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Abstract

It is important for individuals to accurately assess their competence in the information systems they use as individuals are increasingly required to self-manage their IT skills, and self-assessment is critical to self-management. This study conceptualizes the accuracy of self-assessment as the overlap between self-assessed and actual user competence. We argue that a wider frame-of-reference—that is, greater experience in and understanding of the domains of IT—will increase the overlap between self-assessed and actual user competence. This study provides information to assist organizations in identifying over- or under-estimation of user competence, which can lead to inefficiencies, and has found initial support for the notion that exposing employees to a wider range of information technology experiences will reap benefits through more accurate self-assessments and increased effectiveness in software usage. This effectiveness will be achieved by improving individuals' assessment accuracy and by working to solve the "But, I thought I knew that" problem.

Keywords: User competence, self-management.

RESEARCH OBJECTIVES AND QUESTIONS

He who knows best, knows how little he knows
–Thomas Jefferson.

Effective use of information technology (IT) in organizations requires ongoing user learning to enhance capabilities. New learning requirements result from changes in technology and tasks undertaken by individuals in the performance of their work. Research on user training and learning consistently shows that self-training is the most common means by which users learn (e.g., Nelson 1991). Given the importance of self-managed learning, and that self-management begins with an individual's assessment of his or her capability (Mills 1983), it is important that users be able to accurately gauge their capabilities with IT. Yet recent research suggests that users have a tendency to overestimate their IT skills (Marcolin et al. 2000), a tendency which is common in many areas of human functioning yet detrimental to learning (Kruger and Dunning 1999).

The purpose of this research is to investigate users' self-assessments of their IT competence and the influence that frame-of-reference has on the accuracy of this self-assessment. It is our intention to understand the degree to which competence is accurately assessed by users of varying capabilities and to understand the impact of a variety of experiences on their self-

assessments. The importance of frame-of-reference as an anchoring effect on estimation accuracy was suggested by Marcolin et al. They found that subjects' self-reported competence was closer to their demonstrated cognitive knowledge when the self-report was given after the test, thus suggesting prior experience has an anchoring effect on competence estimation. We introduce and discuss the concepts of the *frame-of-reference* and *accuracy of self-assessment* to understand how individuals judge their capabilities. The relationship between self-reported competence and competence as measured by both paper-and-pencil and hands-on tests will be examined empirically in the context of spreadsheet software capability among professionals.

THEORETICAL FOUNDATIONS OF THE STUDY

Understanding the Overlap between Self-Assessed and Actual User Competence

Marcolin et al. (2000) suggest that user competence is a complex construct composed of cognitive, skill-based, and affective dimensions. Kraiger et al. (1993) refer to the cognitive dimension as users' knowledge of what a technology is and how to use it, or declarative knowledge. This study focuses primarily on the cognitive dimension of user competence (UC). Figure 1 represents the relationship between three ways of assessing the user competence construct: self-report, paper-and-pencil, and hands-on. The overlap is illustrated in this model by the shaded area where the estimated and actual UC boundaries overlap, representing accurate UC self-assessment. The larger the discrepancy between estimated and actual UC measures, the smaller the overlap. The fit model is used as it illustrates the similarities, as well as the regions of dissimilarity, in the construct domains (Reisman 1988).

The degree of overlap between self-assessed UC and other assessments is an important concept, since it represents individuals' ability to accurately assess their capabilities. These meta-cognitive abilities (Kruger and Dunning 1999) have a bearing on individuals' decisions about what they need to know, what training they need to obtain, and ultimately on their ability to effectively use IT in their jobs.

Marcolin et al., in a study of spreadsheet and word processing capability, found evidence that the correspondence between self-assessed competence and competence assessed using a paper-and-pencil test was weak. Subjects had a tendency to overestimate their abilities relative to their scores on a paper-and-pencil test. Outside the IS domain, research in psychology (e.g., Kruger 1999; Kruger and Dunning 1999) has found evidence of both an above-average effect (a tendency to overestimate one's capabilities, especially relative to the average) and a below-average effect (a tendency to underestimate one's capabilities).

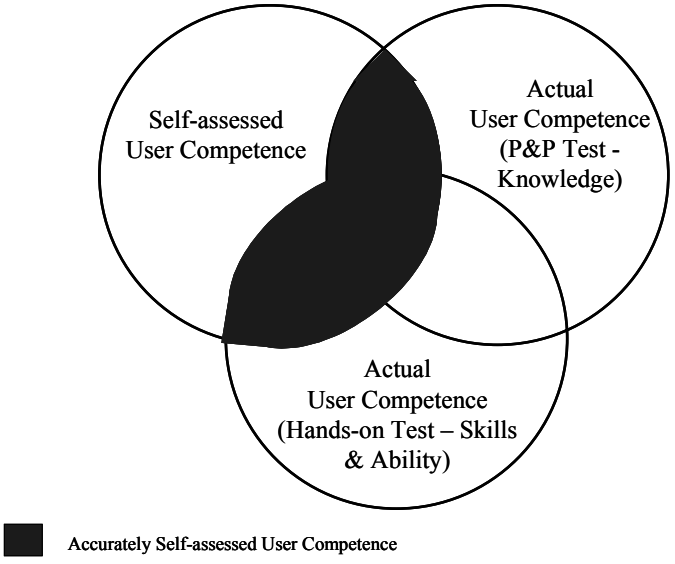

Figure 1. Research Concept of Fit Model

These findings suggest that individuals are not good at assessing their own capabilities. Our research seeks to further examine the evidence of this effect in the IS context, but more importantly, it seeks to understand the factors that influence accurate or inaccurate self-assessments.

The Frame-of-Reference Influence

Frame-of-reference (FOR) is broadly defined as individuals' cognitively stored resources, based on previous experiences, that can be brought to bear in any situation based in the technology context. This is similar to the concept of cause maps (Weick 1979), which are the cognitive schemas or structures (e.g., Feldman 1981) developed as a result of storing all previously codified experiences. FOR is a rich construct with two primary dimensions: experience and ability. The ability dimension addresses individuals' ability to accurately select relevant information, cognitively store that information in an unbiased form, and recall it when required. The experience dimension of FOR considers the role of different types of background experiences.

The relationship between the two dimensions of FOR is illustrated in Figure 2 using an extended version of Weick's enactment-selection-retention (ESR) model. Recall is added to the original model, as discussed by Markus (1977), to address the individual's ability to accurately recall particular frames of stored information when required. The self-schemata has been referenced as frames of cognitively stored information (Markus 1977) that are derived from past experience, that organize and guide the processing of self-related information. This information is cognitively categorized and organized in a discernible pattern which may be used as a basis for future judgment, decisions, inferences, or predictions about the self. The individual's self-schemata, or system of cause maps, develops as the number or breadth of experiences the individual is exposed to increases. The larger the breadth of experiences, the greater the number of stored self-schemas. For people with little experience in a given domain, then, it is unlikely that the self-schema will be well articulated in this area, and they are more likely to make inaccurate judgments.

FOR (Experience)	**FOR (Abilities) to select, store, recall information**		
Enactment	**Selection**	**Retention**	**Recall****
Individuals interaction with the environment (experiences) which provide exposure to information.	Ability to detect relevant information for storage.	Structure of FOR (cause maps) as a result of the retention process.	Ability to retrieve accurate information when required.

Notes: *Weick 1979; ** extension

Figure 2. Frame-of-Reference Dimensions Illustrated Using Extended Weick ESR Model*

Thus, the ability and experience dimensions of frame-of-reference are seen as related. Greater experience leads to the development of greater capabilities. In addition, as will be discussed in developing the hypotheses of the study, each dimension is expected to independently influence the accuracy of self-ratings. For the purpose of this study, the dimensions of FOR are operationalized in four ways. Ability is operationalized as the actual capability to use the software, as measured by paper-and-pencil and hands-on tests. Experience, which is our primary interest, is operationalized in three ways: software specific experience, technology experience generally, and contextual framing—an experimental manipulation.

The concept of experience has a long tradition in IS research. Computer experience has been found to positively influence individuals' utilization of computers in their jobs (e.g., Thompson et al. 1994). Moreover, experience has been found to moderate the effects of various technology adoption variables on usage (e.g., Venkatesh and Davis 1996). It is our intention to extend this work by examining how different kinds of computer experience affect individuals' UC self-assessment accuracy. We expect that those individuals with more and broader experiences with technology would have developed more sophisticated cause maps and would, therefore, be better at estimating their own capabilities.

Hypotheses

This study examines four hypotheses related to the influence of FOR on the accuracy of self-assessed UC. The first three relate to experience-based FOR.

Experience Frames-of-Reference

We argue that three types of experiences will contribute to more accurate UC self-assessments. First, we examine experience in the specific domain of interest (spreadsheet software). Both the number of years of use of spreadsheets and the number of different spreadsheet packages known are relevant variables for capturing spreadsheet experience.

H1: Subjects with greater experience in the domain of spreadsheets will demonstrate greater accuracy in their self-assessments of UC than will those subjects with less experience.

Second, we examine experience with information technology more broadly. Individuals who have been exposed to a greater variety of information technologies can improve their understanding of a particular software package, for example by examining similarities and differences. Kraiger et al. (1993) suggest that development of skill incorporates the notions of discrimination and generalization (i.e., learning the boundaries of the rules). Exposure to multiple types of software may, then, help individuals to discover the things common to multiple packages, and those which are unique to one. In doing so, the individuals' mental models are enhanced. This logic shows how exposure to information technologies broadly speaking can help in the development of capability in one particular technology. We also argue that exposure to a variety of technologies forces users to confront the scale of what can be known about technology, and in doing so they will become more accurate in their self-assessments. As an example, consider the database features in Microsoft Excel. A user who has only ever been exposed to MS Excel has a certain understanding of what this functionality is about. A user who, in addition to the Excel DB features, has been exposed to mainframe and other microcomputer database packages, and who has studied database concepts, will have a richer understanding of what is implied by MS database features. These other experiences will help him or her to more accurately understand the DB functionality and thus he or she will more correctly estimate his or her own capabilities.

H2: Subjects with greater breadth of IT experience will demonstrate greater accuracy in their self-assessments of UC than will those subjects with less breadth of IT experience.

Finally, the influence of experiences set the immediate context for the self-assessments. Marcolin et al. found that subjects who completed UC self-assessments after completing a paper-and-pencil test of their ability were more accurate in their self-assessments (that is, their self-assessment was more aligned with their score on the paper-and-pencil test). They argued that this experience provided an anchoring stimulus, forcing individuals to be more reflective in considering what they did and did not know. This finding suggests that the context in which self-evaluations are made creates a specific frame-of-reference that can influence the accuracy of self-assessments. In this study, we again varied the order of self-assessments and actual tests of ability to further explore the framing role of contextual factors.

H3: Subjects who complete the self-report after the paper-and-pencil and hands-on tests will demonstrate greater accuracy in their self-assessments of UC than will those subjects who complete the self-report first.

Ability Frames-of-Reference

The fourth hypothesis relates to ability as a frame-of-reference for making self-assessments. Studies in other contexts (Kruger and Dunning 1999) have indicated that individuals with low levels of competence, those with lower scores on tests, lack the metacognitive skills required to recognize their performance as inferior. Metacognitive skills determine the individual's ability to recognize how well they are performing and play a key role in the accuracy of self-assessment (e.g., Sinkavich 1995). Based upon this reasoning, this study proposes that individuals achieving lower competency scores will be less accurate in their UC self-assessments..

H4: Subjects with lower test scores will demonstrate less accurate UC self-assessments.

METHODOLOGY

The intention of this study was to compare individual self-assessments of competence to scores on both a paper-and-pencil and hands-on tests. In this within subjects design, subjects completed a background questionnaire measuring breadth of IT experience, extent of spreadsheet experience, and other individual variables. They also completed a self-report of UC and conducted both paper-and-pencil (P&P) and hands-on tests in a controlled environment. To examine the anchoring effect of proximate experience (context) on estimation accuracy, subjects were randomly divided into two treatment groups. Both groups were presented with

the background questionnaire first: group 1 was then presented with the UC self-report followed by the P&P and hands-on test, while group 2 was presented with the P&P and hands-on tests, followed by the UC self-report. This research design allows us to examine the relationship between self-assessed UC, and P&P and hands-on tests of UC, and also allows for analysis of the influence of the experience and ability dimensions of frame-of-reference on the accuracy of individuals' self-assessments.

Subjects: Subjects were solicited from several large organizations in a medium-sized metropolitan area. They were screened to ensure that they used MS Excel in performing their work.

Measures: As noted earlier, frame-of-reference is measured in four ways. The first three relate to the experience dimension of FOR. The first measurement consists of two domain specific measures, one capturing years of spreadsheet software experience, and the other the number of spreadsheet packages known. The second measurement uses the measure of UC breadth developed by Munro et al. (1997). This instrument asks whether the individual has ever used each of 26 different technologies and whether they are familiar with 15 IS concepts. The third measurement is a binary variable reflecting treatment group (the order in which the tests were completed). The **ability** dimension of FOR is assessed using paper-and-pencil and hands-on tests, discussed below. This approach is consistent with that used by Kruger and Dunning (1999).

Self-reported spreadsheet competence was measured by six items, asking subjects to indicate, on a seven-point scale, their familiarity with different dimensions of spreadsheet functionality (editing, graphing, formulas, macro functions, database functions, printing functions). These specific items were chosen based on a review of the main categories of functionality in Excel (e.g., Winter 1999).

The **paper-and-pencil test** consisted of 30 items, focusing on the same range of capabilities as the specific self-reported measure. The **hands-on test** consisted of 22 questions provided by an Excel certification test covering the same range of abilities previously mentioned.

CURRENT STATUS OF THE PROJECT

A pilot study was conducted within a medium-sized organization. The data obtained in this pilot were primarily used to determine improvements required in current study design and experiment procedures. Although the pilot study sample size was too small to draw valid statistical conclusions, a review of preliminary analysis based on this pilot provided positive implications for our hypotheses. Data from 66 subjects has now been gathered, and data from the remaining eight subjects will be gathered by the end of September.

CONFERENCE PRESENTATION

The data collection will be complete by the end of September, and analysis will be complete by ICIS. The relationships between self-assessed and actual UC will be presented, as well as the influence of individuals' FOR upon this self-assessment.

The study results will provide a first step toward understanding individuals' abilities to accurately assess their capability. The findings will have implications for both research and management practice. For research, the study will provide a model for assessing the accuracy of self-assessed UC, evidence of the influence of ability and prior experience—the two dimensions of frame-of-reference—on the size of the overlap, and exploratory evidence of the relationship between the overlap and other constructs from the technology adoption literature. From a management standpoint, the study will provide information about the efficacy of relying on individuals to manage their IT capability. Organizations increasingly find they cannot provide formal training to employees on the technologies they are required to use. Employees find that they cannot take time away from their jobs to undertake training, so they continue to learn as they go. The broad question that this research program seeks to answer (at least in part) is whether the consequences of this downloading of responsibility are going to be acceptable over the longer term.

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