

# Exposure to Information and Communication Technology and its Relationship to Work Engagement

## EXPOSICIÓN A LA TECNOLOGÍA DE LA INFORMACIÓN Y LA COMUNICACIÓN Y SU RELACIÓN CON EL ENGAGEMENT

Marisa Salanova<sup>1</sup>, Susana Llorens<sup>2</sup>

1. PhD. Full professor. Social Psychology. WONT Research Team. Universitat Jaume I. Castellón. Spain.

2. PhD. Associate professor. Social Psychology. WONT Research Team. Universitat Jaume I. Castellón. Spain

### RESUMEN

El presente estudio pone a prueba la hipótesis de que la valoración positiva de la exposición juega un papel mediador en el impacto de la exposición de la tecnología (i. e., frecuencia de uso y formación en tecnología) sobre el engagement en el trabajo (i. e., vigor, dedicación y absorción) en una muestra de 645 trabajadores españoles que trabajan con Tecnologías de la Información y la Comunicación. Los resultados de Modelos de Ecuaciones Estructurales muestran que la valoración positiva media parcialmente el impacto de la exposición a la tecnología sobre el engagement. A mayor exposición, mejor es la valoración y mayor el engagement. Además, se observó una relación directa pero negativa entre frecuencia de uso y engagement. Así, a mayor uso de la tecnología -sin mediación vía la valoración- se observaron niveles más bajos de engagement. Se discuten las limitaciones e implicaciones prácticas del estudio.

(Salanova M, Llorens S. 2009. Exposición a la Tecnología de la Información y la Comunicación y su Relación con el Engagement. *Cienc Trab.* Abr-Jun; 11 (32): 55-62).

Descriptores: TECNOLOGIA DE LA INFORMACION, TRABAJADORES/PSICOLOGIA, EXPOSICION PROFESIONAL, TRABAJO, MOTIVACION, ESPAÑA.

### ABSTRACT

This paper tests the hypothesis that the positive appraisal of exposure mediates the impact of technology exposure (i. e., frequency of use and technology training) on work engagement (i. e., vigor, dedication and absorption) in a sample of 645 Spanish workers who work with Information and Communication Technology. The Structural Equation Modeling results show that the positive appraisal partially mediates the impact of technology exposure on work engagement. The greater the exposure, the better the appraisal and the higher work engagement. Interestingly, we observed a direct but negative relationship between frequency of use and work engagement. Therefore, the greater the use of technology without mediation via appraisal, the lower the levels of work engagement. Study limitations and practical implications are discussed.

Descriptors: INFORMATION TECHNOLOGY; WORKERS/PSYCHOLOGY; OCCUPATIONAL EXPOSURE; MOTIVATION; WORK; SPAIN.

### INTRODUCTION

Information and Communication Technology (ICT) has been constituted as a pivotal role in our society. Specifically, ICT has become an inherent part of work to guarantee the competitiveness of the organizations in the labor market (Majchrzak & Borys 1998). From the very beginning, the impact of technology on psychosocial health has been inconclusive. Meanwhile, different scholars have shown the negative effects of technology on users (e.g., Bohlin & Hunt 1995; Todman & Monaghan 1994), and others have demonstrated that its impact differs depending on the type of exposure and the mediating variables, like appraisal

of exposure (Chua et al. 1999; Majchrzak & Borys 1998; Salanova & Schaufeli 2000). Despite this, numerous studies have focused on the dark side of the impact of technology. Consequently, there is a lack of studies on the positive effects of types of technology exposure on psychosocial health. Based on the Positive Organizational Psychology movement (Salanova et al. 2005), the present study focuses on the positive impact of types of technology exposure and positive appraisal on work engagement.

### Technology Exposure

Although different terms referring to technology exposure exist, for instance, 'technology experience' or 'technology use', a literature review reveals that technology exposure generally refers to the total time a user engages in activities related to technology (Bohlin & Hunt 1995; Majchrzak & Borys 1998). In fact, the literature shows different indicators related to technology exposure, for example, the amount of time using technology, times used before feeling comfortable, frequency of technology use, participation in technology training, use of technology at work and at home, personal computer ownership, computer usage frequency and computer usage level. Despite these different indicators, the

Correspondence / Correspondencia

Marisa Salanova

Departamento de Psicología Social. Universitat Jaume I.

Avenida Sos Baynat, s/n. 12071, Castellón, España.

Tel.: (34 964) 729583 / Fax: (34 964) 729262

e-mail: salanova@psi.uji.es

Received: 13 March 2009 / Accepted: 4 May 2009.

most frequently used in research are frequency of use and technology training (Chua et al. 1999; Salanova et al. 2000b; Salanova & Schaufeli 2000).

Research based on technology exposure reveals that it is considered a key role in explaining the impact of the use of technology on psychosocial health among users despite its complexity. In line with this, the results based on the consequences of technology experience and psychosocial health on technology users are controversial (Hamborg & Greif 2003; Salanova 2003). Some studies have shown that technology exposure (i.e., past experience, training and opportunity to use computers) may lower anxiety/frustration but increase the perceptions of self-efficacy related to the ICT, satisfaction, autonomy and enjoyment/usefulness (Colley et al. 1994; Jones & Wall 1990).

Conversely, other scholars have revealed that different types of technology exposure may have negative or positive consequences on psychosocial health. For example, the meta-analysis of Chua et al. (Chua et al. 1999) demonstrated that the more computer experience, the less computer anxiety among technology users. Furthermore, the results of this study indicated that this positive relationship depends on the type of exposure since exposure to a programming course, for example, did not reduce computer anxiety. Other studies also confirmed this result, for example, the works of Leso and Peck (Leso & Peck 1992) and Woodrow (Woodrow 1991). Moreover, other studies have reflected that technology exposure may have negative consequences for not only technology users (e.g., anxiety, dissatisfaction, burnout, technostress, technoaddiction, depression, lack of a balance among personal life and work life, and lack of motivation), but also for the organization (e.g., absenteeism, lack of performance) (Balo\_lu & Çevik 2009; Chang & Law 2008; Cole 2009; Salanova & Schaufeli 2000; Salanova et al. 2007; Tarafdar et al. 2007; Tekinarslan 2008; Thomee et al. 2007; Towers et al. 2006; Wang et al. 2008).

All in all, these previous and controversial results indicate the possibility that technology exposure per se is not responsible for the consequences noted among users. Instead, they suggest the possibility of including in studies other variables which mediate the relationship between technology exposure and psychosocial consequences in users, such as cognitive processing, attitudes or efficacy beliefs (Beas & Salanova 2006; Johnson 2008; Korunka & Vitouch 1999; Leso & Peck 1992; Popovich et al. 2008; Salanova et al. 2000; Salanova et al. 2003). One of these mediated variables is the cognitive appraisal of past experience with ICT (Salanova & Schaufeli 2000).

### The Mediating Role of Appraisal

The role of cognitive appraisal in different psychosocial domains has been shown, above all in stress phenomena. Lazarus and Folkman's theory (Lazarus & Folkman 1984) considered cognitive appraisal to be the pivotal element in the stress process. Since a cognitive and individual perspective was the basis of this theory, stress is considered to be an internal, mental, subjective and ideographical phenomenon in which the perception of the demanding situation plays a key role. One of the distinctive elements of this theory is that it explains the stress process based on the role of 'cognitive appraisal', conceptualized as the *"process of categorizing an encounter, and its various facets, with respect to its significance for well-being. It is not information processing per se...it is largely evaluative, focused on meaning or*

*significance and takes place continuously during waking life"* (Lazarus & Folkman 1984). Consequently, an event will produce an effect on psychosocial health only when its cognitive appraisal is negative. Accordingly, this model stresses that it is not the situation per se, but appraisal (positive, negative or neutral) that people give about the situation or event. More specifically, the model proposes that people make an appraisal about the way this situation may affect them when they find themselves in a demanding situation (Llorens et al. 2009). Following this reasoning, we may assume that the relationship between technology and psychosocial health does not emerge directly, but indirectly, from the mediating role of the user's appraisal of technology. Only when people consider technology to be either negative or positive do we expect to note any effect of the employee's psychosocial health.

More specifically in ICT contexts, the non deterministic approach, or the sociotechnical perspective, also assumes the neutral role of technology. This perspective assumes the absence of technological determinism since it considers technology in the interaction with the social subsystem within the organization (Martínez-Pérez et al. 2004). Unlike the deterministic approach (Braverman 1974), this last approach assumes that technology may have positive or negative effects on the employee's well-being, which depends on factors such as the employee's evaluation of technology (Clegg et al. 1997; Korunka & Vitouch 1999; Wall & Kemp 1987), or the environmental settings within the organization (Wang et al. 2008). In light of this, we postulate an indirect relationship between the outcomes of technology and particular outcomes (Martínez-Pérez et al. 2004). More specifically, Majchrzak and Borys (Majchrzak & Borys 1998) argued this double effect of technology on ICT users. On the one hand, they argued that, initially, the ICT may generate positive attitudes among users because vendor trainers promise a high and seamless integration. However as the users' experience increases over time, their view of integration may become less positive, thereby decreasing their psychosocial health. On the other hand, users may initially have a negative attitude toward technology, but one that may become increasingly positive as the benefits of the technology become more obvious. As a result, their psychological well-being may also increase. Consequently, Majchrzak and Borys (Majchrzak & Borys 1998) concluded that researchers should pay more attention to users' appraisal of technology.

Despite the relevance of considering the impact of the user's appraisal of technology in explaining the relationship among types of technology exposure and psychosocial health, studies are lacking. In a sample of 202 Spanish workers using ICT, Salanova and Schaufeli (Salanova & Schaufeli 2000) found that types of exposure (time and frequency of use) do not have a direct effect on burnout (i.e., exhaustion and cynicism) as it depends on the user's appraisal of exposure. Therefore, the consequences of types of exposure on burnout are positive and significant only when a user perceives a negative appraisal of exposure.

Since the research into the impact of technology exposure almost exclusively focuses on its negative effects (e.g., technostress, burnout, anxiety, etc.), scholars recently extended their interest to the positive side of psychosocial health. This development reflects an emerging trend toward Positive Psychology that focuses on human strengths and optimal functioning rather than on weaknesses and malfunctioning (Seligman &

Csikszentmihalyi 2000). More specifically in work contexts, the Positive Organizational Psychology (Salanova et al. 2005; Salanova et al. 2009) is currently rewording the studies on positive constructs like work engagement.

## Work Engagement

The study of work engagement constitutes one of the new trends that have recently emerged in burnout research. Originally, this concept was the opposite of burnout. Work engagement focuses on the work itself, and provides a more complex and thorough perspective on an individual's relationship with work (Maslach et al. 2001). We can state that employees who are engaged have a high level of energy, connect effectively with their work activities, and they see themselves as being able to deal completely with the demands of their job. Despite the different conceptualization of engagement and its relationship with other psychological positive constructs such as job implication and satisfaction (Macey & Schneider 2008), one definition of engagement in work and organizational settings is *"a positive, fulfilling, work-related state of mind that is characterized by vigor, dedication, and absorption on the activity"* (Schaufeli et al. 2002: 72).

The willingness to invest effort in one's work, being persistent in the face of difficulties, and displaying high levels of energy and mental resilience while working characterize vigor. Dedication refers to a particularly strong work involvement and identification with one's job. Finally, absorption denotes being fully concentrated and engrossed in one's work, whereby time passes quickly and one has difficulties with detaching oneself from work. This three-dimensional structure of engagement has been tested and found in different scholars with different samples using Confirmatory Factor Analyses (CFA) with the AMOS program, specifically with ICT users (Llorens et al. 2006; Salanova et al. 2000). Recently however, different scholars have shown not a three- but a one-factor model, which suggests the need to confirm the structure of engagement (Britt et al. 2007; Shirom 2003; Wefald & Downey 2009). It also suggests the need to continue researching into the factorial validity of engagement. Despite these CFA analyses, few studies on work engagement have been conducted in ICT settings. Recent research suggests that technology exposure relates positively to work engagement. For example, in a sample of 514 Spanish workers using technology, Salanova et al. (Salanova et al. 2000b) showed that those receiving computer training report high levels of professional self-efficacy, that frequency of use lowered work engagement (i.e., vigor and dedication), whereas computer training had no differential effects for those who reported low levels of self-efficacy. In a cross-sectional study on Spanish and Dutch ICT users using Multigroup Structural Equation Modeling (SEM), Llorens et al. (Llorens et al. 2006) showed a positive relationship between job resources in ICT contexts and work engagement which, in turn, displayed a positive relationship with organizational commitment. Moreover, these relationships emerged when considering different national and occupational contexts and different forms of data collection (computerized vs. paper-and-pencil). Salanova et al. (Salanova et al. 2003) investigated the effects of e-groups on well-being and performance among students working in e-groups, and revealed that technology demands (i.e., time pressure) show increased collective engagement among students, but only when they feel low as regards collective efficacy. The study by Beas and Salanova (Beas & Salanova 2006),

with a sample of 496 ICT users, revealed that computer attitudes moderated the relationship between computer training (i.e., number of training hours) and professional self-confidence. Therefore, employees with a high positive attitude toward ICT, when number of hours was high, their levels of professional self-confidence increased, although this depends on the number of training hours (i.e., more training hours, more self-confidence). Finally, Llorens et al. (Llorens et al. 2007) used a two-way longitudinal design and showed empirical support for a reciprocal relationship among technology task resources (i.e., autonomy), personal resources (i.e., efficacy beliefs) and work engagement over time. More particularly, autonomy at Time 1 was related to self-efficacy at Time 2, and self-efficacy at Time 1 was related to engagement at Time 2. In addition, engagement boosted future efficacy beliefs which, in turn, led to the perception of more task resources in ICT context, thus suggesting a positive reciprocal gain cycle.

## The Current Study

Therefore, the objective of the present study is to test the relationship among technology exposure, appraisal and work engagement in 645 Spanish workers who use ICT in their jobs. We expected the appraisal of technology exposure mediates the impact of this technology exposure on work engagement. That is, the more technology exposure in terms of the frequency of use and techno training, the higher the levels of work engagement, but fully mediated by the positive appraisal of this technology exposure. Consequently, we also expect appraisal plays a full mediating role between technology exposure and work engagement.

## METHOD

### Participants and Procedure

The sample consisted in 645 workers from Spanish private and public companies (337 males, 52.8%) who used technology as an inherent part of their jobs. They worked in heterogeneous jobs and occupational fields, including clerical jobs (33%), education (22%), technical and support staff (11%), laboratory settings (10%), blue-collar workers (8%), sales (7%), human services (6%), and management (3%). The common denominator of all the employees was the use of Information and Communication Technology (ICT) in their jobs for more than 10% of their working time. Their ages ranged from 20 to 60, and the mean age was 32 years (SD = 8).

All the employees received self-report questionnaires at work. The Risk prevention Experts or Human Resources Officers in each firm distributed the questionnaires in an envelope. A cover letter explained the purpose of the study, and emphasized that participation was on a voluntary basis. In addition, the study guaranteed data confidentiality and anonymity. Employees had to return the filled-out questionnaires in a sealed envelope to the person who had distributed them or directly by mail to the research team.

### Measures

We operationalized types of technology exposure by two objective variables: frequency of use and technology training. Frequency of use was measured by asking workers the percentage

of time spent per week (from 0 to 100) on computer-aided technology at work. We transformed the variable to the range of 0 to 10 so that it fitted in with the range of the other variables used in the study. Techno training was measured by asking workers the number of hours of specific training in technology they had received in the last year. Exposure appraisal was assessed by one self-constructed question ('How do you value your experiences with Information and Communication Technology in your job?'), which was also measured by using a 6-point rating scale ranging from (1) 'very negatively' to (6) 'very positively'. Next work engagement was assessed by using the Spanish version of the Utrecht Work Engagement Scale (UWES; Salanova et al. 2000a) for employees. It contains 15 items that reflect three underlying dimensions: vigor (5 items; alpha = 0.78; e.g. 'When I get up in the morning, I feel like going to work'); dedication (5 items; alpha = 0.89; e.g., 'I am enthusiastic about my job'), and absorption (5 items; alpha = 0.74; e.g., 'When I am working, I forget everything else around me'). We used a seven-point scale ranging from 0 'never' to 6 'always' to rate the items.

Data Analyses

Firstly, we computed the internal consistencies (Cronbach's  $\alpha$ ), descriptive analysis and inter-correlations for the study variables with the SPSS 16.0 program (vs. 16.0). Secondly, we considered the recommendations of Podsakoff et al. (Podsakoff et al. 2003), and we computed Harman's single factor test with CFA (Iverson & Maguire 2000) for the study variables in order to test the bias for common method variance. Thirdly, we computed the CFA by the AMOS (Analysis of MOment Structures) software package (v. 17.0) to test the factorial structure of the engagement dimensions. Then, two plausible models were compared: M1, the one-factor model in which all the items load in a single latent factor (engagement factor); M2, the three-structure model in which items load in three dimensions of engagement, such as vigor, dedication and absorption. Finally, we used Structural Equation Modeling (SEM) by AMOS (v. 17.0) to test the hypothesis. We tested the hypothesized model which assumes that technology appraisal mediates between types of technology exposure and work engagement (see Figure 1). Several models were compared: 1) M1 is the full mediated model in which exposure appraisal fully mediates the relationship between types of technology exposure and work engagement; 2) M2 is the partially mediated model in which types of technology exposure directly and indirectly relate to work engagement by appraisal. Maximum likelihood estimation methods were used in which the input for each analysis was the covariance matrix of the items. We assessed the goodness-of-fit of the models using the absolute and relative indices. The absolute goodness-of-fit indices calculated were: the  $\chi^2$  Goodness-of-Fit Statistic, Goodness-of-Fit

Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), and the Root Mean Square Error of Approximation (RMSEA). Because,  $\chi^2$  is sensitive to sample size, the probability of rejecting a hypothesized model increases when the sample size increases. To overcome this problem, Bentler (Bentler 1990) strongly recommended the computation of relative goodness-of-fit indices. Following Marsh et al. (Marsh et al. 1996), we computed three such fit indices: (1) the Comparative Fit Index (CFI); (2) the Incremental Fit Index (IFI); and (3) the Non Normed Fit Index or Tucker-Lewis Index (TLI). Since the distribution of GFI and AGFI is unknown, no critical values exist. Values smaller than .08 for RMSEA indicate an acceptable fit, while values greater than 0.1 should lead to model rejection (Browne & Cudeck 1993). For CFI, IFI, and TLI, and as a rule of thumb, values greater than .90 indicate a good fit (Hoyle 1995). Finally, we computed the Akaike Information Criterion (AIC; Akaike 1987) in order to compare competing models because it is particularly suitable for comparing the adequacy of the non nested models that fit the same correlation matrix. The lower the AIC index, the better the fit is.

RESULTS

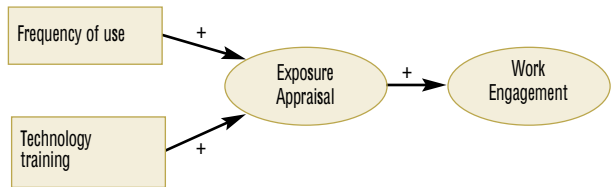
Table 1 displays the means, standard deviations, internal consistencies (Cronbach's  $\alpha$ ), and intercorrelations of all the study variables. All the alpha values meet the criterion of 0.70 (Nunnally & Bernstein 1994), ranging from .74 to .89. Generally speaking, the pattern of correlations shows that, as expected, types of technology exposure positively relate to exposure appraisal and work engagement (i.e., vigor, dedication and absorption) in 87% of the cases. We only came across two exceptions: the correlation between techno training and absorption and frequency of use and vigor are no-significant. It is also interesting to note that the correlation between frequency of use and dedication is significant and negative, i.e., the more frequency of use, the less dedication. Furthermore, the recommendations of Podsakoff et al. (Podsakoff et al. 2003) were given to test for the common method variance. The results of Harman's single factor test with CFA (Iverson & Maguire 2000) reveal a significant inferior fit of the model with one single factor [ $\Delta \chi^2(2) = 13.62, p < 0.001$ ] when compared to the model with three latent factors. Hence, one single factor could not account for the variance in the data. Consequently, we may consider the common method variance is not a serious deficiency in this dataset.

Table 1. Means (M), Standard Deviations (SD), Internal Consistencies (Cronbach's  $\alpha$ ) and zero-order correlations (n = 654).

Variable	M	SD	$\alpha$	1	2	3	4	5
1. Frequency of use	5.84	3.03	-	-				
2. Techno training	66.97	78.82	-	0.11*	-			
3. Exposure Appraisal	5.73	0.98	-	0.10**	0.16**	-		
4. Vigor	3.98	0.93	0.78	-0.06	0.10*	0.23***	-	
5. Dedication	3.79	1.25	0.89	-0.12**	0.11*	0.25***	0.70***	-
6. Absorption	3.60	0.96	0.74	0.11**	0.07	0.22***	0.71***	0.72***

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Figure 1. Conceptual Model. All the relationships predicted positively.



## Factorial Structure of Work Engagement

Table 2 shows the CFA results computed to test the structure of work engagement. The analyses indicate that the three-factor model with correlated factors and no cross-loadings reasonably fitted the data with the RMSEA satisfying the criterion of 0.08, and the GFI, CFI and IFI meeting the criterion of 0.90. The correlations between the latent factors are high, ranging from 0.86 to 0.96. Therefore, the one-factor model, which assumes that all the items load on one single factor, fitted the data. Compared to the proposed three-factor model, the fit of this alternative model was significantly inferior than the fit of the three-factor model [Delta  $\chi^2(3) = 116.97$ ,  $p < 0.001$ ]. Consequently in future analyses, we should consider work engagement as a three-factor model that assumes three latent but correlated scales (i.e., vigor, dedication and absorption).

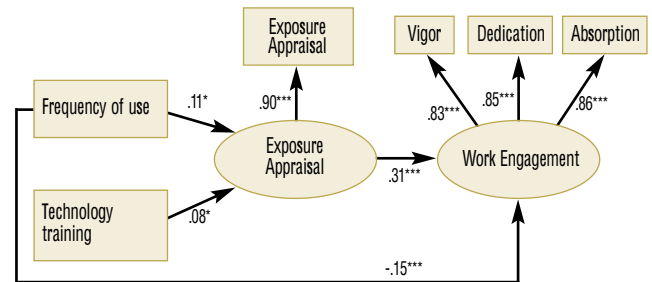
## The Hypothesized Structural Model

In order to test the relationship among technology exposure, appraisal and work engagement, SEM analyses were computed by the AMOS program. Table 3 displays the overall fit indices of the competing models. The results show that, as expected, the hypothesized (fully mediated) model fitted the data well, although the fit increased significantly when a direct relationship is included from frequency of use to work engagement [Delta  $\chi^2(1) = 14.05$ ,  $p < 0.001$ ]. This means that types of technology exposure (i.e., frequency of use and techno training) displays a direct and positive relationship with appraisal of technology exposure which, in turn, presents a positive relationship to work engagement. Moreover, types of exposure (specifically frequency of use) not only has a positive influence on work engagement through appraisal of technology, but also shows a direct and negative relationship to work engagement (see Figure 2).

The analyses of the explained variance reveals that while types of technology exposure accounts for 2% of technology exposure appraisal, appraisal accounts for 3.4% of work engagement, while types of exposure (i.e., the frequency of use) directly accounts for 2%. These results show the mediator role of

**Figure 2.**

Structural path coefficients of the model ( $n = 645$ ). Note. Only the significant coefficients are displayed. \*  $p < 0.05$ , \*\*\*  $p < .001$ .



appraisal of technology between types of technology exposure and work engagement.

More specific analyses were made in order to know the type of mediation (full or partial) that technology exposure appraisal shows between types of exposure and work engagement following the recommendations of Baron and Kenny (Baron & Kenny 1986). These results show the mediating role of exposure appraisal between types of technology exposure and work engagement. SEM analyses also reveals that the direct relationship among types of technology exposure (i.e., frequency of use) remains significant despite the effect of appraisal of technology. In this way, types of technology exposure influences work engagement both directly and through exposure appraisal. Thus, the more intense technology exposure, the more positive appraisal is and the higher the levels of work engagement. Furthermore, the more intense the type of technology exposure, i.e., frequency of use, the lower work engagement is.

## DISCUSSION

The objective of the current study was to test the relationship among technology exposure, appraisal and work engagement in

**Table 2.**  
Fit indices of the CFA of the work engagement dimensions ( $n = 654$ ).

Model	$\chi^2$	gl	GFI	AGFI	RMSEA	CFI	IFI	TLI	$\chi^2$ dif	$\Delta$ GFI	$\Delta$ AGFI	$\Delta$ RMSEA	$\Delta$ CFI	$\Delta$ IFI	$\Delta$ TLI
1. Three-factor model	512.80	87	0.90	0.86	0.08	0.91	0.91	0.89							
2. One-factor model															
Difference between Model 2 & Model 1	629.77	90	0.87	0.83	0.09	0.89	0.89	0.87	116.97***	0.03	0.03	0.01	0.02	0.02	0.01

$\chi^2$  = Chi-square; df = degrees of freedom; GFI = Goodness-of-Fit Index; AGFI = Adjusted Goodness-of-Fit Index; RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; IFI = Incremental Fit Index; TLI = Tucker-Lewis Index.

**Table 3.**  
Fit indices of two competitive models ( $n = 654$ ).

Model	$\chi^2$	df	GFI	AGFI	RMSEA	CFI	IFI	TLI	AIC	$\chi^2$ diff	$\Delta$ GFI	$\Delta$ AGFI	$\Delta$ RMSEA	$\Delta$ CFI	$\Delta$ IFI	$\Delta$ TLI	$\Delta$ AIC
1. Fully Mediated	21.63	9	0.98	0.97	0.046	0.98	0.98	0.98	45.63								
2. Partially Mediated	7.58	8	0.99	0.99	0.001	0.99	0.99	0.99	33.58								
Difference between Model 2 & Model 1										14.05***	0.01	0.02	0.045	0.01	0.01	0.01	12.05

$\chi^2$  = Chi-square; df = degrees of freedom; GFI = Goodness-of-Fit Index; AGFI = Adjusted Goodness-of-Fit Index; RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; IFI = Incremental Fit Index; TLI = Tucker-Lewis Index; AIC = Akaike Information Criterion.

645 Spanish workers using ICT in their jobs. We expected the positive appraisal of technology exposure to mediate the impact of technology exposure on work engagement. That is, the more intense technology exposure is in terms of frequency of use and technology training, the more positive the exposure appraisal. We also expected it to relate positively to higher levels of engagement, that is, more vigor, dedication and absorption. Consequently, we also expected positive appraisal to play a full mediating role between technology exposure and work engagement.

### Exposure of Technology, Appraisal and Work Engagement

Firstly, the factorial validity of engagement by the CFA showed, as expected, the replication of the original three-factor structure of engagement (i.e., vigor, dedication and absorption) among technology users, along with a positive and significant correlation with all the scales. This result confirms previous studies conducted with different samples (Schaufeli et al. 2002), and more specifically in ICT workers (Llorens et al. 2006; Salanova et al. 2000c) present study.

Secondly and as expected, the SEM analyses revealed that more intensive technology exposure related to more positive exposure appraisal which, in turn, related to higher levels of work engagement. However, there was no confirmation of the full mediating role of appraisal because we also obtained a direct negative and significant relationship between technology exposure and work engagement. Consequently, this study partially confirmed our hypothesis.

Given the complex relationship between technology use and its impact on technology users, the objective of the current study was to know the relationship between technology exposure and one of the most relevant and positive constructs of the present-day: work engagement. Despite the fact that a previous study focused on the impact that technology exposure had on burnout (Salanova y Schaufeli 2000), the present study actually went one step further: to study the impact of exposure on the positive constructs based on the POP movement (Salanova et al. 2005). Indeed, we found that it is not technology per se, but the types of technology used in terms of the frequency of use and technology training, that (directly and indirectly) relate to work engagement. In light of this, the results show that, as expected, the effects of technology exposure (i.e., frequency of use and technology training) on work engagement are not direct, but cognitive appraisal mediates them. That is, the more experience with technology, the more positive the technology appraisal and, consequently, the higher the levels of work engagement (i.e., more vigor, dedication and absorption). Once again we obtained the key role of positive appraisal between types of technology exposure and its consequences (in this case, work engagement)

(Salanova & Schaufeli 2000). Consequently, technology exposure is not the proximal antecedent of technology consequences; rather it depends on the positive cognitive meaning of this exposure (Lazarus & Folkman 1984; Salanova & Schaufeli 2000). This result is also in line with the non deterministic approach where technology exposure does not determine the consequences of technology on users; rather, it depends on other factors, such as the employee's evaluation of technology (Majchrzak & Borys 1998; Salanova & Schaufeli 2000).

However, we obtained a result that we did not expect as a direct and negative relationship was found from one of the two types of technology exposure and work engagement. So although frequency of use related directly to work engagement, it also related negatively. That is, the more technology exposure in terms of frequency of use, the lower the work engagement (i.e., less vigor, less dedication and less absorption). Once again, this suggests the differential effect of the psychological consequences of types of technology on users. While both types of technology exposure positively related to work engagement through appraisal of technology, we observed a direct and negative relationship from frequency of technology use to work engagement. All in all, this result also confirms the pivotal but partial mediation role of appraisal between types of technology exposure and work engagement, and the double role of the types of technology exposure on work engagement. These results agree with previous literature (Clegg et al. 1997; Majchrzak & Borys 1998) which states that only when appraisal of technology is positive does it have positive consequences for users; for instance, increased work engagement. However, this only occurs when exposure to technology among employees is greater.

### Limitations and Suggestions for Further Research

One limitation of this paper is its cross-sectional nature. Consequently, we were unable to make any causal inference. To mitigate these limitations, longitudinal studies with at least three times are needed to conduct in order to test our results. Moreover, future studies should use more objective variables to measure types of exposure, as well as multi-item indicators to measure appraisal. Future research could also include other mediator variables, such as technology self-efficacy. Finally, it may prove useful to include other positive constructs instead of work engagement; for example, flow, resilience and optimism, considered to be the positive psychological capital (Salanova 2008).

This study was supported by a grant from the Spanish Ministry of Science and Innovation (#PSI2008-01376/PSIC), Spanish Ministry of Work and Social Affairs (#411/UJI/SALUD), and Universitat Jaume I & Bancaixa (#P11B2008-06).

## REFERENCES

- Akaike H. 1987. Factor analysis and AIC. *Psychometrika*. 52:317-332.
- Balo\_lu M, Çevik V. 2008. Multivariate effects of gender, ownership, and the frequency of use on computer anxiety among high school students. *Comput Human Behav*. 24:2639-2648.
- Baron RM, Kenny DA. 1986. The moderator-mediator variable distinction in social psychological research: conceptual, strategic and statistical considerations. *J Pers Soc Psychol*. 51:1173-1182.
- Beas MI, Salanova M. 2006. Self-efficacy beliefs, computer training and psychological well-being among Information and communication technology workers. *Comput Hum Behav*. 22: 1043-1058.
- Bentler P. 1990. Comparative fit indexes in structural models. *Psychol Bull*. 107:238-246.
- Bohlin RM, Hunt NP. 1995. Course structure effects on student's computer anxiety. *Journal of Educational Computing Research*. 13:263-270.
- Braverman H. 1974. Labour and monopoly capital: The degradation of work in the twentieth century. New York, NY: Monthly Review Press.
- Britt TW, Castro CA, Adler AB. 2007. Self engagement, stressors and health: a longitudinal study. *Pers Soc Psychol Bull*. 31:1475-1486.
- Browne MW, Cudeck R. 1993. Alternative ways of assessing model fit. En: Bollen KA, Long JS, editor. *Testing structural equation models*. Newbury Park, CA: Sage. p. 136-162.
- Chang MK, Law SPM. 2008. Factor structure for young's Internet addiction test: a confirmatory study. *Comput Human Behav*. 24:2597-2619.
- Chua SL, Chen DT, Wong, AFL. 1999. Computer anxiety and its correlates: a meta-analysis. *Comput Human Behav*. 15:609-623.
- Clegg CW, Carey N, Dean G, Hornby P, Bolden R. 1997. Users' reactions to Information Technology: Some multivariate models and their implications. *J Inf Technol*. 12:15-32.
- Cole M. 2009. Using Wiki technology to support student engagement: Lessons from the trenches. *Comput Educ*. 52:141-146.
- Colley EA, Brodzinski JD, Scherer RF, Jones PD. 1994. The impact of cognitive appraisal, locus of control and level of exposure on the computer anxiety of novice computer users. *Journal of Educational Computing Research*. 10(4):329-340.
- Hamborg KC, Greif S. 2003. New technologies and stress. En: Schabracq MJJ, Winnubst AM, Cooper CL, eds. *The handbook of work and health psychology*. New York: John Wiley & Sons. p.161-181.
- Hoyle RH. 1995. The structural equation modeling approach: basic concepts and fundamental issues. En: Hoyle RH, ed. *Structural equation modeling, concepts, issues and applications*. Thousand Oaks, Ca: Sage. p. 1-15.
- Iverson RD, Maguire C. 2000. The relationship between job and life satisfaction: Evidence from a remote mining community. *Hum Relat*. 53:807-839.
- Johnson GM. 2008. Cognitive processing differences between frequent and infrequent Internet users. *Comput Human Behav*. 24:2094-2106.
- Jones PE, Wall RE. 1990. Components of computer anxiety. *Journal of Educational Technology Systems*. 18:161-168.
- 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.
- Lazarus RS, Folkman S. 1984. *Stress, appraisal and coping*. New York, NY: Springer.
- Leso R, Peck KL. 1992. Computer anxiety and different types of computer courses. *Journal of Educational Computing Research*. 8:469-478.
- Llorens S, Bakker AB, Schaufeli WB, Salanova M. 2006. Testing the robustness of the 'Job Demands-Resources' Model. *Int J Stress Manag*. 13:378-391.
- .Libano M, Salanova M. 2009. Modelos teóricos de salud ocupacional. En: Salanova M, director. *Psicología de la salud ocupacional*. Madrid: Síntesis. [En prensa].
- .Schaufeli WB, Bakker A, Salanova M. 2007. Does a positive gain spiral of resources, efficacy beliefs and engagement exist?. *Comput Human Behav*. 23:825-841.
- Macey WH, Schneider B. 2008. The meaning of employee engagement. *Industrial and Organizational Psychology*. 1:3-30.
- Majchrzak A, Borys B. 1998. Computer-aided technology and work: moving the field forward. En: Cooper CL, Robertson IT, eds. *International Review of Industrial and Organizational Psychology*. Wiley. p 305-354.
- Marsh HW, Balla JR, Hau KT. 1996. An evaluation of Incremental Fit Indices: a clarification of mathematical and empirical properties. En: Marcoulides GA, Schumacker RE, editor. *Advanced structural equation modeling, issues and techniques*. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers. p. 315-353.
- Martínez-Pérez MD, Cifre E, Salanova M. 2004. Cambio e innovación tecnológica en las organizaciones. En: Osca A, editor. *Psicología de las Organizaciones*. Madrid: Sanz y Torres. p. 121-154.
- Maslach C, Schaufeli WB, Leiter MP. 2001. Job burnout. *Annu Rev Psychol*. 52:397-422.
- Nunnally JC, Bernstein IH. 1994. *Psychometric theory* (3rd ed.). New York, NY: McGraw-Hill.
- Podsakoff PM, MacKenzie SM, Lee J, Podsakoff NP. 2003. Common method variance in behavioral research: A critical review of the literature and recommended remedies. *J Appl Psychol*. 88:879-903.
- Popovich PM, Gullekson N, Morris S, Morse B. 2008. Comparing attitudes towards computer usage by undergraduates from 1986 to 2005. *Comput Human Behav*. 24:986-992.
- Salanova M, Schaufeli W. 2000. Exposure to information technology and its relation to burnout. *Behav Inf Technol*. 19:385-392.
- .Schaufeli WB, Llorens S, Peiró JM, Grau, R. 2000a. Desde el 'burnout' al 'engagement': ¿una nueva perspectiva?. *Rev de Psicología del Trabajo y las Organizaciones*. 16:117-134.
- .Grau R, Cifre E, Llorens S. 2000b. Computer training, frequency of use and burnout: the moderating role of computer self-efficacy. *Comput Human Behav*. 16:575-590.
- .Schaufeli WB, Llorens S, Peiró JM, Grau R. 2000c. Desde el "burnout" al "engagement": ¿una nueva perspectiva? *Revista de Psicología del Trabajo y de las Organizaciones*. 16: 117-134.
- .2003. Trabajando con tecnologías y afrontando el tecnoestrés: el rol de las creencias de eficacia. *Revista de Psicología del Trabajo y de las Organizaciones*. 19:225-247.
- Schaufeli WB, Salanova M, González-Romá V, Bakker A. 2002. The measurement of burnout and engagement: A confirmatory factor analytic approach. *J Happiness Stud*. 3:71-92.
- .Llorens S, Cifre E, Martínez I, Schaufeli WB. 2003. Perceived collective efficacy, subjective well-being and task performance among electronic work groups: an experimental study. *Small Group Research*. 34:43-73.
- .Martínez IM, Llorens S. 2005. *Psicología Organizacional Positiva*. En: Palaci FJ, editor. *Psicología de la Organización*. Madrid: Pearson, Prentice-Hall. p. 349-376.
- .Llorens S, Cifre E, Nogareda C. 2007. Tecnoestrés: concepto, medida e intervención psicosocial. Nota técnica de prevención, 730, 21ª Serie. Instituto Nacional de Seguridad e Higiene en el Trabajo. Madrid.
- .Llorens S, Rodríguez A. 2009. Hacia una psicología de la salud ocupacional más positiva. En: Salanova M, director. *Psicología de la Salud Ocupacional*. Madrid: Síntesis. [En prensa].
- .2008. Organizaciones saludables: una perspectiva desde la psicología positiva. En: Vázquez C, Hervás G, editors. *Psicología Positiva Aplicada*. Bilbao: Desclee de Brouwer. p. 403-427.
- Seligman MEP, Csikszentmihalyi M. 2000. Positive psychology: an introduction. *Am Psychol*. 55:5-14.
- Shirom A. 2003. Feeling vigorous at work? The construct of vigor and the study of positive affect in organizations. En: Ganster D, Perrewe PL, editors. *Research in organizational stress and well-being*. Greenwich, CT: JAI Press. p. 135-165.
- Tarafdar M, Tu Q, Ragu-Nathan B, Ragu-Nathan TS. 2007. The impact of technostress on role stress and productivity. *J Manage Inform Syst*. 24:301-328.
- Tekinarslan E. 2008. Computer anxiety: A cross-cultural comparative study of Dutch and Turkish university students. *Comput Human Behav*. 24:1572-1584.

- Thomee S, Eklof M, Gustafsson E, Nilsson R, Hagber GM. 2007. Prevalence of perceived stress, symptoms of depression and sleep disturbances in relation to information and communication technology (ICT) use among young adults – An explorative prospective study. *Comput Human Behav.* 23:1300-1321.
- Todman J, Monaghan E. 1994. Qualitative differences in computer experience, computer anxiety and students' use of computers: a path model. *Comput Human Behav.* 10:529-539.
- Towers I, Duxbury L, Higgins C, Thomas J. 2006. Time thieves and space invaders: technology, work and the organization. *Journal of Organizational Change Management.* 19: 593-618.
- Wall R, Kemp N. 1987. The nature and implications of advanced manufacturing technology: Introduction. En: Wall TD, Clegg CW, Kemp N, editors. *The human side of advanced manufacturing technology.* New York, NY: John Wiley. p. 173-195.
- Wang K, Shu Q, Tu, Q. 2008. Tecnostress under different organizational environments: an empirical investigation. *Comput Human Behav.* 24:3002-3013.
- Wefald AJ, Downey, RG. 2009. Construct dimensionality of engagement and its relation with satisfaction. *J Psychol.* 143:91-111.
- Woodrow J. 1991. A comparison of four computer attitude scales. *Journal of Educational Computing Research.* 7:165-187.