although we examined different types of software (i.e., spreadsheet versus presentation applications), delivery mechanisms (i.e., desktop- versus cloud-based), and sample populations (i.e., students versus working adults), further research is necessary to evaluate the utility of our measure in more complex technology use contexts. For example, prior reearch has suggested that system restrictiveness—in enterprise resource planning (ERP) systems (Boudreau and Robey 2005) or social network systems (SNS) software (Smith et al. 2011)—can influence user behavior. Langer's early work (Langer et al. 1989; Lieberman and Langer 1997) suggests that such restrictiveness may shape the effect of IT mindfulness on users' behavior. Future studies should explore the implications of such boundary conditions on the power of IT mindfulness to explain different forms of IT use.

[3]We thank the associate editor for this helpful suggestion.

Future Research

Our findings suggest that future research should further explore the relationship from IT mindfulness to different forms of systems use. One interesting finding of Study 3 was that while self-efficacy predictes all three post-adoption constructs (continuance intention, deep structure usage, and trying to innovate), IT mindfulness related exclusively to active system use constructs (i.e., deep structure usage and trying to innovate). These findings are consistent with exising research, which contends that efficacy beliefs drive behavior in diverse contexts (Bandura 1997; Thatcher and Perrewe 2002), whereas mindfulness relates more closely to those behaviors intimately connected to how individuals actively perceive opportunities for innovating within their immediate task context (Langer 1997). It would be interesting to extend this intuition on IT mindfulness, opportunities, and systems use to other decisions about technology use. It very well might be that IT mindful users are apt to discontinue use of a technology (e.g., break habits) when their environment affords opportunities to use new technologies or when the technology no longer fits the task. By examining the relationship between IT mindfulness and active decision making about about systems use, studies may yield actionable advice for practicing professionals seeking to maximize value derived from IT in their organization.

By suggesting one boundary condition (i.e., active system use) for IT mindfulness, our work suggests clear directions for future studies examining the construct's implications for user performance (i.e., deep use, innovation, and training, among others). Consider, for instance, how simple priming can raise IT mindfulness, as seen in Study 2. Understanding that one can increase IT mindfulness provides opportunities for developers to enhance system use by integrating features into software that prime a user to become more IT mindful of a system's capabilities. Such priming features or actions, in conjunction with systematic training programs, might also help organizations realize the potential of IT investments (Dane 2011; Langer 2009). Consequently, understanding how to integrate features and design training that prime IT mindfulness—particularly, those slipstreamed into social media applications, such as Facebook, or cloud-based applications (O'Reilly and Battelle 2009)—serves as a potentially interesting avenue for future research that examines how users' detect and explore systems' features or how to craft implementation strategies that reap greater value from IT investments.

Finally, it might also prove interesting to explore the contingent nature of the relationships between IT mindfulness and post-adoptive system use. Dane (2011) proposed that dynamic task environments and task expertise moderate the influence of mindfulness on task performance. Dane argued that mindfulness might actually lead to negative task performance in a static environment or among novice users.

Conclusion

Our studies contribute to IS research by conceptualizing IT mindfulness as well as developing and validating a new scale to operationalize the construct. Through three empirical studies, we refined our scale and offered evidence of its validity and reliability. Our results suggest that IT mindfulness differs from important existing IS concepts, can be elevated through manipulation (e.g., priming and training), and relates closely to active system use. Further, we demonstrate that the general trait mindfulness is not sufficient for studying constructs within the domain of IT. We hope our work leads to IS scholars conducting research that examines the implications of the important and emerging concept of IT mindfulness for user performance.

Acknowledgments

Work on this paper was completed with the generous support from the Velux Villum Fellow program at ITU-Copenhagen.

References

Agarwal, R., and Karahanna, E. 2000. "Time Flies When You're Having Fun: Cognitive Absorption and Beliefs About Information Technology Usage," *MIS Quarterly* (24:4), pp. 665-695.

Agarwal, R., and Prasad, J. 1998. "A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology," *Information Systems Research* (9:2), pp. 204-215.

Ahuja, M. K., and Thatcher, J. B. 2005. "Moving Beyond Intentions and Toward the Theory of Trying: Effects of Work Environment and Gender on Post-Adoption Information Technology Use," *MIS Quarterly* (29:3), pp. 427-459.

Allport, G. W. 1961. *Pattern and Growth in Personality*, Oxford, England: Holt, Reinhart & Winston.

Allport, G. W. 1966. "Traits Revisited," *American Psychologist* (21:1), pp. 1-10.

Azen, R., and Budescu, D. V. 2003. "The Dominance Analysis Approach for Comparing Predictors in Multiple Regression," *Psychological Methods* (8:2), pp. 129-148.

Baer, R. A. 2003. "Mindfulness Training as a Clinical Intervention: A Conceptual and Empirical Review," *Clinical Psychology: Science and Practice* (10:2), pp. 125-143.

Bandura, A. 1997. *Self-Efficacy: The Exercise of Control*, New York: Freeman and Company.

Barki, H., Titah, R., and Boffo, C. 2007. "Information System Use-Related Activity: An Expanded Behavioral Conceptualization of Individual-Level Information System Use," *Information Systems Research* (18:2), pp. 173-192.

Barnett, T., Pearson, A. W., Pearson, R., and Kellermanns, F. W. 2015. Five-Factor Model Personality Trits as Predictors of Perceived and Actual Usage of Technology," *European Journal of Information Systems* (24:4), pp. 374-390.

Bhattacherjee, A. 2001. "Understanding Information Systems Continuance: An Expectation-Confirmation Model," *MIS Quarterly* (25:3), pp. 351-371.

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., Segal, Z. V., Abbey, S., Speca, M., Velting, D., and Devins, G. 2004. "Mindfulness: A Proposed Operational Definition," *Clinical Psychology: Science and Practice* (11:3), pp. 230-241.

Boomsma, A. 2000. "Reporting Analyses of Covariance Structures," *Structural Equation Modeling* (7), pp. 461-483.

Boudreau, M. C., and Robey, D. 2005. "Enacting Integrated Information Technology: A Human Agency Perspective," *Organization Science* (16:1), pp. 3-18.

Boyce, C. J., Wood, A. M., Daly, M., and Sedikides, C. 2015. "Personality Change Following Unemployment," *Journal of Applied Psychology* (100:4), pp. 991-1101.

Brown, K. W., Ryan, R. M., and Creswell, J. D. 2007. "Mindfulness: Theoretical Foundations and Evidence for its Salutary Effects," *Psychological Inquiry: An International Journal for the Advancement of Psychological Theory* (18:4), pp. 211-237.

Burton-Jones, A., and Straub, D. W. 2006. "Reconceptualizing System Usage: An Approach and Empirical Test," *Information Systems Research* (17:3), pp. 228-246.

Butler, B. S., and Gray, P. H. 2006. "Reliability, Mindfulness, and Information Systems," *MIS Quarterly* (30:2), pp. 211-224.

Carlo, J. L., Lyytinen, K., and Boland, R. J. 2004. "Systemic Risk, Information Technology Artifacts, and High Reliability Organizations: A Case of Constructing Radical Architecture," in *Proceedings of the 25th International Conference on Information Systems*, Washington, DC, pp. 685-696.

Carlo, J. L., Lyytinen, K., and Boland, R. J. 2012. "Dialectics of Collective Minding: Contrary Appropriations of Information Technology in a High-Risk Project," *MIS Quarterly* (36:4), pp. 1081-1108.

Christopher, J. C., Christopher, S. E., Dunnagan, T., and Schure, M. 2006. "Teaching Self-Care Through Mindfulness Practices: The Application of Yoga, Meditation, and Qigong to Counselor Training," *Journal of Humanistic Psychology* (46:4), pp. 494-509.

Churchill, G. A. 1979. "A Paradigm for Developing Better Measures of Marketing Constructs," *Journal of Marketing Research* (16:1), pp. 64-73.

Cicchetti, D. V., and Sparrow, S. A. 1981. "Developing Criteria for Establishing Interrater Reliability of Specific Items: Applications to Assessment of Adaptive Behavior," *American Journal of Mental Deficiency* (86:2), pp. 127-137.

Cohen, J., Cohen, P., West, S. G., and Aiken, L. A. 2003. *Applied Mulitple Regression/Correlation Analysis for the Behavioral Sciences* (3rd ed.), Mahwah, NJ: Lawrence Erlbaum Associates.

Compeau, D. R., and Higgins, C. A. 1995. "Application of Social Cognitive Theory to Training for Computer Skills," *Information Systems Research* (6:2), pp. 118-143.

Costa, P. T. J., and McCrae, R. R. 1994. "Set Like Plaster: Evidence for the Stability of Adult Personality," in *Can Personality Change,* T. F. Heatherton and J. L. Weinberger (eds.), Washington, DC: American Psychological Association, pp. 21-40.

Csikszentmihalyi, M. 1990. *Flow: The Psychology of Optimal Experience*, New York: Harper Perennial.

Dane, E. 2011. "Paying Attention to Mindfulness and its Effects on Task Performance in the Workplace," *Journal of Management* (37:4), pp. 997-1018.

Davis, F. D. 1989. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly* (13:3), pp. 319-340.

Davis, J. M., and Yi, M. Y. 2012. "User Disposition and Extent of Web Utilization: A Trait Hierarch Approach," *International Journal of Human–Computer Studies* (70:5), pp. 346-363.

Dennis, A. R., Fuller, R. M., and Valacich, J. S. 2008. "Media, Tasks, and Communication Processes: A Theory of Media Synchronicity," *MIS Quarterly* (32:3), pp. 575-600.

Diamantopoulos, A., and Siguaw, J. A. 2006. "Formative Versus Reflective Indicators in Organizational Measure Development: A Comparison and Empirical Illustration," *British Journal of Management* (17:4), pp. 263-282.

The Economist. 2013. "The Mindfulness Business," November 16 (available online at https://www.economist.com/news/business/21589841-western-capitalism-looking-inspiration-eastern-mysticism-mindfulness-business; accessed April 9, 2018).

Edwards, J. R. 2001. "Multidimensional Constructs in Organizational Behavior Research: An Integrative Analytical Framework," *Organizational Research Methods* (4:2), pp. 144-192.

Epstein, S. 1994. "Integration of the Cognitive and Psychodynamic Unconscious," *American Psychologist* (49), pp. 709-724.

Evans, J. S. B. T. 2008. "Dual-Processing Accounts of Reasoning, Judgment, and Social Cognition," *Annual Review of Psychology* (59), pp. 255-278.

Fichman, R. G. 2004. "Going Beyond the Dominant Paradigm for Information Technology Innovation Research: Emerging Concepts and Methods," *Journal of the Association for Information Systems* (5:8), pp. 314-355.

Fiol, C. M., and O'Connor, E. J. 2003. "Waking Up! Mindfulness in the Face of Bandwagons," *The Academy of Management Review* (28:1), pp. 54-70.

Gefen, D., Straub, D., and Boudreau, M. 2000. "Structural Equation Modeling and Regression: Guidelines for Research Practice," *Communications of AIS* (4:7), pp. 1-76.

Grover, V., Teng, J. T. C., and Fiedler, K. D. 2002. "Investigating the Role of Information Technology in Building Buyer–Supplier Relationships," *Journal of the Association for Information Systems* (3:7), pp. 217-245.

Hevner, A. R., March, S. T., Park, J., and Ram, S. 2004. "Design Science in Information Systems Research," *MIS Quarterly* (28:1), pp. 75-106.

Hong, W., Chan, F. K. Y., Thong, J. Y. L., Chasalow, L. C., and Dhillon, G. 2014. "A Framework and Guidelines for Context-Specific Theorizing in Information Systems Research," *Information Systems Research* (25:1), pp. 111-136.

Hsieh, J. P.-A., Rai, A., and Xu, S. X. 2011. "Extracting Business Value from IT: A Sensemaking Perspective of Post-Adoptive Use," *Management Science* (57:11), pp. 2018-2039.

Hu, L. T., Bentler, P. M., and Kano, Y. 1992. "Can Test Statistics in Covariance Structure Analysis Be Trusted?," *Psychological Bulletin* (112:2), pp. 351-362.

Jarvis, C. B., MacKenzie, S. B., and Podsakoff, P. M. 2003. "A Critical Review of Construct Indicators and Measurement Model Misspecification in Marketing and Consumer Research," *Journal of Consumer Research* (30:2), pp. 199-218.

Jensen, M. L., Dinger, M., Wright, R., and Thatcher, J. 2013. "Training to Mitigate Threats from Customized Phishing Attacks," in *Credibility Assessment and Information Quality in Government and Business,* J. Nunamaker (ed.), Los Alamitos, CA: IEEE Computer Society.

Kim, G., Shin, B., and Grover, V. 2010. "Investigating Two Contradictory Views of Formative Measurement in Information Systems Research," *MIS Quarterly* (34:2), pp. 345-366.

Kim, S. S., Malhotra, N. K., and Narasimhan, S. 2005. "Two Competing Perspectives on Automatic Use: A Theoretical and Empirical Comparison," *Information Systems Research* (16:4), pp. 418-432.

Landis, J. R., and Koch, G. G. 1977. "The Measurement of Observer Agreement for Categorical Data," *Biometrics* (33:1), pp. 159-174.

Langer, E. J. 1989. *Mindfulness*, Reading, MA: Addison-Wesley.

Langer, E. J. 1997. *The Power of Mindful Learning*, Reading, MA: Addison-Wesley.

Langer, E. J. 2004. *Langer Mindfulness Scale User Guide and Technical Manual*, Worthington, OH: IDS Publishing Corporation.

Langer, E. J. 2009. *Counterclockwise: Mindful Health and the Power of Possibility*, New York: Random House.

Langer, E. J. 2014. *Mindfulness, 25th Anniversary Edition*, Boston: Da Capo Press.

Langer, E., Hatem, M., Joss, J., and Howell, M. 1989. "Conditional Teaching and Mindful Learning: The Role of Uncertainty in Education," *Creativity Research Journal* (2:1), pp. 140-150.

Langer, E. J., and Moldoveanu, M. 2000. "The Construct of Mindfulness," *Journal of Social Issues* (56:1), pp. 1-9.

Law, K. S., and Wong, C. S. 1999. "Multidimensional Constructs in Structural Equation Analysis: An Illustration Using the Job Perception and Job Satisfaction Constructs," *Journal of Management* (25:2), pp. 143-160.

Levinthal, D., and Rerup, C. 2006. "Crossing an Apparent Chasm: Bridging Mindful and Less-Mindful Perspectives on Organizational Learning," *Organization Science* (17:4), pp. 502-513.

Lieberman, M., and Langer, E. J. 1997. "Mindfulness in the Process of Learning," in *The Power of Mindful Learning,* E. J. Langer (ed.), Reading, MA: Addison Wesley, pp. 65-79.

Limayem, M., Hirt, S. G., and Cheung, C. M. K. 2007. "How Habit Limits Predictive Power of Intention: The Case of Information Systems Continuance," *MIS Quarterly* (31:4), pp. 705-737.

Lockenhoff, C. E., Terracciano, A., Patriciu, N. S., Eaton, W. W., and Costa, P. T. J. 2009. "Self-Reported Extremely Adverse Life Events and Longitudinal Changes in Five-Factor Model Personality Traits in an Urban Sample," *Journal of Traumatic Stress* (22), pp. 53-59.

Louis, M. R., and Sutton, R. I. 1991. "Switching Cognitive Gears: From Habits of Mind to Active Thinking," *Human Relations* (44:1), pp. 55-76.

Magni, M., Taylor, M. S., and Venkatesh, V. 2010. "To Play or Not to Play: A Cross Temporal Investigation Using Hedonic and Instrumental Perspectives to Explain User Intentions to Explore a Technology," *International Journal of Human–Computer Studies* (68:9), pp. 572-588.

Marakas, G., Johnson, R., and Clay, P. F. 2007. "The Evolving Nature of the Computer Self-Efficacy Construct: An Empirical Investigation of Measurement Construction, Validity, Reliability and Stability Over Time," *Journal of the Association for Information Systems* (8:1), pp. 16-46.

McCrae, R. R., and Costa, P. T. 2008. "Empirical and Theoretical Status of the Five-Factor Model of Personality Traits," in *The SAGE Handbook of Personality Theory and Assessment: Volume 1—Personality Theories and Models,* G. Boyle, G. Matthews, and D. Saklofske (eds.), London: SAGE Publications, pp. 273-295.

McKnight, D. H., Choudhury, V., and Kacmar, C. 2002. "Developing and Validating Trust Measures for e-Commerce: An Integrative Typology," *Information Systems Research* (13:3), pp. 334-359.

Moore, G. C., and Benbasat, I. 1991. "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation," *Information Systems Research* (2:3), pp. 192-222.

Motowildo, S. J., Borman, W. C., and Schmit, M. J. 1997. "A Theory of Individual Differences in Task and Contextual Performance," *Human Performance* (10:2), pp. 71-83.

O'Reilly, T., and Battelle, J. 2009. "Web Squared: Web 2.0 Five Years On," *Web 2.0 Summit*, Newton, MA: O'Reilly Media, Inc. ((http://assets.en.oreilly.com/1/event/28/web2009_websquared-whitepaper.pdf; accessed July 6, 2015).

Ply, J. K., Moore, J. E., Williams, C. K., and Thatcher, J. B. 2012. "IS Employee Attitudes and Perceptions at Varying Levels of Software Process Maturity," *MIS Quarterly* (36:2), pp. 601-624.

Pickert, K. 2014. "The Mindful Revolution," *TIME*, February 3 (http://content.time.com/time/subscriber/article/0,33009,2163560,00.html).

Polites, G., Roberts, N., and Thatcher, J. 2012. "Conceptualizing Models Using Multidimensional Constructs: A Conceptual Review and Guidelines for their Use," *European Journal of Information Systems* (21:1), pp. 22-48.

Rerup, C. 2005. "Learning from Past Experience: Footnotes on Mindfulness and Habitual Entrepreneurship," *Scandinavian Journal of Management* (21:4), pp. 451-472.

Rindskopf, D., and Rose, T. 1988. "Some Theory and Applications of Confirmatory Second-order Factor Analysis," *Multivariate Behavioral Research* (23:1), pp. 51-67.

Roberts, N. H., Thatcher, J. B., and Klien, R. 2007. "Using Information Technology Mindfully," in *Proceedings of the 2007 Southern Association for Information Systems Conference* (http://aisel.aisnet.org/sais2007/1).

Ryckman, R. 2012. *Theories of Personality* (9th ed.), Belmont, CA: Thomson Wadswoth.

Salomon, G., and Globerson, T. 1987. "Skills May Not Be Enough: the Role of Mindfulness in Learning and Transfer," *International Journal of Educational Research* (11), pp. 623-638.

Satorra, A. C., and Bentler, P. M. 1988. "Scaling Corrections for Chi-Square Statistics in Covariance Structure Analysis," in *Proceedings of the Business and Economics Sections*, Alexandria, VA: American Statistical Association.

Shapiro, S. L., Oman, D., Thoresen, C. E., Plante, T. G., and Flinders, T. 2008. "Cultivating Mindfulness: Effects on Well-Neing," *Journal of Clinical Psychology* (64:7), pp. 840-862.

Sloman, S. A. 1996. "The Empirical Case for Two Systems of Reasoning," *Psychological Bulletin* (119), pp. 3-22.

Smith, G. T., Combs, J. L., and Pearson, C. M. 2012. "Brief Instruments and Short Forms," in *APA Handbook of Research Methods in Psychology*, H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf, and K. J. Sher (eds.), Washington, DC: American Psychological Association, pp. 395-409.

Smith, H. J., Dinev, T., and Xu, H. 2011. "Information Privacy Research: An Interdisciplinary Review," *MIS Quarterly* (35:4), pp. 989-1016.

Stark, L., and Crawford, K. 2015. "The Conservatism of Emoji: Work, Affect, and Communication," *Social Media + Society* (1:2), pp. 1-11.

Sternberg, R. J. 2000. "Images of Mindfulness," *Journal of Social Issues* (56:1), pp. 11-26.

Straub, D. W., Bourdreau, M.-C., and Gefen, D. 2004. "Validation Guidelines for IS Positivist Research," *Communications of the Association for Information Systems* (13:24), pp. 380-427.

Sun, H. 2011. "Making Sounds Adaption Decisions: A Longitudinal Study of Mindfulness in Technology Adoption and Continued Use," in *Proceedings of the 32nd International Conference on Information Systems*, Shanghai, China.

Sun, H. 2012. "Understanding User Revisions When Using Information System Features: Adaptive System Use and Triggers," *MIS Quarterly* (36:2), pp. 453-478.

Sun, H., and Fang, Y. 2010. "Toward a Model of Mindfulness in Technology Acceptance," in *Proceedings of the 31st International Conference on Information Systems*, St. Louis, MO.

Sun, H., Fang, Y., and Zou, H. 2016. "Making Sound Adoption Decisions: A Mindfulness Perspective," *Journal of the Association for Information Systems* (17:6).

Swanson, E. B., and Ramiller, . C. 2004. "Innovating Mindfully with Information Technology," *MIS Quarterly* (28:4), pp. 553-583.

Teasdale, J. D., Williams, J. M. G., Soulsby, J. M., Segal, Z. V., Ridgeway, V. A., and Lau, M. A. 2000. "Prevention of Relapse/Recurrance in Major Depression by Mindfulness-Based Cognitive Therapy," *Journal of Consulting and Clinical Psychology* (68:4), pp. 615-623.

Teo, T. S. H., Srivastava, S. C., Ranganathan, C., and Loo, J. W. K. 2011. "A Framework for Stakeholder Oriented Mindfulness: Case of RFID Implementation at YCH Group, Singapore," *European Journal of Information Systems* (20:2), pp. 201-220.

Thatcher, J. B., and Perrewe, P. L. 2002. "An Empirical Examination of Individual Traits as Antecedents to Computer Anxiety and Computer Self-Efficacy," *MIS Quarterly* (26:4), pp. 381-396.

Thomas, D. C. 2006. "Domain and Development of Cultural Intelligence," *Group & Organization Management* (31:1), pp. 78-99.

Tiwana, A., and McLean, E. R. 2005. "Expertise Integration and Creativity in Information Systems Development," *Journal of Management Information Systems* (22:1), pp. 13-43.

Venkatesh, V. 1999. "Creation of Favorable User Perceptions: Exploring the Role of Intrinsic Motivation," *MIS Quarterly* (23:2), pp. 239-260.

Venkatesh, V. 2000. "Determinants of Perceived Ease of Use: Integrating Control, Intrinsic Motivation, and Emotion into the Technology Acceptance Model," *Information Systems Research* (11:4), pp. 342-346.

Venkatesh, V., and Bala, H. 2008. "Technology Acceptance Model 3 and a Research Agenda on Interventions," *Decision Sciences* (39:2), pp. 273-315.

Venkatesh, V., Morris, M. G., Davis, G. B., and Davis, F. D. 2003. "User Acceptance of Information Technology: Toward a Unified View," *MIS Quarterly* (27:3), pp. 425-478.

Vogus, T. J., and Sutcliffe, K. M. 2007. "The Safety Organizing Scale: Development and Validation of a Behavioral Measure of Safety Culture in Hospital Nursing Units.," *Med Care* (45:1), pp. 46-54.

Wallace, B. A. 2006. *The Attention Revolution: Unlocking the Power of the Focus Mind*, Boston: Wisdom Publication.

Webster, J., and Martocchio, J. 1992. "Microcomputer Playfulness: Development of a Measure with Workplace Implications," *MIS Quarterly* (16:2), pp. 201-226.

Weick, K. E., and Sutcliffe, K. M. 2006. "Mindfulness and the Quality of Organizational Attention," *Organization Science* (17:4), pp. 514-524.

Weick, K. E., Suttcliffe, K. M., and Obstfeld, D. 1999. "Organizing for High Reliability: Processes of Collective Mindfuless," *Research in Organizational Behavior* (21), pp. 81-123.

Wittmann, M., Peter, J., Gutina, O., Otten, S., Kohls, N., and Meissner, K. 2014. "Individual Differences in Self-Attributed Mindfulness Levels Are Related to the Experience of Time and Cognitive Self-Control," *Personality and Individual Differences* (64), pp. 41-45.

Wong, C. W. Y., Lai, K.-H., and Teo, T. S. H. 2009. "Institutional Pressures and Mindful IT Management: The Case of a Container Terminal in China," *Information & Management* (46), pp. 434-441.

Yi, M. Y., Fiedler, K. D., and Park, J. S. 2006. "Understanding the Role of Individual Innovativeness in the Acceptance of IT-Based Innovations: Comparative Analyses of Models and Measures," *Decision Sciences* (37:3), pp. 393-426.

About the Authors

Jason Thatcher is a professor of Information Systems in the Culverhouse College of Business at the University of Alabama. He also holds an appointment as professor at the Information Technology University–Copenhagen. His research examines the influence of individual beliefs and characteristics on information technology use. He also studies strategic and human resource management issues related to the application of information technologies in organizations. His work appears in *MIS Quarterly, Journal of*

Applied Psychology, and other outlets. He serves as a senior editor at *MIS Quarterly* as well as past-president of the Association for Information Systems. He lives in Greenville, SC, where he enjoys the company of good friends, fresh collards from the local farmers markets, and slow cooked barbecue.

Ryan Wright is an associate professor in the McIntire School of Commerce at the University of Virginia. Ryan holds a Ph.D. in Business Administration from Washington State University. He also holds both a MBA and a B.S. in MIS from The University of Montana. Ryan's research interests include IT security and privacy, diffusion of innovations, and digital entrepreneurship. Ryan's research has been published in *MIS Quarterly, Information Systems Research, Journal of MIS,* and other high quality outlets. He current serves as vice president for the Association for Information Systems.

Heshan Sun is an associate professor in the Division of Management Information Systems of the Price College of Business at the University of Oklahoma. Heshan received his Ph.D. in Information Science and Technology from Syracuse University in 2007. His research interests include human–computer interaction, post-adoptive system use, trust and e-commerce, and business analytics. His research has been published (or will appear) in prestigious journals such as the *MIS Quarterly*, *Journal of the Association for Information Systems*, *Decision Support Systems*, *Journal of the American Society for Information Science and Technology*, *AIS Transactions on Human–Computer Interaction, Communications of the Association for Information Systems, International Journal of Human–Computer Studies, Journal of Information Technology Theory and Application,* and *International Journal of Human–Computer Interaction*, and proceedings of International Conference on Information Systems, among others. Heshan served as an associate editor for *MIS Quarterly*. He won the prestigious Reviewer of the Year Award from *MIS Quarterly* in 2012.

Thomas J. Zagenczyk is a professor in the Department of Management at Clemson University. Tom's research integrates psychological and social network methods to better understand the role that both individual differences and social–contextual factors play in shaping employee–organization relationships and between co-workers. His work has appeared in outlets such as *Journal of Applied Psychology, Organizational Behavior and Human Decision Processes, Journal of Management, Journal of Management Studies*, and *Leadership Quarterly*. Tom serves as an associate editor for *Group & Organization Management*.

Richard Klein is a professor in the Department of Information Systems and Business Analytics as well as the Associate Dean for Undergraduate Affairs at Florida International University's College of Business in Miami, Florida. His research examines healthcare information systems and informatics, electronic business initiatives, and interorganizational information systems. Richard has published work in top journals, including *Decision Sciences, European Journal of Information Systems, Information and Management, Journal of Management Information Systems, MIS Quarterly,* and *Journal of Operations Management*. He also serves as an associate editor for *European Journal of Information Systems* and has co-chaired healthcare related tracks at both the Americas Conference on Information Systems and the European Conference on Information Systems. Additionally, Richard has over a decade of industry experience with Automatic Data Processing and the First Data Corporation.

MIS Quarterly

RESEARCH ARTICLE

MINDFULNESS IN INFORMATION TECHNOLOGY USE: DEFINITIONS, DISTINCTIONS, AND A NEW MEASURE

Jason Bennett Thatcher
Management Department, College of Business, Clemson University,
Clemson, SC 29603 U.S.A. {jthatcher@clemson.edu}
and Technology, Innovation Management, and Entrepreneurship Research Group, Information Technology
University–Copenhagen, Copenhagen, DENMARK {that@itu.dk}

Ryan T. Wright
McIntire School of Commerce, University of Virginia,
Charlottesville, VA 22903 U.S.A. {rtwright@virginia.edu}

Heshan Sun
Division of Management Information Systems, Price College of Business, University of Oklahoma,
Norman, OK 73019 U.S.A. {sunheshan@gmail.com}

Thomas J. Zagenczyk
Management Department, College of Business, Clemson University,
Clemson, SC 29603 U.S.A. {thomasj@clemson}

Richard Klein
Information Systems & Business Analytics, Florida International University,
Miami, FL 33199 U.S.A. {rklein@fiu.edu}

Appendix A

Pilot Study and Study 1 Details

A pilot study was used to help conceptualize an IT mindfulness scale. To do so we recruited 80 MBA students and completed a match and sort exercise. An IT mindfulness scale was developed using this data. Next, Study 1 assessed the measurement properties of our proposed IT mindfulness scale. To do so, we collected two datasets. Our first dataset comprised survey responses from 238 students enrolled in introductory information management courses at two large southeastern universities in the United States, while the second dataset included data from 316 students enrolled in a similar course at a third large southeastern university. We used Internet applications (e.g., Instant Messenger and the World Wide Web) as the target technology for both data collections. This suite of technologies serves as an appropriate platform for examining IT mindfulness as the subjects (1) have opportunities for using these tools; (2) can use these technologies across diverse situations; and (3) possess sufficient experience to have developed a deep understanding of each application's features and functionality. Some 40.2% of respondents were female and 58%, in their third year of study, while the other 42% were in their fourth year (or higher) at their respective institution. Participants received extra credit in exchange for completing a survey during regular class meetings. The following outlines the steps undertaken in the pilot study and Study 1.

Step 1: Content and Face Validity with a Pilot Study (80 Subjects)

We developed our scale for IT mindfulness by adapting Langer's (2004) mindfulness scale to the specific context of IT use. One potential issue with our approach of adapting Langer's items is that the words used in her scale do not always reflect the names of the construct very clearly; some readers may therefore be unsure of the face validity of the scale. To allay these concerns, we offered 80 full-time and part-time MBA students at a public uiversity in the southeastern United States the opportunity to complete a survey, in which they matched the IT mindfulness items with items from Langer's (1997) original scale. Participants received a single extra credit point on an exam for completing the survey.

The matching exercise included an instrument with two columns. The first column provided a numbered list of Langer's (1997) mindfulness items. The second column included a numbered list of our IT mindfulness items. We asked participants to examine each of Langer's items and match each item with the corresponding IT mindfulness item they thought most closely related. The results allowed us to calculate the degree to which respondents perceived Langer's mindfulness and our IT mindfulness items conceptually similar.

We received complete responses from 79 of the 80 students enrolled (98.8%), with the majority of the respondents (55.6%) full-time professionals pursuing their degree part-time. Respondents averaged 32 years in age with the majority male (64.6%). To estimate the face validity of our construct, we calculated the percentage of correct matches (1) overall between the scales and (2) for each pair of items in the scale. We found that,overall, respondents accurately matched the IT mindfulness item with the mindfulness item 87.21% of the time. In addition, no pair of items has a match rate less than 80%. The results provide strong evidence that respondents viewed the IT mindfulness items and Langer's items as conceptually similar.

Step 2: Principal Components Analysis (238 Subjects)

We conducted a principal components analysis (PCA), using the data collected from 238 subjects, to assess dimensionality of our initial 12-item measure. Based on results of the PCA, we dropped one item (MP3) that cross-loaded with both the orientation in the present (0.573) and awareness of multiple perspectives (0.343) dimensions. A subsequent PCA suggested that the remaining 11 items mapped to the appropriate IT mindfulness dimensions (see Table A1).

Table A1. Factor Analysis of IT Mindfulness Items

Item	Mean	S.D.	Alertness to Distinction	Awareness of Multiple Perspectives	Openness to Novelty	Orientation in the Present
ITMD-AD1	5.65	1.18	**0.775**	0.199	0.278	0.232
ITMD-AD2	5.40	1.10	**0.894**	0.135	0.111	0.111
ITMD-AD3	4.42	1.47	**0.808**	0.250	0.201	0.136
ITMD-MP1	4.10	1.52	0.206	**0.896**	0.149	0.151
ITMD-MP2	4.17	1.52	0.253	**0.894**	0.127	0.087
ITMD-ON1	4.36	1.44	0.261	0.133	**0.803**	0.326
ITMD-ON2	4.40	1.46	0.344	0.184	**0.719**	0.363
ITMD-ON3	4.39	1.37	0.093	0.086	**0.772**	0.302
ITMD-OP1	5.65	1.49	0.133	0.021	0.021	**0.879**
ITMD-OP2	5.40	1.44	0.090	0.075	0.048	**0.863**
ITMD-OP3	3.95	1.14	0.156	0.088	0.078	**0.818**
Eigenvalue			2.432	1.857	2.036	3.074
Percent of Variance			20.27	15.48	16.97	25.61

Notes: Principal Components with Varimax rotation
Analysis conducted using SPSS 16.0
ITMD = IT Mindfulness, AD = Alertness to Distinction, MP = Awareness of Multiple Perspectives, ON = Openness to Novelty, and OP = Orientation in the Present

Step 3: Confirmatory Factor Analysis (316 Subjects)

Using our second dataset of 316 subjects, we performed a series of confirmatory factor analyses (CFAs) using EQS 6.1 to assess the dimensionality and convergent validity of our IT mindfulness measure.

We estimated three models using our original 12 items. Model 1 (unidimensional) hypothesized a unidimensional first-order factor, accounting for variance among all items. Model 2 (first-order, multidimensional) hypothesized that the 12-items form four freely correlated first-order factors, namely, (1) alertness to distinction, (2) awareness of multiple perspectives, (3) openness to novelty, and (4) orientation in the present. Model 3 (second-order) evaluated whether a second-order factor accounts for the relationships among the first-order factors. Before conducting model comparisons, we inspected item level loadings. Consistent with our first step, the CFAs consistently found that one item (MP3) loaded at less than 0.404. Therefore, we dropped this item and reestimated CFAs for all three models. The resulting loadings are satisfactory (see Table A2).

Table A2. Item Loadings, Means and Standard Deviations

Item	Standardized Item Loading	Mean	S.D.
ITMD-AD1	0.86	4.14	1.51
ITMD-AD2	0.91	4.16	1.47
ITMD-AD3	0.71	4.66	1.51
ITMD-MP1	0.87	5.35	1.28
ITMD-MP2	0.91	5.47	1.18
ITMD-ON1	0.82	4.16	1.42
ITMD-ON2	0.88	4.16	1.35
ITMD-ON3	0.94	4.22	1.40
ITMD-OP1	0.76	4.34	1.34
ITMD-OP2	0.79	4.48	1.23
ITMD-OP3	0.81	4.51	1.23

Notes: Analysis was conducted in EQS 6.1
ITMD = IT Mindfulness, AD = Alertness to Distinction, MP = Awareness of Multiple Perspectives, ON = Openness to Novelty, and OP = Orientation in the Present
All standardized item loadings are significant at $p < .01$

Step 4: A Higher-Order Conceptualization of IT Mindfulness (316 Subjects)

Using the results of the respecified model, we compared Model 1 (uni-dimensional) with Model 2 (multidimensional) to assess the dimensionality of IT mindfulness from the dataset with 316 subjects. Considering Model 1 ($\chi^2 = 722.66$, d.f. $= 44$, CFI = 0.70, RMSEA = 0.221) and Model 2 ($\chi^2 = 99.70$, d.f. $= 38$, CFI = 0.97, RMSEA = 0.072) nested fit statistics suggest that Model 2 demonstrated a better fit with the data ($\Delta\chi^2 = 622.96$, Δ d.f. $= 6$, $p < 0.0001$). This comparison finds Model 2, a multidimensional model comprised of four correlated first-order factors, superior to Model 1, a unidimensional first-order factor model. Moreover, in Model 2, we find the standardized factor loadings of items on their respective factors all significant ($p < .001$), providing additional support for *discriminant* and *convergent validity* of each dimensions' measures (Gefen et al. 2011). In sum, our analyses confirm the *multidimensional* structure of IT mindfulness.

Next, we compared Model 2 (first-order, multidimensional) and Model 3 (second-order) in an effort to assess the higher-order structure of IT mindfulness. A comparison of Model 2 ($\chi^2 = 99.70$, d.f. $= 38$, CFI = 0.97, RMSEA = 0.072) and Model 3 ($\chi^2 = 105.22$, d.f. $= 40$, CFI = 0.97, RMSEA = 0.072) reveals almost identical fit statistics. Model 3 not only provided acceptable model fit measures (Boomsma 2000; Gefen et al. 2000), but also proved more parsimonious with fewer parameters estimated and greater degrees of freedom (Grover et al. 2002). Moreover, our analysis finds all Model 3 item loadings significant at the $p < 0.001$ level (see Table A3 for item loadings, means, and standard deviations), further supporting the second-order factor model. Therefore, consistent with the mindfulness literature (Sternberg 2000), our analysis suggests that Model 3, a *higher-order multidimensional* operationalization of the IT mindfulness construct, accurately reflects our superordinate second-order conceptualization.

We then used chi-square difference tests to assess the discriminant validity of the four dimensions. For each pair of constructs, we compared the previously identified model's fit with the fit of a model where the two constructs were not set to be distinct. Constraining correlations between pairs of constructs to 1.0 suggests that items measure the same construct, while a significant difference between the χ^2 measures indicates discriminant validity (Venkatraman 1989). We found all chi-square differences significant at the $p < 0.01$ level (see Table A3). In addition, the estimated correlations between all pairs of constructs fell below the 0.90 threshold (Bagozzi et al. 1991), suggesting *discriminant validity* among the four IT mindfulness dimensions (see Table A4).

Table A3. Chi-Square Difference Tests to Assess Discriminant Validity

Dimensions	Constrained Model χ^2 (df)	Unconstrained Model χ^2 (df)	$\Delta\chi^2$
Alertness to distinction **with**			6.64
Awareness of multiple perspectives	26.76 (5)	19.59 (4)	7.17
Openness to novelty	26.08 (9)	19.34 (8)	6.74
Orientation in the present	28.61 (9)	21.14 (8)	7.47
Awareness of multiple perspectives **with**			
Openness to novelty	30.92 (5)	12.57 (4)	18.35
Orientation in the present	23.95 (5)	12.75 (4)	11.20
Orientation in the present **with**			
Openness to novelty	35.85 (9)	23.46 (8)	12.39

Note: Analysis conducted using EQS 6.1

As a final step, we evaluate reliability and average variance extracted (AVE) values (see Table A4). Our measures exceeded the 0.70 thresholds for Cronbach's alpha and composite reliability (Nunnally and Bernstein 1994). Although correlated, each dimension's AVE exceeds off-diagonal elements, suggesting dimensions constitute conceptually related, yet *discriminant*, parts of a superordinate second-order construct (Polites and Karahanna 2012).

Table A4. Construct Means, Standard Deviations, Reliabilities, and Correlation of Constructs

Construct	Mean	S.D.	Composite Reliability	Cronbach's Alpha	1	2	3	4
1. ITMD-AD	4.32	1.32	0.94	0.86	**0.85**			
2. ITMD-MP	5.42	1.17	0.93	0.88	0.48	**0.90**		
3. ITMD-ON	4.18	1.27	0.94	0.91	0.68	0.40	**0.87**	
4. ITMD-OP	4.44	1.09	0.90	0.83	0.63	0.42	0.67	**0.72**

Notes: Analysis conducted using EQS 6.1
Square-roots of the AVEs appear in bold along the diagonal of the correlation of constructs.
ITMD = IT Mindfulness, AD = Alertness to Distinction, MP = Awareness of Multiple Perspectives, ON = Openness to Novelty, and OP = Orientation in the Present

Step 5: Discriminant and Predictive Validity (316 Subjects)

To evaluate predictive and convergent validity of IT mindfulness, we compared our scale using the dataset with 316 subjects again, with cognitive absorption (CA). Although IT mindfulness and CA share a connection to the moment, they differ in terms of their task focus. Task focus refers to the target of a user's attention when completing a task (e.g., a narrow focus on completing a specific task versus a broad focus on using IT to support many aspects of one's job) (Dane 2011). IT mindfulness has a broader task focus than cognitive absorption. An IT mindful user would likely be aware of how more, or new, features of Internet applications enable task completion, all while being sensitive to how their use affects the remainder of their work. In contrast, when cognitively absorbed, users hyper-focus on performing a single task, or narrowly defined set of tasks, to accomplish a desired outcome (Csikszentmihalyi 1990). Because of cognitive absorption's focus on immersion in IT use, CA should exert more influence than IT mindfulness, a more broadly defined construct, on technology acceptance beliefs. This is because technology acceptance beliefs, as conceptualized and measured using constructs like PU and PEOU, are useful and easy to use

for a specific task. Just as Fishbein and Azjen (1975) argued that beliefs will correlated more highly with behaviors if they are at the same level of abstraction, we believe that, compared to IT mindfulness, CA will correlate more strongly with technology acceptance beliefs. In short, IT mindfulness has a broader task focus. As a result, we predict that compared to IT mindfulness, CA will have a stronger influence on PU and PEOU.

Next, with the same dataset of 316 subjects, we evaluate a structural model that includes IT mindfulness, CA, and two technology acceptance constructs of interest (e.g., PU and PEOU). Figure A1 presents the results of the structural model. The measurement model provides evidence of the discriminant validity of IT mindfulness relative to the other three constructs (see Table A5). We also performed a *chi-square* differences test for cognitive absorption and IT mindfulness. The difference is significant ($\Delta \chi^2 = 86.58$, $p < .001$), indicating further strong support for discriminant validity. Moreover, the structural model provides evidence that CA demonstrated greater predictive power than IT mindfulness in affecting both PU and PEU. Indeed, when CA is present, IT mindfulness does not significantly relate to either technology acceptance construct.

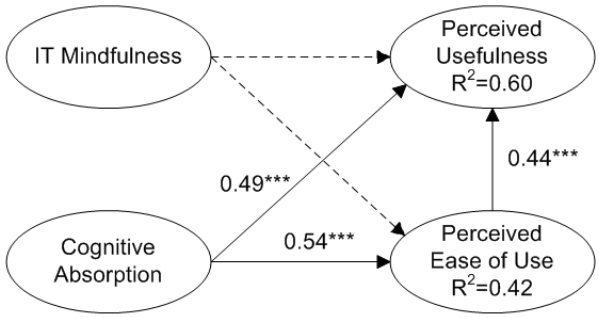

Figure A1. Predictive Validity

Table A5. CA/IT Mindfulness: AVEs, Correlations and Reliabilities

Construct	Mean	S.D.	C.R.	C.A.	1	2	3	4	5	6	7	8	9	10	11
1. ITMD-AD	4.27	1.31	0.93	0.89	**0.87**										
2. ITMD-MP	5.41	1.17	0.94	0.88	0.45	**0.94**									
3. ITMD-ON	4.16	1.22	0.94	0.91	0.65	0.39	**0.88**								
4. ITMD-OP	4.30	1.11	0.92	0.89	0.61	0.36	0.68	**0.84**							
5. CA-CO	4.85	0.96	0.82	0.67	0.29	0.39	0.33	0.36	**0.79**						
6. CA-CU	4.59	1.12	0.97	0.95	0.50	0.43	0.64	0.55	0.37	**0.95**					
7. CA-FI	4.32	1.00	0.87	0.82	0.25	0.17	0.28	0.32	0.31	0.36	**0.77**				
8. CA-HE	4.99	1.03	0.90	0.85	0.32	0.39	0.42	0.44	0.55	0.58	0.41	**0.84**			
9. CA-TD	5.39	1.15	0.96	0.95	0.20	0.27	0.19	0.27	0.39	0.31	0.31	0.59	**0.88**		
10. PEU	5.11	1.06	0.93	0.89	0.35	0.36	0.32	0.39	0.58	0.32	0.38	0.47	0.39	**0.87**	
11. PU	5.28	1.04	0.96	0.94	0.34	0.44	0.36	0.37	0.55	0.42	0.37	0.55	0.51	0.65	**0.92**

Notes: Square Root of AVEs are in bold and reported along the diagonal of the correlation of constructs.
ITMD = IT Mindfulness, AD = Alertness to Distinction, MP = Awareness of Multiple Perspectives, ON = Openness to Novelty, OP = Orientation in the Present, CA = Cognitive Absorption, CO = Control, CU = Curiosity, FI = Focused Immersion, HE = Heightened Enjoyment, TD = Temporal Dissociation, PEU = Perceived Ease of Use, and PU = Perceived Usefulness

Appendix B

Study 2 Details

Langer's (1989) research suggests that absolute instruction produces lower levels of mindfulness, whereas conditional instruction provokes greater levels of mindfulness. Absolute instruction provides a strict set of conditions and outcomes specific to task completion, whereas conditional instruction "allows the processing of information with some uncertainty, as if it could be true rather than as if it is true" (Langer 1989, p. 141). In a series of three experiments, Langer et al. (1989) showed that these conditions result in different levels of mindfulness.

Following Langer's approach, we conducted an experiment that manipulated absolute and conditional instructions as part of an assignment. We asked subjects to develop a "visual resume" using either PowerPoint or Prezi. PowerPoint is a popular computer-based presentation tool; Prezi is a popular cloud-based, open-ended, nonlinear presentation tool (www.prezi.com). In the absolute condition, we outlined specific requirements, including use of template, application of color, inclusion of pictures and content, as well as number of slides. For the conditional instruction, we provided the following much broader instructions.

> *Create a PowerPoint (or Prezi) presentation that highlights you. The presentation will be used to highlight students to alumni and potential employers. We recommend that you think of this presentation as your Visual Resume. The story, look, and feel of the presentation is up to you.*

We invited 390 students enrolled in an introductory information systems course at a large northeastern university to participate in our experiment. Participating students received extra credit. We randomly assigned students to one of the four conditions, specifically, (1) PowerPoint with absolute instructions, (2) PowerPoint with conditional instructions, (3) Prezi with absolute instructions, and (4) Prezi with conditional instructions. We first introduced the students to the focal technology (PowerPoint or Prezi) specific to the respective condition and gave a 10-minute demonstration. The same person provided the demonstration, irrespective of the condition. For subjects in the Prezi condition, the tutorial included two short 5-minute videos instructing them how to create a presentation. All subjects in the PowerPoint condition viewed a similar 10-minute tutorial. Subsequently, we administered a pre-survey at Time 1 asking subjects how they would use the assigned technology. Constructs in this survey included (1) IT mindfulness, (2) computer playfulness (Webster and Martocchio 1992), (3) user experience (Marakas et al. 2007), (4) IS creativity (Tiwana and McLean 2005), and (5) personal innovativeness in IT (PIIT) (Agarwal and Prasad 1998). After completing the pre-survey, students received their assignment with conditional or absolute instructions and were given two business days to complete it. Upon completion of the assignment at Time 2, participants received a post-experiment survey. This survey included scales for (1) IT mindfulness, (2) behavioral intention (Venkatesh and Davis 2000), and (3) satisfaction (Bhattacherjee 2001). We also conducted manipulation checks, confirming experiment validity. In total, 268 students completed both surveys as well as the assignment. Table B1 provides sample characteristics.

Table B1. Sample Characteristics

	Mean	S.D.
Age	20.34	3.44
Prezi Experience	3.31 (7-Point Likert)	1.97
PPT Experience	5.84 (7-Point Likert)	1.39
Gender	Male/Female	133/135

Note: All Students enrolled in a sophomore level business course.

We estimated a confirmatory factor analysis using Mplus 7.0. All items loaded on the appropriate factor at or above 0.70, with the exception of one PIIT item and one IT mindfulness item, with each loading at 0.69 and 0.68 respectively. The average variance extracted (AVE) of all constructs exceeded the 0.05 threshold. Overall, we found evidence of stability in our items. Table B2 reports the composite reliabilities and AVE of IT mindfulness dimensions as well as item loadings.

Table B2. Item Loadings, Means and Standard Deviations

Item	Standardized Item Loading	Mean	S.D.
AD1	0.71	5.48	0.96
AD2	0.87	5.53	1.01
AD3	0.86	5.21	1.07
MP1	0.91	6.01	0.94
MP2	0.96	6.03	0.93
ON1	0.93	5.26	1.14
ON2	0.68	5.40	1.21
ON3	0.89	5.39	1.17
OP1	0.92	5.75	1.10
OP2	0.93	5.68	0.97
OP3	0.96	5.52	1.05

Notes: Analysis was conducted in EQS 6.1
AD = Alertness to Distinction, OP = Orientation in the Present, MP = Awareness of Multiple Perspectives, ON = Openness to Novelty
All standardized item loadings are significant at $p < .01$

We evaluated the discriminant validity of IT mindfulness by comparing the construct to computer playfulness, behavioral intention, IS creativity, PIIT, and satisfaction. We employed the guidelines found in the multiple-dimensional constructs literature and compared off-diagonal elements of our correlations matrix to the square roots of the AVEs at the construct level (Roberts and Thatcher 2009; Wright et al. 2012). As reported in Table B3, IT mindfulness discriminates from the other constructs: no correlation in the appropriate row and column intersection exceeds the square root of the AVE. It is worth noting that PIIT and IS creativity correlated at 0.96, and thus are not discriminant. Given these constructs fall outside of the focus of this study, we moved forward with our analysis. Moreover, fit statistics (see Table B4) exceeded established cutoffs (Brown 2006).

Table B3. Correlation Matrix for Measurement Model

Construct	Mean	S.D.	C.R.	C.A.	1	2	3	4
(1) IT Mindfulness	5.61	1.04	0.87	0.87	**0.83**			
(2) Computer Playfulness	5.36	1.13	0.98	0.98	0.47	**0.97**		
(3) IS Creativity	4.94	1.48	0.93	0.90	0.26	0.31	**0.89**	
(4) PIIT	4.56	1.50	0.87	0.86	0.50	0.39	0.50	0.83

Notes: Square Root of AVEs are in bold and reported along the diagonal of the correlation of constructs.
PIIT = Personal Innovativeness with IT.

Table B4. Fit Statistics for the Measurement Model

Statistic	Value	Cutoffs
CFI	0.95	0.90
RMSEA	0.07	0.08

To determine whether IT mindfulness changed as a result of our experimental manipulations, we estimated several models using the latent factor scores derived from the measurement model. We first used two simple ANOVA analyses to evaluate whether differences existed between how participants viewed their interaction with the Prezi and PowerPoint software. Table B5 suggested that differences exist between Prezi and PowerPoint with respect to IS creativity and personal innovativeness in IT (PIIT), but not computer playfulness or IT mindfulness. Next, we examined whether differences existed in IT mindfulness across PowerPoint and Prezi after training (i.e., T2). Our ANOVA results found no difference ($p > .383$) between IT mindfulness associated with the different types of technology used for the task.

Table B5. Between-Technology Difference		
Construct	**F**	**Sig.**
IT Mindfulness (Time 1)	0.02	0.901
Computer Playfulness	3.08	0.081
Experience with the Prezi / PPT	242.53	0.000
IT Creativity	15.85	0.000
Personal Innovativeness in IT	12.61	0.000

Finally, we conducted an ANCOVA analysis to explore the difference in the mindfulness condition (i.e., absolute and conditional instructions) with respect to IT mindfulness, while controlling for experience with the presentation software as well as participants' age and gender. We find that an absolute task does indeed lower IT mindfulness compared to the conditional instruction ($p < 0.022$). In sum, our results indicate that IT mindfulness can be manipulated based on conditional and absolute task instructions. We report these results in Table B6.

Table B6. ANCOVA for IT Mindfulness (Time 2)		
Construct	**F**	**Sig.**
Mindfulness Condition	5.33	0.022
Age	0.37	0.848
Experience	2.31	0.129
Gender	2.86	0.092

Note: Age, experience, and gender are covariates in this analysis.

Appendix C

Study 3 Details

To further establish the predictive validity of our IT mindfulness scale, Study 3 placed IT mindfulness in the nomological net used to describe post-adoption system use. Also, we used hierarchical regression and dominance analysis to compare the predictive power of IT mindfulness and trait mindfulness. Table C1 reports Study 3 sample characteristics.

Table C1. Sample Characteristics		
	Mean	**S.D.**
Age	46.38	9.73
Excel Experience	5.89 (7-Point Likert)	1.31
PC Experience	6.86 (7-Point Likert)	0.41
Work Experience	9.9 Years	8.60
Gender	Male / Female / Non-report	99 /204 /1
Education level	High school Associates degree Bachelor's degree Post-graduate degree	50 61 112 81

Note: Work experience is the number of years at the current company.

We evaluated whether our second-order construct of IT mindfulness accounts for the relationships among its first-order factors. Consistent with Study 1, the second-order factor model results (χ^2 =76.93, d.f. = 40, CFI = .991 RMSEA = .060) recommended a higher-order construct of IT mindfulness. In addition, we found all chi-square differences between IT mindfulness dimensions significant at the $p < .01$ level, indicating discriminant validity. Finally, the correlations (see Table C2) between all pairs of first-order constructs of IT mindfulness fall below 0.90 (Bagozzi et al. 1991), indicating distinct dimensions. Table C3 provides the item measures as well as means and standard deviations.

Table C2. AVEs, Correlations and Reliabilities

Construct	Mean	SD	CR	CA	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. ITMD-AD	4.26	1.4	.92	.92	**.89**													
2. ITMD-MP	5.59	1.1	.90	.89	.63	**.90**												
3. ITMD-ON	4.83	1.3	.93	.93	.83	.49	**.91**											
4. ITMD-OP	4.50	1.3	.81	.80	.84	.82	.83	**.77**										
5. MD-AD	5.20	1.1	.89	.88	.41	.50	.38	.41	**.82**									
6. MD-MP	5.43	1.0	.79	.78	.37	.35	.39	.37	.57	**.75**								
7. MD-ON	5.84	0.9	.89	.88	.45	.44	.43	.45	.62	.67	**.79**							
8. MD-OP	5.35	0.9	.69	.69	.53	.37	.38	.53	.66	.79	.73	**.66**						
9. CON	5.66	1.2	.79	.85	.34	.63	.37	.34	.07	.05	.14	.12	**.76**					
10. DSU	4.81	1.4	.92	.91	.59	.57	.52	.59	.37	.27	.34	.40	.49	**.83**				
11. TRY	4.24	1.5	.93	.93	.60	.30	.56	.60	.35	.21	.25	.34	.45	.67	**.91**			
12. PEU	5.16	1.1	.86	.85	.49	.40	.50	.49	.14	.12	.12	.14	.41	.38	.42	**.78**		
13. PU	5.48	1.1	.93	.93	.55	.50	.59	.55	.18	.22	.22	.18	.46	.45	.35	.62	**.87**	
14. SSE	7.57	2.3	.95	.95	.39	.60	.38	.39	.25	.20	.29	.32	.50	.53	.52	.41	.50	**.88**

Notes: Square-root of the AVEs are reported in bold along the diagonal of the correlation of constructs.
ITMD = IT Mindfulness, MD = Trait Mindfulness, AD = Alertness to Distinction, MP = Awareness of Multiple Perspectives, ON = Openness to Novelty, OP = Orientation to the Present, CON = Continuance Intention, DSU = Deep Structure Usage, TRY = Trying to Innovate, PEU = Perceived Ease of Use, PU = Perceived Usefulness, and SSE = Spreadsheet Self-Efficacy
Measurement Model Fit Statistics Chi-square 1955.73 with 1,084 degrees of freedom, CFI = .93, RMSEA .051

Table C3. Item Measures

Construct & Item		Mean	S.D.
IT Mindfulness: Alertness to Distinction[a]			
AD1	I find it easy to create new and effective ways of using Excel.	4.32	1.49
AD2	I am very creative when using Excel.	4.23	1.54
AD3	I make many novel contributions to my work-related tasks through the use of Excel.	4.18	1.54
IT Mindfulness: Awareness of Multiple Perspectives[a]			
MP1	I am often open to learning new ways of using Excel.	5.53	1.20
MP2	I have an open mind about new ways of using Excel.	5.66	1.04
IT Mindfulness: Openness to Novelty[a]			
ON1	I like to investigate different ways of using Excel.	4.72	1.36
ON2	I am very curious about different ways of using Excel.	4.84	1.38
ON3	I like to figure out different ways of using Excel.	4.79	1.39
IT Mindfulness: Orientation in the Present[a]			
OP1	I often notice how other people are using Excel.	4.34	1.68
OP2	I attend to the 'big picture' of a project when using Excel.	4.42	1.41
OP3	I 'get involved' when using Excel.	4.76	1.42
Continuance Intention[b]			
CON1	I intend to continue using Excel rather than discontinue its use.	6.96	1.18
CON2	My intentions are to continue using Excel rather than use any alternative means.	6.40	1.31
CON3	If I could, I would like to discontinue my use of Excel [c]	5.06	1.64
Deep Structure Usage[b]			
DSU1	I use features that help me analyze my data.	4.18	1.59
DSU2	I use features that help me compare and contrast aspects of the data.	4.48	1.63
DSU3	I use features that help me test different assumptions in the data.	4.56	1.72
DSU4	I use features that help me derive insightful conclusions from the data.	4.40	1.67
DSU5	I use features that help me perform calculations on my data.	4.69	1.55
Trying to Innovate[b]			
TRY1	I discovered new features of Excel.	4.36	1.52
TRY2	I found new uses of Excel.	4.30	1.59
TRY3	I used Excel in novel ways.	4.24	1.65
Perceived Ease of Use[a]			
PEU1	My interaction with Excel is clear and understandable.	5.27	1.26
PEU2	Interacting with Excel does not require a lot of mental effort.	5.23	1.45
PEU3	I find it easy to get Excel to do what I want it to do.	5.16	1.36
PEU4	I find Excel to be easy to use.	5.09	1.34
Perceived Usefulness[a]			
PU1	Helps me to accomplish tasks more quickly.	5.24	1.16
PU2	Improves the quality of the work I do.	5.35	1.20
PU3	Gives me greater control over my work.	5.31	1.21
PU4	Enhances my effectiveness in my work.	5.27	1.17
Spreadsheet Self-Efficacy[a, d] **I believe I have the ability to…**			
SSE1	manipulate the way a number appears in a spreadsheet.	5.41	2.49
SSE2	use and understand the cell references in a spreadsheet.	6.56	2.38
SSE3	use a spreadsheet to communicate numeric information to others.	7.18	2.33
SSE4	write a simple formula in a spreadsheet to perform mathematical calculations.	7.56	2.50
SSE5	use a spreadsheet to display numbers as graphs.	7.67	2.59

Notes: [a]Collected in Time 1
[b]Collected in Time 2
[c]Reverse coded
[d]1 = Not at all confident, 10 = Totally confident
Unless otherwise noted, items were measured on a 1 = Strongly Disagree, 7 = Strongly Agree format.

Comparing IT and Trait Mindfulness

We used hierarchical regression to determine whether IT mindfulness offered additional explanatory power beyond trait mindfulness in explaining post-adoption system use behaviors. In the first step, we entered control variables; in the second, trait mindfulness; and in the third, IT mindfulness. As noted in Table C4, IT mindfulness explained significant variance beyond trait mindfulness in deep structure usage and trying to innovate. Moreover, we found that although trait mindfulness relates to continuance intention, IT mindfulness does not. In addition, we conducted subsequent *post hoc* analyses for interaction effects. We found, however, no evidence to support interactions between trait mindfulness and IT mindfulness as the constructs relate to our dependent variables. Together, our findings suggest that IT mindfulness and trait mindfulness are distinct from, and relate differently to, post-adoption systems use factors.

Table C4. Hierarchical Regression Analyses Comparing Trait Mindfulness and IT Mindfulness Ability to Predict Post-Adoptive Behaviors

	Try to Innovate			Deep Structure Usage			Continuance Intention		
	Step 1	**Step 2**	**Step 3**	**Step 1**	**Step 2**	**Step 3**	**Step 1**	**Step 2**	**Step 3**
Controls[a]									
PEU	0.28*	0.20***	0.01	0.01	0.04	-0.07	0.06	0.05	0.02
PU	0.14	0.08	-0.11	0.31***	0.27***	0.16*	0.30***	0.32***	0.29***
SSE	0.25**	0.36***	0.30***	0.43***	0.36***	0.32***	0.38***	0.41***	0.40***
Trait Mind.		0.17**	-0.09		0.23***	0.09		-0.09	-0.14
IT Mind.			0.62***			0.36***			0.11
F	47.28***	39.72***	47.75***	59.49***	43.33***	43.55***	53.61***	33.28***	28.21***
Adj. R^2	0.32	0.35	0.49	0.37	0.42	0.47	0.35	0.36	0.36
Δ Adj R^2		0.03**	0.14***		0.05***	0.05***		0.03**	0.00

Notes: [a]Standardized regression coefficients are reported.
* p < .05; ** p < .01; *** p < .001

To test the effect size of IT mindfulness on each of the dependent variables, we compared the R^2 statistics with and without IT mindfulness as an independent variable. The effect size (f^2) is calculated as follows (Chin 1998):

$$f^2 = (R^{2\text{included}} - R^{2\text{excluded}}) / (1 - R^{2\text{included}})$$
$$f^{2\ \text{Trying to Innovate}} = (0.49 - 0.35) / 0.51 = 0.27$$
$$f^{2\ \text{Deep Structure Usage}} = (0.47 - 0.42) / 0.53 = 0.09$$
$$f^{2\ \text{Continuance Intention}} = (0.36 - 0.36) / 0.64 = 0.00$$

Using Cohen's (1988) interpretation of effect size (i.e., f^2 between 0.02 and 0.15 for a small effect size, between 0.15 and 0.35 for medium, and greater than 0.35 for large), our results provide evidence in support of the contention that the effect for IT mindfulness on trying to innovate (i.e., a medium effect with $f^2 = 0.27$) exceeded the effects on continuance intention and deep strcture usage (i.e., a small effect of $f^2 = 0.00$ and 0.07 respectively). We also performed a mediation test and found that IT mindfulness mediates PEU and SSE to DSU and INNOV. Further, we conducted an EFA using Mplus and we found that the fit indices are best for the four-construct conceptualization. Details about these two tests can be requested from the authors.

Finally, we conducted a dominance analysis with continuance intention, deep structure usage, and trying to innovate as the dependent variables. Dominance analysis provides a method to examine the extent to which each predictor (e.g., IT mindfulness or trait mindfulness) contributes to the overall R^2 (Krasikova et al. 2011; LeBreton and Tonidandel 2008). This measurement is relative to the other predictors in the model. General dominance provides a comparative score of which predictor accounts for the proportion of the R^2 value. For example, for the dependent variable, trying to innovate, IT mindfulness accounts for $R^2 = 0.356$ (general dominance) of the total $R^2 = 0.413$ accounted for in a model with both IT mindfulness and trait mindfulness. This is 86.2% of the variance accounted for (e.g., rescaled dominance). Table C5 details our complete dominance analyses. As shown, these results provide strong evidence that IT mindfulness accounts for significantly more of the variance in dependent variables than trait mindfulness.

Table C5. Dominance Analyses Comparing Trait Mindfulness and IT Mindfulness Ability to Predict Post-Adoptive Behaviors			
	Trying to Innovate		
	General Dominance	**Rescaled Dominance**	**R-Squared**
IT Mindfulness	0.356	86.2	0.413
Trait Mindfulness	0.057	13.8	
	Deep Structure Usage		
	General Dominance	**Rescaled Dominance**	**R-Squared**
IT Mindfulness	0.28	75.27	0.374
Trait Mindfulness	0.09	24.73	
	Continuance Behavior		
	General Dominance	**Rescaled Dominance**	**R-Squared**
IT Mindfulness	0.16	91.01	0.178
Trait Mindfulness	0.02	8.99	

Note: Rescaled dominance was computed by dividing the general dominance estimates by the R^2.

Appendix D

A Short-Form Instrument

We developed a short-form scale of IT mindfulness, which conforms to contemporary practices in psychology (Smith et al. 2012). To evaluate the short-form scale, we looked at measurement properties within the IT mindfulness construct and also examined the relationships within the structural model.

Using the data gathered in Study 3, we selected the four highest loading items for each of the four first-order constructs (AD2, MP1, ON3, and OP3). We then executed a simple confirmatory factor analysis (CFA) with these four items to test the convergent and discriminant properties of the new short-form construct. We found the resulting Cronbach's alpha equal to 0.876 and at an acceptable level within 0.006 of the long form measure. We also found acceptable loadings for the short-form construct scale (see Table D1).

Table D1. Item Loadings, Means and Standard Deviations		
Item[a]	**Loading[b]**	**Mean**
AD2	0.91	4.23
MP1	0.87	5.54
ON3	0.94	4.84
OP3	0.81	4.73

Notes: [a]AD = Alertness to Distinction, OP = Orientation in the Present, MP = Awareness of Multiple Perspectives, ON = Openness to Novelty
[b]All standardized loadings have $p < 0.01$

Next, we compared the structural models and found no significant changes in path weights (see Figure 4 in the main paper). Further, the short-form instrument also has acceptable discriminant and convergent validities (see Table D2). Finally, we found the short-form instrument's fit statistics somewhat lower than that of the full model, but still in the acceptable range (see Table D3). In sum, the short-form scale of IT mindfulness provides a means for researchers to parsimoniously include IT mindfulness in their work. With that said, caution must be taken when using short-form measures given potential tradeoffs between validity and reliability (Polites et al. 2012; Smith et al. 2012).

Table D2. Correlation Matrix for Measurement Model

Construct	AVE	C.R.	1	2	3	4
(1) IT Mindfulness (4-items)	0.59	0.85	**0.77**			
(2) Continuance Intention	0.58	0.80	0.40	**0.76**		
(3) Deep Structure Usage	0.68	0.91	0.61	0.67	**0.83**	
(4) Trying to Innovate	0.89	0.96	0.65	0.49	0.67	**0.94**

Notes: AVE = Average Variance Extracted, Square Root of AVEs are in bold and reported along the diagonal of the correlation of constructs. C.R. = Composite Reliabilities.

Table D3. Fit Statistics for the Measurement Model

Statistic	Value	Cutoffs
CFI	0.94	0.90
RMSEA	0.087	0.08

References

Agarwal, R., and Prasad, J. 1998. "A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology," *Information Systems Research* (9:2), pp. 204-215.

Bagozzi, R. P., Yi, Y., and Phillips, L. W. 1991. "Assessing Construct Validity in Organizational Research," *Administrative Science Quarterly* (36:3), pp. 421-458.

Bhattacherjee, A. 2001. "Understanding Information Systems Continuance: An Expectation-Confirmation Model," *MIS Quarterly* (25:3), pp. 351-371.

Boomsma, A. 2000. "Reporting Analyses of Covariance Structures," *Structural Equation Modeling* (7), pp. 461-483.

Brown, T. A. 2006. *Confirmatory Factory Analysis for Applied Research*, New York: The Guilford Press.

Chin, W. W. 1998. "Issues and Opinion on Structural Equation Modeling," *MIS Quarterly* (22:1), pp. vii-xvi.

Cohen, J. 1988. *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.), Hillsdale, NJ: Lawrence Erlbaum Associates.

Csikszentmihalyi, M. 1990. *Flow: The Psychology of Optimal Experience*, New York: Harper Perennial.

Dane, E. 2011. "Paying Attention to Mindfulness and its Effects on Task Performance in the Workplace," *Journal of Management* (37:4), pp. 997-1018.

Fishbein, M., and Azjen, I. 1975. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*, Reading, MA: Addison-Wesley.

Gefen, D., Straub, D. W., and Boudreau, M.-C. 2000. "Structural Equation Modeling and Regression: Guidelines for Research Practice," *Communications of the Association Information Systems* (4:7), pp. 1-77.

Gefen, D., Straub, D. W., and Rigdon, E. E. 2011. "An Update and Extension to Sem Guidelines for Admnistrative and Social Science Research," *MIS Quarterly* (35:2), pp. iii-xiv.

Grover, V., Teng, J. T. C., and Fiedler, K. D. 2002. "Investigating the Role of Information Technology in Building Buyer-Supplier Relationships," *Journal of the Association for Information Systems* (3:7), pp. 217-245.

Krasikova, D., LeBreton, J. M., and Tonidandel, S. 2011. "Estimating the Relative Importance of Variables in Multiple Regression Models," in *International Review of Industrial and Organizational Psychology*, G. P. Hodgkinson and J. K. Ford (eds.), Indianapolis, IN: Wiley.

Langer, E. J. 1989. *Mindfulness*, Reading, MA: Addison-Wesley.

Langer, E. J. 1997. *The Power of Mindful Learning*, Reading, MA: Addison-Wesley.

Langer, E. J. 2004. *Langer Mindfulness Scale User Guide and Technical Manual*, Worthington, OH: IDS Publishing Corporation.

Langer, E., Hatem, M., Joss, J., and Howell, M. 1989. "Conditional Teaching and Mindful Learning: The Role of Uncertainty in Education," *Creativity Research Journal* (2:1), pp. 140-150.

LeBreton, J. M., and Tonidandel, S. 2008. "Multivariate Relative Importance: Extending Relative Weight Analysis to Multivariate Criterion Spaces," *Journal of Applied Psychology* (93:1), pp. 329-345

Marakas, G., Johnson, R., and Clay, P. F. 2007. "The Evolving Nature of the Computer Self-Efficacy Construct: An Empirical Investigation of Measurement Construction, Validity, Reliability and Stability over Time," *Journal of the Association for Information Systems* (8:1), pp. 16-46.

Nunnally, J. C., and Bernstein, I. H. 1994. *Psychometric Theory* (3rd ed.), New York: McGraw-Hill, Inc.

Polites, G., and Karahanna, E. 2012. "Shackled by the Status Quo: The Inibiting Effects of Incumbent System Habit, Switching Costs, and Inertia on New System Acceptance," *MIS Quarterly* (36:1), pp. 21-42.

Polites, G., Roberts, N., and Thatcher, J. 2012. "Conceptualizing Models Using Multidimensional Constructs: A Conceptual Review and Guidelines for Their Use," *European Journal of Information Systems* (21:1), pp. 22-48.

Roberts, N., and Thatcher, J. 2009. "Conceptualizing and Testing Formative Constructs: Tutorial and Annotated Example," *Database* (40:3), pp. 9-39.

Smith, G. T., Combs, J. L., and Pearson, C. M. 2012. "Brief Instruments and Short Forms," in *APA Handbook of Research Methods in Psychology*, H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf, and K. J. Sher (eds.), Washington, DC: American Psychological Association, pp. 395-409.

Sternberg, R. J. 2000. "Images of Mindfulness," *Journal of Social Issues* (56:1), pp. 11-26.

Tiwana, A., and McLean, E. R. 2005. "Expertise Integration and Creativity in Information Systems Development," *Journal of Management Information Systems* (22:1), pp. 13-43.

Venkatraman, N. 1989. "Strategic Orientation of Business Enterprises: The Construct, Dimensionality, and Measurement," *Management Science* (35:8), pp. 942-962.

Venkatesh, V., and Davis, F. 2000. "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Studies," *Management Science* (46:2), pp. 186-204.

Webster, J., and Martocchio, J. 1992. "Microcomputer Playfulness: Development of a Measure with Workplace Implications," *MIS Quarterly* (16:2), pp. 201-226.

Wright, R. T., Campbell, D. E., Thatcher, J. B., and Roberts, N. 2012. "Operationalizing Multidimensional Constructs in Structural Equation Modeling: Recommendations for IS Research," *Communications of the Association for Information Systems* (40), pp. 367-412.