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ABSTRACT

Individuals differ in their abilities to use information systems (IS) effectively, with some achieving exceptional performance in IS use. Using the Repertory Grid Technique, this research identifies attributes of highly competent IS users that distinguish them from less competent users. Using the Grounded Theory approach, we identified categories and sub-categories of these attributes and used them to develop a conceptual framework to explain IS User Competency. The findings indicate that highly competent users differ from less competent users in their Personality Traits and Disposition Factors, General Cognitive Abilities, Social Skills and Tendencies, Experiential Learning Factors, Domain Knowledge of and Skills in IS, Job Experiences, Generation Factors, and Education. The results not only highlight attributes that can be fostered in other IS users to improve their performance with IS use but they also present research opportunities for IS training and potential hiring criteria for IS users in organizations.

Keywords

IS user competence, user attributes, repertory grid, grounded theory.

INTRODUCTION

The ability to utilize information systems (IS) varies among individuals. Some users are able to utilize IS in an effective manner that capitalizes on the opportunities that IS can provide. Others, however, are less likely to experience such benefits from using IS. Jasperson et al. (2005) found that "users employ quite narrow feature breadths, operate at low levels of feature use, and rarely initiate technology- or task-related extensions of the available features" (p. 526). This variation in usage can lead to lower efficiencies in completing a task or lower quality of decision making. Poor quality of IS usage can hinder an IS user's ability to utilize an IS effectively or discover new utilizations of an IS. The reasons behind such variations in quality of IS usage is multi-dimensional (Auer, 1998). One aspect is the differences among individual users themselves. Because the need for proficient and quality IS usage continues to grow, it is important to examine and understand such differences among IS users, and foster these key attributes.

Therefore, in this research, we are interested in identifying the attributes of highly competent IS users in the context of their ability to fully utilize IS. In other words, our research question is: "What are the attributes of highly competent users of IS that differentiate them from less capable users in the context of their ability to more fully utilize IS?" This research question is important because intentions to use or adopt IS which has been studied extensively in the MIS literature do not necessarily translate into quality of IS use. Because differences exist in individuals' abilities to engage in quality IS usage, the potential of understanding how some are able to achieve higher levels of quality usage than others presents opportunities for improving overall IS usage. Therefore, the contribution of this research is in developing a grounded understanding of IS user competency.

LITERATURE REVIEW & THEORETICAL FOUNDATION

Several constructs have been used to describe highly performing IS users in the literature. Marcolin et al. (2000) define user competence as "the user's potential to apply technology to its fullest possible extent so as to maximize performance of specific job tasks" (p. 38). Adapting from Marcolin et al. (2000), the highly competent IS user construct in this study is defined as one who is able to utilize IS to its fullest potential and obtain the greatest performance from IS use. IS, for this research, is defined as a technology-driven system that collects, processes, stores, and distributes information to support the operations, analysis, and decision-making of an organization (Laudon and Laudon, 2006).

Table 1 summarizes our review of the literature by highlighting the various constructs that may be associated with highly competent IS users and their behaviors. Most of these constructs have been utilized to describe IS users and explain intentions to use IS and actual IS usage, but not in the context of achieving quality IS usage by highly competent IS users.

As previously mentioned, actual IS usage and quality IS usage present different outcomes in terms of fully realizing the potential of an IS. Therefore, identifying attributes in IS users by studying highly competent IS users presents opportunities to improve IS usage in other users.

Source	Construct
Agarwal & Prasad, 1998	Personal innovativeness
Yi et al., 2006	Innovativeness
Rank et al., 2004	Creativity and innovativeness
Amabile, 1983 & 1986	Creativity
Butler & Gray, 2006	Mindfulness
Bandura, 1997; Compeau & Higgins, 1995	Perceived self-efficacy, computer self-efficacy
Karahanna, 1999; Karahanna & Agarwal, 2003	Symbolic adoption
Ghani & Deshpande, 1994	Theory of optimal flow
Webster & Martocchio, 1992	Microcomputer playfulness
Chung & Tan, 2004	Focused attention/control (antecedents of perceived playfulness)
Burger & Blignaut, 2004; Loyd & Gressard, 1984	Computer attitude

Table 1. Previous Research Constructs

RESEARCH METHODOLOGY

We utilized the Repertory Grid Technique (RepGrid) as the data collection method. RepGrid is based on Kelly's personal construct theory (Hunter, 1997 citing Kelly 1955, 1963). The premise of personal construct psychology is that each individual is her or her own scientist and that, according to Kelly, each individual creates a theoretical framework or a personal construct system in order to give meaning to various phenomena (Fransella et al., 2004; Stewart, 1981). Hence, RepGrid is an appropriate technique to uncover the personal construct systems associated with attributes of IS users. In the context of this research, RepGrid was used to identify constructs that distinguish highly competent users from others who are less capable of utilizing IS. This RepGrid study was conducted with business professionals who are also IS users in order to elicit their personal constructs of attributes that distinguish highly competent users from others. Details of the RepGrid technique are explained in Stewart (1981) and Fransella et al. (2004). Our research procedures consist of seven main steps:

Step 1: Participant Selection

Participants for the study comprise IS users who are business professionals from a variety of industries (to increase the breadth of participants' personal constructs on highly competent user attributes and increase the generalizability of our findings). Data collection continued until we surpassed the point of saturation (where no new constructs emerged). Tan and Hunter (2002) indicated that a sample size of 15 to 25 is generally adequate to reach the saturation point.

Step 2: Select Elements

In this step, *elements,* which are the focal point of the study, were selected from IS users that a participant is familiar with. The participant was asked questions to help them identify highly and least competent IS users that they know and then asked to identify the top and bottom three IS users from each of these categories. These six identified users were included in the pool of elements and utilized in step 3.

Step 3: Identify Constructs

Elements are interpreted with the use of bipolar dimensions, or personal constructs, with which they can identify what some person/place/thing is and what it is not (Fransella et al., 2004). The research participant was asked to identify constructs using the triadic approach in which three elements were selected by the researcher and the participant was asked to identify how two of them were similar but different from the third in the context of their ability or inability to utilize IS. Confirmation was solicited to identify the positive and negative ends of the construct. Also, the laddering approach was utilized in which questions such as "how" and "why" were asked to gain further insight into the meaning of the participant's constructs (Tan and Hunter, 2002).

Step 4: Develop Links

Links illustrate the relationship between elements and constructs from the research participant's perspective, as well as interpretations of similarities and differences (Tan and Hunter, 2002). In this research, the participant was first asked to physically arrange the elements' cards so they were ranked in terms of representing their relative positions on the bipolar constructs identified. Then, the participant was asked to rate the elements on a 1 to 9 scale, with 1 being the negative end and 9 the positive end.

Steps 3 and 4 were repeated until no new constructs emerged or the point of redundancy was reached. Reger (1990) indicates that previous research identifies seven to ten triads to be sufficient. Once the point of saturation was reached with the existing pool of elements, we proceeded to step 5.

Step 5: Final Elicitation

Two additional elements that represent the extreme ends of the bipolar constructs, an Ideal User and an Incompetent User, were included in the pool of elements to support and enhance the construct elicitation process. Definitions for these individuals (utilizing the definition of highly competent user noted above) were provided to the participant. This step is included *after* the above procedures with the original set of six elements to introduce additional opportunities to elicit any other constructs that the participant felt would be associated with his/her conception of a highly competent user that may have not been identified with the previous six elements. Steps 3 and 4 were repeated ensuring that each triad had the Ideal User, Incompetent User, or both

included. The steps were repeated until the point of redundancy or saturation was reached.

Step 6: Visual Focusing & Review

After the grids completion, visual focusing of the grid was utilized to ensure the participant agreed with what had been accomplished. To further verify the reliability of the constructs elicited, during the final stage of the interview, the participant was asked to focus on the highly competent users of IS that they identified earlier and asked additional probing questions. If any new constructs emerged, they were included in the existing list and step 4 was repeated to develop the links.

Step 7: Analysis of RepGrids

To conduct a qualitative analysis of the RepGrids generated from the data, the constructs that were generated were categorized following Stewart's (1981) approach of content analysis and Strauss and Corbin's (1998) open coding methodology. The Q-sort method was also utilized in which each of two coders grouped the constructs into categories following the method described by Moore and Benbasat (1991). Constructs were grouped based on similarities and differences, and those that were put in the same pile were provided a label. The inter-coder consistencies were then evaluated, followed by allowing independent corrections to be made by each coder. The final discrepancies were then resolved between the two coders through consensus.

Data Collection

A total of 20 RepGrid sessions were conducted with 10 males and 10 females, and 416 constructs were generated from the sessions. Research participants have an average work experience of 15 years and average experience using IS of 11 years. Half of the participants are in management/supervisory positions and examples of information systems used by participants include SAP, AS/400, and Lawson.

Constructs that were generated by participants were coded according to the open coding methodology outlined by Strauss and Corbin (1998) and the sorting procedure described by Moore and Benbasat (1991).

To address potential issues of construct validity and reliability, Yin's (1994) three Principles of Data Collection were followed.

DATA ANALYSIS

The grounded theory approach (including open, axial and selective coding) was used to analyze the qualitative data collected and to develop a conceptualization of IS User Competency. Strauss and Corbin (1998) also acknowledge that the use of existing literature can be supplemental to the theory development stage in a variety of ways. Therefore, existing literature is used to help identify the relationships among the themes and related categories.

Several overarching themes emerged from the coding process. The core category or theme that emerged is the User Competency Chain. The entire framework, as well as the User Competency Chain within the framework, represents our theoretical conceptualization of user competency derived from this research *(note: framework will be included in the presentation)*. General Cognitive Abilities, Personality Traits and Disposition Factors, Job Experience, Education, Generation Factors, and Social Skills and Tendencies are all factors that contribute to the User Competency Chain.

User Competency Chain

User competencies are recognized, as defined earlier within the highly competent user construct, as the ability to utilize IS to its fullest potential and obtain the greatest performance from IS use. The premise of this proposed chain is that Experiential Learning and Domain Knowledge of and Skills in IS are key to development of user competency. These categories acknowledge that the highly competent user develops knowledge and skills from their utilization of and direct interactions with technology.

The category of Experiential Learning (defined as the direct interaction with, perception of, and willingness to explore IS) has been modified to acknowledge Enactive Learning (learning through direct interaction with a task) from the learning or education literature (Bruning et al., 2004 citing Bandura, 1986). Ericsson et al. (1993) indicate that expert performance is obtained by a commitment to deliberate practice. Therefore, Experiential Learning, which would allow continuous practice and exposure to technology, can lead to User Competency.

Within the theme of Experiential Learning is Exposure to Technology, Willingness to Try and to Explore, and Perception of IS Value. Exposure to Technology represents IS users' prior experiences with using technology, and can be influenced by Generation Factors or the generation that an individual belongs to. Willingness to Try and to Explore represents one's comfort with using and trying out technologies. Perception of IS Value recognizes an individual's ability to see the benefits and opportunities that IS can provide.

The category Willingness to Try and to Explore is similar to personal innovativeness in the domain of information technology which is defined as "the willingness of an individual to try out any new information technology" (Agarwal and Prasad, 1998, p. 206).

Perception of IS Value is related to the dimension of symbolic adoption (Karahanna and Agarwal, 2003, Nah et al., 2004) in which one has a positive evaluation of the return to be obtained from using technology or its worthiness. Symbolic adoption research has identified relationships with self-determined motivation and symbolic adoption as an antecedent of intentions to

explore (similar to the attribute of Willingness to Try and to Explore).

Factors Contributing to User Competency Chain

The factors that contribute to the User Competency Chain will be described below.

General Cognitive Abilities, Education, & Job Experience

General Cognitive Abilities encompass one's Intellectual Abilities as well as one's Ability and Desire to Learn, with both of these categories contributing to one's Ability to Solve Problems.

Education refers to IS users holding a higher education degree, which can impact User Competency Chain via Domain Knowledge of and Skills in IS and Exposure to Technology.

Job Experience encompasses specific experiences that contribute to IS skills as well as a variety of experiences.

Personality Traits & Disposition Factors

Personality traits and disposition factors describe highly competent users' ambition and self-assurance, flexible and unconstrained approach to accomplishing a task, natural inclination to explore and probe without fear, and efficiency with which they operate.

Social Skills & Tendencies/Vicarious Learning

The theme of Social Skills and Tendencies incorporates the categories of Willingness to Teach, Share, and Collaborate as well as Communication Skills. This theme highlights the interactions that highly competent IS users have with other users which may produce a different form of learning or provide insights that weren't possible to discover in one's own environment or on one's own, hence potentially influencing User Competency. The category of Social Skills and Tendencies has also been modified to acknowledge Vicarious Learning (Bruning et al.'s 2004 citation of Bandura, 1986) which is achieved through observing or discussing specific tasks with others.

Summary of Findings

Research participants indicated that attributes of highly competent users include their prior use and continued use of technologies as well as their comfort levels with trying technologies and using IS. Highly competent users are able to see the value that IS can provide and have an understanding as well as the capability to operate IS. Participants indicated that the highly competent users they know tend to belong to a younger generation and hold a higher education degree. Communication skills as well as their willingness to use these skills to work with others were also identified. Highly competent users were described as having the capacity to learn and tend to initiate their own learning, have logical and analytical approaches, and have rapid processing and learning speeds. They were labeled as being driven, committed, and positive in their outlook. Also, they were noted as attuned to accuracy and efficiency in managing their time.

With an exploratory nature and openness to change, they are able to reason about new ideas and visualize in multiple dimensions and perspectives. Holding a higher level of self-assurance, they are more willing to expose themselves to risks.

CONCLUSION, IMPLICATIONS & FUTURE RESEARCH

This research contributes to the theoretical conceptualization of IS user competency. A framework for explaining IS User Competency was developed based on Strauss and Corbin's grounded theory approach. Various attributes that distinguish highly competent from less competent users were identified and they provide insight into users' ability to effectively utilize IS.

Identifying the attributes of highly competent IS users may shed light onto promising areas of both research and training that will most benefit other IS users. The attributes that were identified can be further scrutinized and tested to isolate those that can be trained or acquired by others versus those that are not. In future research, specific interventions (e.g., training programs) that encourage or develop the identified attributes will be explored. For those that are more innate, the attributes may present specific criteria that organizations can utilize in hiring individuals whose attributes will more appropriately fit with the job expectations. Overall, identifying the attributes that are most likely to foster highly competent IS users will provide greater opportunities for improved IS proficiency and greater IS benefits being realized for IS users.

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