Increasing learners' satisfaction/intention to adopt more e-learning

Sawang, S, Newton, CJ & Jamieson, K

Original citation & hyperlink:
Sawang, S, Newton, CJ & Jamieson, K 2013, 'Increasing learners' satisfaction/intention to adopt more e-learning' *Education + Training*, vol 55, no. 1, pp. 83-105
https://dx.doi.org/10.1108/00400911311295031

DOI 10.1108/00400911311295031
ISSN 0040-0912

Publisher: Emerald

Increasing learners' satisfaction/intention to adopt more e-learning

Purpose
E-learning is an organizationally risky investment given the cost and poor levels of adoption by users. In order to gain a better understanding of this problem, a study was conducted into the use of e-learning in a rail organization.

Design/Methodology/Approach
Using an online survey, employees of a rail-sector organization were questioned about their use and likelihood of adoption of e-learning. This study explores the factors that affect the way in which learners experience and perceive such systems. Using statistical analysis, twelve hypotheses are tested and explored. Relationships between learning satisfaction, intention to adopt, and the characteristics of e-learning systems were established.

Findings
The study found that e-learning characteristics can buffer the relationship between learner characteristics and intention to adopt further e-learning in the future. Further, we found that high levels of support can compensate individuals who are low in technological efficacy to adopt e-learning.

Research Limitations/Implications
The cross-sectional design of the study and its focus on measuring intention to adopt as opposed to actual adoption are both limitations. Future research using longitudinal design and research employing a time lag design measuring actual adoption as well as intention are recommended.

Practical implications
From a practical perspective, organizations can focus on the actual content and authenticity of the learning experience delivered by the e-learning system to significantly impact how employees will perceive and use e-learning in the future. Low technological efficacy individuals tend not to adopt new technology. Instead of changing individuals' personalities, organizations can implement supportive policies and practices which would lead to higher e-learning adoption rate among low efficacy individuals.

Originality Value
The study integrates technology adoption and learning literatures in developing enablers for e-learning in organizations. Further, this study collects data from rail employees, and therefore the findings are practical to an industry.

Key words
E-learning satisfaction, Technology adoption, Authentic learning, Openness to change, Organizational support

Article classification
Research paper

Increasing learners' satisfaction/intention to adopt more e-learning

E-learning represents an alternative way of teaching and learning in today's knowledge-economy environment, and the number of organizations using these learning strategies for employee development has progressively increased (Hill and Wouters, 2010). While definitions of e-learning broadly encompass computer technology, there exist a number of approaches. For instance, Fry (2001, p. 234) described e-learning as the "delivery of training and education via networked interactivity and a range of other knowledge collection and distribution technologies". Other researchers have defined e-learning as distance education that uses computer-based technologies, information communication technologies (ICTs), and Learning Management Systems (Derouin *et al*., 2005; Govindasamy, 2001; Lowe and Holton, 2005). Although there is a range of e-learning definitions, the common elements are "instructional content or learning experiences delivered or enabled by electronic technology" (Servage, 2005, p. 306). We thus adopted the same definition for our research.

Regardless of the specific definition, research has found that the implementation of e-learning in its various forms can be costly to an organization due to the relatively low adoption rate among users. Indeed, recent research has indicated that most e-learning programs exhibit higher failure rates when compared with traditional instructor-led courses (Zaharias and Poylymenakou, 2009). There are many reasons that can explain the low adoption rates such as relevancy of content, comfort level with technology, and availability of technical support, these being the focal points of our study.

Given the increasing reliance and availability of technology in the modern world, and the potential economies available to organizations, it is vital to understand the factors that might lead to an increased adoption of e-learning in an organizational context. This study aims to examine important factors which may increase learners' satisfaction and intention to adopt

more e-learning in the future. In the next section, we will discuss the e-learning context for this study, review literature in relation to e-learning and develop hypotheses.

1. E-learning in rail industry context

Our case organization provides city and intercity rail services. It also provides freight operators with access to the rails of the metropolitan area. The case organization implemented an e-learning program in 2008, to supplement the existing (face-to-face) system and to provide additional flexible and voluntary training for personal development. The organization adopted a bespoke (i.e. custom built) e-learning system specifically designed to focus on company-specific initiatives. For our case organization, the e-learning system is used for financial management system training, training for security transit officers, and safety related training. The e-learning program is delivered through 2and2 and Adobe Captivate platforms. E-learning in the case organization is limited to mainly passive asynchronous activities including basic services such as the provision of recorded classroom training and online documentation and videos; however, users are also able to interact with the system and take online exercises and quizzes. The e-learning system is used for voluntary training for various job roles; as such, individuals are free to choose if they participate.

The development and implementation of e-learning across the organization has necessitated a high expenditure including cost, time, and training. From an ecological perspective, this expenditure must be balanced with satisfaction obtained (Tatnall and Davey, 2003). Individuals experience satisfaction (or dissatisfaction) when they engage with the e-learning program. Although e-learning adoption in organizations has increased, the rate of failures and abandonment continues to exist (Arbaugh and Duray, 2002; Guri-Rosenblit, 2006; Wu *et al,*. 2006). Little is known about why some users stop engaging e-learning after their initial experience or how we can encourage individuals to use the voluntary e-learning

program (Sun *et al*., 2008). Drawing from information systems literature, authors have found that satisfaction is a critical factor influencing individual to repeat e-learning usages (DeLone and McLean, 1992; 2003). However, in a corporate e-learning environment, other components besides users' satisfaction influence the use of e-learning. These components include the characteristics of the learners, the teachers, content design, and environmental dimensions (Arbaugh and Duray, 2002; Thurmond *et al*., 2002; Wang and Bagaka, 2002). Our study focuses on learners (comfort level with technology and satisfaction), content design (authenticity and complexity), and the environment (organizational support). Moreover, our study proposes that these key factors influence the intention of users to engage in voluntary e-learning in the future. Intention to use e-learning is a motivational factor that captures individuals' willingness trying to perform a behavior (Ajzen, 1991). Based on meta-analysis of 87 studies, a strong correlation between behavioral intention and actual behavior was .53, and the behavioral intention is considered as the most influential predictor of behavior (Pavlou and Fygenson, 2006; Sheppard *et al*., 1988).

2. Factors influencing successful e-learning implementation

Peslak *et al*. (2007) reviewed information systems literature and found that 30% of technology failed to be implemented successfully. Researchers have found various reasons for this failure, including individual learner characteristics, characteristics of the e-learning itself, and organizational support for the use of e-learning. Successful implementation of e-learning is frequently measured by learners' satisfaction (Sachs and Hale, 2003). It should be noted, however, that theoretically and practically, an important measure of success of e-learning implementation is the adoption of e-learning. This section provides a necessary literature review identifying key factors related to satisfaction and future adoption of e-learning.

2.1 *Learner characteristics*

A key area of research regarding successful e-learning implementation relates to the individual characteristics of the learner. Indeed, several studies have linked various learner characteristics with e-learning satisfaction or dissatisfaction (e.g. Hong, 2002; Piccoli *et al*., 2001; Sturgill *et al*., 1999; Sun *et al*., 2008). A common learner characteristic found across studies relates to learners' self-efficacy. The concept of self-efficacy is derived from Bandura's (1982) social learning theory which explains that efficacy expectations can affect intrinsic motivation for performing a task. In an e-learning context, confidence in one's ability to complete a task using technology is defined as technological efficacy (Compeau and Higgins, 1995; McDonald and Siegall, 1992). Empirical studies in e-learning have demonstrated that learners with better computer skills have reported higher levels of satisfaction with web-based courses (Hong, 2002). Similarly, Piccoli *et al*. (2001) found that e-learning participants reported higher levels of technological efficacy than traditional classroom participants. In an organizational context, it has been found that employees with higher levels of technological efficacy have reported more satisfaction with their work (with using technology) than employees with lower levels of technological efficacy (McDonald and Siegall, 1992).

Efficacy also plays a major role in adoptive behavior. For instance, computer efficacy has been found to be a significant predictor of adoption of technologies such as the internet (Dholakia and Kshetri, 2004), web-based information systems (Yi and Hwang, 2003), and e-tax filing systems (Wang, 2003). Self-efficacy, and technological self-efficacy in particular, is an important factor in determining which employees will effectively adopt a technology (Bandura, 1997). According to self-efficacy theory, individuals evaluate their ability to cope with a new challenge (i.e. e-learning) and, based on this judgment, individuals initiate and continue with behavioral strategies to manage the challenge (i.e. e-learning adoption). In the

innovation literature, early technological innovation adopters are described as having a high self-efficacy trait (Burkhardt and Brass, 1990; Pedersen, 2005).

Another individual-level learner characteristic that can be related to higher levels of satisfaction with e-learning implementation is openness to change (i.e. being open to new ways of doing things and experiences). Indeed, the openness to change trait has been related to many forms of satisfaction including life and career satisfaction (Kwan *et al*., 1997; Lounsbury *et al*., 2003). In the present context, changing from traditional learning to e-learning can be a challenging task requiring a psychological transition for employees, and such change-related adjustment is likely to be more satisfying for those that are open to change (such as adopting e-learning as a new way of personal learning and development). Put another way, the new challenge of learning (i.e. e-learning) may provide those with an openness to change with a positive experience, and access to variety that they naturally enjoy. Given the established relationship between openness to change and other types of satisfaction, it follows that individuals who are open to change will be more likely to have a positive experience with previous e-learning than those who are resistant to change.

Openness to change has also been demonstrated to significantly influence adoption behavior. For instance, Baylor and Ritchie (2002) found that individuals who scored highly on openness to change were also more willing to try new ideas in the work environment as well as in their personal life. Similarly, openness to change was found to be the most significant predictor of the successful adoption of classroom technology among teachers (Vannatta and Fordham, 2004). In an e-learning context, individuals who are willing to experience new things are expected to be more likely to adopt new e-learning strategies and systems as a part of their learning and development:

> **Hypothesis 1a**: Higher levels of technological efficacy and openness to change will be related to higher levels of e-learning satisfaction.

Hypothesis 1b: Higher levels of technological efficacy and openness to change will be related to higher levels of intention to adopt e-learning in the future.

2.2. *E-learning characteristics*

A second major factor that can be linked to successful e-learning implementation relates to the characteristics of e-learning itself. Two key aspects of e-learning characteristics involve the authenticity and the complexity of the e-learning. First, authentic activities are defined as tasks that are relevant and useful to the real world, and provide learners with a scenario to identify the questions and activities that are logically related to the scenario (Bransford *et al*., 1990; Jonassen, 1991). Authentic learning occurs when learners are stimulated with real life experience or future professional practice (Gulikers *et al*., 2005). Authentic activities in e-learning have been shown to have many benefits for learners. One such outcome is satisfaction (Meyers and Nulty, 2009). Indeed, Huang (2002) suggested that learners were more satisfied with their online course when the problems were presented in a relevant and realistic context that resulted in the gaining of new knowledge that helped them to solve problems in their professional lives. Authentic learning within e-learning design can also be linked to adoption of e-learning. For instance, employees may be more motivated to use e-learning due to the authentic activities which they can apply in their work situation. Motivation has been identified as a critical antecedent of effective learning and learning outcomes (Hodges, 2004). This link between authenticity and adoption of e-learning is supported by the Diffusion of Innovation (DOI) theory (Rogers, 1995). For example, DOI theory states that one of the key factors that influence individuals to adopt innovation (such as e-learning in the present context) is compatibility— the extent to which an innovation can be assimilated into an individual's life. If learners have negative experiences with e-learning (e.g. the content is not related to their real life or working situation), they may not want to

adopt further e-learning as a part of their learning and development. Therefore, it is proposed that e-learning that integrates authentic activities will increase the likelihood of employees adopting e-learning as a part of their learning and development (rather than its being a once-off experience).

A second e-learning characteristic that is important to implementation success is complexity. For instance, e-learning that is perceived as relatively difficult to understand and use can lead to learners' disengagement and dissatisfaction (Davis, 1989; Tornatzky and Klein, 1982). Although complexity does not equate with the inverse of ease of use, the broad body of research relating to innovation diffusion supports the close relationship between complexity and ease of use, and if one of these factors was found to be significant, the other would be also significant (Keil *et al*., 1995; Rogers, 1995). Habitually, technology learners expect and desire the expenditure of minimal effort in dealing with a new technology (Robinson *et al*., 2005). According to expectation-confirmation theory (Oliver, 1980), effort expectancy is a determinant of satisfaction because it provides the baseline for individuals to form evaluative judgments about the focal technology. Therefore, e-learning that requires a high level of learners' effort will negatively impact on e-learning satisfaction.

A review of literature also supports the notion that complexity of use of an e-learning system will relate to its adoption. Again, drawing on DOI theory (Rogers, 1995), if an innovation (or e-learning system in this case) is too difficult to use or takes too much time to use, individuals will be less likely to adopt that innovation. Similarly, the technology adoption literature is characterized by many studies which have found that the likelihood of technology adoption increased when individuals perceived less effort to use such technology (e.g. Brown, 2002; Devaraj *et al.*, 2002; Wixom and Todd, 2005). Therefore, e-learning that is complex may receive little attention or use from potential learners, ultimately stifling its successful implementation:

Hypothesis 2a: E-learning characteristics (authenticity and complexity) will be related to levels of e-learning satisfaction, such that authenticity will have a positive effect and complexity will have a negative effect on e-learning satisfaction.

Hypothesis 2b: E-learning characteristics (authenticity and complexity) will be related to levels of intention to adopt e-learning in the future, such that authenticity will have a positive effect and complexity will have a negative effect on intention to adopt e-learning.

2.3. *Organizational support toward e-learning*

E-learning has become a high priority for many public and private sectors. In all sectors, e-learning has been implemented to enable training and development of employees in the workplace without the need to relocate people to central training rooms and employ large numbers of trainers. Indeed, many organizations convert their traditional training delivery methods to e-learning for economic reasons in the belief that it is cheaper (Strother, 2002). In the education sector especially, a rise in e-learning has been driven by increasing student demand for flexibility and convenience and also the demand for more off-campus and distance learning programs.

However, successful implementation of e-learning requires institutional support (Selim, 2007). This support is not limited to the provision of an e-learning platform, technical assistance, and troubleshooting but also includes information availability. In Australia, over 70% of institutions have adopted WebCT and the Blackboard Learning Management System for Australian postgraduate subjects (60%) and undergraduate subjects (25%) (Coates *et al*., 2005). Likewise, between 55% and 62% of institutions in the United States use WebCT or Blackboard (Coates *et al*., 2005). However, many institutions have not expended significant resources supporting e-learning implementation (Black *et al*., 2007), leading to low levels of satisfaction with such systems for users who are not exposed to the systems' optimal

capabilities. The issue of organizational support has also been highlighted in the technology adoption literature (Agarwal and Karahanna, 2000; Neufeld *et al*., 2007). Sufficient support helps individuals become comfortable with systems and software which then leads to learners' satisfaction with e-learning.

While organizational support for e-learning can lead to greater satisfaction, it can also impact the adoption of such systems. Indeed, e-learning is often introduced at a rapid rate; if employees are to be keen to adopt such technologies, they require extensive support, training, and guidance on how to use the e-learning system (Nelson, 1990). In fact, a perceived lack of support can seriously and negatively impact employees' intentions to adopt e-learning as part of their and their subordinates' professional development and training. Thus it is proposed that organizational support forms a vital factor in predicting the success of e-learning implementation:

Hypothesis 3a: Organizational support for e-learning will be related to higher levels of e-learning satisfaction.

Hypothesis 3b: Organizational support for e-learning will be related to higher levels of intention to adopt e-learning in the future.

2.4. *E-learning characteristics and organizational support as moderators of the learner characteristics–satisfaction/adoption relationship*

While we have highlighted several main effect relationships relating to e-learning, we also propose that the relationships among these variables are more complex. Specifically, we propose that the relationship between individual learner characteristics and satisfaction/intention outcomes will be independently moderated by the more situational or external factors related to the e-learning characteristics and organizational support.

First, we expect e-learning characteristics to moderate the relationship between user characteristics and satisfaction/adoption outcomes. More specifically, e-learning that is designed in such a way that is easy for individuals to navigate (effortless to use) or is characterized by real life and contextually relevant cases that are applicable to individuals' work situations (authentic activities) can be expected to increase learners' satisfaction and future adoption, even for individuals who are classified as having low technological efficacy and are hesitant to experience new things (openness to change). Although previous literatures established a direct relationship between ease of use and technology adoption (see Legris *et al.*, 2003; Unsworth *et al*., forthcoming)), the interaction between e-learning characteristics and user characteristics has not been explored and remains a gap in understanding in the literature:

Hypothesis 4: Individuals reporting higher technological self-efficacy (H4a) and openness to change (H4b) will report higher satisfaction when authenticity of e-learning is high.

Hypothesis 5: Individuals reporting higher technological self-efficacy (H5a) and openness to change (H5b) will report higher intention to adopt e-learning when authenticity of e-learning is high.

Hypothesis 6: Individuals reporting higher technological self-efficacy (H6a) and openness to change (H6b) will report higher satisfaction when complexity of e-learning is low.

Hypothesis 7: Individuals reporting higher technological self-efficacy (H7a) and openness to change (H7b) will report higher intention to adopt e-learning when complexity of e-learning is low.

Second, we expect that organizational support will also be a moderator of the learner characteristics–satisfaction/adoption outcomes relationship. Indeed, psychology literature

provides support for this hypothesis. More specifically, stress theory (e.g. Theorell and Karasek's [1996] Demand-Control-Support theory) identifies the role of support, empirically noted as a moderator between stressors and outcomes, such as the intention to quit and job satisfaction (Bussing, 1999). In the context of the present study, individuals who have low technological efficacy and are reluctant to try new things (openness to change) may perceive using e-learning as a stressor. With organizational support toward e-learning (such as users' training, technical support, encouragement to use e-learning), individuals may perceive the organizational support as a coping resource to help them use e-learning. As such, this support will then potentially buffer the relationship between learner characteristics, satisfaction, and intention to adopt e-learning:

> **Hypothesis 8:** Individuals reporting higher technological self-efficacy (H8a) and openness to change (H8b) will report higher satisfaction when organizational support for e-learning is high.
>
> **Hypothesis 9:** Individuals reporting higher technological self-efficacy (H9a) and openness to change (H9b) will report higher intention to adopt e-learning when organizational support for e-learning is high.

While we expect a range of potential two-way moderating effects we also anticipate that e-learning characteristics and support may additionally interact to influence the relationship between user characteristics and satisfaction with, and intention to adopt, e-learning:

> **Hypothesis 10:** Individuals reporting higher technological self-efficacy (H10a) and/or openness to change (H10b) will report higher satisfaction and intentions to adopt e-learning when e-learning characteristics and organizational support for e-learning are high.

Insert Figure 1 about here

---

3. Method

This section outlines the research methodology adopted for our study: describing the participants and explaining how the data was collected. Further, we describe the measures employed used in our study as well as validity issues.

3.1. *Participants and procedure*

An organization which operates and maintains an Australian state suburban, interurban, and rural rail network for passenger and freight services took part in the study. The organization started utilizing voluntary e-learning in 2008 for employees in financial systems, security transit officers, and safety related policies and practices. The population of interest included all employees in the organization who had participated in corporate e-learning in the past three years. The study was endorsed by top management from the participating organization with the online survey invitation sent to all employees (15,000) via senior management. This invitation provided a link to the survey which was located on a secure university server to ensure participant confidentiality. Employees received a reminder four weeks after the initial invitation.

Two thousand six hundred and twenty six employees visited the survey link, and 1047 responses were received (response rate of 39.87%). Within this sample, 364 respondents reported that they never experienced e-learning and were excluded from this study, leaving a total usable sample of 683. Within this sample, 67% of respondents were male and 33% were female, with the mean age being 40 years (SD = 11.80; range = 18 to 71). Sixty percent of

respondents had obtained high school, trade certification, or diploma qualifications, while 40% had obtained bachelor or post graduate degrees. Mean organizational tenure was 10 years (*SD* – 10.56; range -1 to 44 years) and the majority of respondents (76.5%) worked in non-managerial positions (e.g. technical, administration, operational workers). Most respondents reported participating in one to two e-learning courses.

3.2. *Measures*

In this section we describe measures used in our present study, including reliability analyses. We adopted these measures from previous empirical studies to ensure the construct validity. We also examined validity and reliability tests with our samples to confirm the trustworthiness of our measures.

3.2.1. *Openness to change*. Openness to change is defined as a propensity to adjust beliefs and behaviors when exposed to new types of information or ideas (John, 1990; McCrae and Costa, 1999). Openness to change was measured with a four-item scale based on the scales developed by Gosling *et al*. (2003). Sample items from this scale include "I consider myself to be 'open' to changes at work" and "I am reluctant to consider changing the way I do my work (R)". The scale ranged from 1 (strongly disagree) to 5 (strongly agree).

3.2.2. *Technological efficacy*. Technological efficacy refers to an individual's belief about his/her ability to successfully execute a behavior required to use e-learning (Conrad and Munro, 2008). A three-item scale adapted from Conrad and Munro (2008) was used to assess technological efficacy. Respondents rated their recent e-learning experiences from 1 (strongly disagree) to 5 (strongly agree). An example item from this scale includes "I had only manuals or user guides for references".

3.2.3. *Authenticity*. Authenticity is defined as tasks that are relevant and useful to the real world and provide learners with a scenario to identify the questions and activities that are logically related to the scenario (Bransford *et al*., 1990; Jonassen, 1991). Authenticity was measured using an adapted version of a five-item scale developed by Walker and Fraser (2005). Respondents were asked to rate how much e-learning programs provided authentic activities on a rating scale ranging from 1 (strongly disagree) to 5 (strongly agree). An example item includes "I worked on activities that dealt with real world information".

3.2.4. *Complexity*. Complexity refers to the degree of complexity associated with the use of e-learning (Thompson*et al*., 1991). Complexity was measured with a five-item scale developed by Thompson *et al*. (1991). Respondents were asked to rate the complexity of e-learning using a scale that ranged from 1 (strongly disagree) to 5 (strongly agree). An example item includes "Doing the e-learning was so complicated that it was difficult to follow".

3.2.5. *Organizational support toward e-learning*. Organizational support refers to the degree to which an individual believes that an organizational infrastructure supports the use of e-learning (Thompson *et al*., 1991). Support was assessed using a five-item scale developed by Thompson *et al*. (1991). Respondents rated items including "My supervisor was very supportive of the use of e-learning for my job" in a scale that ranged from 1 (strongly disagree) to 5 (strongly agree).

3.2.6. *Intention to adopt e-learning in the future*. This construct refers to the possibility of adopting e-learning in the future and respondents rated basing on a scale that ranged from 1 (strongly disagree) to 5 (strongly agree). The item was adapted from Sawang *et al*. (2007).

The item in this scale is "Based on my experience I would use e-learning again in the future".

3.2.7. *Overall satisfaction with e-learning*. Satisfaction with e-learning was assessed using an item adapted from McLaren (2010). Respondents rated their satisfaction with their e-learning experiences on a scale ranging from 1 (strongly disagree) to 5 (strongly agree). The item in this scale is "I am satisfied overall with the e-learning that was provided by my organization".

3.3. *Construct validity*

Construct validity was tested using exploratory factor analysis. All independent construct items loaded unidimensionally on one factor and had no significant cross-loadings with other factors. Cross-loadings were all well below the cut-off of .40 suggested by Raubenheimer (2007) and our factor loadings were all above .50, which is considered a good loading (Hair *et al*., 1998). Five factors (namely openness to change, technology efficacy, authenticity, complexity, and organizational support) were found to have an eigenvalue over 1.0, explaining 60.24% of the total variance.

4. Results

Descriptive statistics, correlations, and reliability coefficients for focal variables of this study are displayed in Table 1. As can be seen, all variables reported satisfactory reliability coefficients (i.e. over .70; see Tabachnick *et al*., 2001). Correlations ranged from .15 to .65 and were in the expected directions. Overall, intention to adopt e-learning was significantly associated with e-learning characteristics (authenticity: $r = .42$, $p < .01$, and complexity: $r = -.20$, $p < .01$), learner characteristics (technological efficacy: $r = .15$, $p < .01$, and openness to

change: $r = .29$, $p < .01$), and organizational support ($r = .36$, $p < .01$). E-learning satisfaction was significantly associated with authenticity ($r = .65$, $p < .01$), openness to change ($r = .19$, $p < .01$), and organizational support ($r = .55$, $p < .01$), but not significantly related to simplicity and technological efficacy.

Insert Table 1 about here

To examine the roles of e-learning characteristics, learner characteristics, and organizational support on e-learning satisfaction and intention to adopt, which are specified by the research hypotheses, three identical hierarchical multiple regression analyses were constructed. To control for possible confounding effects, personal demographic information (gender, age, education [dummy], job position [dummy]) were entered into each equation at Step 1. To test the main effect of the predictors on criterion variables after controlling for the influence of confounding variables, e-learning characteristics (authenticity and complexity), learner characteristics (technological efficacy and openness to change), and organizational support were entered at Step 2. Next, the two-way interaction terms between e-learning characteristics, learner characteristics, and organizational support were entered at Step 3. Finally, the three-way interaction terms were entered at Step 4. To calculate this interaction term, both independent variables were centered in order to reduce problems of multicollinearity (Aiken and West, 1991).

4.1. *Testing hypotheses*

The initial four steps in the regression equations explained 52% of the variance in e-learning satisfaction ($F(21, 567) = 25.08$, $p < .001$) and 36% of the variance in intention to adopt e-learning ($F(21, 567) = 14.78$, $p < .001$). After the inclusion of the control variables, e-

learning characteristics, learner characteristics, and organizational support accounted for a significant proportion of additional variance for the prediction of criterion variables. Table 2 demonstrated that authenticity (β = .49, t(576) = 13.85, p < .001), openness to change (β = .08, t(576) = 2.42, p < .05), and organizational support (β = .28, t(576) = 7.88, p < .001) significantly influenced e-learning satisfaction. Table 2 also illustrated that authenticity (β = .29, t(576) = 7.07, p < .05), complexity (β = -.13, t(576) = -3.70, p < .001), technological efficacy (β = .10, t(576) = 2.97, p < .01), openness to change (β = .18, t(576) = 4.86, p < .001), and organizational support (β = .16, t(576) = 3.96, p < .001) significantly predicted intention to adopt e-learning among rail employees.

The interaction effects of e-learning characteristics, learner characteristics, and organizational support were assessed after controlling for four main effects (Table 2). Entry of the two-way interaction terms at Step 3 revealed a significant two-way interaction between complexity and organizational support (β = .26, t(576) = 3.22, p < .001) on e-learning satisfaction. Further, the two-way interactions between authenticity and technological efficacy (β = -.20, t(576) = -4.53, p < .001), between authenticity and openness to change (β = -.10, t(576) = -2.80, p < .01), and between organizational support and technological efficacy (β = .13, t(576) = 2.89, p < .01) on intention to adopt e-learning were also significant. The three-way interaction among complexity, openness to change, and organizational support (β = -.10, t(576) = 2.75, p < .01) on intention to adopt e-learning was also significant. These interactions were plotted at one standard deviation above and below the mean (see Aiken and West, 1991) as shown in Figure 2 to Figure 5 (two-way) and Figure 6a and Figure 6d (three-way).

Insert Table 2 about here

Firstly, the results from simple slope analyses reveal that when employees perceived abundant support from their organization to use e-learning, even though e-learning was perceived as a complex system to use, employees still reported higher satisfaction with e-learning than those who perceived insufficient organizational support (Figure 2).

Secondly, we found that when e-learning was perceived to be of high or low authenticity, intention to adopt future e-learning was similar among employees who were high technological efficacy. However, among employees who were low technological efficacy, intention to adopt future e-learning dramatically reduced when e-learning was perceived as low authenticity (Figure 3).

Thirdly, we found that when e-learning was perceived to be of high or low authenticity, intention to adopt future e-learning was similar among employees were very open to change. However, among employees who were described as less open to change, intention to adopt future e-learning significantly reduced when e-learning was perceived as of low authenticity (Figure 4).

Fourthly, we found that when employees perceived themself as low technical efficacy, intention to adopt future e-learning was low in both low organizational support and high organizational support individuals. However, when employees perceived abundant support from their organization to use e-learning, high technological efficacy individuals' intention to adopt future e-learning were higher than those who were of low technical efficacy (Figure 5).

Finally, we found that when perceptions of organizational support were low, employees with low openness to change and who perceived previous e-learning to be highly complex were less likely to adopt e-learning in the future (Figure 6a). When perceptions of organizational support were high, employees with high openness to change and who

perceived previous e-learning to be less complex were more likely to adopt e-learning in the future (Figure 6b).

Insert Figures 2, 3, 4, 5, 6a, and 6d about here

---

5. Discussion

This study examined the roles of learner characteristics, e-learning characteristics, and organizational support on e-learning satisfaction and intention to adopt further e-learning in the future. Our main effect hypotheses in relation to intention to adopt further e-learning were supported (H1b, H2b, and H3b). In line with previous studies, this study demonstrated that learner characteristics (both openness to change and technological efficacy), e-learning characteristics (both authenticity and complexity), and organizational support significantly predicted learners' intention to adopt further e-learning in the future (Colquitt *et al*., 2002; Dabholkar and Bagozzi, 2002).

However, our main effect hypotheses in relation to learners' satisfaction were only partially supported for H1a and H2a. This suggests that certain learner characteristics (i.e. openness to change) and e-learning characteristics (i.e. authenticity) significantly contributed towards learners' satisfaction with e-learning. Individuals who are open to new experiences are more likely to be satisfied with e-learning as a new experience of personal learning and development (Vishwanath, 2005). Likewise, previous studies also support that learners are more satisfied when e-learning includes authentic activities (Huang, 2002; Meyers and Nulty, 2009). E-learning content design is the precedent factor for learners' satisfaction (Piccoli *et al*., 2001). Sun *et al*. (2008) compared the impact of e-learning system design and e-learning medium (i.e. internet quality) on e-learning users. They found that the way e-learning was designed (e.g. interactive) as opposed to the technology itself significantly impacted on users'

satisfaction. Clearly, the design of e-learning content should incorporate the application of a pedagogical model relevant to the specific learning objective, target group, and context or knowledge domain (Knight *et al*., 2006). Thus, e-learning users' experience satisfaction when e-learning content incorporates a relevant and realistic context that facilitates the gaining of new knowledge and helps them to solve problems in their professional lives.

The non-significant result between technological efficacy and satisfaction could be explained by self-efficacy theory (Bandura, 1997). As self-efficacy is often found to be highly associated with behavioral change, technological efficacy seems to be an appropriate predictor of intention to adopt (behavioral change) rather than satisfaction (emotional state). Our main effect of organizational support on learners' satisfaction was fully supported (H3a). In line with previous studies, adequate supports help learners feel comfortable using e-learning which then leads to learners' satisfaction with e-learning (Black *et al*., 2007; Nelson, 1990).

Inspection of two-way interactions revealed significant results for H4b, H5c, and H6b. In line with predictions, individuals who reported low technological efficacy and openness to change but experienced high authenticity tended to adopt further e-learning over those who perceived low authenticity. Our study suggests that e-learning characteristics can possibly alleviate the barrier of learner characteristics, such as technology ability or change reservation. E-learning which integrates authentic activities may encourage learners, who may potentially avoid using e-learning due to low technological efficacy or hesitate to try a new way of learning, to adopt e-learning as a part of their personal learning and development. We also found a significant two-way interaction between organizational support and technological efficacy, providing only partial support for H9. This means that individuals with low technological efficacy but who experienced high organizational support tended to adopt further e-learning more than those who perceived low organizational support.

Inspection of the three-way interaction revealed significant interaction among openness to change, complexity, and organizational support on intention to use e-learning in future. Our study partially support H10, demonstrating that the best chance for encouraging employees to use e-learning as part of their personal development is when they are highly open to change and perceive high organizational support and low complexity in relation to the e-learning system.

Nonetheless, inspection of the moderating effects revealed several unexpected results. First, authenticity and complexity (e-learning characteristics) did not moderate the relationship between learners' characterization and e-learning satisfaction as well as organizational support on e-learning satisfaction. Second, authenticity and complexity did not moderate the relationship between organizational support and future adoption of e-learning. We also did not find a significant interaction between complexity and learner characteristics on future adoption of e-learning (H5b). Lastly, we found only one out of four three-way interaction hypotheses that was significant. Non-significant interaction between e-learning characteristics and organizational support could be explained by the notion that learners' satisfaction may be influenced by self-determination rather than the environment (Ryan *et al*., 1997). This means self-motivation and personality integration influence individuals' satisfaction; therefore, environmental factors such as e-learning characteristics and organizational support may not play a major role in buffering the relationship between learner characteristics and satisfaction. Future research is recommended (discussed in the next section).

5.1. *Limitations and future research*

There are a number of limitations and future research directions associated with this study. Firstly, our study is limited by the design. Cross-sectional data captures a statistical view of e-learning; however, the results are not fully elaborated with the time dimension. Self-reported surveys can cause informants to inflate their opinion or responses. This inflation may affect true relationships among the constructs (Tsai and Ghoshal, 1998). Nonetheless, we minimized these effects by performing the exploratory factor analysis of our constructs. The evidence was that the measure items for each construct illustrated good localization. There were low to moderate correlations among constructs, distinguishing our study constructs. A longitudinal design should be employed in future research to investigate the relationships among constructs over time.

Second, we measured intention to adopt e-learning, rather than the actual adoption. It may be the case that individuals might report their intention but may not perform according to that intention. Nonetheless, literature in psychology and innovation adoption establishes a strong relationship between intention and actual behavior (see Ajzen, 1985; Conner and Armitage, 1998). We recommend future research employ a time lag design, measuring actual adoption as well as intention to adopt.

Further, our study examined satisfaction based on individuals' past experience of e-learning usage. Our study did not compare users' satisfaction between traditional and e-learning activities, as this was not our study objective. Therefore, we cannot draw a conclusion on which factors (e.g. e-learning characteristics or user's characteristics) more effectively influence learners' satisfaction. Future research should employ a comparative approach, measuring satisfaction between traditional and e-learning activities to further understand the impact of e-learning.

Finally, our study was based on a single organization in the rail industry which limits the generalizability of our findings. Nonetheless, using a single case organization minimizes

confounding variables such as organizational cultures, organizational structures, and type of introduced e-learning. Our research findings could be extended to similar organizations dealing with the introduction of e-learning in the Australian context, or in other industrialized countries such as the United States or Canada.

Despite these limitations, our study sheds a light for organizations that may have employees who perceive themselves as having low technological efficacy. Even with low technological efficacy employees, organizations can motivate these individuals to adopt further e-learning by providing more e-learning support. Overall, our study confirms a direct influence of learner characteristics, e-learning characteristics, and organizational support on learners' satisfaction and intention to adopt further e-learning in the future. Our study, for the first time, establishes knowledge that e-learning characteristics can possibly buffer the relationship between learner characteristics and intention to adopt further e-learning in the future.

5.2. *Practical implications and conclusions*

The results of this study have a number of implications for managers and practitioners, particularly relating to corporate e-learning introduction. Organizations considering e-learning adoption need not necessarily be concerned that potential users lack technical competency or confidence with computer technology. Although this study indicates technically confident learners are more likely to adopt e-learning, there are other factors at play. Technical ability is not an obstacle when learners are provided with an authentic learning task. In other words, the authenticity of the task and the content of the e-learning system act as a bridge mechanism for exemplifying perceived benefit from e-learning; put simply, the system must be, and must be seen to be, a good way of learning.

Organizations can do little to fundamentally alter employees' openness to change, except by fostering a change-friendly environment. Using technology such as e-learning as a supplemental system and allowing it to demonstrate its perceived benefit may alter the intention to adopt. However, it is essential that the system clearly demonstrates relative advantage as the lever for adoption.

Finally, in order to overcome technological barriers, learners need to be provided with organizational support. However, the very nature of the support source is multi-dimensional, given it includes user training, technical support, and managerial encouragement to use e-learning. Organizations adopting e-learning need to examine the support requirements of the potential learners, and, where necessary, have resources for that support in place. The alternative is tokenistic and affects learners' perceptions of relative advantage and their e-learning "experience".

The key message from this study is that if an organization is implementing e-learning, it is not just the technology that has to work. The e-learning content and experience have to be real and demonstrate relative advantage. This means the content and structure are more important than the platform and technology, requiring a planned investment in learning and support. Without this, the effectiveness, the rate of adoption, and the use of future investment in e-learning will be compromised.

6. References

Agarwal, R. and Karahanna, E. (2000), "Time flies when you're having fun: cognitive absorption and beliefs about information technology usage", *MIS Quarterly*, Vol. 24 No. 4, pp. 665-94.

Aiken, L.S. and West, S.G. (1991), *Multiple Regression: Testing and Interpreting Interactions*, Sage, Thousand Oaks, CA.

Ajzen, I. (1985), "From intention to action: a theory of planned behavior", in Kuhl, J. and Beckman, J. (Eds.), *Action-control: From Cognition to Behavior*, Springer, Heidelberg, pp. 11-39.

Ajzen, I. (1991), "The theory of planned behavior", *Organizational Behavior and Human Decision Processes*, Vol. 50, pp. 179-211.

Arbaugh, J. and Duray, R. (2002), "Technological and structural characteristics, student learning and satisfaction with web-based courses", *Management Learning*, Vol. 33 No. 3, pp. 331-47.

Bandura, A. (1982), "Self-efficacy mechanism in human agency", *American psychologist*, Vol. 37 No. 2, pp. 122-47.

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

Baylor, A.L. and Ritchie, D. (2002), "What factors facilitate teacher skill, teacher morale, and perceived student learning in technology-using classrooms?", *Computers and Education*, Vol. 39 No. 4, pp. 395-414.

Black, E.W., Beck, D., Dawson, K., Jinks, S. and DiPietro, M. (2007), "Considering implementation and use in the adoption of an LMS in online and blended learning environments", *TechTrends*, Vol. 51 No. 2, pp. 35-53.

Bransford, J.D., Vye, N., Kinzer, C. and Risko, V. (1990), "Teaching thinking and content knowledge: toward an integrated approach", in Jones, B.F. and Idol, L. (Eds.), *Dimensions of Thinking and Cognitive Instruction*, Lawrence Erlbaum Associates, Hillsdale, NJ, pp. 381-413.

Brown, I.T.J. (2002), "Individual and technological factors affecting perceived ease of use of web-based learning technologies in a developing country", *The Electronic Journal of Information Systems in Developing Countries*, Vol. 9 No. 5, pp. 1-15.

Burkhardt, M.E. and Brass, D.J. (1990), "Changing patterns or patterns of change: the effects of a change in technology on social network structure and power", *Administrative Science Quarterly*, Vol. 35 No. 1, pp. 104-27.

Bussing, A. (1999), "Can control at work and social support moderate psychological consequences of job insecurity? Results from a quasi-experimental study in the steel industry", *European Journal of Work and Organizational Psychology*, Vol. 8 No, 2, pp. 219-42.

Coates, H., James, R. and Baldwin, G. (2005), "A critical examination of the effects of learning management systems on university teaching and learning", *Tertiary Education and Management*, Vol. 11 No. 1, pp. 19-36.

Colquitt, J.A., Hollenbeck, J.R., Ilgen, D.R., LePine, J.A. and Sheppard, L. (2002), "Computer-assisted communication and team decision-making performance: the moderating effect of openness to experience", *Journal of Applied Psychology*, Vol. 87 No. 2, pp. 402-10.

Compeau, D.R. and Higgins, C.A. (1995), "Computer self-efficacy: development of a measure and initial test", *MIS Quarterly*, Vol. 19 No. 2, pp. 189-211.

Conner, M. and Armitage, C.J. (1998), "Extending the theory of planned behavior: a review and avenues for further research", *Journal of Applied Social Psychology*, Vol. 28, No. 15, pp. 1429-64.

Conrad, A.M. and Munro, D. (2008), "Relationships between computer self-efficacy, technology, attitudes and anxiety: development of the computer technology use scale (CTUS)', *Journal of Educational Computing Research*, Vol. 39 No. 1, pp. 51-73.

Dabholkar, P.A. and Bagozzi, R.P. (2002), "An attitudinal model of technology-based self-service: moderating effects of consumer traits and situational factors", *Journal of the Academy of Marketing Science*, Vol. 30 No. 3, pp. 184-201.

Davis, F.D. (1989), "Perceived usefulness, perceived ease of use, and user acceptance of information technology", *MIS Quarterly*, Vol. 13 No. 3, pp. 319-40.

DeLone, W.H. and McLean, E.R. (1992), "Information systems success: the quest for the dependent variable", *Information Systems Research*, Vol. 3 No. 1, pp. 60-95.

Delone, W.H. and McLean, E.R. (2003), "The DeLone and McLean model of information systems success: a ten-year update", *Journal of management information systems*, Vol. 19 No. 4, pp. 9-30.

Derouin, R.E., Fritzsche, B.A. and Salas, E. (2005), "E-learning in organizations", *Journal of Management*, Vol. 31 No. 6, pp. 920-40.

Devaraj, S., Fan, M. and Kohli, R. (2002), "Antecedents of B2C channel satisfaction and preference: validating e-commerce metrics", *Information Systems Research*, Vol. 13 No. 3, pp. 316-33.

Dholakia, R.R. and Kshetri, N. (2004), "Factors impacting the adoption of the Internet among SMEs", *Small Business Economics*, Vol. 23 No. 4, pp. 311-22.

Fry, K. (2001), "E-learning markets and providers: some issues and prospects", *Education+ Training*, Vol. 43 Nos. 4/5, pp. 233-39.

Gosling, S.D., Rentfrow, P.J. and Swann, W.B. (2003), "A very brief measure of the Big-Five personality domains", *Journal of Research in Personality*, Vol. 37 No. 6, pp. 504-28.

Govindasamy, T. (2001), "Successful implementation of e-Learning: pedagogical considerations", *The Internet and Higher Education*, Vol. 4 Nos. 3/4, pp. 287-99.

Gulikers, J., Bastiaens, T.J. and Martens, R.L. (2005), "The surplus value of an authentic learning environment", *Computers in Human Behavior*, Vol. 21 No. 3, pp. 509-21.

Guri-Rosenblit, S. (2006), "Eight paradoxes in the implementation process of e-learning in higher education", *Distances et Savoirs*, Vol. 4 No. 2, pp. 155-179.

Hair, J.F., Anderson, R.E., Tatham, R.L. and Black, W.C. (1998), *Multivariate Data Analysis with Readings* (5th ed.), Prentice-Hall, Englewood Cliffs, NJ.

Hill, N.S. and Wouters, K. (2010), "Comparing apples and oranges: toward a typology for assessing e-learning effectiveness", in Martocchio, J., Liao, H. and Joshi, A. (Eds.), *Research in Personnel and Human Resources Management*, Emerald Group Publishing Limited, Bingley, UK, Vol. 29, pp. 201-42.

Hodges, C.B. (2004), "Designing to motivate: motivational techniques to incorporate in e-learning experiences", *The Journal of Interactive Online Learning*, Vol. 2 No. 3, pp. 1-7.

Hong, K.S. (2002), "Relationships between students' and instructional variables with satisfaction and learning from a Web-based course", *The Internet and Higher Education*, Vol. 5 No. 3, pp. 267-81.

Huang, H.M. (2002), "Toward constructivism for adult learners in online learning environments", *British Journal of Educational Technology*, Vol. 33 No. 1, pp. 27-37.

John, O.P. (1990), "The 'big five' factor taxonomy: dimensions of personality in the natural language and questionnaires", in Pervin, L.A. (Ed.), *Handbook of Personality*, Guilford Press, New York, pp. 66-100.

Jonassen, D. (1991), "Evaluating constructivistic learning", *Educational Technology and Society*, Vol. 31 No. 9, pp. 28-33.

Keil, M., Beranek, P.M. and Konsynski, B.R. (1995), "Usefulness and ease of use: field study evidence regarding task considerations", *Decision Support Systems*, Vol. 13 No. 1, pp. 75-91.

Knight, C., Gasevic, D. and Richards, G. (2006), "An ontology-based framework for bridging learning design and learning content", *Journal of Education Technology and Society*, Vol. 9 No. 1, pp. 23-37.

Kwan, V.S.Y., Bond, M.H. and Singelis, T.M. (1997), "Pancultural explanations for life satisfaction: adding relationship harmony to self-esteem", *Journal of Personality and Social Psychology*, Vol. 73 No. 5, pp. 1038-51.

Legris, P., Ingham, J. and Collerette, P. (2003), "Why do people use information technology? A critical review of the technology acceptance model", *Information and Management*, Vol. 40 No. 3, pp. 191-205.

Lounsbury, J.W., Loveland, J.M., Sundstrom, E.D., Gibson, L.W., Drost, A.W. and Hamrick, F.L. (2003), "An investigation of personality traits in relation to career satisfaction", *Journal of Career Assessment*, Vol. 11 No. 3, pp. 287-307.

Lowe, J.S. and Holton, E.F. (2005), "A theory of effective computer-based instruction for adults", *Human Resource Development Review*, Vol. 4 No. 2, pp. 159-88.

McCrae, R.R. and Costa Jr., P.T. (1999), "A five-factor theory of personality", in Pervin, L.A. and John, O. (Eds.), *Handbook of Personality: Theory and Research* (2 ed.), Guilford Press, New York, pp. 139-53.

McDonald, T. and Siegall, M. (1992), "The effects of technological self-efficacy and job focus on job performance, attitudes, andwithdrawal behaviors", *Journal of Psychology*, Vol. 126 No. 5, pp. 465-75.

McLaren, A.C. (2010), "The effects of instructor-learner interactions on learner satisfaction in online masters courses", PhD dissertation, Wayne State University, Detroit, MI.

Meyers, N.M., and Nulty, D.D. (2009), "How to use (five) curriculum design principles to align authentic learning environments, assessment, students' approaches to thinking and learning outcomes", *Assessment and Evaluation in Higher Education*, Vol. 34 No. 5, pp. 565-77.

Nelson, D.L. (1990), "Individual adjustment to information-driven technologies: a critical review", *MIS Quarterly*, Vol. 14 No. 1, pp. 79-98.

Neufeld, D.J., Dong, L. and Higgins, C. (2007), "Charismatic leadership and user acceptance of information technology", *European Journal of Information Systems*, Vol. 16 No. 4, pp. 494-510.

Oliver, R.L. (1980), "A cognitive model of the antecedents and consequences of satisfaction decisions", *Journal of Marketing Research*, Vol. 17 No. 4, pp. 460-69.

,Pavlou, P.A. and Fygenson, M. (2006), "Understanding and predicting electronic commerce adoption: an extension of the theory of planned behavior", *Management Information Systems Quarterly*, Vol. 30 No. 1, pp. 115-43.

Pedersen, P.E. (2005), "Adoption of mobile internet services: an exploratory study of mobile commerce early adopters", *Journal of organizational computing and electronic commerce*, Vol. 15 No. 3, pp. 203-22.

Peslak, A.R., Subramanian, G.H. and Clayton, G.E. (2007), "The phases of ERP software implementation and maintenance: a model for predicting preferred ERP use", *The Journal of Computer Information Systems*, Vol. 48 No. 2, pp. 25-34.

Piccoli, G., Ahmad, R. and Ives, B. (2001), "Web-based virtual learning environments: a research framework and a preliminary assessment of effectiveness in basic IT skills training", *MIS Quarterly*, Vol. 5, pp. 401-26.

Raubenheimer, J. (2007), "An item selection procedure to maximise scale reliability and validity", *SA Journal of Industrial Psychology*, Vol. 30 No. 4, pp. 59-64.

Robinson, L., Marshall, G.W. and Stamps, M.B. (2005), "Sales force use of technology: antecedents to technology acceptance", *Journal of Business Research*, Vol. 58 No. 12, pp. 1623-31.

Rogers, E.M. (1995), *Diffusion of Innovations*, Free Press, New York.

Ryan, R.M., Kuhl, J. and Deci, E.L. (1997), "Nature and autonomy: an organizational view of social and neurobiological aspects of self-regulation in behavior and development", *Development and Psychopathology*, Vol. 9 No. 4, pp. 701-28.

Sachs, D. and Hale, N. (2003), "Pace University's focus on student satisfaction with student services in online education", *Journal of Asynchronous Learning Networks*, Vol. 7 No. 2, pp. 36-42.

Sawang, S., Unsworth, K. and Sorbello, T.M. (2007), "An exploratory study of innovation effectiveness measurment in Australian and Thai SMEs", *Internationsl Journal of Organizational Behaviour*, Vol. 12 No. 1, pp. 110-25.

Selim, H.M. (2007), "Critical success factors for e-learning acceptance: confirmatory factor models", *Computers and Education*, Vol. 49 No. 2, pp. 396-413.

Servage, L. (2005), "Strategizing for workplace e-learning: some critical considerations", *Journal of Workplace Learning*, Vol. 17 Nos. 5/6, pp. 304-17.

Sheppard, B.H., Hartwick, J. and Warshaw, P.R. (1988), "The theory of reasoned action:a meta-analysis of past research with recommendations for modifications and future research", *Journal of Consumer Research*, Vol. 15 No. 3, pp. 325-43.

Strother, J.B. (2002), "An assessment of the effectiveness of e-learning in corporate training programs", *The International Review of Research in Open and Distance Learning*, Vol. 3 No. 1. http://www.icaap.org/iuicode?149.3.1.x

Sturgill, A., Martin, W. and Gay, G. (1999), "Surviving technology: a study of student use of computer-mediated communication to support technology education", *International Journal of Educational Telecommunications*, Vol. 5 No. 3, pp. 239-59.

Sun, P.C., Tsai, R.J., Finger, G., Chen, Y.Y. and Yeh, D. (2008), "What drives a successful e-learning? An empirical investigation of the critical factors influencing learner satisfaction." *Computers and Education*, Vol. 50 No. 4, pp. 1183-202.

Tabachnick, B.G., Fidell, L.S. and Osterlind, S.J. (2001), *Using Multivariate Statistics* (4th ed.), Allyn and Bacon Boston, Boston, MA.

Tatnall, A. and Davey, B. (2003), ICT and training: a proposal for an ecological model of innovation", *Educational Technology and Society*, Vol. 6 No. 1, pp. 14-17.

Thompson, R.L., Higgins, C.A. and Howell, J.M. (1991), "Personal computing: toward a conceptual model of utilization", *MIS Quarterly*, Vol. 15 No. 1, pp. 125-43.

Theorell, T. and Karasek, R.A. (1996), "Current issues relating to psychosocial job strain and cardiovascular disease research", *Journal of Occupational Health Psychology*, Vol. 1 No. 1, pp. 9-26.

Thurmond, V.A., Wambach, K., Connors, H.R. and Frey, B.B. (2002), "Evaluation of student satisfaction: determining the impact of a web-based environment by controlling for student characteristics", *American Journal of Distance Education*, Vol. 16 No. 3, pp. 169-90.

Tornatzky, L.G. and Klein, K.J. (1982), "Innovation characteristics and innovation adoption-implementation: a meta-analysis of findings", *IEEE Transactions on Engineering Management*, Vol. 29 No. 1, pp. 28-45.

Tsai, W. and Ghoshal, S. (1998), "Social capital and value creation: the role of interfirm networks", *Academy of Management Journal*, Vol. 41 No. 4, pp. 464-76.

Unsworth, K., Sawang, S., Murray, J., Norman, P. and Sorbello, T. (forthcoming), "Understanding innovation adoption:effects of orientation, pressure and control on adoption intentions", *International Journal of Innovation Management*. doi: http://dx.doi.org/10.1142/S1363919611003593

Vannatta, R. A. and Fordham, N. (2004), "Teacher dispositions as predictors of classroom technology use", *Journal of Research on Technology in Education*, Vol. 36 No. 3, pp. 253-72.

Vishwanath, A. (2005), "Impact of personality on technology adoption: an empirical model", *Journal of the American Society for Information Science and Technology*, Vol. 56 No. 8, pp. 803-11.

Walker, S.L. and Fraser, B.J. (2005), "Development and validation of an instrument for assessing distance education learning environments in higher education: the Distance Education Learning Environments Survey (DELES)", *Learning Environments Research*, Vol. 8 No. 3, pp. 289-308.

Wang, L.C.C. and Bagaka, J.G. (2002), "Understanding the dimensions of self-exploration in web-based learning environments", *Journal of Research on Technology in Education*, Vol. 34 No. 3, pp. 364-73.

Wang, Y.S. (2003), "The adoption of electronic tax filing systems: an empirical study", *Government Information Quarterly*, Vol. 20 No. 4, pp. 333-52.

Wixom, B.H. and Todd, P.A. (2005), "A theoretical integration of user satisfaction and technology acceptance", *Information Systems Research*, Vol. 16 No. 1, pp. 85-102.

Wu, J., Tsai, R.J., Chen, C.C. and Wu, Y. (2006), "An integrative model to predict the continuance use of electronic learning systems: hints for teaching", *International Journal on e-Learning*, Vol. 5 No. 2, pp. 287-302.

Yi, M.Y. and Hwang, Y. (2003), "Predicting the use of web-based information systems: self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model. *International Journal of Human-Computer Studies*, Vol. 59 No. 4, pp. 431-49.

Zaharias, P. and Poylymenakou, A. (2009), "Developing a usability evaluation method for e-learning applications: beyond functional usability", *International Journal of Human–Computer Interaction*, Vol. 25 No. 1, pp. 75-98.

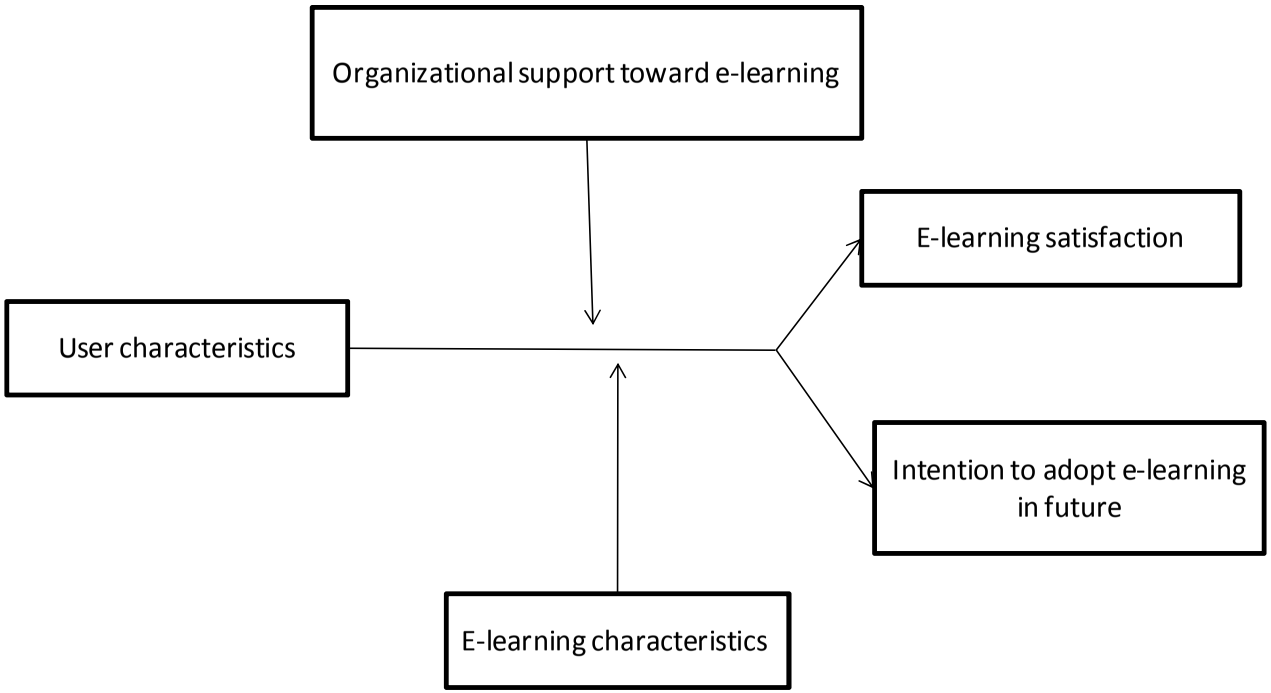

Figure 1: Model displaying proposed relationships between user characteristics, e-learning characteristics, and support on satisfaction with e-learning and intention to adopt e-learning.

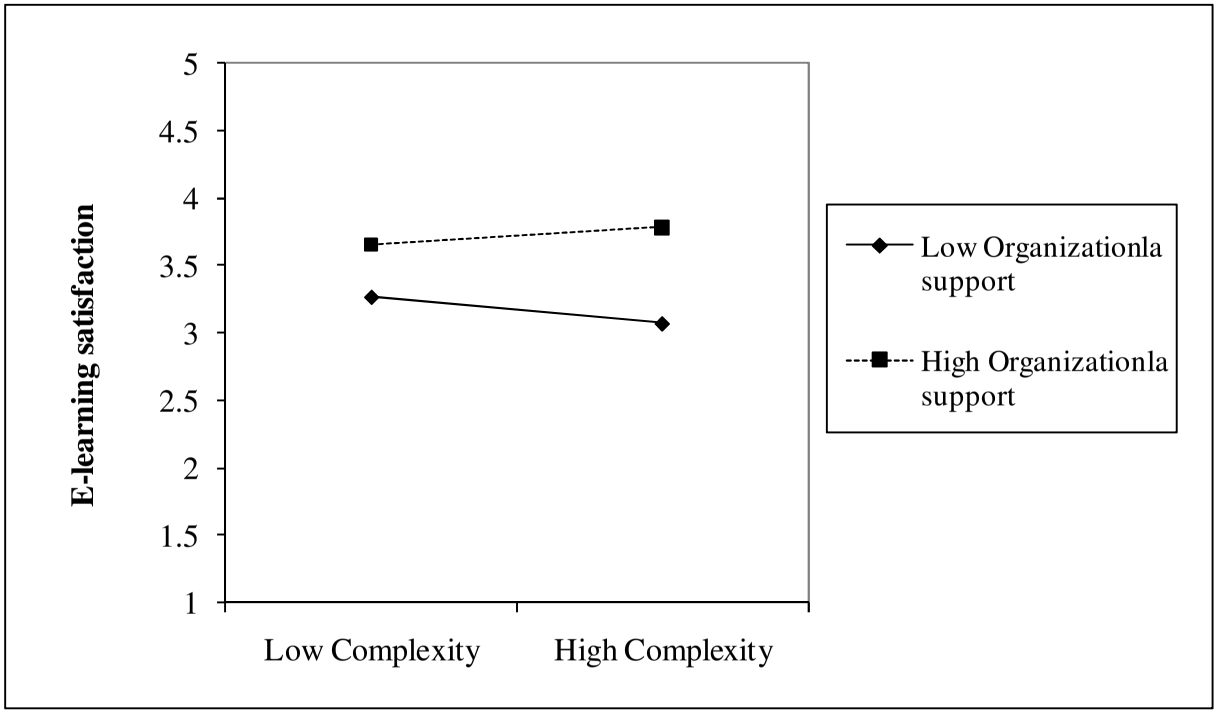

Figure 2: Two-way interaction of Complexity and organizational support on e-learning satisfaction

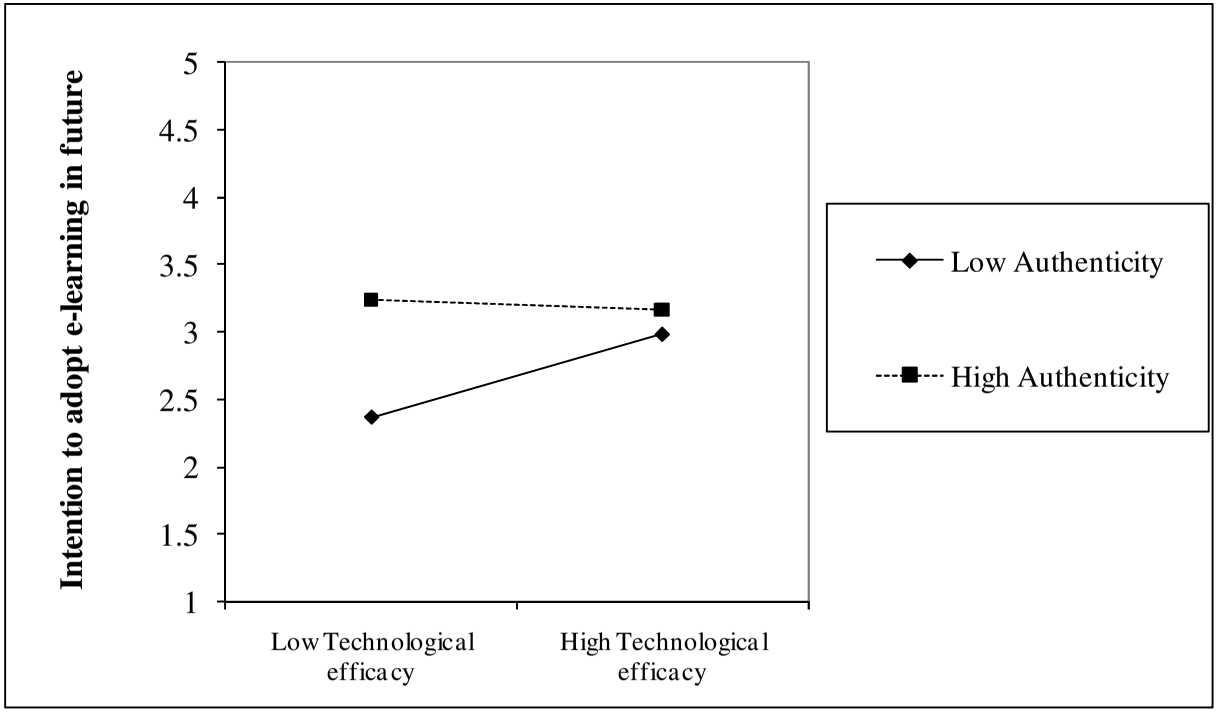

Figure 3: Two-way interaction of technological efficacy and authenticity on intention to adopt further e-learning in the future

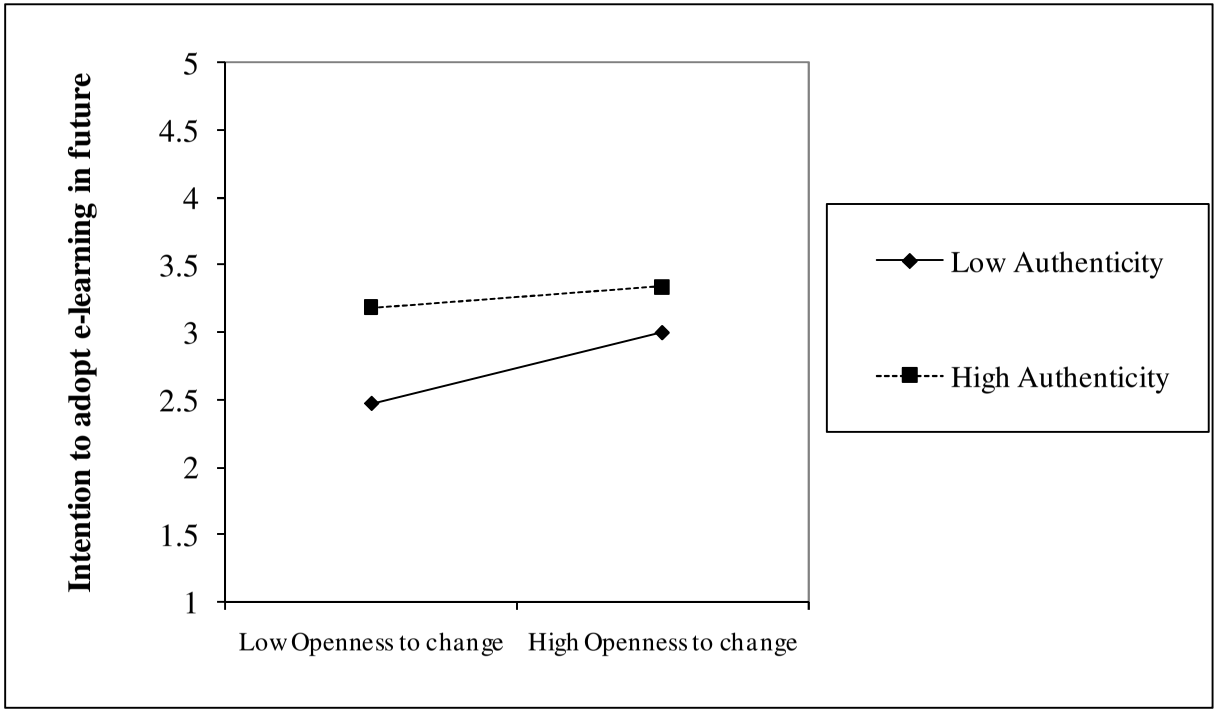

Figure 4: Two-way interaction of openness to change and authenticity on intention to adopt further e-learning in the future

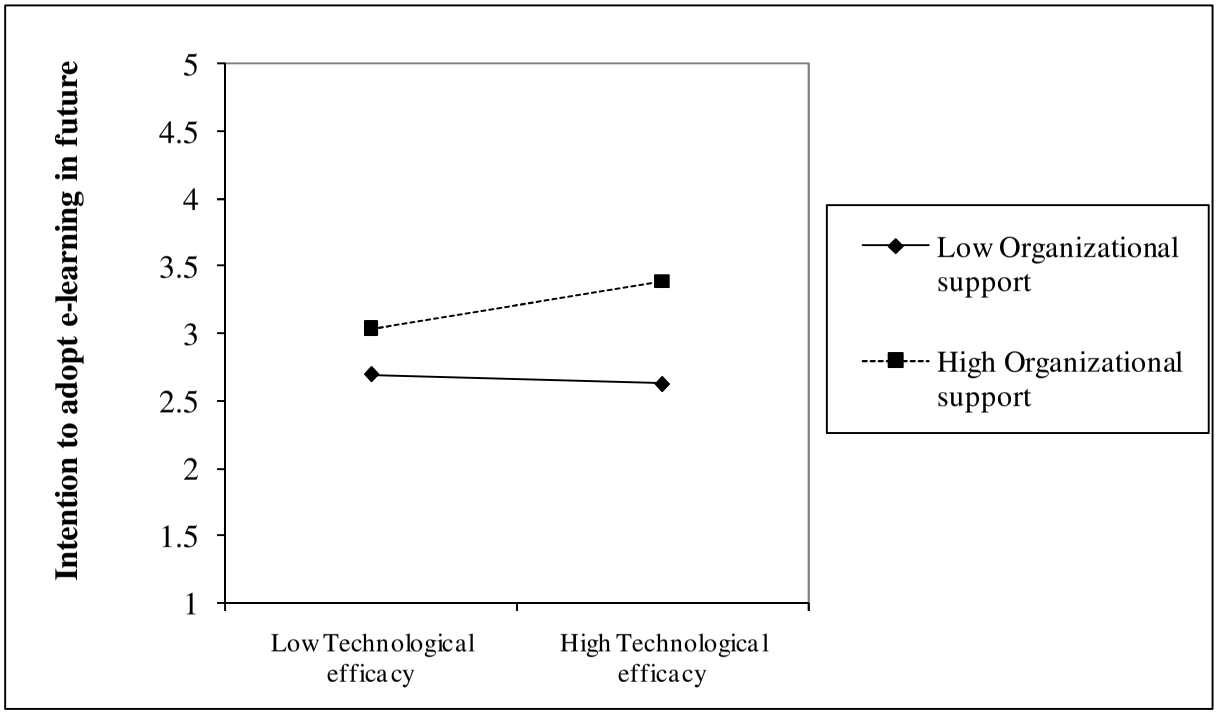

Figure 5: Two-way interaction technological efficacy and organizational support for e-learning on intention to adopt further e-learning in the future

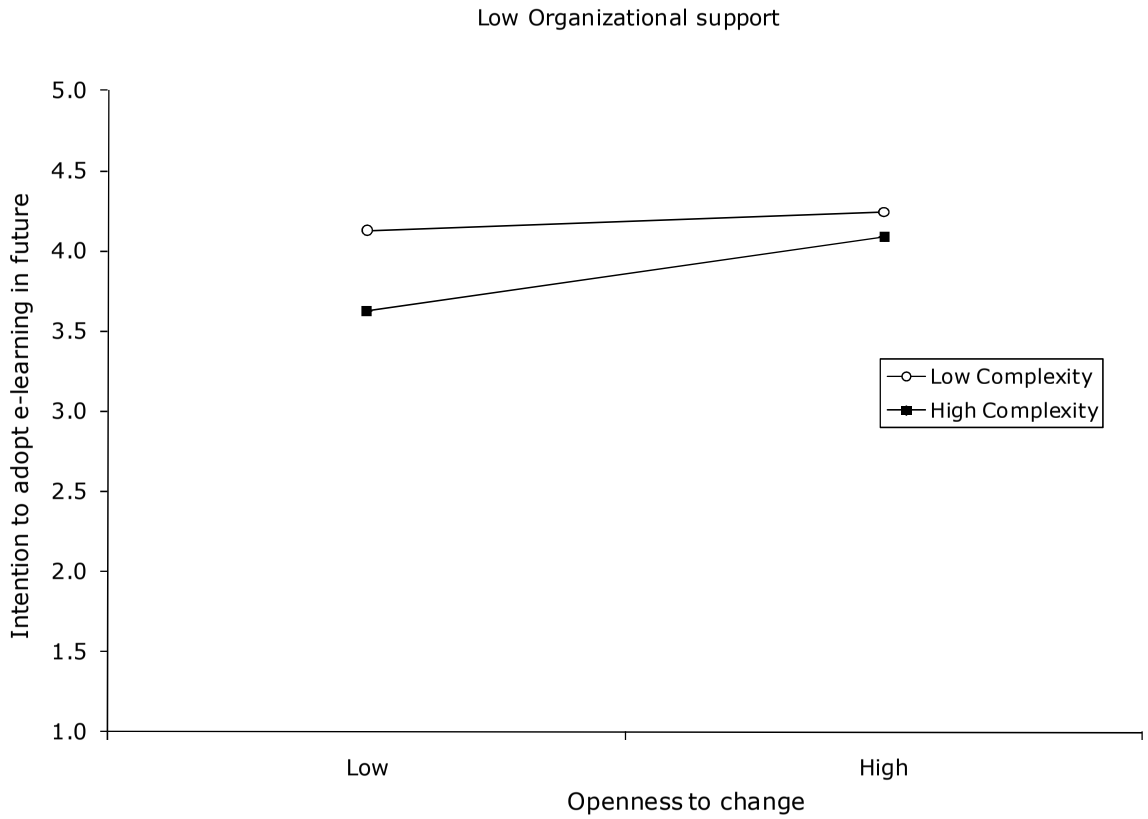

Figure 6a: Interaction of openness to change and complexity on intention to adopt e-learning in future at low levels of organizational support

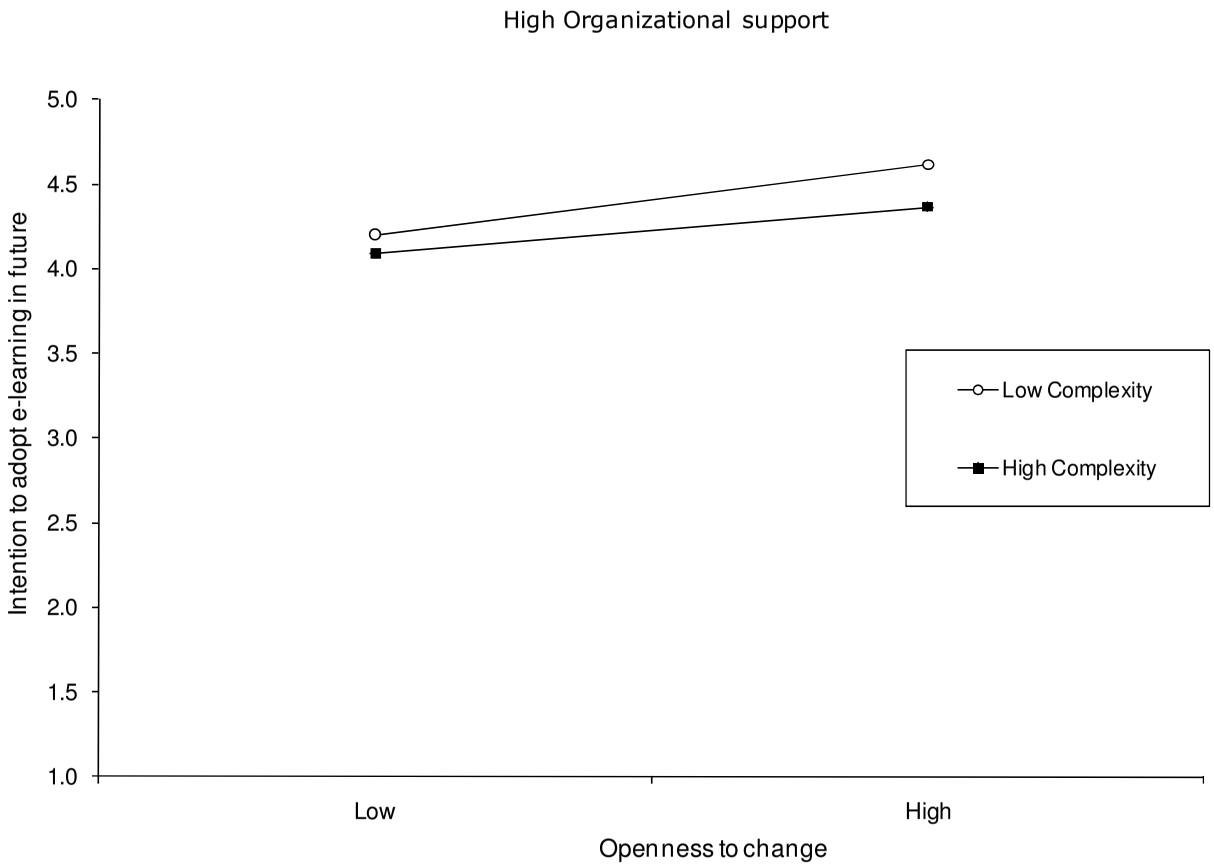

Figure 6b: Interaction of openness to change and complexity on intention to adopt e-learning in future at high levels of organizational support

Table 1: Descriptive and correlation coefficients for focal variables (*N*=1047).

	Variables	1	2	3	4	5	6	7	8	9	10	11
1.	Satisfaction		.43**	.65**	-.03	.04	.19**	.55**	. 02	-.14**	.04	-.01
2.	Intention to adopt			.42**	-.20**	.15**	.29**	.36**	.01	-.11**	.08*	.07
3.	Authenticity			(.83)	-.02	.05	.16**	.51**	.01	-.07	-.01	.01
4.	Complexity				(.72)	-.04	-.23**	-.28	-.03	-.01	-.04	-.07
5.	Technology efficacy					(.75)	.08**	.04	-.02	-.04	.07*	.04
6.	Openness to change						(.75)	.14**	-.06*	.07*	.14**	.07*
7.	Organizational support							(.82)	.02	-.11**	.05	.04
8.	Gender									.13**	-.02	.14**
9.	Age										-.08**	.26**
10.	Education											.08**
11.	Position											
Mean		3.25	3.86	3.46	2.77	3.24	3.77	3.08	0.67	40.23	0.38	0.26
SD		0.98	0.89	0.69	0.46	0.93	0.61	0.68	0.47	11.81	0.48	0.44

Note:**p<.01, *p<.05, Gender (0=female, 1=male), position (0= non supervisor, 1= supervisor or higher) and education (0 = lower than bachelor degree, 1 bachelor degree or higher) are dummy coded. Cronbach alphas (internal reliabilities) are in the diagonals.

Table 2: Hierarchical regression analyses predicting e-learning satisfaction and intention to adopt further e-learning in the future.

	E-learning satisfaction β				Intention to adopt further e-learning β			
Step 1: Control variables	1	2	3	4	1	2	3	4
Gender	.05	.03	.03	.03	.00	-.00	.01	.01
Age	-.15**		-.06*	-.07*	-.13*	-.08*	-.09*	-.09*
Education	.03	-.07*	.01	.01	.05	.02	.01	.00
Position	.02	.02	-.01	-.02	.09*	.04	.04	.03
Step 2: Main effects								
Authenticity		.49***	.47***	.48***		.29***	.27***	.28***
Complexity		.00	.03	.02		-.13***	-.14*	-.13***
Technology efficacy		-.01	-.01	-.01		.10**	.14***	.12**
Openness to change		.08**	.10**	.10**		.18***	.17***	.20***
Organizational support		.28***	.27***	.27***		.16***	.16***	.14**
Step 3: Two-way interaction								
Authenticity x technological efficacy			.02	.02			-.20***	-.19***
Authenticity x openness to change			-.01	-.04			-.10**	-.13**
Authenticity x organizational support			-.04	-.03			-.04	-.03
Complexity x technological efficacy			-.02	-.01			-.04	-.05
Complexity x openness to change			-.03	-.03			.01	.01
Complexity x organizational support			.10***	.09*			.06	.04
Technological efficacy x organizational support			.04	.03			.13**	.12**
Openness to change x organizational support			.01	.01			.02	.02
Step 4: Three-way interaction								

Authenticity x technological efficacy x support				.02				.03
Authenticity x openness to change x support				-.05				-.04
Complexity x technological efficacy x support				-.01				-.00
Complexity x openness to change x support				-.01				-.10**
R^2	.02	.50	.52	.52	.02	.30	.35	.36
R^2 Ch	.02**	.48***	.01*	.00	.02**	.27***	.05***	.01*

Note: ***$p < .001$, **$p < .01$; *$p < .05$. The coefficients reported are standardized regression weight. Significance of ΔR^2 tested with partial F-tests in regression equations.