RE-EVALUATION OF THE COMPUTER SELF-EFFICACY MODEL: DEVELOPMENT AND USE OF THE BUSINESS COMPUTER SELF-EFFICACY SCALE

Paul Stephens
Foster College of Business Administration
Bradley University
prs@bradley.edu

Joyce Shotick
Foster College of Business Administration
Bradley University
jas@bradley.edu

ABSTRACT

The literature defines computer self-efficacy (CSE) as a "judgment of one's capability" to apply computer technology to specific tasks (e.g. send an electronic file to a friend or preparing an electronic presentation). [3, p.192] Recent research has expanded the concept to offer a model of ***general computer self-efficacy*** *and* ***task specific self-efficacy****. [9] This paper expands the model further by including the concept of* ***profession-oriented self-efficacy****. CSE is important for both college students and professionals because the use of technology is an integral part of many courses and most occupations. Research has found a relationship between CSE and an individual's willingness to adopt and use technology. [2] Additionally, CSE has an impact on performance in learning and applying technology. [4], [11] Therefore, it is important for academics and managers to provide experiences to students and employees that improve an individual's CSE while avoiding experiences that can inflict long term damage to CSE. Over the years, researchers have developed computer self-efficacy scales in order to examine the relationship between CSE and human behavior with respect to using computers. The items found on a computer self-efficacy scale may become quickly obsolete or inadequate as technology changes and grows. It is not uncommon to find research today using a scale based on a set of common computer skills needed in the late 1980's. This research argues that: (1) the items that should be included in any self efficacy scale need to be updated to reflect the current computing environment, (2) a single self-efficacy scale to measure general computer self-efficacy should be used by researchers (3) multiple self efficacy scales need to be developed so that they can be applied appropriately to the sub-populations that are studied by researchers. This research develops a self-efficacy scale for business professionals (those individuals that endeavor in the fields of accounting, finance, marketing, economics, and management.) Finally, the paper demonstrates how this scale can be used to determine the need for computer literacy training with incoming college freshmen majoring in business related fields.*

Keywords: Computer Self-Efficacy, Scale, Literacy, End-User Computing

DEFINING SELF-EFFICACY

Self-efficacy was initially defined as an individual's belief about their ability to successfully execute behavior required to produce a desired outcome. [1] As the concept was further studied and discussed, researchers provided a more focused definition of self-efficacy. Self-efficacy is a person's belief in their capability to perform specific tasks and it consists of three dimensions: Magnitude, Strength and Generality: (A) Magnitude – the level of task difficulty an individual believes that he or she can attain, (B) Strength – the confidence one has in attaining a particular level of difficulty and (C) Generality – the degree to which the expectation is generalized across situations. [5] Researchers have shown that it is important to capture both the magnitude and strength dimensions when measuring self-efficacy. [8]

COMPUTER SELF-EFFICACY (CSE)

The concept of computer self-efficacy (CSE) emerged from the self-efficacy literature and has been defined as a "judgment of one's capability" to apply computer technology to specific tasks (e.g. send an electronic file to a friend or preparing an electronic presentation). [3, p. 192] These tasks or skills are based on technological related abilities needed to be computer/information literate. In other words, computer self efficacy can be defined as an individuals belief in their ability to use technology in order to solve problems, make decisions, and to gather and disseminate information. Recent research has expanded the concept. "CSE can be operationalized at both the general computing behavior level and at the specific computer application level."[9, p. 128] Task specific computer self-efficacy (TCSE) examines self-efficacy as related to specific computer related tasks. For example, a study might concentrate on TCSE with spreadsheet software. (Note: Markas, et al. used CSE instead of TCSE but since we are already using CSE to refer to the general concept, we have elected to change the acronym to TCSE.) General computer self-efficacy (GCSE) examines self-efficacy across multiple technological platforms. "GCSE is more a product of a lifetime of related experiences… It can be thought of as a collection of all TCSE's accumulated over time." [9, p. 129] In this paper, we introduce an intermediate form of computer self-efficacy. We refer to this as *profession oriented self-efficacy(PCSE).* PCSE refers to an individuals' judgment of efficacy across computer applications that comprise those needed to work in a particular profession. In other words, PCSE is a subset of GCSE that is a collection of TCSE's that are needed for a profession. (See Figure 1) A task specific self-efficacy might be part of several profession-oriented self-efficacies but a PCSE is generally a somewhat unique combination of TCSE's. For example, the engineering computer self-efficacy scale would include the use of CAD (computer aided design software). The inclusion of this TCSE makes it unique from other professions but at the same time it would also include applications like word processing and spreadsheets that are common TCSE's across several professions. Another important characteristic of each type of computer self-efficacy is the number of types within a subset. Each person only has one GCSE, while an individual will have self-efficacy for each TCSE and each PCSE. The number of TCSE's change frequently. Some TCSE's become obsolete and others are added to the list. For example, the TCSE that focuses on DOS is somewhat obsolete while the TCSE that deals with using web page development software is new in the last ten years. PCSE's change less frequently but the content changes as TCSE's become obsolete or are introduced. These theoretical subsets of computer self-efficacy should have a real impact on research. Researchers must consider the type of self-efficacy they are studying, the characteristics of the individuals in their sample and use the appropriate self-efficacy tool.

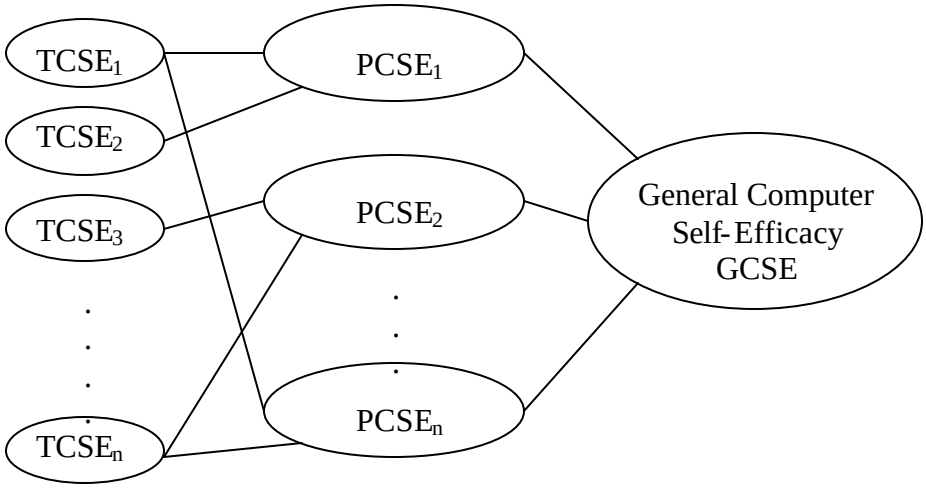

Figure 1 – Adapted Model of General, Profession Oriented and Application Specific Computer Self-Efficacy [9, p. 129]

THE DEVELOPMENT AND USE OF COMPUTER SELF-EFFICACY SCALES

Over the years, researchers have developed computer self-efficacy scales in order to examine the relationship between CSE and human behavior with respect to using computers. A detailed study summarizing many aspects of CSE research illustrates that a variety of instruments have been developed over the years with little cross over between researchers. The authors point out that the various needs of researchers and the types of self-efficacy being studied have driven the need for a variety of self-efficacy scales. [9] Instruments designed to measure computer self-efficacy tend not to differentiate on the distinction of different types of computer self-efficacy, sometimes incorporating multiple types of self-efficacy while ignoring others. One study demonstrated that the majority of scales were measuring some form of software specific self-efficacy and that given the definition of computer self-efficacy, the scales were "an inadequate reflection of self-efficacy." [3, p. 193] But, if we differentiate between the types of computer self-efficacy then there is room for both types of measures. Given our discussion of the different types of computer self-efficacy, there should be one scale that measures general computer self-efficacy and multiple scales focusing on the different types of profession-oriented computer self-efficacy and task specific computer self-efficacy.

Another reason for the variety of scales is the ever-changing nature of computer technology. In other knowledge domains, items found on a self-efficacy scale apply to the domain over a period of many years. Whereas, the items found on a computer self-efficacy scale may become quickly obsolete or inadequate as technology changes and grows. For example, our review of the literature reveals that a significant amount of research today is based upon a computer self-efficacy scale developed in 1989. [7], [10] This scale was based on a set of common computer skills needed in the late 1980's. The scale was developed prior to common use of local area networks, widespread use of Windows based operating systems, today's common electronic communication devices and at that time the world wide web (WWW) protocol was not in use nor was the first Windows based web browser developed. In fact, the Internet as we know it today was barely conceptualized. Skills such as logging directly onto a mainframe computer were important. Whereas today, mainframe systems reside in the background of most company

systems and are commonly accessed through PC based networks. At that time, Windows based operating systems were still fairly new and DOS based PC systems were still commonly used. Common tasks needed to deal with DOS based operating systems required that users have knowledge of technical commands that have now been eliminated by advances in operating system design and graphical user interfaces. In other words, information systems, both PC's and Mainframe environments were much less user friendly than they are today. Self efficacy tasks were perceived as requiring more technical know how and less emphasis was put on tasks based on improving communication and managing information. It is our assertion that items on any computer self-efficacy scale should be re-examined and re-validated periodically.

DEVELOPMENT OF THE BUSINESS COMPUTER SELF-EFFICACY SCALE

Twenty-one items and several sub-items have been generated after a review of the literature, the analysis of skills taught in the computer literacy classes of high schools and university undergraduate business programs, and interviews with academics, end users and employers. Following the guidelines established by researchers in the field of self-efficacy, we have developed a scale that uses a composite measure of magnitude and strength. [1] This form of self-efficacy scale has been shown to provide the best correlations with goals and performance in research. [8] The complete scale can be found at **http://bobcat.bradley.edu/~prs/bcse.htm**

For our scale, we include a wide variety of skills that can be segregated into three categories of business computer literacy skills that we call communications, data organization and analytical tools. Validation of the scale and these factors is needed.

THE IMPORTANCE OF COMPUTER SELF EFFICACY

Information systems have expanded into many aspects of our lives. Today, technology is pervasive in terms of information storage and retrieval, productivity tools and telecommunications. Additionally, in recent years, opportunities to learn and use technology have increased in elementary and secondary education. The user friendliness of technology has improved and the types of skills included in computer literacy have changed. Self-efficacy levels need to be sufficient enough so that individuals will choose to take advantage of opportunities to enhance their skills. This concerns all stakeholders in our society given that we accept that literacy of any kind is essential to the continued growth and prosperity of society.

CSE is important for college students and professionals because the use of technology is an integral part of many courses and occupations. Research has found a relationship between CSE and an individual's willingness to adopt and use technology. [2] Individuals with strong CSE will try out new innovations in technology and are willing to try to teach themselves how to use software. Additionally, CSE has an impact on performance in learning and applying technology. [4], [11] A firm belief in one's ability to deal with technology allows a person to quickly adapt related skills and provides them with the opportunity to imagine how such skills could be applied to a variety of tasks. While individuals with weak CSE will let small setbacks intimidate them more readily and they will spend less time critically thinking about how technology can be used to help them. These individuals see computer technology as a roadblock to their knowledge and productivity. Therefore, it is important for academics and managers to provide experiences to students and employees that increase an individual's CSE while avoiding experiences that can inflict long term damage to CSE.

ONE USE FOR THE BUSINESS COMPUTER SELF-EFFICACY SCALE

There was a time when it was necessary to provide computer literacy training for all university students. As primary and secondary school systems began to offer computer skills training, computer literacy training in post secondary institutions (colleges and universities) started to become redundant. Ten years ago, college educators were positing that given a few years, the vast majority of incoming students would come to college with basic computer literacy. In fact, today, many higher education facilities have assumed that there is no longer a need for computer literacy training. On the contrary, research indicates that the need for computer literacy training of incoming university students is still necessary for a significant portion of those students. Our findings from last year found that the computer literacy skills of 12% of an incoming freshman class of business majors were non- existent while another 13% could be categorized as significantly deficient. [12] Therefore, it becomes necessary to determine which students need literacy training while others do not. It would seem to be a simple solution to test all students prior to the start of classes to determine if they are exempt from the class or need to take the class. This solution presents two problems: (1) the testing is time consuming and expensive and more importantly (2) for those students that lack computer skills, failure has a prolonged negative effect upon their computer self-efficacy. A person's introductory interaction with computers is a source of self-efficacy information. [11] Creating an environment in which failure is guaranteed is not desirable. Therefore, we need to use a method for determining computer literacy that does not inflict prolonged damage to the student's self-efficacy. Traditionally, computer self-efficacy scales have been developed and used to determine the effectiveness of literacy training. But, this paper argues that these scales can be used to decide which students need training and which do not.

An early study found evidence of a relationship between self-efficacy and registration in computer courses at universities. [6] So, we should not allow students to decide what their computer literacy training needs are. Logic dictates that students with low CSE will attempt to avoid developing the skills they need for their future professions. Our review of the data from our university tends to supports this assertion. We met with all incoming business students during orientation and discussed with them the computer literacy requirements for the college. Students were explicitly told that they were required to take the computer literacy class or proficiency exams during their freshman year. The rule is documented in course catalogs and

advisors are also asked to encourage students to complete the requirement. At the end the year, we tracked the students to discover if they chose to take the computer literacy class, took proficiency exams to substitute for the class or avoided doing either. We did not enforce the rule and allowed students to decide for themselves what actions to take. Over 40% of the students avoided both the exams and class in their first year. Half the students decided to take the class. (See Table 1) From our assessment of the students, we feel that 75% were qualified to take the exams while only 25% needed to take the class. We believe that one significant factor in these decisions was low CSE. With the business computer self-efficacy scale (BCSE), we believe we can now decide for students whether they need to take the class or exams. And by using the BCSE tool, we can avoid creating a negative experience while providing the most appropriate route for students to follow.

Table 1 - Tracking Incoming Business Students	
n	110
# no longer in FCBA	8
Adjusted n	102
% who took prof exam	7.8%
% who took class	50.0%
% who avoided	42.2%

Different academic units would define the specifics of computer literacy in different ways. Basic computer/information literacy in engineering might mean the ability to use CAD (Computer Aided Design) software, in advertising it might mean the ability to use publishing software to create brochures, in multi-media it might mean the ability to use simple photo editing software to incorporate images in electronic media, in chemistry it might mean the ability to interact with instrumentation software in the lab. It is the cross section of all disciplines that defines the basic computer/information literacy required of all college graduates. Therefore, given the needs of the academic institution, different computer self-efficacy scales would be appropriate to use. In this research, we propose the use of a business computer self-efficacy scale to determine the training needs of incoming students who have chosen to pursue degrees in business. Of course, the scale needs to be validated before it is applied on an on-going basis.

CONCLUSIONS

The following list is a summary of the findings of this research:

1. An intermediate form of CSE is needed to complete the model provided by research. [9] This form of CSE is known as profession oriented self-efficacy. Scales based on this form of self-efficacy will be useful in studying students and professionals who concentrate on certain fields.
2. A single GCSE scale can be developed, validated and used uniformly across CSE research.
3. All CSE scales should be periodically reviewed, updated and re-validated.
4. A variety of TSCE and PSCE scales should be developed and validated to serve the various needs of researchers. For example, recent publication has seen the development of an Internet self-efficacy scale. [13]

5. Scale developers should follow the guidelines established and validated by research. [1], [8]
6. A PCSE called the business computer self-efficacy scale has been proposed but not validated in this research. This provides an opportunity for further study.

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