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UNDERSTANDING ATTRIBUTES OF HIGHLY COMPETENT INFORMATION SYSTEM USERS: A QUALITATIVE APPROACH

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Abstract

Individuals differ in their abilities to use information systems (IS) effectively, with some achieving exceptional performance in IS use. Various constructs have been identified in the literature to describe IS users with regard to their intentions and actual usage of IS, but studies to describe highly competent IS users or their ability to achieve higher quality of IS usage are lacking. 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 framework includes 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 Formal Education as attributes of highly competent users. 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, IS Training.

INTRODUCTION

The ability to utilize information systems (IS) varies among individuals. Some IS users are able to utilize an 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. 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. As 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 among all IS users to increase their proficiency in using IS. In this research, the focus is to identify these attributes in IS users that contribute to their IS user competency. The context of the study is on individuals who utilize IS within organizational boundaries to accomplish specific tasks in their organization. The focus of this research is to identify the attributes of IS users who are not only able to efficiently and effectively complete routine tasks, but are also able to accomplish novel tasks using IS.

With regard to usage of IS applications, 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). Therefore, maximizing the performance from IS use is not predominant. Individuals are also less likely to be able to apply subject-matter knowledge if their IS skills are lacking. Mackay and Elam (1992) found that in the application of a decision aid to resolve a problem, users needed to develop a certain level of expertise before they could apply their subject-matter knowledge. Elite IS users are able to apply many of the features that IS provide and go beyond the basic IS training to apply IS in more extensive and beneficial ways. For example, Boudreau (2003) studied a state institution's successful implementation of an enterprise system and found different degrees of usage, with some employees struggling with using the new system. Other individuals in the same organization were identified as becoming functional, experienced users of the system, while the others remained less functional and relied on their more proficient colleagues for assistance. These more proficient users became familiar with the system and utilized it beyond the rudimentary ways to develop processes that better suited their needs. Also, Carte et al. (2005)

found project teams' performances were noted as being enhanced by individuals who maintained both relevant business and technology capabilities. Therefore, studying differences in these individuals may provide explanations as to the variances in effective IS usage and provide insights into possibilities of training/interventions that can improve users' abilities to utilize IS.

Jain and Kanungo (2005) studied the nature of IS use, or the difference in the ways IS are used, and its impact on IS-enabled productivity. They suggest that these differences 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. More specifically, the question that exists among many in research and practice is: Why is it that some individuals are better able to utilize IS than others? This research expands on this question to ask: Are there certain characteristics or attributes about these individuals that make them different from others in regards to their ability to utilize IS? Answering this question can provide insights into potential training interventions or hiring mechanisms that can be employed to achieve greater IS proficiency in organizations. 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?"

Our 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. Some IS users are able to identify novel, beneficial uses in comparison to their peers. Others, however, may be able to use IS, but to a limited degree. For example, they may be able to carry out specific tasks that they have been shown through training or that have been demonstrated by others, but are especially limited in utilizing the system in novel ways or effectively applying the system to derive additional benefits beyond what others have communicated to them. 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 presents opportunities to understand and improve usage of IS. Therefore, the contribution of this research is in developing a grounded understanding of IS user competency.

LITERATURE REVIEW AND THEORETICAL BACKGROUND

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). 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. 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 presents 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 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 1: PREVIOUS RESEARCH CONSTRUCTS

Source	Construct	Description	Findings
Agarwal & Prasad, 1998	Personal Innovativeness in the Domain of IT (PIIT)	"The willingness of an individual to try out any new IT" (p. 206)	Validated scale for measuring PIIT. Found significant moderation for perception of compatibility and usage intentions.
Yi et al., 2006	Adopter Category Innovativeness	Individual innovativeness as an adopter category	Found individual innovativeness to be direct determinant of user perceptions of innovation characteristics (usefulness, ease of use, and compatibility)
Rank et al., 2004	Creativity and Innovativeness	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	Identified research gaps in process differentiation, integration of concepts, and cross-cultural analysis
Amabile, 1983, 1996	Components of Creativity	A novel and appropriate, useful, correct or valuable response to the task at hand	Identifies Components of Creativity: domain-relevant skills (or expertise), creativity-relevant skills (or creative thinking), and task motivation

Butler & Gray, 2006	Mindfulness	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)	Suggest including individual and collective mindfulness in studies of design, use, and management of IS in realizing reliable work performance
Bandura, 1997; Compeau & Higgins, 1995; Thatcher & Perrewé, 2002	Perceived Self-efficacy; Computer Self-efficacy	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	Development and validation of measurement. Compeau & Higgins (1995) found computer self-efficacy to influence affect (or liking), computer anxiety, outcome expectations, and actual usage. Self-efficacy positively influenced by work group associates and their usage. Thatcher & Perrewé (2002) found computer self-efficacy to be influenced by computer anxiety and personal innovativeness in IT.
Karahanna, 1999; Karahanna & Agarwal, 2003; Nah, et al., 2004	Symbolic Adoption	A user's voluntary mental acceptance of technology. Dimensions of symbolic adoption include mentally accepting the technology, committing to its usage, positive evaluation of the return to be obtained from using the technology (worthiness), and high levels of enthusiasm and eagerness to engage the technology	Found to be an antecedent of intentions to explore when uses are other than voluntary. Found differences between symbolic adoption and behavioral intention to adopt. Found perceptions of fit and usefulness, mediated through attitude, influence symbolic adoption. Found perceptions of compatibility and ease of use influence symbolic adoption directly and through attitude.
Ghani & Deshpande, 1994	Theory of Optimal Flow	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	Sense of control and task challenge factors resulted in optimal flow. Flow related to exploratory behavior which was related to extent of computer use.
Webster & Martocchio, 1992	Microcomputer Playfulness	Degree of cognitive spontaneity in microcomputer interactions	Developed measure and found microcomputer playfulness to have positive relationships with computer attitude, computer competence, computer efficacy, and an inverse relationship with computer anxiety

Chung & Tan, 2004	Focused attention/control (antecedents of perceived playfulness)	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	Studied the antecedents of perceived playfulness and found focused attention and control to be important cognitive dimensions.
Fagan et al., 2003-2004; Torkzadeh & Angulo, 1992; Thatcher & Perrewé, 2002	Computer Anxiety	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	Studied relationships among computer self-efficacy, anxiety, experience, support and usage. Found computer anxiety negatively related to self-efficacy and experience; Presents the concept, correlates, and suggestions for future research. Computer anxiety is influenced by personal innovativeness in IT and trait anxiety, and influences computer self-efficacy.
Burger & Blignaut, 2004; Loyd & Gressard, 1984	Computer Attitude	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	Found negative relationship between computer attitude and computer experience; Examine reliability and validity of Computer Attitude Scale

In summary, the literature seems to suggest that desirable IS users are not only creative, innovative, playful, willing to accept and use technology, and not afraid of technology, but they also have high self-efficacy and positive computer attitudes. However, the various constructs identified from the literature review have been utilized mainly to describe IS users with regard to their intentions to use IS and their actual usage, but not to explain or address quality of IS usage or explicitly describe highly competent IS users. Although these attributes may be descriptive of highly competent IS users, there may be *new* constructs that have not been previously identified that describe highly competent IS users. In other words, it is not clear if these identified constructs would apply in describing highly competent IS users and if there are new constructs to describe highly competent users that may not have been previously explored in the MIS literature.

Hence, the research question posed for this study is: "What are the attributes of highly competent users of IS that distinguish them from other IS users?" Generating an understanding of attributes of highly competent IS users presents opportunities to identify any link between current research constructs (i.e., those presented in Table 1) to these users as well as determine if other constructs may be relevant. Identifying key attributes of highly competent users can also assist in exploring opportunities to enhance training in other users, which may lead to

improvements in IS usage, or the development of hiring criteria to more effectively identify individuals better suited to perform tasks associated with a highly competent user function.

RESEARCH METHODOLOGY

The Repertory Grid Technique (RepGrid) was utilized 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 from the perspective of business professionals who are also IS users. Details of the RepGrid technique are explained in Stewart (1981) and Fransella et al. (2004). The research procedures consist of six main steps explained briefly below:

Step 1: Participant Selection

IS users were selected from a variety of industries, versus just one organization, to increase the breadth of highly competent user attributes and increase the generalizability of our findings. If just one organization was selected, a smaller number of highly competent users may have been identified (i.e., several participants may have identified the same highly competent users) and, hence, only attributes from this smaller selection would potentially be obtained. 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. The definition of IS was provided to participants to determine eligibility for participating in this research and when selecting IS users that they know, as described in Step 2. IS 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.

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 who 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 for the RepGrid study and utilized in Step 3.

Step 3: Identify Constructs

The *construct* identifies the interpretation of the elements (Tan and Hunter, 2002). According to Fransella et al. (2004), individuals interpret events 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. The research participant was first asked to identify constructs using the triadic approach. More specifically, three elements were selected by the researcher (i.e., randomly drawn but ensuring that both highly competent and least competent categories were represented) 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 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). 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. If elements were construed as being the same, they were placed together so the participant was not forced to rank one over the other. 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. Then, 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. Definitions for these individuals (utilizing the definition of highly competent user noted above) were provided to the participant. These cards were 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 was reached.

Step 5: 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 ensure they agreed with what had been accomplished. Also, the participant was asked if the ratings given to the respective elements represented the participant's conception of an 'Ideal User' and 'Incompetent User.' 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 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 steps 4 and 5 were repeated.

Step 6: 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.

Data Collection

A total of 20 RepGrid sessions were conducted with 10 males and 10 females. Table 2 shows the demographic information of the participants. As presented in Table 2, research participants have an average work experience of 15 years and an average of 11 years of using IS. Half of the participants are in management/supervisory positions and examples of IS used by participants include SAP, Siebel, and Lawson.

TABLE 2: DEMOGRAPHIC INFORMATION				
Age	**21-30**	**31-40**	**41-50**	**51-60**
# of Participants	6	7	5	2
Job Position	**Management**	**Non-Management**		
# of Participants	10	10		
	Mean	**Max**	**Min**	
Work Experience	15	30	4	
IS Experience	11	30	2	
No. of people supervised	2	14	0	
Industry Examples	*Retail* *Publishing*	*Healthcare* *HR Consulting*	*Manufacturing* *Insurance*	*Chemical Engineering* *Financial Services*
IS Examples	*Lawson* *Quadra Med*	*SAP* *Rumba*	*Siebel* *COGNOS*	*Datatel* *Custom Developed*

A total of 416 constructs were identified from the participants. The saturation point was reached after the sixth participant. However, additional interviews were conducted to ensure validity. Also, to ensure the order of the participants did not influence the saturation point, the saturation point was reviewed as if participants were interviewed in reverse order. If the reverse order of conducting interviews had taken place, the saturation point would have happened after 12 participants. Hence the saturation point was adequately reached.

All participants were able to identify 3 top and bottom IS users except for one participant who could only identify 2 of each. A minimum of 7 triads were conducted for all participants and most sessions lasted approximately 1 to 1 ½ hours. To develop an understanding of highly competent user attributes, the 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) with the results detailed below.

To address potential issues of construct validity and reliability, Yin's (1994) three Principles of Data Collection are addressed. The three principles are addressed using independent coders, creating a database, and maintaining a chain of evidence. In the first round of independent coding, Cohen's Kappa of .76 was achieved between the two coders. In the second round, each coder then independently reviewed their own and the other coder's sorting results, and indicated if they agreed with their original classification or the other coder's classification for constructs where they coded differently. After reviewing each other's coding and making any corrections each of them deemed appropriate, Cohen's Kappa of .94 was obtained. The results are acceptable as Sun and Zhang (2006) who cite Moore et al. (1995) and Jarvenpaa (1989) that Kappa scores no lower than .65 are considered acceptable. The remaining discrepancies were discussed and resolved through consensus between the coders. In addition, coding results were verified with the participants by presenting the results to them and giving them the opportunity to rename categories or subcategories, reclassify attributes, redefine any category or subcategory, or pose any other changes or questions. A validation check was also performed to ensure that research participants identified individuals who met the definition of highly competent IS user and not just one who is technology savvy with no business application capacity.

DATA ANALYSIS

The grounded theory approach was used to analyze the qualitative data collected and to develop a conceptualization of IS User Competency. The strength of this approach is providing a means with which theory can be grounded in categories of data that have been developed through identification of distinctive relationships. Hence, the grounded theory approach is appropriate for developing a grounded theoretical conceptualization of IS User Competency.

Open coding entails identifying and categorizing like phenomena and then labeling these categorizations. Open coding was executed in this research by examining the bipolar attribute pairs that participants generated and identifying the similarities and differences as described by Strauss and Corbin. Categories that contained a rich set of dimensions were further broken down into subcategories. The categories and subcategories generated from this process and examples of bipolar ends of the constructs are shown in Table 3.

TABLE 3: CONSTRUCT CATEGORIZATION EXAMPLES		
CATEGORY/*SUBCATEGORY* (No. of Constructs)	**Examples of Positive-Negative Bipolar Ends**	**Definition**
Domain Knowledge of and Skills in IS Usage (40)		Understanding how IS operate and ability to operate IS
Domain knowledge of IS (21)	"Understand how IS operates - Being a strict user/not a supporter"	Technical understanding and basic knowledge of IS & operations
Proficiency at using IS (19)	"Effective use of system - Can't effectively use system"	Ability to perform normal IS operations well and utilize IS
Perception of IS Value (27)	"Recognize potential benefits of IS - Not being able to recognize value/connection to job"	Ability to see the benefits and opportunities that IS can provide
Sense of Curiosity (5)	"Curiosity w/ technology - Phobia of technology"	Possess a curious, exploratory nature
Dedication (9)	"Takes ownership of information/reports - Just doing job"	Commitment to one's job with high ownership and pride in tasks performed
Precision in Task Execution (13)	"Likes to verify accuracy - Produce reports only/not verify"	Attention to accuracy and detail
Ability and Desire to Learn (48)		Ability and interest to self-initiate learning, find solutions to problems and discover new knowledge
Willingness to Ask Questions (2)	"Willing to ask ?'s - Don't ask ?'s"	Willingness to probe deeper to find answers
Capacity for learning (9)	"Ability to learn - Not able to learn"	Ability to assimilate new knowledge
Ability to learn quickly (9)	"Quick learner - Slow learner"	Ability to quickly understand and apply knowledge gained
Ability to learn independently (9)	"Facilitate own learning of IS - Have to be taught how"	Ability to self-initiate learning
Willingness to learn (19)	"Willing to understand new IS - Unwilling to try to understand"	Desire to obtain new knowledge and understanding
Ability to Solve Problems (10)	"Find ways to make things work - Make bigger problems/affects other things"	Capacity to resolve issues and find solutions
Willingness to Try and Explore (37)	"Not afraid of IS - Fearful"	Willingness and comfort with trying technology and using IS
Adaptability (17)	"Willing to change - Unwilling to change"	Willingness to embrace change and flexibility to adapt to changes
Motivation/Perseverance (39)	"Doing whatever it takes to get job done - Clock-watchers/not focused on job"	Highly driven and determined to accomplish a task, hold a strong work ethic and is reluctant to give up one's pursuits
Generation Factors (8)	"Younger - Older"	Generation one belongs to

Formal Education (8)	"Higher education - Less education"	Holds higher education degree
Open-mindedness (27)	"Sees big picture - Narrow-minded"	Being able to reason about new ideas/approaches and being aware of multiple perspectives
Positive Attitude (4)	"Focus on positive - Focus on negative"	Having a positive attitude
Confidence (13)	"Self-confident/assured - Lacking confidence"	Sense of self-assurance in one's abilities
Job Experience (30)		Specific experiences in job-related tasks
Variety of Job Experience (11)	"Exposure to multiple situations - Not exposed to multiple situations"	Exposure to multiplicity and variation
Task Experience (19)	"Users of IS reports - Not IS report user"	Specific experience in job-related tasks
Communication Skills (7)	"Communicator (oral & written) - Inability to communicate"	Capacity to communicate (oral and written)
Willingness to Teach, Share, and Collaborate (19)	"Able to train others - Not able to train others"	Willingness to share knowledge and work with others
Intellectual Abilities (18)	"Logical thinking - Illogical"	Being quick, logical, and analytical in thinking processes with a high-degree of intelligence
Risk Taking (3)	"Not fearful/takes risks - Afraid of breaking/doing something wrong"	Willingness to take risks
Efficiency at Task (3)	"Efficiency at using IS - Inefficient at using"	Ability to manage time well and carry out tasks efficiently
Exposure to Technology (31)		Prior experiences with technology
Prior Experience (26)	"Grew up w/ technology - Minimal exposure to technology"	Previous opportunities to learn/use IS
On-going Use (5)	"Technology part of life - Have to learn how to incorporate"	Continuous routinized use of technology

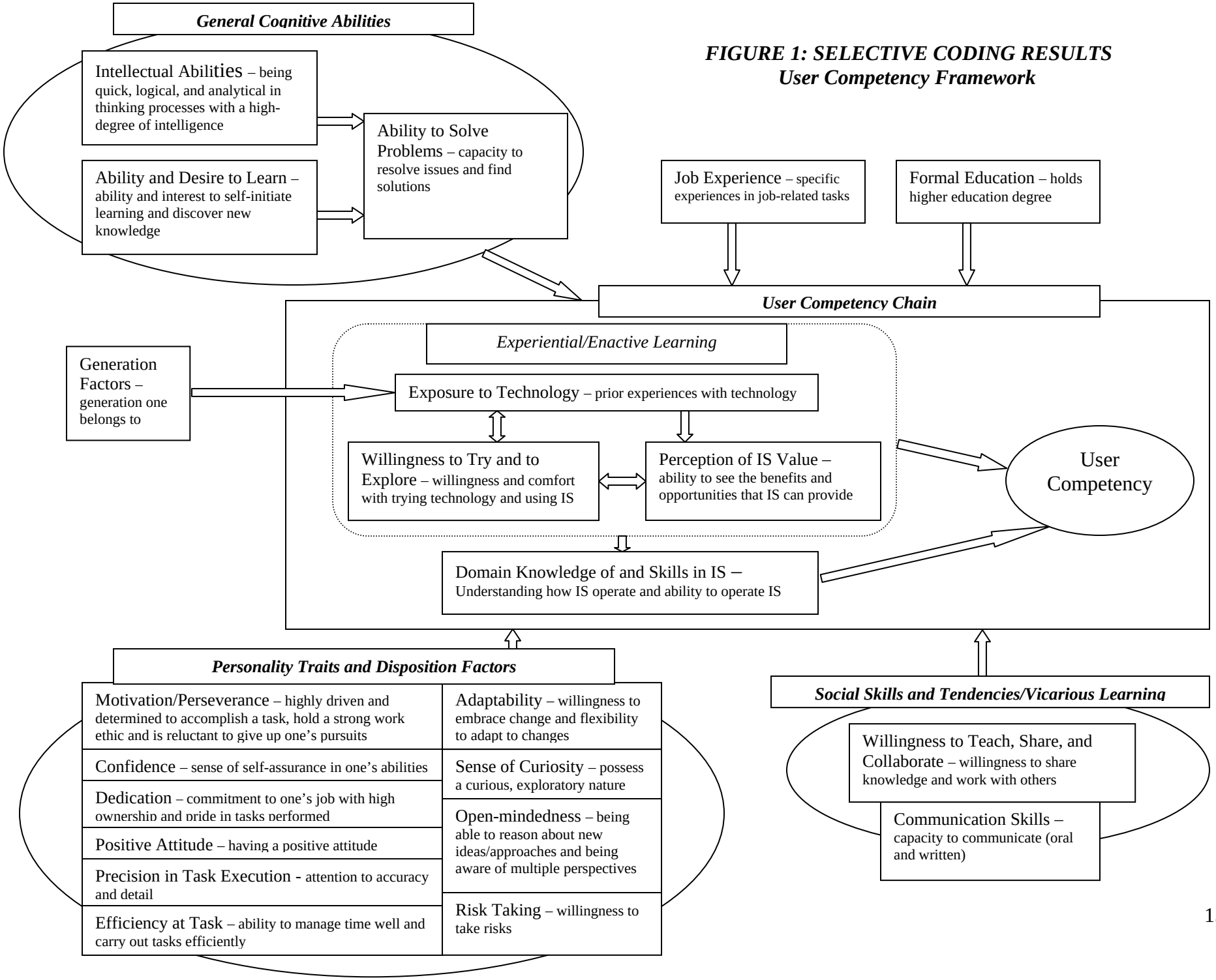
The next step is axial coding which entails relating categories to their respective subcategories. Strauss and Corbin state that "In axial coding, categories are related to their subcategories to form more precise and complete explanations about phenomena…along the lines of their properties and dimensions" (p. 124). For this research, the term *theme* is substituted for the overarching *category*. The final step, selective coding, is the process in which a core category is identified and "The process of integrating and refining the theory takes place" (Strauss and Corbin, 1998, p. 143). This step also entails integrating the concepts as Strauss and Corbin indicated, "if theory building is indeed the goal of a research project, then findings *should* be presented as a set of interrelated concepts, not just a listing of themes." (p. 145). Strauss and Corbin also acknowledge that the use of existing literature can be supplemental to the theory development stage in a variety of ways. They suggest that being familiar with the literature can increase a researcher's sensitivity to significant concepts that are common in the literature and are generated in the data and "can be used to confirm findings (p. 51)…allows for extending, validating, and refining knowledge in the field" (p. 52). Therefore, existing literature is used to help identify the relationships among the themes and related categories.

As can be seen in Figure 1, several overarching themes emerged during axial coding. During selective coding, 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 that this figure does not incorporate the links between the themes or the factors within each theme that are outside the User Competency Chain, but only their potential influence on the Chain. General Cognitive Abilities, Personality Traits and Disposition Factors, Job Experiences, Formal 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.

FIGURE 1: SELECTIVE CODING RESULTS
User Competency Framework



Shanteau's Theory of Expert Competence (1992) acknowledges that certain factors contribute to competency – one of these is domain knowledge that can be obtained from hands-on experiences dealing with problems as well as from textbooks. Therefore, Domain Knowledge and Skills may also come from training as well as formal schooling.

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) which is more consistent with the 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, may lead to User Competency.

Within the theme of Experiential Learning, Exposure to Technology is proposed to be influenced by Generation Factors considering the exposure to technology is different for each generation and continually changes for each generation, which thereby influences one's potential experiences. This category, Exposure to Technology, is proposed to have an effect on Willingness to Try and to Explore and on Perception of IS Value because one's experiences may determine the likelihood that they will explore technology again and will influence their interpretation of the benefits that IS can provide. Willingness to Try and to Explore may in turn have an effect on Exposure to Technology because one's initial comfort level with trying technology might impact the extent of their experiences.

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). This exploratory nature may also be associated with microcomputer playfulness, which is described as "the degree of cognitive spontaneity in microcomputer interactions" (Webster and Martocchio, 1992, p. 204). In Webster and Martocchio's research, they found positive relationships between microcomputer playfulness and computer competency. Hence, the category Willingness to Try and to Explore is expected to influence Exposure to Technology, and the entire theme of Experiential/Enactive Learning would impact User Competency. This relationship between Exposure to Technology and Willingness to Try and to Explore might also work in the reverse. As one continues to be exposed to technology, their comfort levels with technology could increase for highly competent

users as could their propensity to continue exploring. Therefore, Exposure to Technology is proposed to be an influential factor of Willingness to Try and to Explore.

Willingness to Try and to Explore is also expected to influence Perception of IS Value, and vice versa, because one's exploratory nature may influence the opportunities one might envision, and the perception one holds of the potential of IS may influence future ambitions to explore IS. Perception of IS Value is related to the dimension of symbolic adoption (Karahanna and Agarwal, 2003) 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 as well as identified as an antecedent of intentions to explore (similar to the attribute of Willingness to Try and to Explore noted above). Therefore, Perception of IS Value is proposed to influence Willingness to Try and to Explore as well as the reverse.

Social Skills and 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. For example, responding to questions can cause one to create new inferences not previously considered, which contributes to one's ultimate 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 a task with others.

Communication skills have also contributed to part of this learning process as it provides the means with which discussions can take place. Shanteau (1992) identified the psychological traits of excellent communication skills as a factor influencing expert competency. Therefore, the Social Skills and Tendencies theme is renamed to include Vicarious Learning and is shown in the figure as a potential factor influencing the User Competency Chain.

Job Experience

Job Experiences encompasses specific experiences that contribute to IS skills as well as a variety of experiences. The User Competency Chain is proposed to be impacted by Job Experiences because one's experiences at completing certain tasks may influence their learning an IS through hands-on application or the Domain Knowledge and Skills obtained. Ackerman (1988) states

that performance is determined in some part by "task-appropriate broad-content abilities (e.g. verbal abilities for tasks that demand processing of semantic material" (p. 293). Sternberg (1996) suggests that concepts one obtains are organized in a meaningful mental structure called schema. In novel situations, information in schemas can be used to draw inferences. Therefore, these mental structures that may have been developed with one's Job Experiences may be referenced when one is involved with Experiential Learning of IS.

Formal Education

Formal 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. Through education programs, IS users may achieve greater knowledge and enhanced skill sets through formal training and opportunities to explore technology/IS, by increasing their understanding of the benefits and opportunities that IS can provide, and by being encouraged to utilize IS or technology.

General Cognitive Abilities

General Cognitive Abilities encompasses 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. Being analytical and logical as well as holding a certain degree of intelligence may certainly influence one's capacity to solve problems. In addition, being willing to learn and able to learn could influence one's general problem-solving ability in terms of their ability to reference previously learned material and apply such material to a given problem. Overall, one's general cognitive abilities are expected to influence the User Competency Chain. Ericsson and Charness's (1994) citing Gardner's work (1983) make the argument that "exceptional performance results from a close match between the individual's intelligence profile and the demands of a particular domain" (p. 726). Also, as previously mentioned, Shanteau's (1992) Theory of Expert Competence suggests that domain knowledge can be obtained from experiences dealing with problems. Therefore, working specifically with problems might contribute to Domain Knowledge that is achieved, thus impacting the User Competency Chain.

Personality Traits and 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. These traits and factors are considered influential to the User Competency Chain in that without these specific traits, a very different outcome may be obtained. For example, research participants indicated that highly competent users were inquisitive and open to new ways of doing things. Without open-mindedness, they may be limited to performing very structured tasks and may not have any novelty to resolving issues. Having a flexible and unconstrained approach when experiencing technology first-hand might influence the novelty in IS competency gained. In addition, one research participant indicated that highly competent users were motivated to help solve problems. Without motivation and perseverance, their competencies may not be deployed or may only be deployed to a very limited degree. Also, one's natural curiosity and risk-taking propensities may influence one's willingness to explore technology and a positive attitude could possibly impact one's perception or view of IS value.

Research participants also identified confidence as an attribute of highly competent IS users (category labeled Confidence) and indicated that these users were confident in their abilities. Bandura (1997) defines perceived self-efficacy as the beliefs one has in their capabilities. Although he noted that confidence is different from self-efficacy in that it indicates strength in belief and not specifically what the certainty pertains to, he also notes that confidence is more of a catchword. Therefore, this catchword provided by research participants (and the definition that they confirmed being sense of self-assurance in one's abilities) is similar to Bandura's definition of self-efficacy. Therefore, we construe that the research participants were using the catchword confidence synonymously as self-efficacy. Computer self-efficacy is defined as one's judgment of his/her abilities to utilize a computer and was also found to influence emotional reactions to computers and actual computer use (Compeau and Higgins, 1995). Therefore, based on the above description, Confidence is considered overlapping with the construct Computer Self-Efficacy in this context. These findings indicate that Confidence or Self-efficacy could influence the User Competency Chain.

Summary of Findings

The results from this study have provided insights into the attributes of highly competent IS users. Research participants indicated that, from their personal construct systems that they developed, 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 an IS can provide and have an understanding as well as the capability to operate an 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.

CONCLUSIONS, IMPLICATIONS AND 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.

A possible limitation of this RepGrid study is that it may not tap on cognitive processes of highly competent users as cognitive processes are largely 'hidden' or not directly 'visible' to others. Further, the proposed framework requires additional testing to provide support for the suggested links as well as exploration of additional factors that may influence the User Competency Chain, such as work environment. The attributes identified in this study are for IS users and additional research is needed to understand the generalizability to other types of phenomena such as Internet usage.

The implications of this research are many. As noted by the research participants, highly competent users have been and continued to be exposed to technology, implying that continuous practice can occur. Practice is, of course, heavily emphasized in any learning or expertise subject-matter (Feltovich et al., 2006), and would hence be a vital area of consideration in acquiring IS competence and increasing the amount of IS training. For individuals who are less

familiar with technology and need more time to learn to use an IS, practice provides even greater promise. Ackerman (1988) indicates that practice can reduce performance differences between the fastest and slowest learners. Of importance to note, however, is the type of practice. Ackerman suggests that "With practice, though, consistent tasks allow for skill acquisition, whereas inconsistent tasks generally do not" (p. 294). Hence, the structure of practice exercises needs to incorporate consistency initially for certain IS skills to be acquired.

Future interventions may consider training users to be self-sufficient learners and problem-solvers. Doll et al. (2003) have proposed a benchmarking process to assess post-implementation learning (learning after an application is put into operation). They acknowledge that post-implementation learning "represents 'firm-specific' knowledge that must be developed internally…without this continuing IT learning, there will always be a gap between how technology is actually used and the realization of its full potential" (pp. 199-200). Their model presents the impact of both induced learning (being aware of one's efforts to improve) and autonomous learning (being unaware of learning which takes place through repetitive use). Models and benchmarks such as these can be utilized to gain further insights into the process of highly competent user's learning ability. These interventions may also enhance problem-solving skills. For example, IS users may engage in problem representation tasks or be taught various problem-solving strategies such as means-ends analysis (Bruning et al., 2004). They can be encouraged to conduct solution evaluations that entail evaluating both the product and the process of the problem-solving process so they can determine if the best solution was obtained and what refinements in the process can be made or utilized in future problem-solving tasks.

Considering that highly competent IS users were able to visualize processes and understood how the pieces (referring to the various functions of the system) fit together, initial forums to teach IS users how to conceptualize the processes of and functions within the system and understand what takes place in the "black box" may be beneficial. Many of the participants commented that the incompetent users were the ones who only looked at the data entered or retrieved on the screen, but had no idea what took place behind the screens. Hence, focusing IS training on conceptual understanding of the system and its relationship to business functions or processes is key. They can visualize the functioning of the system as they are executing certain procedures, and visualize how the system's processes function in an interrelated manner. This may assist in their overall knowledge of the system's functioning and may assist in trouble-

shooting. For example, when an issue arises, they can visualize the processes that may have caused the issue and be able to trace through the system to explore the issue further.

Participants also indicated that highly competent users are adaptable in that they are willing to embrace change and be flexible. Another consideration is to focus on change-orientation before any system training commences. Informing trainees of changes that are imminent and the impact these changes will have so they are aware and can be mentally prepared. Also, to build confidence which was also identified as an attribute of highly competent users, more scaling and scaffolding approaches can be considered. Initial tasks can be relatively easy and then increase in difficulty, with support gradually taken away as appropriate, so confidence levels are built throughout the experience. Also, incorporating stress relievers throughout may help with maintaining a positive attitude and improve perseverance.

Although training may be considered to improve certain attributes, some of these may be more appropriately considered as hiring criteria. Although every position and job responsibility will vary on the requirement for these attributes (e.g., formal education, intellectual ability), some general attributes were highlighted by the research participants and hence, are worth considering when developing employment screening mechanisms. For example, attention to detail may be considered for those positions in which accuracy is paramount. One's sense of curiosity and creativity may not necessarily be enhanced by intervention efforts and could best be used as hiring criteria for those positions requiring these attributes. Dedication was also identified as an important factor. Hence, one may want to consider the fit of the particular job and the organization with the goals of the individual.

This research provides future research opportunities when considering the many relationships, categories, subcategories, and themes that present the need for additional exploration. Future research may include developing a more in-depth understanding of the relationships among the attributes that were identified. A richer insight into the development process of highly competent users and the development of their knowledge structures also warrants future research. Further exploration may be pursued to understand the knowledge structures created by highly competent users and how these structures can be incorporated in training mechanisms for other IS users.

Future research can also undertake the testing of the relationships presented in Figure 2 and expanding upon this framework. For example, organizational factors such as management

support or incentives can be studied. Additional consideration can be given to test the generalizability of this IS Competency framework in other contexts such as Internet usage.

In summary, 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. 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. 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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