Understanding Factors Influencing Proficient Information Systems Usage

Brenda Eschenbrenner  
*University of Nebraska at Lincoln, beschenb@unlserve.unl.edu*

Fiona Fui-Hoon Nah  
*University of Nebraska at Lincoln, fnah@unlnotes.unl.edu*

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UNDERSTANDING FACTORS INFLUENCING PROFICIENT INFORMATION SYSTEMS USAGE

Brenda Eschenbrenner  
University of Nebraska-Lincoln  
beschenb@unlserve.unl.edu

Dr. Fiona Fui-Hoon Nah  
University of Nebraska-Lincoln  
fnah@unlnotes.unl.edu

ABSTRACT

Variations exist among information system (IS) users’ abilities to effectively utilize an IS. Some users are able to maximize IS potential, while others are not. This research proposes to understand the attributes of individuals who are most capable of exploiting IS to its fullest potential as well as the management and organizational factors that facilitate the development of highly competent users. The Repertory Grid Technique was utilized to identify user attributes contributing to IS proficiency in Phase One of this research and will be utilized to identify management and organizational factors in Phase Two. The results will provide a comprehensive framework of cross-level factors contributing to IS user competency. Also, the results will highlight attributes that can be fostered in other IS users through training interventions or potential hiring criteria as well as management/organizational factors that can be implemented to improve individual performance with IS use.

Keywords

Repertory Grid, IS proficiency, IS user attributes, management factors, organizational factors

INTRODUCTION

Although information systems (IS) are readily implemented and utilized throughout many organizations today, the ability to utilize IS varies among individuals. For example, Boudreau (2003) studied a state institution’s successful implementation of an enterprise system and found different degrees of usage existed. Some individuals were readily struggling with using the system, while others became proficient and functional with the system. A user in Boudreau’s study even noted that employees “know the buttons to push for their task, but not necessarily what is around [the system]” (p. 232). Differences in abilities to utilize IS can be attributed to many different factors. Some may be intrinsic factors such as computer self-efficacy, and others may be extrinsic factors such as lack of appropriate training. With organizations developing greater dependencies on IS and gaining strategic advantages with IT/IS, being able to utilize IS effectively is becoming a necessity for every individual within the organization.

In a study by Jain and Kanungo (2005) on the nature of IS use and its impact on IS-enabled productivity, they assert that the nature of IS use, or the difference in the ways IS are used, may arise from many individual factors, such as personality and user competence, and that further research is needed to identify these antecedents and relationships with nature of IS use. To more effectively utilize IS in organizations, we need to understand not only the individual factors, but also the management and organizational factors influencing IS user competency. More specifically, the questions for this research are: What characteristics or attributes differentiate highly competent users of IS from those who are less competent? What management and organizational factors influence or facilitate the development of IS users’ competencies?

This research proposes to develop a cross-level analysis to understand IS user competency. First, this research examines the attributes of individuals who are highly effective at utilizing IS. Identifying these attributes will provide an opportunity to not only determine those attributes that can potentially be encouraged or enhanced with training (e.g., through more directed training programs or specific interventions to improve IS usage performance), but also to highlight specific hiring criteria that can be employed when evaluating individuals for such positions. Second, identification of management and organizational factors will help to generate recommendations of various mechanisms that can be employed to contribute to the development and continued sustenance of user competency.

LITERATURE REVIEW AND THEORETICAL BACKGROUND

In our review of the literature to describe highly competent or capable IS users, several constructs were identified. 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). Other user descriptions discuss superior IS usage as being able to “correctly exploit the appropriate capabilities of software in the most relevant circumstances” (Boudreau, 2003, p. 236).
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.

Our review also entailed identifying existing attributes of IS users that have been previously studied in MIS research. Table 1 presents a summary of our review 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 usage, but not in the context of achieving quality IS usage by highly competent IS users. In short, there has been no cohesive or integrative effort to identify the key attributes contributing to IS user competency.

<table>
<thead>
<tr>
<th>Source</th>
<th>Construct</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agarwal &amp; Prasad, 1998</td>
<td>Personal Innovativeness in the Domain of IT (PIIT)</td>
<td>“The willingness of an individual to try out any new IT” (p. 206)</td>
</tr>
<tr>
<td>Rank et al., 2004</td>
<td>Creativity and Innovativeness</td>
<td>Creativity refers to idea generation, whereas innovation refers to idea implementation… Creativity is truly novel, whereas innovation can be based on ideas that are adopted</td>
</tr>
<tr>
<td>Amabile, 1983, 1996</td>
<td>Components of Creativity</td>
<td>A novel and appropriate, useful, correct or valuable response to the task at hand</td>
</tr>
<tr>
<td>Butler &amp; Gray, 2006</td>
<td>Mindfulness</td>
<td>Individual mindfulness includes reasoning about new phenomena (openness to novelty), viewing situations from multiple perspectives (awareness of multiple perspectives), evaluating similarities and differences (alertness to distinction), recognizing the features of the present issue (sensitivity to different contexts), and orienting in the current situation (orientation in the present)</td>
</tr>
<tr>
<td>Bandura, 1997; Compeau &amp; Higgins, 1995; Thatcher &amp; Perrewé, 2002</td>
<td>Perceived Self-efficacy; Computer Self-efficacy</td>
<td>Beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments or a judgment of one’s capability to use a computer</td>
</tr>
<tr>
<td>Ghani &amp; Deshpande, 1994</td>
<td>Theory of Optimal Flow</td>
<td>The state in which people are so intensely involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost</td>
</tr>
<tr>
<td>Webster &amp; Martocchio, 1992</td>
<td>Microcomputer Playfulness</td>
<td>Degree of cognitive spontaneity in microcomputer interactions</td>
</tr>
<tr>
<td>Chung &amp; Tan, 2004</td>
<td>Focused attention/control (antecedents of perceived playfulness)</td>
<td>Focused attention is a user’s attention being completely absorbed in the interaction, and control is perception of being in charge of a given activity</td>
</tr>
<tr>
<td>Fagan et al., 2003-2004; Torkzadeh &amp; Angulo, 1992; Thatcher &amp; Perrewé, 2002</td>
<td>Computer Anxiety</td>
<td>Anxiety or fear experienced when confronted with possibilities of computer usage or the tendency of individuals to be uneasy, apprehensive, or fearful about current or future use of computers</td>
</tr>
<tr>
<td>Burger &amp; Blignaut, 2004; Loyd &amp; Gressard, 1984</td>
<td>Computer Attitude</td>
<td>Computer attitude is a mental state of mind which influences the way a person reacts towards computers… Computer attitude is composed of Computer Liking, Computer Anxiety, and Computer Confidence</td>
</tr>
</tbody>
</table>
In summary, the MIS literature seems to suggest that desirable IS users not only possess certain traits and characteristics such as creativity, self-efficacy, and positive computer attitudes, but they are also playful, innovative, and willing to accept, explore, and use technology. However, the various constructs identified from the MIS literature have been utilized mainly to describe IS users with regard to their intentions to use IS and their actual amount of IS usage, but not to explain or address quality of IS usage or to explicitly describe highly competent IS users.

Research regarding management/organizational factors that influence IS user competency has been somewhat limited considering most research has focused on various dimensions of IS/technology usage and perceptions of IS/technology users. As presented in Table 2, factors such as management support/commitment, training, facilitating conditions (e.g., help desk), and empowerment of employees have been studied in MIS research, but not in the context of developing IS competency among users. Other management or organizational factors that have not been studied in MIS research or IT/IS innovation research could also be relevant. Therefore, research is needed to generate a more complete understanding of the management/organizational factors that influence IS user competency in organizations.

<table>
<thead>
<tr>
<th>Source</th>
<th>Construct</th>
<th>Findings</th>
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<tbody>
<tr>
<td>Sabherwal et al., 2006</td>
<td>Top management support; facilitating</td>
<td>Found top management support to be directly related to IS use (effort or behavior of using the system), perceived usefulness, user satisfaction, user participation (in IS development), and facilitating conditions (process and resources such as a help desk). Facilitating conditions was found to directly influence user training, attitude, and experience.</td>
</tr>
<tr>
<td>Ragu-Nathan et al., 2004</td>
<td>Top management support</td>
<td>Found top management support influenced IS performance (perceptions of decision-making and management activity support, user satisfaction, achieving performance goals, and costs outweighing benefits) both directly and indirectly (through current and future IS portfolios as well as the structuring and control of IS).</td>
</tr>
<tr>
<td>Sanders &amp; Courtney, 1985</td>
<td>Top management support; training</td>
<td>Found that factors such as training and top management support were important factors in the successful use of DSS, with successful use measured as overall satisfaction and decision-making satisfaction.</td>
</tr>
<tr>
<td>Mathieu et al., 2007</td>
<td>Management support; empowerment of</td>
<td>Found that management support of technology usage influenced salespeople’s self-efficacy and their amount of technology usage, and management’s actions of empowering employees moderated the relationship between technology self-efficacy and technology usage.</td>
</tr>
<tr>
<td>Stratman and Roth, 2002</td>
<td>Strategic IT planning; executive</td>
<td>Developed a multi-item scale to assess ERP competence (considered a set of organizational, managerial, and technical skills that are antecedents to improved performance with an ERP) and identified eight constructs which include</td>
</tr>
</tbody>
</table>

Table 1. Attributes of IS Users from Previous Research
Table 2. Management/Organizational Factors from Previous Research

| Project management; IT skills; business process skills; ERP training; learning; change readiness | strategic IT planning, executive commitment, project management, IT skills (IS configuration and maintenance skills), business process skills, ERP training, learning (identifying recent ERP applications), and change readiness. |

Hence, our research question is two-fold: “What are the attributes of highly competent users of IS that distinguish them from other IS users?” and “What are the management/organizational factors that contribute to the development of highly competent IS users?” Identifying key attributes of highly competent users will assist in exploring opportunities to enhance training in other users, which can lead to improvements in quality of IS usage. For those attributes that are not feasibly trainable, specific hiring criteria can be developed to more effectively identify individuals better suited to perform tasks associated with a highly competent user function. Also, identification of management and organizational factors that support the development of highly competent users will help to promote increased and continued levels of user competencies in IS usage.

RESEARCH METHOD AND PROCEDURES

There are two phases in this research. These two phases are described below.

**PHASE ONE:**

To identify attributes of highly competent users of IS, the Repertory Grid (RepGrid) Technique (Kelly, 1955) was utilized. The strength of the RepGrid technique is in capturing individuals’ personal constructs that bring meaning and understanding to various phenomena (Stewart, 1981). Hence, it is an appropriate technique to uncover attributes of highly competent users. The research procedure involved interviewing users who utilize IS on a regular basis and asking them to identify other IS users that they know. Details of the RepGrid technique are explained in Stewart (1981) and Fransella et al. (2004). The research procedures consist of seven main steps:

**Step 1: Participant Selection**

IS users were selected from a variety of industries to increase the breadth of highly competent user attributes being elicited and to increase the generalizability of our findings. The sample size for the study was determined by the point of saturation where no new constructs emerged from interviews with additional subjects. 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**

The next step was to solicit elements which are the focal point of the study (Tan and Hunter, 2002). In this research, the potential elements are IS users that the participant is familiar with whom either currently work with or have previously worked with IS. At the beginning of each interview, the participant was asked questions to help them identify highly and least competent IS users that they know. The participant was 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**

The construct identifies the interpretation of the elements (Tan and Hunter, 2002). Research participants were 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 to its full potential. 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 meanings 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).

The participant was asked to first arrange the elements’ cards so they were ranked in terms of representing their relative positions on the bipolar constructs identified, and then 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) indicated that previous research identifies seven to ten triads to be sufficient.

Step 5: Add Two Bipolar Elements

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 the construct elicitation process. These cards were included after the above procedures with the original set of six elements to introduce additional opportunities to elicit any other relevant constructs. Steps 3 and 4 were repeated ensuring that each triad had the Ideal User, Incompetent User, or both included until the point of redundancy was reached.

Step 6: Visual Focusing and Review

After the grids completion, visual focusing was utilized in which the participant was asked to review the grid and evaluate the ratings given to each element for the respective construct to provide opportunities for changes. To further verify the reliability of the constructs elicited, the participant was asked to focus on the highly competent users of IS that they identified earlier and asked probing questions such as: “If you can envision, for a moment, those individuals that you most closely associate with an Ideal User, how would you describe these people in terms of what makes them ideal users of information systems?” If any new constructs emerged, they were included in the existing list and step 4 was repeated.

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 by each of two coders to group these constructs into categories following the method described by Moore and Benbasat (1991). Based on these prescribed procedures, constructs were placed on individual cards, and each coder sorted the cards into piles of similar constructs and provided a label to each pile. 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.

Findings

Two coders examined the 416 bipolar attribute pairs that participants generated and identified the similarities and differences using the sorting procedure described by Moore and Benbasat (1991). As noted in Figure 1, several categories emerged including Personality Characteristics and Personal Abilities, Social Skills, Experience & Education, and Experiential Learning.

**Personality Characteristics & Personal Abilities**

Research participants indicated that highly competent users have certain personality characteristics that describe highly competent users as persevering in their pursuits, maintaining self-assurance, being committed and taking pride in what they do, and holding a positive attitude. They are flexible and open-minded, but are also detail-oriented and focused on time management. They possess an exploratory nature and are considered risk takers.

Their personal abilities include their intellect, problem-solving skills, and propensity to learn. They were described as being both logical and analytical. Being labeled as problem-solvers, they have the ability to find solutions to their IS dilemmas and assist with trouble-shooting. They are willing to invest the time to learn, experience the learning curve, and are willing to make mistakes.
Social Skills

Highly competent users were described as individuals who are willing to collaborate, share information, and train others. They maintain both oral and written communication skills as well. Hence, they work well with others and can communicate effectively.

Experience & Education

Research participants indicated that highly competent users have varying ranges of experiences in tasks and responsibilities. Interestingly, research participants identified specific non-IS experiences that they believed contribute to competence in IS and indicated that highly competent users have the ability to transfer these skills to the IS domain.

Research participants also indicated that the highly competent IS users they identified for this research have some type of advanced or technical degree. After research participants provided attributes related to this category, laddering questions were utilized to understand why and how education impacted competency in using IS. These subsequent attributes that were generated are included in the other respective categories.

Experiential Learning

Experiential Learning encompasses previous encounters with technology as well as continued use of technology. Research participants indicated that highly competent users were individuals who grew up and/or had experiences using technology. These individuals have also incorporated technology and IS as a routine part of their jobs and some even as part of their lives.

Associated with this is their propensity to explore technology, and to be unafraid to try new technologies and research how things work. Highly competent users were also described as appreciating the value that technology presents and the benefits that IS can provide. Some participants noted that these users see the opportunities of IS and see how it can contribute to their work.

As presented in the bottom half of Figure 1, Personality Characteristics and Personal Abilities, Social Skills, and Experience & Education are attributes that contribute to one’s Experiential Learning and, ultimately, to IS User Competency.

![Figure 1. Cross-level Factors Influencing IS User Competency in Organizations](image-url)
PHASE TWO:
To develop a cross-level analysis of factors that influence user competency, Phase Two will focus on management and organizational factors. Upon identification of these factors, the findings from Phase One will be further expanded to a comprehensive framework that incorporates both individual (identified in Phase One) and management/organizational (to be identified in Phase Two) factors influencing user competency – see Figure 1.

Phase Two will also be conducted utilizing the Repertory Grid technique as described above. The same steps will be followed but the research participants will be highly competent IS users from a variety of industries. The elements will be managers and other executives that have influenced the research participants’ learning and ultimate proficiency in using IS. The research participants will then be asked to identify those managers/executives that had the most positive influence and those that had the most negative influence on their abilities to use IS, and these elements will be the pool of elements to be utilized during construct elicitation. The constructs that are elicited will be in the context of describing how the elements are similar and different in terms of their influence on the research participant’s learning and development into a proficient IS user. The same steps (Steps 4 through 7) for developing links, adding bipolar elements, visual focusing and review, and analysis of RepGrids will be followed as they are described in Phase One.

The categories that emerge from the coding steps of grounded theory for this phase will then be incorporated into a comprehensive user competency framework as depicted in Figure 1 with the categories that emerged from the coding process in Phase One. This framework will then provide a cross-level analysis of individual and management/organizational factors that contribute to IS user competency in organizations.

CONTRIBUTIONS AND FUTURE RESEARCH
In summary, identifying the attributes of highly competent IS users and the management/organizational factors that influence user competency 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 versus those that are not. If users are trained or encouraged to foster similar attributes that are identified as trainable, they may be able to reach higher levels of performance. 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.

The management and organizational factors that are identified can be further evaluated for potential mechanisms that can be employed to facilitate user competency. The identified factors can also be assessed for changes in training formats or organizational policies regarding IS usage. Therefore, various organizational features or management support devices can be identified to help facilitate the development of competent IS users. Overall, identifying the attributes and management/organizational factors that are most likely to foster highly competent IS users will provide opportunities for improving IS proficiency in organizations.

REFERENCES


