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The Influence of Technological Reliability and Supervisor Supportiveness on Work Stress

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Abstract: Despite the prevalence of workplace stress, little research has identified interactions between social and technological sources of stress. In two studies, the researchers examined the role of supervisor support and reliable technology in the alleviation of stress. In Study 1, working adults in Mechanical Turk (n = 225) completed an online survey asking them about their workplace attitudes and opportunities. The results of a regression analysis showed that supervisor supportiveness and technological reliability were the only unique predictors of lowered stress, even while accounting for coworkers, pay, promotion opportunities, and everyday workplace tasks. In Study 2, undergraduate students (n = 186) completed a computer task that either malfunctioned or worked normally and were either supervised by a supportive or unsupportive research assistant. The results showed a significant main effect of technology reliability and a Supervisor X Technology interaction effect, but only for female participants. Implications for improving workplace conditions are discussed.

Keywords: Supportiveness, Technological Reliability, Work, Stress, Supportiveness, Reliability

Everyone gets stressed. Stress might look different for different people, but popular media has shown that work is a common source of stress. In general, when people get extremely stressed, they feel fatigued, which is much different than when someone experiences eustress, also known as a “normal,” beneficial type of stress (Parker & Ragsdale, 2015). While some stress is healthy, stress can disrupt normal functions like digestion, sleep, and mood while long-term stress may result in illnesses or mental health problems such as diabetes, heart disease, depression, and anxiety (National Institute of Health, 2016). Due to the negative consequences associated with stress, it is important for people to try and manage their chronic sources of stress like their work environment. Sources of workplace stress need to be identified to help reduce the affect it has on employees. This research seeks to identify the social and technological sources of stress specifically related to supervisors and reliable technology.

Supervisor Support and Stress

There are many productive ways to manage stress such as physical activity and social support (Whitebird, Asche, Thompson, Rossom, &

Heinrich, 2013). Overall, having support is helpful when managing stress. Supervisor support, in particular, is negatively correlated with stress (Kang & Kang, 2016) and positively correlated with workability (Sugimura, & Thériault, 2010). A work program called STAR (Support, Transform, Achieve, Results) has been shown to decrease perceived stress, psychological distress, and burnout while also increasing job satisfaction when applied to employees and managers (Moen et al., 2016). Supervisors were trained to be supportive of employee's personal and work lives as well as their job performance; employees were taught to manage work time. Afterward, this intervention demonstrated how important supportiveness is for managing stress. An unsupportive supervisor will cause stress and decrease work ability while a supportive supervisor will decrease stress and improve an employee's work ability, making supervisor support important for both the employee and the employer. Although this was a successful experiment, there was no random assignment/sampling, and it did not take place in a controlled setting. Randomizing the conditions and doing this in a controlled environment would help reduce confounds like sampling errors or environmental factors.

These associations could be due, in part, to a supervisor's role in work-to-family conflicts, or Family-Supportive Supervisor Behaviors (FSSB). Stressors exist in both the workplace and at home, and the interaction between the two can create additional stressors at work (work-to-family conflicts), which are usually discussed between the supervisor and the employee where FSSB could make a difference. FSSB have been found to be negatively associated with self-reported sleep insufficiency and self-reported insomnia symptoms (Crain et al., 2014), and they were also related to a decrease in the stress involved with work-to-family conflicts (Almeida et al. 2016). Additionally, FSSBs are negatively related to stress-related physical outcomes, exhaustion, cynicism, job dissatisfaction, and organizational turnover intentions (Yragui, Demsky, Hammer, Dyck, & Neradilek, 2017). Unfortunately, poor emotional control in supervisors was associated with more employee stress (Tucker, Jimmieson, & Bordia, 2016). In comparison, high emotional management was negatively correlated with a team's role overload. Role overload occurs when someone is facing too many role conflicts stemming from multiple "roles" in their lives. Role overload was positively related to physical fatigue, turnover intentions, cognitive weariness [sample 1 only], and/or emotional exhaustion [sample 2 only]. In other words, supervisor support should appear genuine or else the supervisor risks making the situation worse for the employee.

Technology and Stress

Stress at work is not only characterized by social interactions in the workplace; technological interactions are also commonplace during work. Therefore, there is a need for more information on technology's influence on stress in the workplace so that interventions can be created to promote employee health and overall wellness (Richardson, 2017). These interventions are necessary because technology at work can result

in both emotional stress and physical stress (Soylu & Campbell, 2012). Understanding how technology creates stress is the first step in effectively reducing the amount of stress an employee feels in relation to technology at work.

Information & Communication Technologies (ICTs) like computers and smartphones are one source of stress. This stress can come from a variety of stressors like constant availability (anyone can reach you at any time), connectivity pressure (social pressures to stay connected), inner obligation for availability (personal pressures to be available), and increased workload (Ninaus, Diehl, Terlutter, Chan, & Huang, 2015). While technology can result in stress from normal use, complications may also arise, which could lead to additional stress. For example, physical restrictions (i.e. limitations like not being able to reach or being unable to move a specific way to use the technology) are negatively related to the perceived ease of use of technology, which may create unnecessary computer anxiety (Immonen & Sintonen, 2015). These complications hint at how technology might be related to stress.

In fact, the relationship between technology and stress is so well known that people often refer to technology-related stress as technostress. Two main aspects characterize technostress: techno-strain and techno-addiction. Techno-strain, like computer anxiety, which is predicted by work overload (similar to burnout), role ambiguity (unclear roles at work or in life), emotional overload (burnout related to emotional issues), mobbing (psychological intimidation in the workplace), obstacles hindering ICT use, and lack of autonomy (Salanova, Llorens, & Cifre, 2013). Techno-addiction, or the uncontrollable overuse of ICTs, was predicted by work overload, role ambiguity, mobbing, and a lack of emotional competencies with the effects being more significant for more intensive users of technology. The longer a person is exposed to a technological stressor, the more stressed it makes them.

This may not be the case, though, if technological incompetence is causing the stress. Once someone becomes competent with the technology they use, they have better technology-enabled performance and are more technologically innovative, which can increase sales production and reduce technostress conditions, respectively (Tarafdar, Pullins, & Ragu-Nathan, 2015). Even a positive attitude towards Internet usage reduces stress and increases job satisfaction, versus a neutral or negative view towards Internet usage (Koivunen, Kontio, Pitkänen, Katajisto, & Välimäki, 2013). Technological competency and a positive attitude cannot prevent every complication that arises from technology. The technology itself can be stressful, particularly when it is unreliable, too complex, and/or not useful (Sharma & Gill, 2015). Neither study considered these factors, but they may need to be accounted for in future workplace studies.

Supervisors and Technology

When examining stress at work, it is important to focus on multiple factors. Only a few studies have looked at the interaction between supervisor

support and technological reliability in relation to stress. Technostress can lead to work exhaustion, thereby decreasing job satisfaction, but supportive leadership can reduce work exhaustion and increase job satisfaction (Fieseler, Grubenmann, Meckel, & Müller, 2014). In addition, Human Resource Management effectiveness (HRMe) moderates the negative relationship between technology-related overload and perceived organizational support such that the effect is less strong when HRMe is high (Harris, Lambert, & Harris, 2013). Thus, supervisors and technology may be key predictors of workplace stress, but these factors have not been examined in relation to other potential predictors.

Overviews

Past research has shown that having a supportive supervisor and functional technology is related to lower levels of stress. To date, however, no one has examined how these factors predict stress while controlling for other important workplace factors, nor have these factors been examined experimentally. In Study 1, the researchers examined the degree to which supervisor support and technology predict workplace stress while controlling for other factors (e.g., pay, coworkers). In Study 2, researchers examined the interaction between supervisor and technology on a laboratory-based computer task. In both studies, it was expected that both supervisor support and reliable technology would be associated with lower levels of stress. The interaction between the two was not examined until the second study.

Study 1

In Study 1, the researchers sought to identify the key workplace components that predict stress. The study included the Job Descriptive Index to cover common workplace concerns: coworkers, supervisors, pay, promotion opportunities, and everyday workplace tasks. Additional questions about the age and reliability of the technology used at work were also included. It was hypothesized that supervisor support and the reliability of technology would predict low levels of stress above these other variables.

Method

Participants. Participants were 225 employed American citizens recruited through Amazon Mechanical Turk. The majority of the sample was male (60%), European-American (82%), and the average age was in middle adulthood ($M_{age} = 39.43$). They were compensated \$0.50 for completing the survey.

Measures

Job Aspects. Participants completed the Job Descriptive Index, or JDI, to assess their attitudes toward a variety of aspects at their job (Balzer et al., 1990). The JDI has demonstrated considerable validity over the years. Participants rated each item using a 3-point scale (0 = “no”, 1 = “?”, 3 = “yes”) as to whether or not each aspect was present at their place of work. The JDI has subscales related to various job aspects so that a higher score indicated

higher levels of the construct. These constructs included attitudes toward: People ($M = 2.10$, $SD = 0.76$, $\alpha = .89$), Tasks ($M = 1.83$, $SD = 0.90$, $\alpha = .92$), Pay ($M = 1.87$, $SD = 1.06$, $\alpha = .91$), Promotion Opportunities ($M = 1.25$, $SD = 1.12$, $\alpha = .93$), and Supervision ($M = 2.11$, $SD = 0.92$, $\alpha = .94$).

Technology Aspects. To examine participants' experiences with technology at their workplace, participants completed three scales. Participants were asked, "What is the main form of technology you use at work?" and they answered the question through free response. For Technology Age ($M = 1.97$, $SD = 0.83$), they were then asked to indicate when that technology was first invented from several options (1 = since 2015, 2 = 2001-2015, 3 = 1981-2001, 4 = 1965-1981, 5 = 1946-1965, 6 = before 1946). For Technology Era ($M = 2.07$, $SD = 0.54$), participants were then asked to indicate their perception of the age of that method based on three options (1 = brand new, 2 = modern, 3 = traditional). For Technology Reliability ($M = 4.35$, $SD = 0.70$), participants were then asked, "How reliable is this method?" They provided their answer based on a 5-point scale (1 = never works, 5 = works all of the time).

Job Stress. Mackie, Holahan, & Gottlieb's (2001) 7-item Perceived Work Stress Scale (PWSS) was used to assess the amount of stress each participant experienced at their job within the past month ($M = 3.33$, $SD = 1.22$, $\alpha = .89$). Items were rated using a 5-point Likert scale (1 = never, 7 = extremely often).

Results

To examine the zero-order associations among the variables, a series of bivariate correlations across all variables in the study were conducted (see Table 1). The results showed that all of the JDI variables correlated negatively with Work Stress, but only Technology Reliability correlated negatively with Work Stress; the other technology variables were not related to stress.

To examine the strongest predictors of work stress, the researchers conducted a simultaneous regression analysis with the JDI scores and the technology scores entered as independent variables, and Work Stress as the dependent variable (see Table 2). The results indicated that only JDI Supervisor and Technology Reliability were significant predictors of Work Stress.

Discussion

Even after taking employee perceptions of pay, promotional opportunities, people at work, the task, and the age of the technology being used, the results of Study 1 showed that supervisor support and the reliability of technology were the only two unique predictors of stress. Since both variables were unique predictors of stress, it is important to take them into account when studying work-related stress.

Although supervisor support and reliable technology are two variables that influence stress, it is difficult to determine the degree of their interaction from Study 1 and other prior studies. This is because there has been little research that considers both the supportiveness of the supervisor and the reliability

of the technology, let alone how they interact. Most of the literature on the subject is based on survey designs, so they also lack internal validity for causation. The purpose of Study 2 was to expand upon these findings and test the causal direction of the associations noted in Study 1.

Study 2

To examine the impact of supervisor support and the reliability of technology on stress, the researchers utilized an experimental design and developed four hypotheses for Study 2. Hypothesis 1 was that a supportive supervisor would result in lower stress than an unsupportive supervisor. Hypothesis 2 was that unreliable technology would result in more stress than reliable technology. Hypothesis 3 was that an unsupportive supervisor would result in more stress than poor reliability of technology. Hypothesis 4 was that the unsupportive-unreliable condition would have the highest amount of stress compared to the other conditions.

Method

Design. This experiment had a 2 x 2 between-subjects design, so there were four different conditions. The two independent variables were supervisor supportiveness (supportive or unsupportive) and machine reliability (reliable or unreliable).

Experimenter Supportiveness. This is a modification of “Supervisor Supportiveness” as the research assistants are only temporary supervisors compared to supervisors in the workplace. The supportive conditions involved a friendly, helpful research assistant versus the unsupportive condition, which involved an unfriendly, stern research assistant. The supportive experimenter said things like “You are almost done! Now we just have a couple of surveys for you to fill out...” and “Oh no! I do not know why it would do that... It is OK. We can move on from here...” depending on if they were in the reliable or unreliable conditions, respectively. This was also the case for the unsupportive supervisor. The unsupportive supervisor said things like, “Are you finished?... Finally,” (reliable) and “What? Why not?... Anyways, you had plenty of time to finish the task, so now I need you to fill out these surveys” (unreliable). These scripts were generated on behavior that is more or less supportive, depending on the circumstances.

Technological Reliability. In the reliable technology conditions, participants viewed a slideshow and answered a question after each picture they were shown. They were given an example photo and question before being shown each picture for six seconds (30 total) and they had 10 seconds to answer one question about each photo. For the unreliable technology conditions, the photos went at the same speed as the reliable condition, then, halfway through, the photos slowed down and stayed on the screen for ten seconds while the questions stayed on for thirteen and a half seconds. Beginning on the twenty-fifth photo, the photos and questions only flashed for one second total, leaving the participant unable to answer the last five questions. This was done intentionally to mimic a computer malfunction

that affects the task at hand. When compute's become overloaded they often run slowly, and then rapidly "catch up," and this task attempts to replicate such a malfunction.

Participants. For this experiment, there were 186 undergraduate psychology students from a regional university in central Kentucky participating in this study. The majority of the sample was female (79%), European-American (88%), employed (64%), and between the ages of 18 and 23 (86%, $M = 21.11$, $SD = 5.19$). Students were recruited voluntarily through the SONA system and were awarded credits in this system for participating in the experiment. Participants were given a consent form before the experiment began in case they decided to not continue with the study. Participants were assigned to the four conditions with the first participant beginning at the first condition, the next at on the second, then third, and fourth for the last, until the fifth participant started back on the first condition.

Measures

Experimenter supportiveness. The study examined how the participant perceived the experimenter's supportiveness level through a questionnaire about the research assistant. This included ten attributes of the research assistant for the participant to rate on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). The target item for this was "Supportive." Participants in the Unsupportive condition rated the Research Assistant significantly lower ($M = 4.30$, $SD = 0.80$) than in the Supportive condition ($M = 4.48$, $SD = 0.67$).

Stress. To measure stress, participants took an emotional-state measure to measure how the participant felt after the experiment. Questions are rated on a 5-point Likert scale (1 = Not at All, 5 = Very Much).

Procedure

Experiments were performed individually in the psychology department's research facility at a regional university in central Kentucky. After consenting to the experiment, the participants were given an answer sheet and were told that they would be shown thirty pictures and that a question would follow each picture. They were told to write the answer to the question on the corresponding blank of the answer sheet. Throughout the interaction with the participant, the assistant made different comments to the participant based on the script for the assigned condition and participants were told that they are being filmed during the experiment. The participant then began the slideshow (either reliable or unreliable depending on which one the experimenter set-up beforehand) and set an eight-minute timer before exiting the room. Afterward, the participant was given the emotional state questionnaire and the research assistant survey, and the research assistant waited outside for them to finish. The participants were then debriefed.

For this experiment, it was important that the participant remained unaware of the fact that this study focuses on the reliability of the technology and the supportiveness of the supervisor. If a participant was aware of this, then this

could have influenced their stress levels. Therefore, it was important that the manipulations (experimenter supportiveness and technological reliability) occurred without the participants' knowledge in order to collect genuine results. For this reason, deception was necessary for this study.

Results

To test the four hypotheses for the study, the data were analyzed using a univariate ANOVA. For this test, experimenter supportiveness (supportive, unsupportive) and technological reliability (reliable, unreliable) were entered as the independent variables and stress was entered as the dependent variable. The results indicated a significant main effect of Technological Reliability ($F(1, 182) = 7.05, p < .01$) and that the unsupportive-unreliable condition was the most stressful in females only ($F(1, 142) = 7.21, p < .01$). Thus, Hypothesis 2 and only part of Hypothesis 4 was supported.

A post hoc analysis was conducted examining the moderating effects of gender. To investigate these effects, the same univariate ANOVA was conducted while adding Gender as an additional independent variable. The results indicated a marginal main effect of Technological Reliability, $F(1, 178) = 3.49, p = .06$, and a significant Supervisor X Technology X Gender three-way interaction effect, $F(1, 178) = 15.36, p < .01$. There were no other significant effects.

Follow-up simple interaction effects were conducted to further examine the interaction. To conduct these tests, the original univariate test was conducted for males and females separately. The results showed that the Technology main effect was significant for females, $F(1, 142) = 3.90, p = .05$, but not for males, $F(1, 36) = 1.57, ns$. Thus, Hypothesis 2 was only supported for females.

The Supervisor X Technology interaction effect was significant for both females, $F(1, 142) = 7.21, p < .01$, and for males, $F(1, 36) = 11.17, p < .01$. The mean levels of stress in each condition varied widely for males and females (see Figure 1). For males, stress was highest in the Supportive-Unreliable condition, whereas stress was highest in the Unsupportive-Unreliable condition for females. Thus, Hypothesis 4 was only supported for females.

Discussion

This study demonstrates the causation between the reliability of technology and stress, which supports the negative correlation found in Study 1. In terms of supervisor supportiveness, only Study 1 found a negative correlation between supervisor supportiveness and stress. This could have been because the research assistants were consistently rated as supportive in both supportive and unsupportive conditions, which implies that participants did not find the research assistants to be significantly more unsupportive in the unsupportive conditions. Therefore, the supervisors (research assistants) may not have accurately portrayed the same level of unsupportiveness and authority as the real supervisors that participants

were rating in the first study.

One of the more interesting findings about the supervisor supportiveness aspect of this experiment was the gender difference in which condition was most perceived as most stressful. For women, the results went as expected, or that having a cold supervisor in the face of failure was very stressful. Men reported being stressed out the most by the supportive supervisor in unreliable conditions than the unsupportive supervisor. A possible, untested explanation for this was that the males perceived the supportiveness as pity during unreliable conditions. While not all hypotheses were supported for Study 2, it did show that Study 1 was relatively reliable in their implications on the importance of technological reliability and supervisor supportiveness in relation to stress.

General Discussion

Reliability of technology and supervisor supportiveness must be examined when looking into lowering workplace stress, even over promotion, pay, or workplace relationships. Poor technological reliability results in higher levels of stress, and supervisor supportiveness is negatively correlated with stress. While causation was not established between supervisor supportiveness levels and stress, these studies do show that supervisor supportiveness matters and that it can be perceived differently between genders.

Implications

These results are mostly congruent with previous studies, which showed that reliable technology is associated with lower levels of stress (Harris et al., 2013; Fieseler et al., 2014; Sharma & Gill, 2015). Most importantly, these results imply that management should focus on providing employees with software/systems that are reliable instead of the “latest” technology to reduce employee stress. This implication is emphasized because many industries believe that they need to have the latest technology to be competitive, but it has been shown that the age of the technology is not the main factor that influences stress. Upgrading to a new, unreliable system would likely negatively impact employees’ stress.

The researchers found that supervisor support was associated with lower stress with the workplace sample and for female undergraduate students, which may suggest this factor is more important in workplace settings and/or with female workers (e.g. Kang & Kang, 2016). However, this consideration should not be completely ignored for male employees as supervisor support could create more stress when technology is being unreliable. Supervisor training should, therefore, encourage all workplace managers/supervisors to largely be more supportive of employees, and this training should cover different approaches to handling males and females during stressful situations. While there are times when an employee needs to be reprimanded, this should not be a supervisor’s first instinct.

The three-way interaction in Study 2 also provides some interesting

insights into how supervisor support and task failure due to unreliable technology may function differently for men and women. Our hypothesized effect only occurred among women: having an aloof authority in the face of a failed task resulted in relatively higher levels of stress than in the other conditions. For men, the highest levels of stress instead were noted in the supportive-unreliable condition. This difference may suggest a tendency for men to perceive supervisor support in the context of a failure as pity, which may make them feel worse. This effect should be further examined in future studies, which should also address some of the limitations of the current research.

Limitations and Future Directions

Study 2 did not find a significant effect for experimenter supportiveness and stress, but it did find that females were most stressed out during the unsupportive-unreliable condition. Since this was the first study to experimentally look at supervisor supportiveness, technological reliability, and stress together, future studies are needed to examine these relationships further. These studies should focus on real-world supervisors, how supervisor supportiveness is perceived differently between genders, and improving the script involved with future studies.

The effects were more apparent with the sample from Study 1, who were current workers, versus the undergraduate population used in Study 2. This difference in sample characteristics could have also limited the study, as many undergraduate students do not have extensive work experience. In addition, real-life supervisors are not scripted the way the research assistants were, and real supervisors are not necessarily restricted by the same ethical regulations as social science experimenters.

Although these studies provide compelling evidence for the role that technological reliability and supervisor supportiveness play in stress, it takes more than one study to reach a definitive finding. More research must be conducted in this area to reveal how supervisor supportiveness is linked to stress (including gender differences) and to further support the finding that unreliable technology results in higher stress.

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