Journal of Occupational Health Psychology
2012, Vol. 17, No. 4, 473–491

1076-8998/12/$12.00 DOI: 10.1037/a0029837

Perceived Information and Communication Technology (ICT) Demands on Employee Outcomes: The Moderating Effect of Organizational ICT Support

Arla Day
Saint Mary's University

Stephanie Paquet
Knightsbridge Human Capital Solutions, Calgary, Alberta, Canada

Natasha Scott
Saint Mary's University

Laura Hambley
The Leadership Store, Calgary, Alberta, Canada

Although many employees are using more information communication technology (ICT) as part of their jobs, few studies have examined the impact of ICT on their well-being, and there is a lack of validated measures designed to assess the ICT factors that may impact employee well-being. Therefore, we developed and validated a measure of ICT demands and supports. Using Exploratory Structural Equation Modeling, we found support for 8 ICT demands (i.e., availability, communication, ICT control, ICT hassles, employee monitoring, learning, response expectations, and workload) and two facets of ICT support (personal assistance and resources/upgrades support). Jointly, the ICT demands were associated with increased strain, stress, and burnout and were still associated with stress and strain after controlling for demographics, job variables, and job demands. The two types of ICT support were associated with lower stress, strain, and burnout. Resources/upgrades support moderated the relationship between learning expectations and most strain outcomes and between ICT hassles and strain. Personal assistance support moderated the relationship between ICT hassles and strain.

Keywords: technology stressors, support, strain and burnout, job demands, scale development

Information and communication technology (ICT) refers to any electronic device or technology that has the ability to gather, store, or send information (Steinmueller, 2000), and it is a ubiquitous part of today's work world. For example, more than half of the United States labor force uses a computer to accomplish work tasks (Bureau of Labor Statistics, 2005). Approximately 90% of U.K. businesses have Internet access, and about half of them report using the Internet to complete administrative tasks (Office for National Statistics, 2009). Similarly, 81% of Canadian private sector businesses and almost 100% of public sector businesses use e-mail for work correspondence (Statistics Canada, 2009).

The use of ICT in the workplace can have both positive and negative effects on employees' work experiences (for overviews, see Day, Scott, & Kelloway, 2010; O'Driscoll, Brough, Timms, & Sawang, 2010). For example, ICT can enhance employees' ability to solve problems by increasing their access to information (Morgan, Morgan, & Hall, 2000), and improve employees' performance efficiency by increasing their ability to communicate with other organizational members (Dewett & Jones, 2001). However, ICT also can increase the number of demands placed on employees by increasing employee accessibility to the workplace and increasing expectations for productivity (O'Driscoll et al., 2010). These ICT-related demands can have a negative effect on employees' work experiences and create further problems for employees (Coovert & Thompson, 2003; Korunka & Vitouch, 1999; Morgan et al., 2000), such as poor health and well-being (Day et al., 2010). ICT can aid flexible work options, such as telecommuting, which subsequently may lead to opposing employee outcomes by simultaneously decreasing work-to-family conflict and increasing family-to-work conflict (Golden et al., 2006). Moreover, negative effects may be mitigated through supportive organizational ICT practices (Day et al., 2010).

Despite some recent theoretical work in the area of workplace ICT (e.g., Day et al., 2010; O'Driscoll et al., 2010), there is little empirical evidence identifying the specific ICT demands and supports, with even fewer empirically validated scales of these constructs beyond general measures of computer stress (e.g., Hudiburg, 1989a, 1995), and little research examining the influence of these ICT factors on employee strain. Therefore, the purpose of this research is to (a) develop a multidimensional scale designed to assess ICT-specific demands and supports at work; (b) examine whether ICT demands and supports can explain additional variance in employee stress and strain outcomes after controlling for the effect of more general job-role demands; and (c)

Arla Day and Natasha Scott, Department of Psychology, Saint Mary's University, Halifax, Nova Scotia, Canada; Stephanie Paquet, Knightsbridge Human Capital Solutions, Calgary, Alberta, Canada; Laura Hambley, The Leadership Store, Calgary, Alberta, Canada.

Correspondence concerning this article should be addressed to Dr. Arla Day, Department of Psychology, Saint Mary's University, Halifax, NS B3H 3C3, Canada. E-mail: arla.day@smu.ca

examine the direct and moderating effects of organizational ICT support on the ICT demands-strain relationships.

ICT Demands and Supports

In developing a framework of ICT demands and supports, there are several relevant models of general work stress (e.g., the Job Demands-Resources Model; Demerouti, Bakker, Nachreiner, & Schaufeli, 2001; the Conservation of Resources; Hobfoll, 1989; see Sonnentag & Frese, 2003, for an overview of stress models). Many of the main components of these models are based on the basic conceptualizations of demands and stress. For example, Lazarus and Folkman's (1984) work identified demands or stressors as external events in the environment that have the potential to create negative outcomes for individuals (see also Demerouti et al., 2001). Perceived stress is defined in terms of a psychological threat, in which the individual views a situation as potentially threatening (Singer & Davidson, 1986). Demands and stressors can be distinguished from perceived stress in that demands are "objective" events and stress is one's subjective reaction to the demand (Barling, 1990). Strain is the physiological, behavioral, or psychological outcome of perceived stress (Barling, 1990). Burnout can be characterized as another long-term reaction to stress (Sonnentag & Frese, 2003), which is contextualized to the work environment. It is operationalized in terms of emotional exhaustion, cynicism, and reduced professional efficacy (Leiter & Schaufeli, 1996; Maslach & Jackson, 1981). In keeping with Lazarus and Folkman's (1984) stress model, we can examine ICT's impact both on an immediate perceived stress outcome, as well as a more distal strain outcome. Similarly, in keeping with a job-demands-resource model (Demerouti et al., 2001), it is important to include a longer-term, work-specific outcome of stress, such as burnout. That is, can ICT demands elicit more distal outcomes (strain and burnout) as well as more immediate perceived stress outcomes?

Recently, several theoretical frameworks examined the impact of workplace ICT on employees. O'Driscoll et al. (2010) argued that specific characteristics of ICT can both contribute to and hinder employees' acceptance and engagement with work-related ICT. Similarly, Day et al. (2010) proposed that ICT may be perceived as both a resource that assists employees in the completion of their work and as an additional work demand, such that ICT characteristics contribute to workplace stress and strain outcomes. They argued that the impact of ICT on employee outcomes is a function of the extent to which ICT (a) influences the accessibility of employees to their workplace and colleagues, (b) influences employees' access to information, (c) impacts on communications with others, (d) is implemented as a means of monitoring employees' performance and providing feedback, and (e) impacts employees' control over their work and home life. They also draw on the computer hassles literature to identify ICT hassles that employees may experience (i.e., experiencing ICT malfunctions, using incompatible ICTs, facing increased demands, and having to continually update skills for new forms of ICTs).

We use Day et al.'s (2010) review to provide a preliminary framework for identifying ICT demands, in terms of (1) the extent that employees experience hassles, such as malfunctions while using ICT; (2) the amount of information ICT provides; (3) the extent that ICT increases employees' availability to work outside of business hours; (4) the extent that ICT increases employees' workloads; (5) the lack of control employees have over ICT; (6) the requirement of learning and mastering new ICT knowledge and skills; (7) the extent that ICT influences communication among employees; and (8) the extent that ICT is used to monitor employees.

ICT Hassles

The concept of daily hassles is embedded within traditional stress models and is defined as critical and regular demands placed on an individual (DeLongis, Coyne, Dakof, Folkman, & Lazarus, 1982). Because of their ubiquitous nature, hassles may be viewed as being inconsequential in predicting employee health outcomes; however, research indicates that they are associated with increased strain (Cooper, Kirkcaldy, & Brown, 1994; Zohar, 1999) and decreased psychological health (Gruen, Folkman, & Lazarus, 1988). Previous research on ICT hassles has focused mainly on computer hassles (e.g., lost data, obsolete computers; Hudiburg, 1989a, 1989b, 1992, 1995). Although this research is not specific to the workplace, it does provide evidence that experiencing hassles while using computers is associated with lower well-being (Hudiburg, Ahrens, & Jones, 1994; Hudiburg, Brown, & Jones, 1993).

One of the most common ICT hassles is technology malfunctions (e.g., crashes, breakdowns, freezes; Day et al., 2010). ICT that is not functioning properly may increase employees' frustration with using ICT (Ceaparu, Lazar, Bessiere, Robinson, & Shneiderman, 2004; Lazar et al., 2006; O'Driscoll et al., 2010), and may increase their feelings of stress (Hudiburg, 1995). O'Driscoll et al. (2010) suggested that employees who have previously encountered ICT malfunctions or other hassles which they were unable to resolve are more likely to experience greater frustration when using ICT in the future and may be more prone to experience strain.

Information Overload

Information overload is a widespread issue in today's workplace (Edmunds & Morris, 2000). In a recent survey of management personnel across five countries, 74% of managers experienced stress from information overload (Klausegger, Sinkovics, & Zou, 2007). Although the increased use of ICT has been argued to intensify overload (Edmunds & Morris, 2000), ICT also may provide a means to easily access and review a large amount of information in a short time. ICT provides employees with opportunities to gain information at a faster speed than ever before (Edmunds & Morris, 2000). However, even though the amount of information available to employees has increased, workloads have not decreased, suggesting that employees have a limited amount of time to sift through information to process what is relevant (Johansson-Hiden, Wastlund, & Wallin, 2003; Tarafdar, Tu, Ragu-Nathan, 2010). Moreover, the constant barrage of information increases the number of disruptions to employees' work (O'Driscoll et al., 2010). For example, employees tend to feel an obligation to respond to e-mail messages within six seconds of receiving the e-mail, potentially interrupting their flow of work and creating overload (Jackson et al., 2003).

Availability

Demands to respond immediately may extend beyond regular work hours. Many work ICT devices are transportable, allowing employees to continue working even when they are not physically at work (Porter & Kakanadse, 2006), and allowing individuals to be more accessible. That is, although ICT can foster flexibility for employees, making it easier to complete work away from the workplace, the increased accessibility has created an "always on work environment" (Middleton, 2007, p. 165), resulting in greater expectations for employees to be constantly available and accessible outside of work hours (Porter & Kakanadse, 2006).

This increased accessibility may blur the lines between work and nonwork (O'Driscoll et al., 2010). Ironically, although ICT can improve flexibility, improving work-life balance, technology can facilitate the spillover of work to the family domain (Rosen & Weil, 1997) and increase work-family conflict (Boswell & Olson-Buchanan, 2007), resulting in decreased well-being (Kinnunen et al., 2006). Constant ICT connectivity to the workplace also can prevent employees from mentally detaching from work (Park, Fritz, & Jex, 2011), which may increase fatigue and negative mood (Sonnetag & Bayer, 2005). Conversely, employees who use less ICT at home for work purposes tend to be better able to keep work and home lives separate, which is associated with a greater ability to psychologically detach from work (Park et al., 2011).

Workload

Although ICT was developed to be 'labor-saving' in nature, it may enable excessive work (Porter & Kakabadse, 2006), increasing employees' workload and strain (Ilies, Dimotukis, & De Pater, 2010). For example, employees who frequently use ICT are more likely to report feeling overworked (Galinsky, Kim, & Bond, 2001). Although employees who use ICT frequently report that its use generally improves their work efficiency, they may also report that frequent ICT use increases the amount of work they have to complete (Chesley, 2010).

Control Over Technology

Some of the potential negative effects from the above demands may be a result of having a lack of control over ICT. Much research has demonstrated that a lack of perceived and actual job control is associated with increased employee strain (e.g., Day & Jreige, 2002; de Jonge, Dollard, Doramann, LeBlanc, & Houtman, 2000; Dwyer & Ganster, 1991; Liu et al., 2005), and similar effects may be observed when examining lack of control over work-related ICT (Day et al., 2010). When workers feel a lack of control or decision authority over ICT, they may experience increased anxiety (Mikkelsen, Ogaard, Lindoe, & Olsen, 2002; O'Driscoll et al., 2010), stress (Hair, Renaud, & Ramsay, 2007), and frustration (O'Driscoll et al., 2010). Conversely, employees who have input into the implementation of new ICT at work (i.e., control over the implementation process) tend to experience less strain than employees who have no control over the process (Coovert & Thompson, 2003).

Continuous Learning Expectations

Changes in the work environment, such as new ICT, can influence employee well-being (Stewart & Barling, 1996). ICT hardware and software are continually being enhanced to provide a constant stream of updates and "improvements" to the technology. Although the intention of upgrades is to improve the function of ICT and thus improve employee well-being, the process of implementing and learning new ICT can be frustrating for employees (Korunka, Zauchner, & Weiss, 1997; Zorn, 2002) and may increase work demands (Korunka, Huemer, Litschauer, & Karetta, 1996), and perceived stress (Korunka et al., 1997). In addition, expectations from the organization for employees to master complex ICT can lead to employees developing negative feelings toward the ICT (Wood, 2001).

Communication Ability

As noted above, ICT can increase information and accessibility both at work and away from the workplace, increasing the frequency and ease of communication among employees. However, because of this increased information and accessibility, ICT offers an occasion for greater occurrences of miscommunication (Ramirez, Walther, Burgoon, & Sunnafrank, 2002). Of all the different communication forums (e.g., face-to-face, written), ICT-mediated communication has the greatest margin of error resulting from limited verbal and nonverbal cues that assist the receiver in inferring tone and intonation of the message (Rainey, 2000). Therefore, it is not surprising that ICT-mediated communication creates greater opportunities for miscommunication. Because effective communication is a cornerstone of a healthy workplace (O'Donnell, 2007), frequent miscommunication and misinterpretation of communication content may result in negative employee outcomes, such as employee anger (Marcus, 1994), frustration, stress, and strain (Day et al., 2010).

Employee Monitoring

The above sections focus on issues pertaining to the employees' use of ICT and expectations surrounding ICT usage. Another potential ICT demand in the workplace may arise not from employees' direct use of it, but from the organization's use of ICT to monitor performance. For example, some organizations monitor and record keystroke information (e.g., speed, accuracy), employee telephone conservations with clients, and e-mail and Internet use (Miller & Weckert, 2000; Mishra & Crampton, 1998; Stanton & Weis, 2000). Employees may perceive monitoring technology to be an infringement on their personal space and privacy, resulting in increased stress (Coovert & Thompson, 2003; Fairweather, 1999) and increased strain symptoms, including anxiety, depression, health complaints, anger, and fatigue (Amick & Smith, 1992; Lund, 1992; Schleifer & Shell, 1992). These negative symptoms can be exacerbated if employees believe the information collected through monitoring devices leads to negative repercussions, such as social isolation or job loss (Levy, 1994; Stanton & Weiss, 2000).

ICT Supports

We also use O'Driscoll et al.'s (2010) and Day et al.'s (2010) reviews to provide a framework for ICT supports. Although ICT was created to improve efficiency and make work life easier, ICT demands have the potential to increase strain. O'Driscoll et al.

(2010) argued that an organizational climate that fails to support or reward technology usage may be an impediment to employee engagement with ICT. However, adverse employee outcomes are not inevitable because organizational resources may alleviate negative consequences of such demands. That is, the extent to which ICT demands exist in organizations and elicit a strain response in employees may be influenced by the extent to which the organization frames and supports employees' use of ICT. There is a large body of literature showing that general organizational support is associated with positive employee outcomes, such as greater job satisfaction (Patrick & Laschinger, 2006), improved mood, and decreased strain (Rhoades & Eisenberger, 2002). Organizational support also has been shown to buffer some of the negative effects of workplace demands on employees' health and well-being (Schat & Kelloway, 2003; Witt & Carlson, 2006). Therefore, ICT-specific support may have the same types of direct and buffering effects on the relationships between ICT demands and strain.

In addition to fostering a general 'supportive climate,' organizations can support employees' use of ICT in a number of different ways. For example, organizations can ensure that they have competent IT professionals to assist in solving ICT problems and they can provide resources, such as up-to-date ICT and technical training (Day et al., 2010). Providing resources such as training to employees when new ICT is introduced into the workplace may boost employees' self-efficacy and confidence in using the new ICT, which can reduce their perceived stress and strain symptoms (Beas & Salanova, 2006). Korunka and Vitouch (1999) found that employees who were properly trained to use ICT and were involved in the implementation of new ICT experienced less dissatisfaction, stress, and strain. In addition to training, having consistent technical ICT support may increase employees' engagement with ICT (O'Driscoll et al., 2010) and may minimize strain. Effective technical assistance tends to resolve employees' technical problems more quickly, which can minimize disruptions to their work (Ragu-Nathan et al., 2008). Therefore, just as general organizational support (e.g., clear communication guidelines; a culture embracing work-life balance) may influence employee experience of the ICT demands, and ultimately, employee strain outcomes, specific ICT organizational supports aimed at providing (a) personal technical assistance and (b) ICT resources and upgrades to employees may be particularly helpful in minimizing ICT demands that are problem-based and related to employees' actual use of ICT. No study to date has investigated whether organizational ICT-related support can buffer the negative impact of ICT in the workplace. Therefore, we examined the moderating effects of organizational support on the relationship between ICT demands and employee strain outcomes.

ICT Demands, Support, and Employee Outcomes

Based on the literature, we argue that ICT demands are associated with employee strain and well-being. Moreover, because general job demands are associated with decreased well-being (Beehr, Jex, Stacy, & Murray, 2000; Day & Livingstone, 2001; Liu et al., 2005), we wanted to assess whether the measure of ICT demands could explain additional variance in the outcomes over the variance explained by these job demands to assess the utility of a new measure of ICT demands. That is, we examined the extent to which these ICT demands are associated with these outcomes even after controlling for the traditional job-role demands of a lack of job control, role overload, job boredom, and role ambiguity. These specific demands were chosen because of the accumulation of research on these demands, demonstrating their strong impact on employee strain and well-being. Job control and overload were specifically chosen because of their overlap with ICT control and ICT workload. Several personal and demographic variables tend to be associated with strain outcomes (e.g., gender; Liu, Spector, & Shi, 2008), and other work-related variables, such as tenure and use of technology, also may be associated with technology demands and strain. Therefore, it is important to control for these variables when examining the link between ICT demands and strain outcomes.

Summary

Workplaces are likely going to become even more technologically advanced in the coming years (Coovert & Thompson, 2003), with new applications of ICT being adopted in a wide variety of occupational settings. Despite the important role that ICT plays in many occupations, few studies have examined the impact of specific ICT demands and supports on employee strain. Therefore, we conducted a two-phase study to examine ICT demands and supports: In the first phase of the study, we use content validity methods to develop and validate a scale of ICT demands and a scale of ICT organizational support. In the second phase of the study, we use this scale to examine the relationship among ICT demands, supports, and employee outcomes (i.e., stress, strain, and burnout).

Phase 1: Scale Development

To develop a scale assessing ICT demands, we followed classic test theory and scale development best practices (see Crocker & Algina, 1986; Hinkin, 1995, 1998). That is, based on our review of the literature, we first defined ICT demands as "any ICT factor or process at work involving some type of storing, transmitting, or processing technology (e.g., computer programs) or device (computer, cell phone) that has the potential to be perceived as stressful by workers" (Day et al., 2010, p. 324). We then identified potential ICT demands and categories of demands outlined in the literature (e.g., Hudiburg, 1995; Porter & Kakanadse, 2006).

Scale Development Method

Using an inductive approach to item generation (Hinkin, 1998), we initially asked four ICT subject matter experts (SMEs) to identify aspects of technology that people may find to be demanding or challenging. They also were instructed to identify organizational support factors that may help alleviate any negative effects of ICT demands. We allowed the SMEs to identify demands and supports without imposing a model or structure on their discussions. These SMEs identified several general areas of technology-related difficulties, demands, and support, and they provided specific examples of each. After we gathered the initial data, we used more a deductive item generation process by reviewing some of the categories identified within the literature with the SMEs to (a) assess the perceived efficacy and relatedness of these categories and (b) identify any additional demands that may have been overlooked.

Using the information from these ICT experts as an initial guide, we solicited input from a convenience sample of 20 general SMEs (i.e., individuals who dealt with ICT regularly in their jobs): We conducted six individual interviews and two focus groups (with six and eight participants in each). In all cases, these experts were asked to spend up to 60 minutes brainstorming about technological issues. They then were asked to think about the various forms of ICT they use as part of their jobs (e.g., computers, phones, faxes, pagers, copiers, video conferencing) and identify the aspects of the technology that may be demanding, as well as factors that may ameliorate these demands. Next, they were asked to generate overall categories of demands, and group these factors into these categories. Further evidence for the validity of these groupings was established by using an additional sample of eight ICT SMEs, who were asked to classify each factor into the identified categories.

Scale Development Results

Based on the SMEs categorizations, eight ICT demand domains, consistent with those outlined by Day et al. (2011) and O'Driscoll et al. (2011) were identified: (1) everyday hassles in using technology (e.g., losing data; computer crashing); (2) information overload; (3) expectations to be available 24/7; (4) increased workload; (5) a lack of control over technology; (6) expectations for continuous learning; (7) ineffective communication; and (8) use of ICT to monitor employees' behaviors. The SMEs also identified two aspects within a general category of organizational support: (1) providing personal assistance for employees to deal with ICT issues; and (2) ensuring necessary upgrades and up-to-date materials to encourage and support the use of technology within the organization. These types of ICT demands and supports make a unique contribution to the understanding of a larger ICT demands construct, and as such, they should be considered formative or causal indicators (MacKenzie, Podsakoff, & Jarvis, 2005; Podsakoff, Shen, & Podsakoff, 2006) of the latent ICT demands construct. That is, the construct of ICT demands can be viewed as a combination of these eight defining characteristics, such that we would argue that a worker has high ICT demands *because* they experience high overload and/or low control, and so forth (see Diamantopoulos, 2006; Jarvis, MacKenzie, & Podsakoff, 2003; Podsakoff, Mackenzie, & Podsakoff, 2012, for an overview of formative indicators).

When identifying ICT factors, there was not always a clear distinction between demands and supports: That is, a *lack* of support may be viewed as a demand, or providing control may be seen as a support. To avoid biasing the SMEs, we allowed them to define the categories according to their initial reactions. After they rated the categories, we asked for clarification to ensure that the support categories were best conceptualized as support, and the demands were best conceptualized as demands. However, we note the potential for alternative models.

Using classic test theory guidelines for item writing (e.g., Crocker & Algina, 198l; Nunnally & Bernstein, 1994), and based on the frameworks developed by Day et al. (2011) and O'Driscoll et al. (2011), we used the factors identified by the SMEs to develop a total of 64 items, with 54 items covering these eight ICT demand domains and 10 items covering the general domain of organizational support. These items were given to a small convenience sample of six graduate students, three faculty members, and five individuals employed in a variety of occupations (e.g., ICT; accounting). These individuals were asked to identify any issues regarding clarity, comprehension, bias, and grammar. Based on their data, we reduced the number of items to avoid fatigue and ensure scale parsimony, such that we deleted repetitive items, focused on general characteristics of ICT rather than on specific practices and types of technology, avoided focusing on individual competence using ICT, and focused on relatively "objective" aspects of the technology or the expectations associated with the technology. As a result of this process, the ICT Demands Scale was reduced to 31 items, representing the eight domains. Finally, the authors reviewed the final set of items, and further reduced it to 27 items based on the recognition that the information overload demand included items that measured expectations to respond instead of feelings of being overloaded. The final version of the organizational ICT Support Scale was reduced to eight items, representing both the personal assistance and resources/upgrades concepts.

Phase 1 Summary

Through a review of current literature and models (e.g., Day et al., 2011; O'Driscoll et al., 2011) and through a comprehensive scale development process, we developed an ICT Demands Scale consisting of 27 items representing eight formative indicators (i.e., hassles, information overload, availability expectations, workload, lack of control, continuous learning expectations, ineffective communication, and ICT-monitoring of employees) as well as an ICT Support Scale consisting of eight items representing personal assistance and resources/upgrades. Once we had indices to assess ICT demands and supports, we wanted to examine the relationships of ICT demands and supports with employee well-being outcomes. That is, based on this initial test development phase, we examined the relationship of the newly developed ICT demands and support measures with perceived stress, strain, and burnout. We then tested the extent to which ICT support moderated the demands-strain relationships.

Phase 2: Relationship of ICT Demands, Support, and Employee Well-Being

To examine these relationships, our first step was to examine the validity of the scales, in terms of the scales' factor structure. We also wanted to examine the extent to which both the demand and support scales are associated with employee stress, strain, and burnout. Few studies have empirically examined the specific ICT characteristics that may be perceived as potential demands. We wanted to focus not only on subjective, immediate stress reactions to the specific demands (i.e., ICT stressors), but also on a more general psychological and physical strain measure and a work-related outcome (burnout).

Hypothesis 1a: The ICT Demands Scale will factor into eight components, and these subscales will demonstrate high internal reliability.

Hypothesis 1b: The ICT Support Scale will factor into two components, and these two subscales will demonstrate high internal reliability.

Hypothesis 2: ICT demands will be associated jointly with increased (a) perceived ICT stress, (b) strain, and (c) burnout (i.e., increased emotional exhaustion and cynicism, and decreased professional efficacy).

Hypothesis 3: ICT demands will account for additional variance in (a) perceived ICT stress, (b) strain, and (c) burnout, after controlling for the impact of demographic variables (i.e., age, gender), job variables (i.e., tenure, number of technologies used), and job-role demands (i.e., lack of job control, role overload, job boredom, role ambiguity).

As further construct validity evidence, we would expect specific ICT demands to be more highly related to their general work demand counterparts (i.e., convergent validity) than with other role demands (i.e., discriminant validity). We would expect ICT lack of control to demonstrate the highest relationship with job lack of control than with the other job role demands. Similarly, we would expect workload to demonstrate the highest relationship with role overload.

Hypothesis 4a: ICT control will be more highly correlated with the lack of job control scale than with the other job role demands.

Hypothesis 4b: ICT workload will be more highly correlated with the job role overload scale than with the other job role demands.

Finally, based on the literature and our focus groups and interviews in Phase 1, ICT-specific support was defined in terms of the extent to which organizations could decrease employee frustration in using ICT by ensuring employees have (a) proper technological assistance and (b) resources. These supports may have direct effects on the outcomes as well as moderate the relationship between the ICT demands and outcomes.[1] Organizations can provide resources (e.g., technical training) and can ensure that there are IT professionals available to assist in solving ICT problems (Day et al., 2010), both of which may minimize negative effects of ICT demands on employees.

Hypothesis 5: ICT support (i.e., personal assistance and resources) will be associated with lower levels of employees' strain outcomes.

In line with general demands and support theory, it is important to consider the context in which this specific type of support would moderate the effects of ICT demands. This type of ICT-specific support should be particularly helpful in minimizing the negative effects from ICT demands pertaining to ineffective or problematic ICT, or pertaining to ICT that is constantly changing. More specifically, because continuous learning expectations are created by the organization for employees to keep current with new programs and technology developments, providing employees with the most current technologies (to be in line with these expectations) and providing technical assistance to deal with any issues arising from staying current should help mitigate any strain created by these expectations.

Similarly, although daily hassles that are common when dealing with ICT may be seen as unavoidable, providing technical assistance to problem solve (and to a lesser extent, providing current technologies) should decrease employee frustration, minimize the negative impact of these hassles, and, ultimately, decrease employee strain. Therefore, we focus solely on these two types of demands for the moderator analyses and propose the following:

Hypothesis 6a: ICT support (i.e., personal assistance and resources) will moderate the relationship between learning expectations and employees' strain outcomes.

Hypothesis 6b: ICT support (i.e., personal assistance and resources) will moderate the relationship between hassles and employees' strain outcomes.

Phase 2 Method

Participants. Participants consisted of a convenience sample of 258 adults (136 women; 120 men; two respondents did not indicate gender) working in a random sample of occupations (e.g., engineers, accountants, management, psychologist, IT specialist). The majority of the sample was Caucasian (85.7%), with 8.6% reporting as Chinese, Japanese, or Asian; 1.2% as Latin American; and 4% as "other" (with two participants not responding). Fifty-three percent held a university degree, with an additional 34.5% holding a graduate or professional degree. Thirty-seven percent of participants held supervisory positions, with 55% of them supervising fewer than four employees. The sample was recruited through a snowball technique through contacts in various organizations and occupations. All participants used ICT in their jobs, with 96% of respondents indicating that they use ICT "All the time: More than 4 times per day." The average age of the participants was 34.92 (SD = 9.40), and the average organizational tenure was 5.84 years (SD = 6.14; ranging from 1 month to 37.92 years). Participants used an average of 5.53 forms of ICT (SD = 1.12).

Procedure. We contacted managers and employees at organizations to gauge their interest in ICT issues. If these individuals agreed to act as the organizational contact person, the individual was sent information on the study and was asked to complete the questionnaire and, if possible, to distribute the information to their subordinates and coworkers. Data were collected through two processes: (1) participants received instructions through an e-mail, directing them to the online survey; (2) participants received a Word version of the survey through e-mail, which they had the option of completing electronically and returning through e-mail or printing and returning through regular mail.

Measures

Demographic/job information. Participants were asked to indicate their age, gender, occupation, number of years working for their current organization, and use of ICT at work.

ICT Demands Scale. Participants completed items developed in the scale development phase assessing the eight theorized areas of ICT-related demands: (1) Response expectations; (2) 24/7

[1] Other general types of organizational supports that could be beneficial to alleviating any negative effects produced by ICT demands (e.g., organizational culture and communication) were intentionally excluded for the purpose of this study.

Availability; (3) Ineffective communication; (4) Lack of control over ICT; (5) Hassles using ICT; (6) Employee monitoring; (7) ICT Learning Expectations; and (8) Workload (see Table 1 for items). Using a five-point scale (0 = *Never*; 4 = *Almost Always*), participants indicated the frequency to which they experienced each potential demand. Information on the factor structure and scale reliabilities is presented in the results section.

ICT support. Participants completed eight items assessing the extent to which the organization supported them in their ICT use. Using a five-point scale (0 = *Never*; 4 = *Almost Always*), participants indicated the extent to which the organization provides the necessary ICT upgrades and up-to-date materials and provides personal technical support and assistance (see Table 2 for items). Information on the factor structure and scale reliabilities is presented in the results section.

Role demands. Three of the subscales from the Occupational Environment Scales (OES; Osipow & Spokane, 1983) were used to assess the kinds of demands people experience in their work. Respondents used a five-point Likert-type scale (1 = *rarely or never*; 5 = *most of the time*) to indicate the extent to which each statement fit their personal circumstances. Nine items assessed role overload (e.g., "At work, I am expected to do too many different tasks in too little time").[2] Ten items assessed their job boredom in terms of lack of job stimulation and job fit (e.g., "I am bored with my job"). Ten items assessed respondents' work-role ambiguity (e.g., "The priorities of my job are clear to me"; see Table 3 for scale reliabilities & item-total correlations).

Lack of job control. Job control was measured using a condensed version of the Job Control Scale (Dwyer & Ganster, 1991; Ganster, 1989). Using a five-point Likert-type scale (1 = *very little*; 5 = *very much*), participants responded to 14 items assessing the degree of control they had over various aspects of their job (e.g., "How much control do you have personally over the quality of your work?"; see Table 3 for scale reliabilities and item-total correlations).

ICT Perceived Stress Scale. A seven-item scale based on the general Perceived Stress Scale (Day & Ziemer, 2003) was used to assess perceived ICT stress. Using a five-point Likert-type scale (1 = *strongly disagree*; 5 = *strongly agree*), participants indicated the extent to which they perceived ICT to be stressful in general (e.g., "I feel stressed out by technology in my workplace"; see Table 3 for scale reliabilities and item-total correlations).

Strain symptoms. Strain was assessed using the 20-item Symptoms Checklist (Bartone, Ursano, Wright, & Ingraham, 1989), which describes physical and psychological symptoms (e.g., "Common cold or flu; headaches"). Respondents indicated the extent to which they had experienced each symptom over the past few weeks, using a five-point Likert-type scale (1 = *never*; 5 = *very often*; see Table 3 for scale reliabilities and item-total correlations).

Burnout. Participants' levels of burnout were assessed using the 16-item Maslach Burnout Inventory – General Survey (MBI; Maslach, Jackson, & Leiter, 1996). Respondents rated each item (e.g., "I feel used up at the end of the workday") using a seven-point Likert-type scale (0 = *never* to 6 = *every day*). Scores were calculated for the three burnout subscales: (1) Emotional exhaustion (5 items), (2) Cynicism (5 items), and (3) Professional Efficacy (6 items; see Table 3 for scale reliabilities and item-total correlations).

Results

Factor Structure of Demands and Supports Scales

ICT demands. We conducted an Exploratory Structural Equation Modeling analysis (ESEM; Asparouhov & Muthén, 2009; Marsh et al., 2010; Marsh et al., 2009), using MPlus version 5.2 (Muthén & Muthén, 2008). This method is appropriate for theoretically derived scales that are still in the early stages of development because it combines features of both confirmatory and exploratory factor analysis. It allows the researcher to specify the number of factors, allows tests of alternative models of the number of factors, but it does not identify the specific factor on which each item should load, nor does it constrain the items to load on only one factor, as is the case for the typical application of CFA. We chose this analysis because we had strong theory suggesting the number and nature of subscales, but conducting a CFA would be premature at this initial phase of scale development. In evaluating the ESEM results, we followed Meyers, Gamst, and Guarino's (2006) recommendation to examine the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA) to assess model fit, with CFI values of .95 and above indicating acceptable model fit, and values of less than .08 indicating good fit of the RMSEA (Meyers et al., 2006).

We estimated the hypothesized eight-factor structure based on the eight categories of ICT demands. Consistent with an exploratory factor analysis, each item was allowed to load on each of the eight factors. Each loading or parameter estimate was assessed for statistical significance. The eight-factor structure provided moderate fit to the data, $\chi^2(163) = 288.47$, $p < .001$; CFI = .91; RMSEA = .06, *ns* (see Table 1 for the standardized parameter estimates). Each item significantly loaded on its intended factor, and there were four items that also loaded to a lesser extent on a second factor. In the final ICT Demands Scale, there were five items assessing Hassles, two items assessing response expectations, four items assessing Availability, three items assessing Workload, three items assessing Lack of Control, three items assessing Learning Expectations, four items assessing Employee Monitoring, and three items assessing Communication.

ICT support. We then estimated the hypothesized two-factor structure of the ICT supports. Again, consistent with an exploratory factor analysis approach, each item was allowed to load on both factors. Each loading or parameter estimate was assessed for statistical significance. The two-factor structure provided a good fit to the data, $\chi^2(13) = 38.15$, $p < .001$; CFI = .97; RMSEA = .09, $p < .05$. Standardized parameter estimates are presented in Table 2. Although the RMSEA was slightly higher than the .08 recommended level, the CFI was high, there were no significant cross-loadings, each item significantly loaded on its intended factor, and there were no significant cross-loadings. In the final ICT Support Scale, there were four items assessing Personal Assistance Support and four items assessing Resources/Upgrades Support.

Based on these data, we computed scale scores and examined their reliabilities (see Table 3). Cronbach's alphas for the eight subscales ranged from $\alpha = .70$ to $\alpha = .79$, with item-total correlations ranging between $r = .41$ and $r = .68$. The reliability

[2] The item "I feel competent in what I do" was deleted because it did not adequately represent the domain of role overload.

Table 1
Exploratory Structural Equation Modeling: Standardized Estimates of the ICT Demand Scale Items

Item	Component							
	Hassles	Response expectations	Availability	Workload	Lack of control	Learn	Monitor	Poor communication
1. I am expected to respond to e-mail messages immediately.		**.72**						
2. I am expected to respond to voicemail messages immediately.		**.98**						
3. I am expected to be accessible at all times (e.g., through pager, cell phone, instant messaging).			**.37**					
4. Technology enables people I work with to contact me at any time.			**.27**					
5. I'm expected to check e-mail and/or voicemail when I'm out of the office.			**.73**					
6. I'm contacted about work-related issues outside of regular work hours.			**.69**					
7. People misinterpret my e-mail messages.					−.22			**.61**
8. I receive rude e-mails from my colleagues and/or clients.								**.53**
9. I have misinterpreted the tone of my incoming e-mail messages.								**.80**
10. I have control over how I use technology at work. ***(R)***					**.68**			
11. I choose the types of technology I use in my job. ***(R)***					**.99**			
12. Technology allows me the flexibility to do my job when and where I want. ***(R)***			.24		**.38**			
13. My computer freezes.	**.80**							
14. I experience problems with my internet connection (e.g., speed, access, downloads).	**.64**							
15. Computer viruses hinder the completion of my work.	**.41**							
16. I lose files because my computer crashes.	**.39**							
17. I experience glitches with software.	**.54**					.26		
18. My organization uses technology to monitor my work.							**.68**	
19. My organization monitors my internet usage.							**.89**	
20. My organization monitors my e-mails.							**.79**	
21. My organization monitors my phone calls.						−.40	**.32**	
22. I am expected to stay current with technological advances related to my work.						**.71**		
23. I am expected to learn computer programs that are not directly applicable to my job.						**.59**		
24. The technology I use changes at a rapid pace.						**.79**		
25. Technology creates more work for me.				**.72**				
26. As a result of technology, I work longer hours at and away from the office.				**.76**				
27. Using the internet increases my workload.				**.60**				

Note. Monitor = Employee Monitoring; Learn = Learning requirements. Only parameters that are $p < .01$ are reported; nonsignificant parameters are not shown. Estimates that correspond to hypothesized model are in bold.

of the support scales were $\alpha = .87$ & .86, with item-total correlations ranging from $r = .55$ to $r = .81$.

Correlations Between Demands and Strain

The correlations among the study variables are presented in Table 4. The demands subscales demonstrated low to moderate correlations with each other (*r*s ranged from. $r = -.28$ to $r = .51$, $p < .001$). The demands subscales were somewhat related to perceived stress, increased strain, and the three burnout subscales (*r*s ranged from $r = .14$, $p < .05$ to $r = .54$, $p < .001$). With only three exceptions, the job demand components (i.e., role overload, job boredom, role ambiguity, and lack of job control) were associated with perceived stress, increased strain, and the three burnout subscales (*r*s ranged from $r = .13$, $p < .05$ to $r = .54$, $p < .001$).

To examine whether the ICT demands were jointly associated with the strain outcomes, we conducted five regression analyses in which the strain outcomes were regressed on the eight ICT demands (see Table 5). The ICT demands accounted for a significant amount of variance in all five outcomes ($R^2 = .16$ for strain; $R^2 = .42$ for perceived stress; $R^2 = .14$ for exhaustion; $R^2 = .15$ for cynicism; $R^2 = .11$ for professional efficacy, all $p < .001$),

Table 2
Exploratory Structural Equation Modeling: Standardized Estimates of the ICT Supports Scale Items

Item	Component	
	ICT personal assistance	ICT resources/ Upgrades
1. My organization implements appropriate software as it becomes available.		**.76**
2. My organization uses the latest technology.		**.94**
3. I receive the technology upgrades that I need.		**.76**
4. New information technology systems in my organization are implemented on a timely basis.	.22	**.62**
5. Technical support is available at work when I need it.	**.70**	
6. Our information technology support staff are helpful.	**.87**	
7. My organization's technical support people respond promptly to any of my problems.	**.85**	
8. My information technology department teaches me to solve problems in case they happen again.	**.56**	

Note. All parameters $p < .01$; nonsignificant parameters are not shown. Loadings corresponding to hypothesis are in bold.

providing support for Hypothesis 2. Interestingly, lack of control over ICT was a unique predictor of all outcomes.

Incremental, Convergent, and Discriminant Validity

To examine whether the technology demands would be able to account for additional variance in employee strain outcomes after controlling for the demographic and job variables and job demands, a hierarchical regression was conducted for each of the five outcomes. In each regression, each outcome was regressed on the control variables in the first step; on the four job-role demands (i.e., overload, job boredom, ambiguity, and lack of job control) in the second step; and then on the eight technology demand subscales in the third step (see Table 6).

When entered on the first step, the four demographic and job variables accounted for a significant amount of variance in strain ($R^2 = .04$, $p < .05$) and perceived stress ($R^2 = .05$, $p < .05$), cynicism ($R^2 = .04$, $p < .05$), and professional efficacy ($R^2 = .04$, $p < .05$). The four job-role demands accounted for a significant increase in variance in strain ($R^2 = .14$, $p < .001$), perceived stress ($R^2 = .23$, $p < .001$), exhaustion ($R^2 = .27$, $p < .001$), cynicism ($R^2 = .38$, $p < .001$), and professional efficacy ($R^2 = .26$, $p < .001$) when entered on the second step.

Table 3
Mean, Range, Scale, Number of Items, Reliability, and Item-Total Correlations for All Study Variables

Subscale	*M*	*SD*	Scale (range)	# of items	Reliability (α)	Item-total correlations
Demographics					—	—
1. Age	35.01	9.42		1	—	—
2. Gender	—	—	0–1	1	—	—
3. Job tenure	5.74	6.18	.08–38	1	—	—
4. # of technologies used	5.55	1.11	3–8	1	—	—
ICT demands						
1. Response expectations[a]	2.64	.91	0–4	2	—	.64
2. Availability	2.10	0.92	0–4	4	.71	.44–.57
3. Poor communication	1.04	0.69	0–4	3	.76	.51–.67
4. Lack of control	1.64	0.98	0–4	3	.76	.48–.68
5. Hassles	1.37	0.54	0–4	5	.70	.41–.59
6. Employee monitoring	1.21	0.96	0–4	4	.79	.44–.62
7. Learning expectations	1.96	0.92	0–4	3	.73	.49–.62
8. Workload	1.63	0.90	0–4	3	.73	.51–.60
ICT support						
1. Personal assistance	2.55	0.93	0–4	4	.86	.55–.81
2. ICT resource/upgrades support	2.35	0.81	0–4	4	.87	.57–.78
Job demands						
1. Role overload	3.12	.74	1–5	9	.83	.23–.74
2. Job boredom	2.47	0.78	1–5	10	.88	.32–.77
3. Role ambiguity	2.22	0.58	1–5	10	.79	.30–.68
4. Lack of job control			1–5	14	.87	.37–.79
Outcomes						
1. Strain	2.11	0.60	1–5	20	.91	.30–.67
2. Perceived ICT stress	2.26	0.80	1–5	7	.90	.66–.78
3. Burnout-exhaustion	3.81	1.47	0–6	5	.92	.78–.82
4. Burnout-cynicism	3.24	1.41	0–6	5	.87	.45–.81
5. Burnout-professional Efficacy	5.67	0.88	0–6	6	.82	.43–.70

[a] The response expectations scale only has two items. The correlation between these two items is presented. Listwise $n = 244$.

Table 4
Correlations Among the Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Demographics																						
1. Age																						
2. Gender	−.11																					
3. Tenure	.62***	−.14*																				
4. # technology	.21***	−.25***	.17**																			
ICT Demands & Supports																						
5. Response expectations	−.02	.11	−.01	.12	—																	
6. Availability	.16*	−.17**	.16*	.38***	.22**	(.71)																
7. Communicat.	−.02	−.12	.05	.08	.15*	.16*	(.76)															
8. Lack of control	−.14*	.19**	−.01	−.18**	−.03	−.22***	.17**	(.76)														
9. Hassles	−.10	.07	−.10	.11	.04	.15*	.28***	.16*	(.70)													
10. Monitor	−.00	.10	.02	.07	.14*	.00	−.02	.20**	.10	(.79)												
11. Learning	.07	−.27***	.05	.20**	.23***	.29***	.20***	−.06	.10	.10	(.73)											
12. Workload	.17**	−.11	.17**	.17**	.17**	.33***	.21***	−.02	.20**	.10	.39***	(.73)										
13. Personal assistance	.02	−.11	.08	.03	.04	−.06	−.06	−.20**	−.24***	.12	.05	.03	(.86)									
14. Resources/ upgrades	.09	−.18**	.09	.07	.14*	.03	−.06	−.28***	−.19**	.02	.25***	.05	.51***	(.87)								
Job demands																						
15. Overload	.17**	−.03	.12	.19**	.19**	.39***	.25***	.12	.29***	.12	.40***	.44***	−.18**	−.12	(.83)							
16. Ambiguity		−.01	−.11	−.03	−.12	−.02	.25***	.21***	.27***	.02	.11	.23***	−.19**	−.22***	.30***	(.88)						
17. Boredom	−.14*	.00	−.22***	−.19**	−.14*	−.13*	.06	.29***	.09	.07	−.09	−.05	−.09	−.13	.00	.49***	(.79)					
18. Lack of job control	−.23***	.28***	−.27***	−.30***	−.09	−.25***	−.06	.55***	.15*	.24***	−.15*	−.09	−.27***	−.40***	.10	.33***	.41***	(.87)				
Outcomes																						
19. Strain	−.08	.18**	−.10	−.04	.03	−.02	.16*	.28***	.33***	.15*	−.04	.09	−.15**	−.24***	.24***	.28***	.22***	.31***	(.91)			
20. Stress	.15*	.07	.16*	.12	.18**	.10	.34***	.30***	.22***	.18**	.18**	.54***	−.12	−.09	.46***	.34***	.10	.13*	.32***	(.90)		
21. Exhaust	−.07	.12	−.08	−.11	.04	.01	.14*	.27***	.24***	.07	.01	.21***	−.16**	−.29***	.44***	.30***	.20***	.30***	.61***	.41***	(.92)	
22. Cynicism	−.12	−.02	−.15*	−.16*	−.04	−.02	.19**	.28***	.22***	.03	.06	.17**	−.22***	−.23***	.30***	.47***	.54***	.30***	.43***	.30***	.58***	(.87)
23. Efficacy	.18**	−.03	.13	.14*	.10	.21***	−.12	−.25***	−.08	−.12	.04	−.02	.14*	.17**	−.02	−.39***	−.42***	−.47***	−.24***	−.18**	−.17**	−.35***

Note. Listwise $n = 244$.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 5
Relationship of ICT Demands on Health and Well-Being Outcomes

	Burnout									
	ICT stress		Strain		Exhaustion		Cynicism		Professional efficacy	
	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2
Step 1: Controls		.05*		.04*		.02		.04*		.04*
Age	.06		−.02		−.02		−.03		.14	
Gender	.11		.17**		.10		−.07		.02	
Tenure	.12		−.06		−.04		−.10		.02	
# of technologies	.11		.02		−.07		−.16*		.11	
Step 2: ICT demands		.42***		.16***		.14***		.15***		.11***
Response expectations	.07		.00		.00		−.04		.09	
Availability	−.08		.01		.03		.02		.18*	
Poor communication	.19***		.08		.03		.09		−.12	
Lack of ICT control	.25***		.19**		.21**		.24***		−.15*	
Hassles	.03		.25***		.15*		.14*		−.02	
Employee monitoring	.06		.08		.00		−.03		−.11	
Learning expectations	−.05		−.08		−.06		.03		.02	
Workload	.51***		.08		.22**		.16*		−.10	
Total R^2		.46***		.20***		.17***		.29***		.15***

Note. $n = 256$.
* $p < .05$. ** $p < .01$. *** $p < .001$.

When entered on the third step, the eight ICT demand subscales also accounted for a significant increase in variance in strain ($R^2 = .07$, $p < .05$) and perceived stress ($R^2 = .23$, $p < .001$), providing partial support for Hypothesis 3. Hassles was a unique predictor of strain (β = .20, $p < .01$), and availability (β = −.12, $p < .01$), poor communication (β = .15, $p < .01$), a lack of control (β = .22, $p < .01$), and workload (β = .44, $p < .001$) were all unique predictors of stress. Learning expectations was the only unique predictor of exhaustion (β = −.16, $p < .05$), and availability was the only unique predictor of professional efficacy (β = .15, $p < .05$).

Tests of dependent correlations indicated that the correlation between the ICT lack of control scale and the job role lack of control scale was significantly higher than the correlations between the ICT lack of control scale and boredom, $t = 4.52$, $p < .001$, and ambiguity, $t = 5.91$, $p < .001$, supporting Hypothesis

Table 6
Incremental Variance of ICT Demands Beyond Job Role Demands

	Burnout									
	ICT stress		Strain		Exhaustion		Cynicism		Professional efficacy	
	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2
Step 1: Controls		.05*		.04*		.02		.04*		.04*
Age	.06		−.02		−.02		−.03		.14	
Gender	.11		.17**		.10		−.07		.02	
Tenure	.12		−.06		−.04		−.10		.02	
# of technologies	.11		.02		−.07		−.16*		.11	
Step 2: Role demands		.23***		.14***		.27***		.38***		.26***
Role overload	.35***		.21**		.44***		.28***		.04	
Job boredom	−.01		.08		.06		.43***		.18*	
Role ambiguity	.24***		.11		.08		.16**		−.20	
Lack of job control	.06		.19**		.15*		.01		−.32**	
Step 3: ICT demands		.23***		.07*		.04		.02		.03
Response expectation	.09		.01		.01		.01		.03	
Availability	−.12*		−.03		−.08		−.03		.15*	
Poor communication	.15**		.06		.02		.04		−.11	
Lack of ICT control	.22**		.09		.08		.09		.05	
Hassles	−.02		.20**		.06		.06		.04	
Employee monitoring	.06		.07		−.02		.05		−.06	
Learning expectations	−.11		−.11		−.16*		−.02		.00	
Workload	.44***		.03		.12		.08		−.06	
Total R^2		.51***		.25***		.33***		.44c		.33***

* $p < .05$. ** $p < .01$. *** $p < .001$.

4a.[3] Similarly, a test of dependent correlations indicated that the correlation between the ICT workload scale and the job role overload scale was significantly higher than the correlation between the ICT workload scale and role ambiguity, $t = 3.14$, $p < .001$, supporting Hypothesis 4b.[4]

Direct and Moderating Effect of ICT Support

ICT personal assistance and resource support were negatively related to increased strain and burnout (*r*s ranged from $r = -.14$, $p < .05$ to $r = -.29$, $p < .001$), thus partially supporting Hypothesis 5. Using Aiken and West's procedures, moderated hierarchical regression analyses were conducted to examine whether having ICT support in terms of personal assistance and ICT resource support moderated the relationship between continuous learning expectations and strain outcomes (i.e., Hypothesis 6a; see Table 7), and between ICT hassles and strain outcomes (i.e., Hypothesis 6b; see Table 8). Separate regression analyses were conducted for each of the five outcomes. The demographic and job variables were entered in the first step; the respective demand was entered in the second step (i.e., either learning expectations or ICT hassles), both support variables were entered into the third step (i.e., personal assistance and resource support), and the two interaction terms were entered in the fourth step (i.e., the interaction of stress by each of the two support variables).

After controlling for the demographic and job variables, ICT learning expectations accounted for a significant increase in explained variance only in stress ($R^2_{change} = .03$, $p < .01$; see Table 7). The support variables accounted for increased variance in all of the outcomes (R^2_{change} ranged from .02, $p < .05$ to .08, $p < .001$). In the fourth step, the interaction terms accounted for a significant increase in explained variance in all outcomes (R^2_{change} ranged from .03, $p < .05$ to .04, $p < .01$), except for exhaustion ($R^2_{change} = .02$, $p = .052$). Personal assistance did not moderate any of the relationships between learning expectations and the outcomes. However, resource support moderated the relationship between learning and all of the outcome variables (βs ranged from −.15, $p < .05$ to .20, $p < .01$), with the exception of exhaustion (although the pattern of relationships was consistent with the other interactions; $\beta = -.13$, $p < .05$). As illustrated in Figure 1, when employees experienced low levels of learning expectations, strain was relatively low for all employees, regardless of the degree of ICT resource support they received. However, there was a significant positive relationship between learning expectations and strain for employees who have a low degree of ICT resource support at work. That is, strain was significantly higher for employees who experienced demands to learn new technologies and when they had low levels of ICT resource support. The pattern of results for the learning expectations by resource support interactions was similar across all negative outcomes, and the pattern was flipped for professional efficacy, in that efficacy was high when resource support was high, regardless of the level of learning expectations; however, professional efficacy was significantly lower when employees experience high learning expectations and low levels of support.

For the second set of analyses, after controlling for the demographic and job variables, ICT hassles accounted for a significant increase in explained variance in all of the outcomes (R^2_{change} ranged from $R^2_{change} = .05$ to $R^2_{change} = .10$, $p < .001$), with the exception of professional efficacy ($R^2_{change} = .01$, *ns*; see Table 8). The support variables accounted for increased variance in all of the outcomes (R^2_{change} ranged from .03, $p < .05$ to .05, $p < .001$), with the exception of stress ($R^2_{change} = .01$, $p = ns$) and efficacy ($R^2_{change} = .02$, $p = ns$). In the fourth step, the interaction terms only accounted for a significant increase in explained variance in strain ($R^2_{change} = .03$, $p < .01$), although they accounted for ≥1% of the variance in all outcomes.

Personal assistance moderated the relationships between hassles and strain ($\beta = -.19$, $p < .01$) and between hassles and cynicism ($\beta = -.14$, $p < .05$). Strain was moderate at low levels of assistance, regardless of the amount of hassles experienced. However, there was a negative relationship between hassles and strain at high levels of personal assistance, such that strain was lowest when employees reported high hassles and high assistance (see Figure 2). As illustrated in Figure 3, at low levels of hassles, cynicism is moderate for all employees, regardless of the degree of ICT personal assistance they receive. However, there is a significant positive relationship between hassles and cynicism for employees who have a low degree of personal ICT assistance, and a negative relationship between hassles and cynicism for employees who receive a high degree of personal ICT assistance. That is, cynicism is significantly higher for employees who experience many ICT hassles when they have a low degree of assistance. Conversely, cynicism is significantly lower for employees who experience many ICT hassles when they have high degrees of assistance. The pattern for the personal assistance × hassles interaction for strain was similar in that there was a negative relationship between hassles and strain at high levels of personal assistance. At low levels of personal assistance, there is no relationship between hassles and strain.

Furthermore, ICT resource support moderated the relationship between hassles and strain ($\beta = -.15$, $p < .05$). As illustrated in Figure 4, hassles are unrelated to strain at low levels of resource support. That is, strain is relatively moderate for employees who receive little ICT resource support, regardless of the degree of hassles they experience. However, for employees who receive a high degree of resource support, there is a significant relationship between hassles and strain, such that strain is significantly lower when they experience few ICT hassles.

Discussion

The current study makes several contributions to the ICT demands literature. To extend the theory on ICT demands and support, we first developed and validated comprehensive measures of perceived ICT demands and supports. These scales provide a valuable framework to examine the impact of ICT demands and supports on employee well-being. This study provides evidence that the commonly reported negative effect of general job demands on employee health and well-being (Beehr et al., 2000; Liu et al., 2005) also may extend to ICT-specific demands, which demonstrated incremental validity over the traditional demands when predicting stress and strain. Finally, ICT

[3] The correlation between lack of job control and ambiguity was not significant and therefore was not included in the analyses.

[4] The correlations between workload and boredom and between workload and lack of control were not significant and therefore were not included in the analyses.

Table 7
The Moderating Effects of ICT Personal Assistance and Resource Support on the Relationship Between ICT Learning Expectations and Health and Well-Being Outcomes

	Burnout									
	ICT stress		Strain		Exhaustion		Cynicism		Professional efficacy	
	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2
Step 1: Controls		.05*		.04*		.02		.04*		.04*
Age	.06		−.03		−.03		−.03		.15	
Gender	.11		.17**		.10		−.07		.02	
Tenure	.12		−.06		−.04		−.10		.02	
# of technologies	.11		.02		−.07		−.15*		.10	
Step 2: ICT demand		.03**		.00		.00		.01		.00
Learning expectations	.19**		.00		.05		.10		.02	
Step 3: Moderator		.02*		.05**		.08***		.07***		.03*
ICT personal assistance	−.09		−.01		.00		−.14		.09	
ICT resources/upgrades support	−.10		−.22**		−.30***		−.18*		.12	
Step 4: Interactions		.03*		.03*		.02		.03*		.04**
Learning × Personal assistance	−.02		.05		−.04		−.02		.00	
Learning × Resource support	−.15*		−.17*		−.13		−.16*		.20**	
Total R^2		.13***		.11***		.13***		.16***		.11***

Note. $n = 247$.
* $p < .05$. ** $p < .01$. ** $p < .001$.

specific supports were associated with reduced employee strain, and they may help minimize the negative impact of ICT demands on employee well-being.

ICT Demands and Organizational Support

Using an ESEM methodology, the final 27-item ICT Demands Scale factored into the eight theorized ICT demands employees may experience at work, with all items loading significantly on their respective factors, and all fit indices being acceptable. The eight ICT demand subscales were relatively independent of each other and demonstrated adequate to high reliability, thus providing support for Hypothesis 1. However, the response expectations scale was initially conceptualized to assess the larger construct of overload: therefore, future research should examine whether different aspects of information overload (i.e., quantity of information; expectations to response to information) are equally demanding on employees. Based on these results, the information overload subscale may be revised to better capture the various forms of ICT overload. Future scale development using confirmatory factors analysis is warranted.

Table 8
The Moderating Effects of ICT Personal Assistance and Resource Support on the Relationship Between ICT Hassles and Health and Well-Being Outcomes

	Burnout									
	ICT stress		Strain		Exhaustion		Cynicism		Professional efficacy	
	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2
Step 1: Controls		.05*		.04*		.02		.04*		.04*
Age	.06		−.02		−.02		−.03		.14	
Gender	.11		.17**		.10		−.07		.02	
Tenure	.12		−.06		−.04		−.10		.02	
# of technologies	.11		.02		−.07		−.16*		.11	
Step 2: ICT demand		.05***		.10***		.06***		.05***		.01
ICT hassles	.23***		.32***		.25***		.24***		−.08	
Step 3: Moderator		.01		.03*		.05***		.04**		.02
ICT personal assistance	−.07		.04		.03		−.12		.18	
ICT resource/upgrades support	−.03		−.18**		−.25***		−.13		.08	
Step 4: Interactions		.01		.03*		.01		.02		.01
Hassles × Personal Asistance	.07		−.19**		−.11		−.14*		−.06	
Hassles × Resource support	−.10		.15*		.03		.08		.12	
Total R^2		.11***		.20***		.14***		.16***		.09*

Note. $n = 246$.
* $p < .05$. ** $p < .01$. ** $p < .001$.

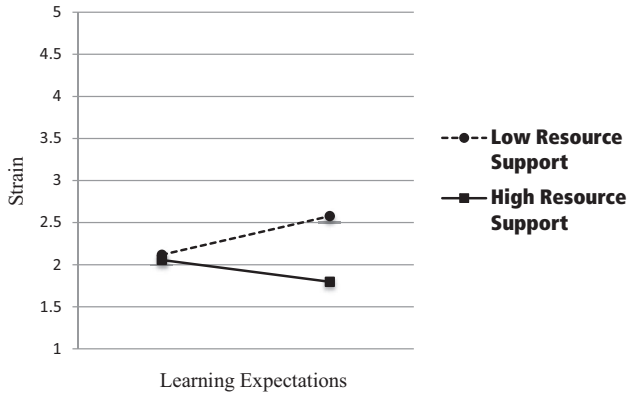

Figure 1. The moderated impact of resource support on the relationship between ICT learning expectations and strain.

Using the same methodology, the ICT Support Scale factored into two hypothesized components, with all items loading significantly on their respective factors, and all fit indices being acceptable. Both components demonstrated high reliability. Based on information gathered in the development phase, a conscious decision was made to limit the construct of support to the technical support that organizations can provide to employees, both in terms of technical resources (e.g., technology upgrades) and technical assistance. However, this perspective may be viewed as rather narrow in focus, and it may have resulted in construct deficiency. We argued that many of the ICT demands may not be responsive to these two types of support. That is, some of the ICT demands are a function of how other individuals within the organization use ICT (e.g., poor communication; being available 24–7) and would be better addressed through other types of general organizational supports (e.g., improvements to organizational communication and culture and through the implementation of policies regarding organizational expectations and the use of ICT). For example, employees in organizations that encourage employees to create boundaries between their work and nonwork lives (Park et al., 2011) may feel less connected and available to the workplace. Similarly, because employee monitoring is a demand generated by how the organization uses ICT, increasing employee trust through

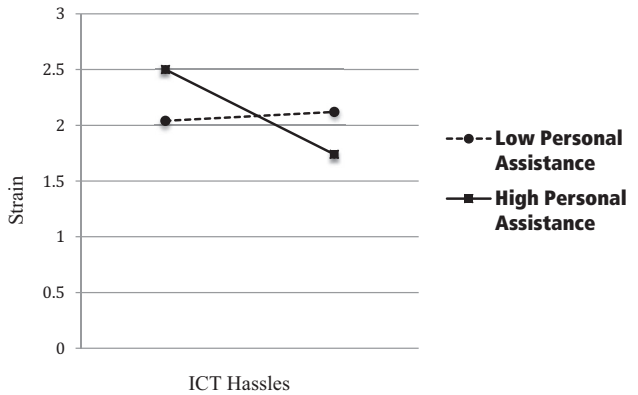

Figure 2. The moderating impact of personal assistance on the relationship between hassles and strain.

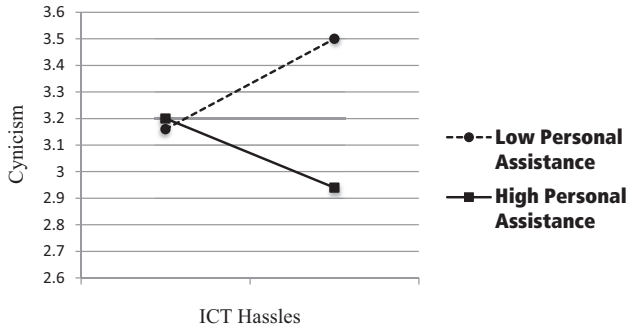

Figure 3. The moderating impact of personal assistance on the relationship between ICT hassles and cynicism.

effective organizational communication could minimize its negative effects. These general support mechanisms require minimal organizational resources and may be particularly cost-effective ways to minimize the potential negative employee health effects of using ICT in the workplace. Therefore, to ensure adequate sampling of the construct domain, it may be valuable to expand the construct of ICT support to include other aspects of organizational support that are non-ICT specific.

ICT and Job Stressors

As expected, ICT demands were correlated with all of the employee well-being outcomes in general, but they only accounted for additional variance in perceived stress and strain. These results extend past research on the negative impact of job demands on health (e.g., Demerouti et al., 2001), suggesting the efficacy of examining ICT specific demands. These results for burnout may reflect the cross-sectional nature of the study: That is, although burnout is more directly related to the work environment, it is considered a longer term outcome of work stress, in that it occurs after repeated exposure to stressors. Therefore, it would be valuable to examine the longer terms effects of ICT demands and whether they are associated with burnout in the longer term. The consistency of the relationships between lack of ICT control and all of the outcomes suggests it as a viable avenue for future research. Moreover, because it demonstrated convergent validity with job control, yet still was associated with outcomes after

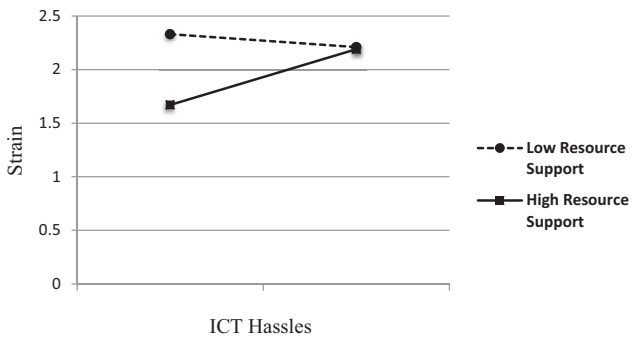

Figure 4. The moderating impact of resource support on the relationship between ICT hassles and strain.

controlling for job control, it may be considered an addition to traditional job control measures for jobs that involve ICT. Moreover, it may be valuable to look more closely at the individual components of burnout in relationship with ICT. For example, although ICT may prompt emotional distancing (by providing opportunities for non-face-to-face work), it may increase efficacy in that it can be used a resource to expand one's influence and job tasks. Therefore, it is possible that specific ICT components have differential relationships with burnout over the long term.

Both components of the ICT organizational support were negatively correlated with the well-being outcomes, and each scale moderated some of the demand-outcome relationships, although the pattern of relationships differed slightly for each type of support. They provide interesting preliminary data about the importance of ICT supports in employee well-being and as potentially beneficial in moderating the demand-outcome relationship. In recognizing the constraints of conducting substantive validity research while conducting tests of construct validity (Schwab, 1980), we suggest that these moderation results should be interpreted with some caution.

We interpreted the resource by hassles on strain interaction, as resource support moderating the impact of hassles on strain. However, we may view the moderation in a different way, such that hassles moderated the impact of resource support on strain.[5] Using this perspective, having new IT resources is only a support if ICT become problematic (i.e., creates hassles). That is, if employees keep getting new ICT, but it is problematic or faulty, then it is as stressful as never receiving these new resources in the first place. However, if you do get ICT resources and they are not problematic, they can reduce your strain.

Although personal ICT assistance did not have the consistent impact that organizational resource support had across outcomes, it moderated the relationships between hassles and cynicism and strain. This interaction indicates that cynicism is lowest when both assistance and hassles are high, suggesting that a high-hassles and assistance situation may allow this type of support more opportunity to help alleviate the cynicism that might arise from experiencing a lot of ICT hassles, and it may even enhance employee well-being by reducing their cynicism.[6]

Limitations and Future Research

We followed a thorough scale development process based on classical test theory and scale development best practices to identify ICT demands and to develop valid and reliable scales. Future research should now examine the scale factor structure using confirmatory methods, expanding the indicators of construct validity to other related constructs, establishing more explicit evidence for convergent and discriminant validity, and examining other outcomes.

Moreover, further development of these scales may be warranted to identify other possible ICT demands (e.g., the extent that ICT isolates employees or invades their privacy) and expand the current ICT demand categories (e.g., other aspects of information overload, such as quantity of information, quality of information, expectations for addressing information received; Jackson et al., 2003; Johansson-Hiden et al., 2003) and other types of supports.

For example, based on Jett and George's (2003) research on work interruptions, two types of interruptions (i.e., intrusions and distractions) may be relevant to the ICT construct: *Intrusion* into work is an "unexpected encounter [such as a phone call] . . . that interrupts the flow and continuity of an individual's work and brings that work to a temporary halt" (p. 495). It may have positive effects on employees if the goal of the intrusion is to improve communications or relationships. However, intrusions can be negative because they decrease time available for task completion, create stress as a result of time pressures, and disrupt one's involvement in a task (Jett & George, 2003). Similarly, *distractions* are "external stimuli or secondary activities that interrupt focused concentration on a primary task" and are often unrelated to work, such that they divert cognitive processes required for attention (Jett & George, 2003, p. 500). Although they can increase stimulation during performance of repetitive tasks, they also can have negative consequences, including decreased performance on complex, new, or demanding tasks.

Components of ICT may have positive impact on employees, and there is a growing body of literature identifying potential positive responses to work demands (see Nelson & Simmons, 2011 for a review). Interestingly, although the focus of the development process allowed for both positive and negative implications of ICT, and although we consciously created more neutral terms for the categories, the negative factors were more salient, and thus became more central, for the SMEs. Future research should focus on expanding the ICT Demands Scale to incorporate some of the more potentially positive elements of ICT to provide more balance. Future research should investigate the extent to which ICT demands elicit positive responses from employees and promote employee engagement. Future research also should build on this area by incorporating O'Driscoll et al.'s (2010) work on how individual factors may influence one's perception, acceptance, and engagement with ICT.

Conversely, several demands (i.e., response expectations, learning expectations, and employee monitoring) failed to uniquely contribute to the variance explained in any of the outcomes. Although they all demonstrated zero-order correlations with perceived stress, their lack of relationships with the other outcomes is interesting, suggesting that they may not be integral to the ICT demands construct, or perhaps that they elicit only a lower-level, immediate stress response and not are not directly related to more enduring negative strain and burnout responses. Future research should examine the utility of these components in the operationalization of this construct and their contribution in predicting important outcomes.

Based on the literature and suggestions from SMEs during the development process, we chose to use a frequency measure to assess ICT demands and support. However, there have been criticisms about the use of frequency measures in terms of producing variability in how respondents interpret survey questions (e.g., Schwarz, 1999). Future research may examine the impact of using alternate rating scales in assessing ICT demands and support.

We tried to minimize common method variance concerns by examining the incremental variance of the demands scale above

[5] Thanks to an anonymous reviewer for suggesting these alternative explanations in explaining the moderations.

[6] Thanks to an anonymous reviewer for suggesting this alternative explanation for the moderated regression.

the variance explained by the control variables and job stressors. Future research should examine demands and resources from multiple sources, use nested designs so as to examine the group-level supports and demands for a group of employees, and examine other outcomes using objective measures, such as physiological indicators of stress and job performance ratings. There is a growing body of literature examining the physical ailments associated with prolonged ICT use (e.g., musculoskeletal disorders, Coovert & Thompson, 2003; shoulder and neck problems, Brandt et al., 2004; eye sight; Blehm et al., 2005). Examining the extent to which ICT demands exacerbate these physical ailments (and the extent to which supports buffer the negative impact of ICT use) would be valuable. Similarly, although we viewed demands as being objective events (cf. Barling, 1990) and tried to focus on relatively objective ICT demands (e.g., "I experience glitches with software") and not on individual perceptions (e.g., "I'm stressed with dealing with software glitches"), all of these ICT demands were measured using subjective self reports. Future research may try to consider the possibility of using more objective measures of the demands (beyond self-report measures).

In our scale development process, we distinguished between demands and supports/resources based on the job demands-resources model and based on feedback from SMEs. However, similar to the literature on work demands and resources, the distinction between these two categories may be artificial. That is, it is possible that demands and resources may be two ends of the same continuum. For example, a lack of job control is viewed as a common work demand, but providing job control to employees is seen as a resource or support. Future research should explore the dimensionality of these constructs in greater detail.

Finally, perceptions of ICT demand and support may be related to type of occupation (e.g., ICT vs. non-ICT occupations). That is, people in technology-related jobs may view "everyday" ICT demands as being less stressful and may not react to the same way to the supports. These demands and supports may not have the same pattern of relationships with the outcomes. Future research should examine the extent to which occupation and ICT familiarity and usage may change the perception of demands, as well as mitigate the impact of demands (or even resources) on the outcomes.

Practical Implications

Our conceptualization and operationalization of ICT demands and support involves not only purely ICT demands but also an interaction of organizational culture and norms (in terms of expectations and use of technology) and human interaction with technology. Therefore, managers must take into consideration not only the actual demands within their workplace, but also the culture and context in which the organization operates. Although organizations often introduce new ICT into the workplace to create more efficiencies at work and to improve the working lives of employees, aspects of ICT may have the opposite effect. ICT demands can create negative employee outcomes, in addition to the negative effects from regular job demands (e.g., role overload) employees may experience. As well as focusing on the demands that had a general effect on all of the outcomes (e.g., lack of control), organizations should review other ICT components, identify the demands that are most prevalent in the organization, and develop cost-effective ways to manage the potential negative employee health outcomes associated with these demands, as well as identify and manage the supports offered to employees.

Concluding Remarks

Because of the importance of ICT in the workplace, and because of the limited measures of specific ICT demands and supports, we developed a comprehensive scale to measure specific ICT work demands and supports. Preliminary evidence on the scales was promising, providing a conceptual framework to develop future research in this area. Its relationships with job stressors, its ability to explain incremental validity in worker outcomes over these stressors, coupled with the critical role ICT plays in many jobs, suggests that it is a fruitful area of exploration.

References

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, CA: Sage.

Amick, B. C., & Smith, M. J. (1992). Stress, computer-based work monitoring and measurement systems: A conceptual overview. *Applied Ergonomics, 23,* 6–16. doi:10.1016/0003-6870(92)90005-G

Asparouhov, T., & Muthén, B. (2009). Exploratory structural equation modeling. *Structural Equation Modeling, 16,* 397–438. doi:10.1080/10705510903008204

Barling, J. (1990). *Employment, stress and family functioning*. New York, NY: John Wiley & Sons.

Bartone, P. T., Ursano, R. J., Wright, K. M., & Ingraham, L. H. (1989). The impact of a military air disaster on the health of assistance workers: A prospective study. *Journal of Nervous and Mental Disease, 177,* 317–328. doi:10.1097/00005053-198906000-00001

Beas, M. I., & Salanova, M. (2006). Self-efficacy beliefs, computer training and psychological well-being among information and communication technology workers. *Computers in Human Behavior, 22,* 1043–1058. doi:10.1016/j.chb.2004.03.027

Beehr, T. A., Jex, S. M., Stacy, B. A., & Murray, M. (2000). Work stressors and coworker support as predictors of individual strain and job performance. *Journal of Organizational Behavior, 21,* 391–405. doi:10.1002/(SICI)1099-1379(200006)21:4<391::AID-JOB15>3.0.CO;2-9

Blehm, C., Vishnu, S., Khattak, A., Mitra, S., & Yee, R. W. (2005). Computer vision syndrome: A review. *Survey of Ophthalmology, 50,* 253–262. doi:10.1016/j.survophthal.2005.02.008

Boswell, W. R., & Olson-Buchanan, J. B. (2007). The use of communication technologies after hours: The role of work attitudes and work-life conflict. *Journal of Management, 33,* 592–610. doi:10.1177/0149206307302552

Brandt, L. P., Andersen, J. H., Lassen, C. F., Kryger, A., Overgaard, E., Vilstrup, I., & Mikkelsen, S. (2004). Neck and shoulder symptoms and disorders among Danish computer workers. *Scandinavian Journal of Work, Environment and Health, 30,* 399–409. doi:10.5271/sjweh.828

Bureau of Labor Statistics. (2005). *Computer and internet use at work in 2003*. Report # USDL 05–1457, Washington, D.C.

Ceaparu, I., Lazar, J., Bessiere, K., Robinson, J., & Shneiderman, B. (2004). Determining causes and severity of end-user frustration. *International Journal of Human-Computer Interaction, 17,* 333–356. doi:10.1207/s15327590ijhc1703_3

Chesley, N. (2010). Technology use and employee assessments of work effectiveness, workload, and pace of life. *Information, Communication & Society, 13,* 485–514. doi:10.1080/13691180903473806

Cooper, C. L., Kirkcaldy, B. D., & Brown, J. (1994). A model of job stress and physical health: The role of individual differences. *Personality and Individual Differences, 16,* 653–655. doi:10.1016/0191-8869(94)90194-5

Coovert, M. D., & Thompson, L. F. (2003). Technology and workplace health. In J. C. Quick & L. E. Tetrick (Eds.), *Handbook of occupational health psychology* (pp. 221–241). Washington, DC: American Psychological Association. doi:10.1037/10474-011

Crocker, L., & Algina, J. (1986). *Introduction to classical and modern test theory*. Orlando, FL: Harcourt Brace Jovanovich, Inc.

Day, A. L., & Jreige, S. (2002). Examining Type A Behavior Pattern to explain the relationship between job demands and psychosocial outcomes. *Journal of Occupational Health Psychology, 7,* 109–120. doi:10.1037/1076-8998.7.2.109

Day, A. L., & Livingstone, H. (2001). Chronic and acute demands among military personnel: Do coping styles buffer their negative impact on health? *Journal of Occupational Health Psychology, 6,* 348–360. doi:10.1037/1076-8998.6.4.348

Day, A., Scott, N., & Kelloway, E. K. (2010). Information and communication technology: Implications for job stress and employee well-being. In P. Perrewe & D. Ganster (Eds), *New developments in theoretical and conceptual approaches to job stress: Research in occupational stress and well being* (Vol. 8, pp. 317–350). Burlington, VT: Emerald Group Publishing Ltd. doi:10.1108/S1479-3555(2010)0000008011

Day, A. L., & Ziemer, K. (2003). Subjective and objective measures of task control and stress. Presentation at the annual meeting of the Administrative Sciences Association of Canada, Halifax, NS, June 16.

de Jonge, J., Dollard, M. F., Doramann, C., LeBlanc, P., & Houtman, I. (2000). The demand-control model: Specific demands, specific control, and well-defined groups. *International Journal of Stress Management, 7,* 269–287. doi:10.1023/A:1009541929536

DeLongis, A., Coyne, J. C., Dakof, G., Folkman, S., & Lazarus, R. S. (1982). Relationship of daily hassles, uplifts, and major life events to health status. *Health Psychology, 1,* 119–136. doi:10.1037/0278-6133.1.2.119

Demerouti, E., Bakker, A. B., Nachreiner, F., & Schaufeli, W. B. (2001). The job demands–resources model of burnout. *Journal of Applied Psychology, 86,* 499–512. doi:10.1037/0021-9010.86.3.499

Dewett, T., & Jones, G. R. (2001). The role of information technology in the organization: A review, model, and assessment. *Journal of Management, 27,* 313–346.

Diamantopoulos, A., & Siguaw, J. A. (2006). Formative versus reflective indicators in organizational measure development: A comparison and empirical illustration. *British Journal of Management, 17,* 263–282. doi:10.1111/j.1467-8551.2006.00500.x

Dwyer, D. J., & Ganster, D. C. (1991). The effects of job demands and control on employee attendance and satisfaction. *Journal of Organizational Behavior, 12,* 595–608. doi:10.1002/job.4030120704

Edmunds, A., & Morris, A. (2000). The problem of information overload in business organizations: A review of the literature. *International Journal of Information Management, 20,* 17–28. doi:10.1016/S0268-4012(99)00051-1

Fairweather, B. N. (1999). Monitoring in employment: The case of teleworking. *Journal of Business Ethics, 22,* 39–49. doi:10.1023/A:1006104017646

Galinsky, E., Kim, S. S., & Bond, J. T. (2001). *Feeling overworked: When work becomes too much*. New York, NY: Families and Work Institute.

Ganster, D. C. (1989). Measurement of worker control. Final Report to the National Institute for Occupational Safety and Health, Contract No. 88–79187.

Golden, T. D., Veiga, J. F., & Simsek, Z. (2006). Telecommuting's differential impact on work-family conflict: Is there no place like home? *Journal of Applied Psychology, 91,* 1340–1350. doi:10.1037/0021-9010.91.6.1340

Gruen, R. J., Folkman, S., & Lazarus, R. S. (1988). Centrality and individual differences in the meaning of daily hassles. *Journal of Personality, 56,* 743–762. doi:10.1111/j.1467-6494.1988.tb00475.x

Hair, M., Renaud, K. V., & Ramsay, J. (2007). The influence of self-esteem and locus of control on perceived email-related stress. *Computers in Human Behavior, 23,* 2791–2803. doi:10.1016/j.chb.2006.05.005

Hinkin, T. R. (1995). A review of scale development practices in the study of organizations. *Journal of Management, 21,* 967–988. doi:10.1177/014920639502100509

Hinkin, T. R. (1998). A brief tutorial on the development of measures for use in survey questionnaires. *Organizational Research Methods, 1,* 104–121. doi:10.1177/109442819800100106

Hobfoll, S. E. (1989). Conservation of resources: A new attempt at conceptualizing stress. *American Psychologist, 44,* 513–524. doi:10.1037/0003-066X.44.3.513

Hudiburg, R. A. (1989a). Psychology of computer use: VII. Measuring technostress: Computer-related stress. *Psychological Reports, 64,* 767–772. doi:10.2466/pr0.1989.64.3.767

Hudiburg, R. A. (1989b). Psychology of computer use: XVII. The Computer Technology Hassles Scale: Revision, reliability, and some correlates. *Psychological Reports, 65,* 1387–1394. doi:10.2466/pr0.1989.65.3f.1387

Hudiburg, R. A. (1992). Factor analysis of the Computer Technology Hassles Scale. *Psychological Reports, 71,* 739–744.

Hudiburg, R. A. (1995). Psychology of computer use: XXXIV. The Computer Hassles Scale: Subscales, norms, and reliability. *Psychological Reports, 77,* 779–782. doi:10.2466/pr0.1995.77.3.779

Hudiburg, R. A., Ahrens, P. A., & Jones, T. M. (1994). Psychology of computer use: XXXI. Relating computer users' stress, daily hassles, somatic complaints, and anxiety. *Psychological Reports, 75,* 1183–1186. doi:10.2466/pr0.1994.75.3.1183

Hudiburg, R. A., Brown, S. R., & Jones, T. M. (1993). Psychology of computer use: XXXIX. Measuring computer users' stress: The Computer Hassles Scale. *Psychological Reports, 73,* 923–929. doi:10.2466/pr0.1993.73.3.923

Ilies, R., Dimotakis, N., & De Pater, I. E. (2010). Psychological and physiological reactions to high workloads: Implications for well-being. *Personnel Psychology*, *63,* 407–436. doi:10.1111/j.1744-6570.2010.01175.x

Jackson, T. W., Dawson, R., & Wilson, D. (2003). Understanding Email Interaction Increases Organizational Productivity. *Communications of the ACM, 46,* 80–84. doi:10.1145/859670.859673

Jarvis, C. B., MacKenzie, S. B., & Podsakoff, P. M. (2003). A critical review of construct indicators and measurement model misspecification in marketing and consumer research, *Journal of Consumer Research, 30,* 199–218. doi:10.1086/376806

Jett, Q., & George, J. (2003). Work interrupted: A closer look at the role of interruptions in organizational life. *Academy of Management Review, 28,* 494–507.

Johansson-Hiden, B., Wastlund, E., & Wallin, S. (2003). Reflecting on ICT and stress: Conceptional connections and a suggested application. In J. S. Petterson (Ed), *HumanIT2003* (pp. 35–57). Karlstad, Sweden: Karlstad University Studies.

Kinnunen, U., Feldt, T., Geurts, S., & Pulkkinen, L. (2006). Types of work-family interface: Well-being correlates of negative and positive spillover between work and family. *Scandinavian Journal of Psychology, 47,* 149–162. doi:10.1111/j.1467-9450.2006.00502.x

Klausegger, C., Sinkovics, R., & Zou, H. (2007). Information overload: A cross-national investigation of influence factors and effects. *Marketing Intelligence & Planning, 25,* 691–718. doi:10.1108/02634500710834179

Korunka, C., Huemer, K. H., Litschauer, B., & Karetta, B. (1996). Working with new technologies: Hormone excretion as an indicator for sustained arousal. A pilot study. *Biological Psychology, 42,* 439–452. doi:10.1016/0301-0511(95)05172-4

Korunka, C., & Vitouch, O. (1999). Effects of the implementation of information technology on employees' strain and job satisfaction: A

context dependent approach. *Work & Stress, 13,* 341–363. doi:10.1080/02678379950019798

Korunka, C., Zauchner, S., & Weiss, A. (1997). New information technologies, job profiles, and external workload as predictors of subjectively experienced stress and dissatisfaction at work. *International Journal of Human-Computer Interaction, 9,* 407–424. doi:10.1207/s15327590ijhc0904_5

Lazar, J., Jones, A., Hackley, M., & Shneiderman, B. (2006). Severity and impact of computer user frustration: A comparison of student and workplace users. *Interacting with Computers, 18,* 187–207. doi:10.1016/j.intcom.2005.06.001

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, & coping*. New York, NY: Springer Publishing Co.

Leiter, M. P., & Schaufeli, W. B. (1996). Consistency of the burnout construct across occupations. *Anxiety, Stress & Coping: An International Journal, 9,* 229–243. doi:10.1080/10615809608249404

Levy, M. (1994). The electronic monitoring of workers: Privacy in the age of the electronic sweatshop. *Legal Reference Service Quarterly, 14,* 5–56. doi:10.1300/J113v14n03_02

Liu, C., Spector, P., & Shi, L. (2008). Use of both qualitative and quantitative approaches to study job stress in different gender and occupational groups. *Journal of Occupational Health Psychology, 13,* 357–370. doi:10.1037/1076-8998.13.4.357

Liu, C., Spector, P. E., & Jex, S. M. (2005). The relation of job control with job strains: A comparison of multiple data sources. *Journal of Occupational and Organizational Psychology, 78,* 325–336. doi:10.1348/096317905X26002

Lund, J. (1992). Electronic performance monitoring: A review of research issues. *Applied Ergonomics, 23,* 54–58. doi:10.1016/0003-6870(92)90011-J

MacKenzie, S. B., Podsakoff, P. M., & Jarivs, C. B. (2005). The problem of measurement model misspecification in behavioral and organizational research and some recommended solutions. *Journal of Applied Psychology, 90,* 710–730. doi:10.1037/0021-9010.90.4.710

Marcus, J. H. (1994). *The complete job interview handbook*. New York: Harper Collins.

Marsh, H. W., Lüdtke, O., Muthén, B., Asparouhov, T., Morin, A. J. S., Trautwein, U., & Nagengast, B. (2010). A new look at the big-five factor structure through exploratory structural equation modeling. *Psychological Assessment, 22,* 471–491. doi:10.1037/a0019227

Marsh, H. W., Muthén, B., Asparouhov, A., Lüdtke, O., Robitzsch, A., Morin, A. J. S., & Trautwein, U. (2009). Exploratory Structural Equation Modeling, Integrating CFA and EFA: Application to Students' Evaluations of University Teaching. *Structural Equation Modeling, 16,* 439–476. doi:10.1080/10705510903008220

Maslach, C., & Jackson, S. (1981). The measurement of experienced burnout. *Journal of Organizational Behavior, 2,* 99–113.

Maslach, C., & Jackson, S. E., & Leiter, M. P. (1996). *Maslach Burnout Inventory Manual,* 3rd ed. Palo Alto, CA: Consulting Psychologists Press.

Meyers, L. S., Gamst, G., & Guarino, A. J. (2006). *Applied multivariate research: Design and interpretation*. Thousand Oaks, CA: Sage Publications.

Middleton, C. A. (2007). Illusions of balance and control in an always-on environment: A case, study of BlackBerry users. *Continuum: Journal of Media & Cultural Studies, 21,* 165–178. doi:10.1080/10304310701268695

Mikkelsen, A., Øgaard, T., Lindøe, P. H., & Olsen, O. E. (2002). Job characteristics and computer anxiety in the production industry. *Computers in Human Behavior, 18,* 223–240. doi:10.1016/S0747-5632(01)00051-6

Miller, S., & Weckert, J. (2000). Privacy, the workplace and the internet. *Journal of Business Ethics, 28,* 255–265. doi:10.1023/A:1006232417265

Mishra, J. M., & Crampton, S. M. (1998). Employee monitoring: Privacy in the workplace? *SAM Advanced Management Journal, 6393,* 4–15.

Morgan, K., Morgan, M., & Hall, J. (2000). Psychological developments in high technology teaching and learning environments. *British Journal of Educational Psychology, 31,* 71–79.

Muthén, L., & Muthén, R. (2008). *Mplus: The comprehensive modeling program for applied researchers, version 5.2*. Los Angeles, CA.

Nelson, D. L., & Simmons, B. L. (2011). Savoring eustress while coping with distress: The holistic model of stress. In J. C. Quick & L. E. Tetrick (Eds.), *Handbook of occupational health psychology* (2nd ed., pp. 55–74).Washington, DC: American Psychological Association.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric Theory* (3rd ed.). Toronto, ON: McGraw Hill Inc.

O'Donnell, M. P. (2007). Psychologically healthy workplaces. *American Journal of Health Promotion, 21*, p. iv. doi:10.4278/0890-1171-21.3.iv

O'Driscoll, M. P., Brough, P., Timms, C., & Sawang, S. (2010). Engagement with information and communication technology and psychological well-being. In P. L. Perrewe and D. C. Ganster (Eds.), *Research in occupational stress and well-being. Volume 8: New developments in theoretical and conceptual approaches to stress* (pp. 269–316). Bingley, UK: Emerald.

Office for National Statistics. (2009). Statistical Bulletin: E-commerce and ICT 2009. Retrieved from: www.statistics.gov.uk/pdfdir/ecom1110.pdf

Osipow, S. H., & Spokane, A. R. (1983). *A manual for measures of occupational stress, strain, and coping*. Columbus, OH: Marathon Consulting Press.

Park, Y., Fritz, C., & Jex, S. M. (2011). Relationships between work-home segmentation and psychological detachment from work: The role of communication technology use at home. *Journal of Occupational Health Psychology, 16,* 457–467. doi:10.1037/a0023594

Patrick, A., & Laschinger, H. K. S. (2006). The effect of structural empowerment and perceived organizational support on middle level nurse managers' role satisfaction. *Journal of Nursing Management, 14,* 13–22. doi:10.1111/j.1365-2934.2005.00600.x

Podsakoff, N. P., Shen, W., & Podsakoff, P. M. (2006). The role of formative measurement models in strategic management research: Review, critique, and implications for future research. *Research Methodology in Strategy and Management, 3,* 197–252. doi:10.1016/S1479-8387(06)03008-6

Podsakoff, P. M., Mackenzie, S. B., & Podsakoff, N. P (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual Review of Psychology, 63,* 539–569. doi:10.1146/annurev-psych-120710-100452

Porter, G., & Kakabadse, N. K. (2006). HRM perspectives on addiction to technology and work. *Journal of Management Development, 25,* 535–560. doi:10.1108/02621710610670119

Ragu-Nathan, T. S., Tarafdar, M., & Ragu-Nathan, B. S. (2008). The consequences of technostress for end users in organizations: Conceptual development and empirical validation. *Information Systems Research, 19,* 417–433. doi:10.1287/isre.1070.0165

Rainey, V. P. (2000). The potential for miscommunication using e-mail as a source of communication. *Journal of Integrated Design and Process Science, 4,* 21–43.

Ramirez, A., Walther, J. B., Burgoon, J. K., & Sunnafrank, M. (2002). Information-seeking strategies, uncertainty, and computer-mediated communication. *Human Communication Research, 28,* 213–228.

Rhoades, L., & Eisenberger, R. (2002). Perceived organizational support: A review of the literature. *Journal of Applied Psychology, 87,* 698–714. doi:10.1037/0021-9010.87.4.698

Rosen, M. M., & Weil, L. D. (1997). *TechnoStress: Coping with technology @ work @ home @ play*. New York, NY: John Wiley & Sons.

Schat, A. C., & Kelloway, E. K. (2003). Reducing the adverse consequences of workplace aggression and violence: The buffering effects of

organizational support. *Journal of Occupational Health Psychology, 8,* 110–122. doi:10.1037/1076-8998.8.2.110

Schleifer, L. M., & Shell, R. L. (1992). A review and reappraisal of electronic performance monitoring, performance standards and stress allowances. *Applied Ergonomics, 23,* 49–53. doi:10.1016/0003-6870(92)90010-S

Schwab, D. P. (1980). Construct validity in organizational behavior. In B. M. Staw & L. L. Cummings (Eds.), *Research in organizational behavior* (Vol. 2, pp. 3–44). Greenwich CT: JAI Press Inc.

Schwarz, N. (1999). Self-reports: How the questions shape the answers. *American Psychologist, 54,* 93–105. doi:10.1037/0003-066X.54.2.93

Singer, J. E., & Davidson, L. M. (1986). Specificity and stress research. In M. H. Appley & R. Trumbull (Eds.), *Physiological, psychological, and social perspectives* (pp. 47–61). New York, NY: Plenum.

Sonnentag, S., & Bayer, U. V. (2005). Switching off mentally: Predictors and consequences of psychological detachment from work during off-job time. *Journal of Occupational Health Psychology, 10,* 393–414. doi:10.1037/1076-8998.10.4.393

Sonnentag, S., & Frese, M. (2003). Stress in organizations. In W. C. Borman, D. R. Ilgen, & R. J. Klimoski (Eds.), *Comprehensive handbook of psychology, Volume 12: Industrial and organizational psychology* (pp. 453–491). Hoboken, NJ: Wiley.

Stanton, J. M., & Weiss, E. M. (2000). Electronic monitoring in their own words: An exploratory study of employees' experiences with new types of surveillance. *Computers in Human Behavior, 16,* 423–440. doi:10.1016/S0747-5632(00)00018-2

Statistics Canada. (2009). Table 358–0007: Survey of electronic commerce and technology, use of information and communication technologies, by North American Industry Classification System (NAICS), annual (percent), (1338 series). Retrieved from: http://www5.statcan.gc.ca/cansim/pick-choisir?lang=eng&id=3580007&pattern=3580007&searchTypeByValue=1

Steinmueller, W. E. (2000). Will new information and communication technologies improve the 'codification' of knowledge? *Industrial and Corporate Change, 9,* 361–376. doi:10.1093/icc/9.2.361

Stewart, W., & Barling, J. (1996). Daily work stress, mood, and interpersonal job performance: A mediational model. *Work & Stress, 10,* 336–351. doi:10.1080/02678379608256812

Tarafdar, M., Tu, Q., & Ragu-Nathan, T. S. (2010). Impact of technostress on end-user satisfaction and performance. *Journal of Management Information Systems, 27,* 303–334. doi:10.2753/MIS0742-1222270311

Witt, L. A., & Carlson, D. S. (2006). The work-family interface and job performance: Moderating effects of conscientiousness and perceived organizational support. *Journal of Occupational Health Psychology, 11,* 343–357. doi:10.1037/1076-8998.11.4.343

Wood, C. (2001). Dealing with tech rage. *MacLean's, 114,* 41–42.

Zohar, D. (1999). When things go wrong: The effect of daily work hassles on effort, exertion and negative mood. *Journal of Occupational and Organizational Psychology, 72,* 265–283. doi:10.1348/096317999166671

Zorn, T. E. (2002). The emotionality of information and communication technology implementation. *Journal of Communication Management, 7,* 160–171. doi:10.1108/13632540310807296

Received July 12, 2011
Revision received July 27, 2012
Accepted July 30, 2012 ■