

THE EFFECTS OF FOUR DIFFERENT STRATEGIES OF INFORMATION PRESENTATION  
IN  
SOFTWARE TRAINING

by

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## ABSTRACT

The purpose of this study was to investigate whether learners' computer self-efficacy and prior computer knowledge influence their performance and satisfaction when presented with various instructional strategies of information presentation in computer-based software training.

Seventy-eight undergraduate students were randomly assigned into four groups (a) deductive-inquisitory, which present general information first and then require learner to generates examples, (b) deductive-expository, which present general information first then present examples, (c) inductive-inquisitory, which present examples first and then require learners to discover relationship, (d) inductive-expository, which present examples first then present general information. The instructional materials were computer-based Netscape Composer 7.1 tutorials.

For the comparison of inductive-inquisitory and inductive-expository groups, results indicated that learners with higher computer self-efficacy not only performed better but also were more satisfied towards inductive-inquisitory strategy for information presentation. Learners with low computer self-efficacy benefited more from the inductive-expository approach of information presentation. Furthermore, for the comparison of deductive-expository and inductive-expository groups, learners with high computer self-efficacy performed better in deductive-expository strategy, while learners with low computer self-efficacy benefited more in inductive-expository strategy.

Some of the research recommendations for further research included using a larger sample size for the generality of the finding, measuring how different instructional strategies

influence the learners' long term memory, and exploring other possible moderating factors and other strategies for information presentation that has positive impact on learners' performance in and satisfaction towards computer based software training.

In loving memory of my Father,  
Jung-Tung Tsai (1941-2001).

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## **CHAPTER 1**

### **INTRODUCTION**

Due to the growing complexity of today's software application, the role of software training is becoming increasingly important, especially to inexperienced users. Bannert (2000) defines software training as "a systematically planned teaching and learning process, the aim of which is to enable users to handle particular functions of an application software independently" (p. 336). Although the traditional style of software training required people to attend a course or workshop (Mackay, 2002), people can now learn software at their own pace. They can use either paper-based instruction, such as user's manuals and trade books, or computer-based training such as stand alone or Internet-based tutorials, help (electronic user manual), and FAQ's (Shelly, Cashman, Gunter, & Gunter, 2002). However, according to a survey investigating how college students prefer to learn new software, only one-third of the respondents prefer self-learning, which included using online tutorials or demonstrations, reading hardcopy instructions, manuals, books, documents and reading online instructions, manuals, documents (Bohman, 2001). Such results suggest that there may still be room for improvements in the design and delivery of self-instructional software training.

In spite of the variety of methods people use to educate themselves, training is normally delivered through two major approaches in today's marketing: task-oriented and function-oriented. Task-oriented training shows learners how to complete a real example by presenting the information step by step, while function-oriented training presents explanations for each function (Dutke & Reimer, 2000). In other words, through receiving task-oriented instruction first,

learners are able to obtain a general picture of what the application software can produce. Those who receive function-oriented instruction first get more detailed information about the functions embedded in the application software. Depending on each learner's characteristics, both type of instructional formats should be provided to satisfy differences among students. Two questions arise: (a) who determines what type of training to give to learners, and (b) beside those two approaches described above, are there any other approaches that can make software training effective?

In the early 1990s, van Merriënboer (1997) introduced a four-component instructional design (4C/ID) model for training complex cognitive skills. According to the 4C/ID model, there are four approaches of information presentation: deductive vs. inductive approaches and expository vs. inquisitory approaches (inquiry learning).

The deductive approach is characterized by presenting general information first, then illustrating with examples. In contrast, an inductive approach is characterized by presenting examples first and acquiring general information from them.

The expository approach is characterized by presenting explicit relationships between pieces of information to the learners. On the other hand, the inquisitory approach asks the learners to discover the relationships by themselves.

The four approaches listed above can be combined into four information presentation strategies: deductive-expository, deductive-inquisitory, inductive-expository and inductive-inquisitory. Table 1 shows the differences among the four strategies.

Table 1

Strategies for Information Presentation

	Inquisitory	Expository
Deductive	Present general abstract knowledge, then learner generates cases, examples.	Present general abstract knowledge, and then present cases, examples.
Inductive	Present cases, examples, then require learners to discover relationship.	Present cases, examples, then present relationship.

Based on the four strategies of information presentation suggested by the model, van Merriënboer (1997) indicated that learners' prior knowledge is a factor which will affect the selection of the four strategies. For example, if learners have no prior knowledge about the skill they are going to learn, it is appropriate to present examples first then present general information (Inductive approach). In contrast, if learners have enough relevant experience, van Merriënboer recommended presenting general information first then presenting examples (Deductive approach). When there is plenty of instructional time, or when a deep level of understanding is required, van Merriënboer suggested that knowledge could be incorporated implicitly so that students could discover the information by themselves (Inquisitory approach). However, when the instruction time is limited, or when a deep level of understanding is not required, knowledge may be explained explicitly (Expository approach).

## Purpose of Study

The purpose of this study was to investigate whether learners' computer self-efficacy and prior computer knowledge influence their performance and satisfaction when presented with various instructional strategies of information presentation in computer-based training.

## Research Question

Specific research questions that general guide this study included:

1. To what extent will different instructional strategies for information presentation affect learner performance in software training?
2. To what extent will different instructional strategies for information presentation affect learner satisfaction regarding software training?
3. To what extent is the impact of instructional strategies for information presentation on learner performance in software training moderated by learner computer self-efficacy and learner prior computer knowledge?
4. To what extent is the impact of instructional strategies for information presentation on learner satisfaction regarding software training moderated by learner computer self-efficacy and learner prior computer knowledge?

Based on 4C/ID model, it is suggested that a deductive approach to information presentation promotes more effective training for those who have higher prior knowledge, while an inductive approach is recommended for those who have no prior knowledge or experience. Therefore, it was hypothesized that in computer software training, when learners with higher computer knowledge receive a deductive approach of instruction, they will have higher

performance and will report greater level of satisfaction with the training process compared to learners with lower computer knowledge. Conversely, learners with low prior knowledge who receive an inductive approach to instruction will perform better and be more satisfied than those who receive the deductive approach. In addition, based on a review of the literature, the researcher hypothesized that computer self-efficacy is another variable that influences learners' performance and their satisfaction toward the format of instruction they receive. Figures 1 and 2 illustrate the relationships between the key variables under study.

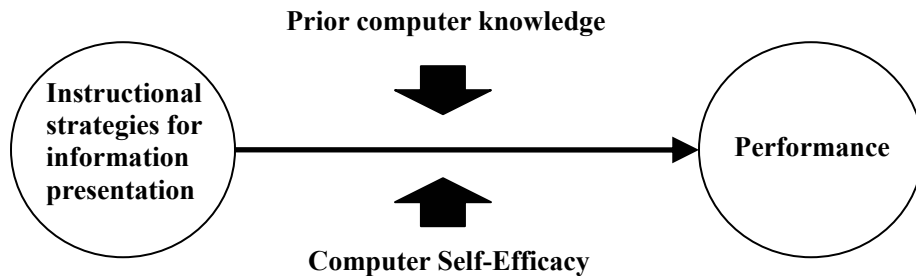


Figure 1: Hypothetical Model with Performance as an Outcome Variable.

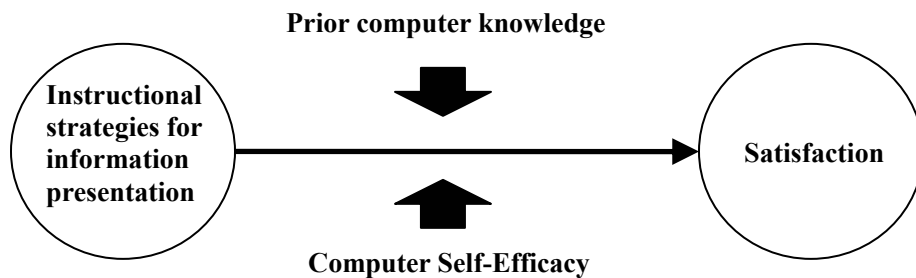


Figure 2: Hypothetical Model with Satisfaction as an Outcome Variable.



For the purpose of this study, the following definitions were used:

Constituent skills: “Subskills or component skills of a complex cognitive skill that may best be seen as aspects of the whole skill.” (van Merriënboer, 1997, p.312)

Deductive-expository strategy: First present general information to learners, then explicit examples are also presented to the learners. (van Merriënboer, 1997)

Deductive-inquisitory strategy: First present general information to learners, then learners find examples that illustrate the general information. (van Merriënboer, 1997)

Inductive-expository strategy: First present examples to learners, then general information is also explicitly presented to the learners. (van Merriënboer, 1997)

Inductive-inquisitory strategy: First present examples to learners, then learners have to discover the general information based on the examples. (van Merriënboer, 1997)

Part-task practice: “A term used in the 4C/ID model for practice in a selected recurrent constituent skill. Practice mainly aims at the automation of rules by compilation and, eventually, strengthening.” (van Merriënboer, 1997, p.318)

Rule automation: “Automation is mainly a function of the amount and quality of practice that is provided to the learners and eventually leads to automated rules that directly control behavior.” (van Merriënboer, Clark, & de Croock, 2002)

Self-efficacy: “people’s judgments of their capabilities to organize and execute courses of action required to attain designated types of performances.” (Bandura, 1986, p.391)

Whole-task practice: “A term used in the 4C/ID model to indicate practice in either the whole complex cognitive skill or a meaningful cluster of constituent skills.” (van Merriënboer, 1997, p.323)

## Significance of Study

According to van Merriënboer (2000), recent research conducted on software training focused on the effects of different learning content (“what to teach”), different training methods (“how to teach”), and different ways for information presentation (“how to present”). However, not many research considered learners’ characteristics as factors which would influence the learners’ outcome in software training. Incorporating four strategies for information presentation, the current study used computer-self efficacy and prior computer knowledge as moderating factors in an attempt to predict learners’ performance and satisfaction. Thus the significance of this study can be discussed in terms of two target audience. On the one hand, for instructional system designers, this study provides information on how to best select from the four strategies for information presentation based on learners’ computer self-efficacy and prior computer knowledge. For researchers, on the other hand, the significance is two-fold. First, as proven through past research that learners performance may be affected by the different level of prior knowledge they possess and the information presentation strategies used, the present study offers a measure of prior computer knowledge to predict the relationship between the four different strategies for information presentation and learners’ performance as well as learners’ satisfaction towards the computer based software training. Second, computer self-efficacy was often examined in prior research as a mediating factor (Compeau & Higgins, 1995b), however, the present study tested computer self-efficacy as moderating factor to find the relationship between information presentation and performance and satisfaction.

## **CHAPTER 2**

### **REVIEW OF LITERATURE**

The review of the literature is divided into four sections. The first section describes the components and steps for applying the 4C/ID model. The second section describes the theoretical concepts and related research related to the four instructional strategies provided by the 4C/ID model. The third section describes research related to prior knowledge in computer-based learning, and the final section explains computer self-efficacy and its relationship to the research.

#### **Four-Component Instructional Design (4C/ID) Model**

An instructional development (ID) model is a systematic process for improving instruction, which generally consists of five major elements: Analysis, Design, Development, Implementation, and Evaluation. From the 1960s to the present, an increasing number of ID models have been developed in the instructional technology field (Gustafson & Branch, 1997, p.239). Arguing that ID models don't provide specific guidelines for designing efficient training programs for complex cognitive skills, van Merriënboer (1997) proposed his 4C/ID model. According to van Merriënboer, et al. (2002), the 4C/ID model is different than other ID models in three ways. First, the 4C/ID model focuses on what learners should be able to (competency-based training) rather than what learners should know after the training (knowledge-based training). Second, the model clearly distinguishes supportive information and just-in-time information (which will be explained later). Third, van Merriënboer (1997) integrated part-task

and whole-task practice in the 4C/ID model while most ID models focus on either part-task or whole-task practice.

The 4C/ID model consists of four layers and four components in training complex cognitive skills. The four layers are four systematic steps to analyze complex cognitive skills (steps 1 and 2) and design appropriate training strategies (steps 3 and 4). The four layers are:

1. Identify a complex cognitive skill and decomposing it into recurrent and non-recurrent constituent skills,
2. Analyze the two sets of constituent skills and related knowledge that support the skills,
3. Select instructional methods for practicing the constituent skills, and
4. Compose a training strategy containing the selected instructional methods.

In the model, van Merriënboer (1997) classified constituent skills as either recurrent constituent skills, which are performed using the same process each time, or non-recurrent constituent skills, which are performed differently in different situations. In other words, the desired performance of recurrent skills is very similar from one problem solving situation to another while the desired performance of non-recurrent skills varies significantly from situation to situation. For example: for the complex skill “computer programming,” skills related to creating computer programs are considered non-recurrent skills. Recurrent skills in the example concern the procedures for operating the computer system. Recurrent skills involve rule-based behavior and require just-in-time information to perform the skills. Learners can reach skill automation through part-task practicing. Non-recurrent skills, which can be taught through whole-task training, are schema-based using supportive information to enhance the learner’s understanding (van Merriënboer et al., 2002).

4C/ID model also divided essential complex learning processes into four components (Bastiaens, van Merriënboer, & Hoogveld, 2002; van Merriënboer, 1997; van Merriënboer, Kirschner, & Kester, 2003).

1. Learning tasks, or “whole-task practices,” are actual tasks the learners will be working on to promote schema construction for non-recurrent skills. Learning tasks are usually organized from simple to complex. Instructional methods in learning tasks focus on induction, which construct the learners’ schemata by the working-out examples provided by the learning tasks.
2. Supportive information, which is foundational to the learning and performance of non-recurrent skills. Supportive information connects learners’ prior knowledge to the learning tasks. Supportive information focuses on elaboration, which promotes the acquisition of learners’ non-recurrent skills by establishing relationships between new elements and what learners already know.
3. Part-task practice, promotes rule automation for recurrent skills by compiling the learner skills and knowledge.
4. Just-in-time information, is prerequisite to the learning and performance of recurrent skills of either part-task practice or learning tasks. Instructional methods of just-in-time information focus on restricted encoding, which embed information in rules to reach rule automation.

The 4C/ID model methodology can be described as a combination of four layers and four components. De Croock, Paas, Schlanbusch, and van Merriënboer (2002) mentioned that the following activities which combined the four layers and the four components may help to create a detailed training plan for complex skills.

1. Identify complex skills and decomposing them into recurrent and non-recurrent constituent skills.
2. Analyze knowledge prerequisites related to the use of recurrent skills and categorize the knowledge as just-in-time information.
3. Analyze knowledge supportive to the performance of non-recurrent skills and categorize the knowledge as supportive information.
4. Design instructional methods for promoting just-in-time information and supportive information.
5. Design learning tasks (whole-task practice) and part-task practice.
6. Sequence tasks from simple to complex.

#### Instruction Strategies of Information Presentation

According to the 4C/ID model, using examples to facilitate learning is an essential process in designing instructional methods for acquiring supportive information (knowledge to support the acquisition of non-recurrent skills) and just-in-time information (knowledge to support the acquisition of recurrent skills). van Merriënboer and Paas (1990) also support the importance of using examples in learning. In short, they discussed how to apply automation and schema acquisition processes in learning computer programming. The authors indicated that worked examples should be provided to facilitate automation (for recurrent skills) and schema acquisition (for non-recurrent skills). The reason that using worked examples is not only an effective way to present procedural knowledge and to shorten the training for automation of recurrent skills but also provokes mindful abstraction to build, or generalize learners' schemata.

To effectively present general information and examples to learners, four distinct approaches about “how to present the information to learners” were clearly distinguished in the 4C/ID model: deductive vs. inductive approaches and expository vs. inquisitory approaches (van Merriënboer, 1997).

### *Deductive vs. Inductive Approaches*

The difference between deductive and inductive approaches is the order in which general information and examples are presented. The deductive approach is characterized by presenting general information first, then illustrating with examples. In contrast, an inductive approach is characterized by presenting examples first and then acquiring general information from them. According to Fleming and Levie (1993), the deductive approach is best applied when the concept can be understood in abstract form by the learners. However, if the concept is difficult or too abstract for learners, it is appropriate to use an inductive approach. In other words, the selection for the two approaches depends on whether the learners have enough prior knowledge to understand the concept. Fleming and Levie further suggested using a combined approach instead of the inductive approach, that is, “give examples first, derive from them the rule, and then apply it to further examples” (p. 246).

### *Expository vs. Inquisitory Approaches*

The expository approach is characterized by constructing relationships between pieces of information explicit and available to the learners. In the inquisitory approach, the relationships are implicit and rely on the learners to discover the relationships on their own. Learners are able

to make connections of the new information to their prior knowledge and leave sufficient room for elaboration; however, it is time-consuming. Therefore, inquisitory approach is used when there is enough instructional time, or when a deeper understanding is required. The expository approach is just the opposite, the 4C/ID model suggests that instructors use the expository approach only when there is limited instructional time (van Merriënboer, 1997; van Merriënboer et al., 2002).

#### *Four Strategies for Information Presentation*

The four approaches listed above can be combined into four information presentation strategies: a deductive-inquisitory strategy, a deductive-expository strategy, an inductive-inquisitory strategy and an inductive-expository strategy.

1. Deductive-inquisitory strategy: First present general abstract information to learners, and then ask learners to generate cases or examples that illustrate the general information
2. Deductive-expository strategy: First present general abstract knowledge to learners, and then present cases or explicit examples that illustrate the general information.
3. Inductive-inquisitory strategy: First present cases or examples to learners, and then require learners to discover the general information and relationships on the basis of the presented examples.
4. Inductive-expository strategy: First present cases or examples to learners, and then explicitly present the general information and relationship between the presented examples.



### *Strategy Selection for Information Presentation*

Based on the features of deductive, inductive, inquisitory, and expository approaches, the 4C/ID model proposes that the selection of an appropriate strategy for information presentation depends on three factors, availability of instructional time, learners' prior knowledge about the content, and the required level of understanding. A deductive-expository strategy is suggested when instructional time is limited, the learners have enough prior knowledge and deep understanding is not necessary. When there is enough instructional time, the learners have no prior knowledge to understand the general information and a deep level of understanding is required, the 4C/ID model recommends using an inductive-inquisitory strategy. An inductive-expository offers a middle road since it is time-effective and does not require learners' prior knowledge about the content. A deductive-inquisitory strategy fits with the whole 4C/ID model and whole-task practice; however, it is not frequently used for information presentation because it is time consuming. (Kester, Kirschner, Merrienboer, & Baumer, 2001; van Merrienboer, 1997; van Merrienboer et al., 2002).

### *Studies Related to Strategy Selection for Information Presentation*

Before the 4C/ID model made a distinction among the four strategies, the four approaches, namely, deductive, inductive, expository, inquisitory, had been studied by researchers. For example, Merrill's (1994) component display theory included expository and inquisitory approaches. The following studies are related to instructional strategy selection for information presentation.

In 1985, McKinney conducted a study of 70 undergraduate students who were to learn unfamiliar concepts under different form of information presentation. In the study, the author defined an expository presentation as the instructor presenting examples and non-examples to students, and explaining to them why each instance is or is not an example of the concept. And an inquisitory practice presentation was defined as the instructor presenting several new examples and non-examples and requesting the students to explain which one is or is not an example. The purpose of McKinney's study was to examine where there is a difference in the students' outcomes under six treatments: (a) Definition only; (b) Expository presentation only; (c) Definition and expository presentation; (d) Definition and inquisitory practice presentation; (e) Expository presentation and inquisitory practice presentation; (f) Definition, expository presentation, and inquisitory practice presentation. The results showed that the outcome score of "Definition Only" group was significantly smaller than all the other groups. No other significant differences were found among the remaining groups. In regard to 4C/ID Model, when there is sufficient time, inquisitory approach is recommended more than expository approach. However, in McKinney's study, the use of inquisitory approach did not help students more in their performance than expository approach.

In 1995, Rieber and Kini conducted a study using computer simulations for fifth grade students learning Newton's laws of motion. Although Rieber and Kini indicated they used deductive and inductive approaches to design computer simulations, what they really compared, according the four strategies described above, were deductive-expository and inductive-inquisitory strategies. In the deductive-expository approach group, the computer simulation first presented students a tutorial with science concepts and principles, immediately followed by

simulation activities as practice. The students in the inductive-inquisitory group only received simulation activities and they needed to discover and apply the laws of motion by themselves. The results showed that the deductive-expository approach group performed better on the post-test and felt they had learned more than did the inductive-inquisitory group. The author explained that a possible reason is that the time provided to students might be too short for the inductive-inquisitory group to produce any learning effects. At the end, Rieber and Kini concluded that the selection of instructional strategies depended on the relationship between learners' prior knowledge, learners' motivation to participate in a task, learners' ability to monitor and organize comprehension, and the amount of time provided for the task. The findings of Rieber and Kini's study were congruent with that prior knowledge and availability of instructional time are factors for selecting information presentation suggested by the 4C/ID Model.

In addition, Al-Kharrat (2000) used deductive and inductive approach, which are actually deductive-expository and inductive-inquisitory strategies, to teach college students English as a second language. The author reported that (a) the inductive-inquisitory strategy involved students more in analyzing language than the deductive-expository strategy; (b) the students in the inductive-inquisitory group were highly motivated and got more benefit in understanding the material presented to them; (c) The students in the inductive-inquisitory group promoted more thinking skills than those in the deductive-expository group; (d) The effectiveness of the inductive-inquisitory strategy depended on how the instructor guided students during the process of information presentation. The findings were matched with the 4C/ID Model in that the inductive-inquisitory strategy can help learners to have deeper understanding in the learning content than the deductive-expository strategy. For this reason, when language learning requires

a deep understanding for students to acquire the language, use the inductive-inquisitory strategy. Otherwise, use the deductive-expository strategy for its time-effective.

### Prior Knowledge

Prior knowledge serves a crucial role in learning. In the context of information/instructional technology, extensive research has been done in determining the relationship between different levels of prior knowledge and various instructional methods: how information should be presented, different formats of presentation (Chanlin, 2001), how much information should be presented at a time (Vetere & Howard, 1999), and what type of feedback should be given (Huang, 1995).

Vetere and Howard (1999) studied the effects of redundancy in computer interface design with students who have different levels of prior knowledge. Four different combinations and formats of computer-based instruction were presented: diagram-only, diagram-text, diagram-speech and diagram-text-speech. The explanatory speech, or spoken words, was identical to the written text. The four computer based instruction formats only varied in terms of whether or not explanatory text and/or speech was included. The results showed that students with high prior knowledge performed significantly better with diagram-speech format. The students did not do well when redundant text was added to speech in the diagram-text-speech format. On the contrary, diagram-text-speech worked best for students with low-prior knowledge. The redundant visual and auditory elements in interface design were beneficial to learners with low prior knowledge, and detrimental for those with higher prior knowledge.

Huang (1995) conducted a study on the effects of different types of feedback on students' achievement in a computer-based cooperative learning setting. Students were tested for their pre-existing knowledge of weight training and were identified as being either high or low prior knowledge learners. During their six weeks of computer-based instruction, they were given four different treatments: no feedback (NF), knowledge correct response feedback (KCF) stating "right" or "wrong," and elaborative feedback (EF). The results showed that students with high prior knowledge benefited from elaborative feedback and showed significant higher achievement than those who were given no feedback (NF) or knowledge correct response feedback (KCF). As for students with low prior knowledge, there was no significant difference between those who had knowledge of correct response feedback and those who received elaborative feedback; however, both students in KCF and EF treatments significantly outperformed those who received no feedback. Huang explained that high prior knowledge learners gain more by providing them with additional information and low prior knowledge learners benefit more from feedback that contains information which does not require much processing.

Presentation formats in computer-based lesson affects students' learning and the effects were investigated in terms of students' prior knowledge. Chanlin (2001) investigated the effects of three types of presentation format, namely animation, still graphics, and text, and students' prior knowledge in a computer-based physics lesson. The learning materials included declarative knowledge and procedural knowledge. Declarative knowledge was defined as "knowing that," which involved description of facts, objects, or events; and procedural knowledge was defined as "knowing how," which involved learning problem solving steps (Gagne, Yekovich, & Yekovich, 1993). In the study, Chanlin found that for lower prior knowledge students, still-graphics were

most effective in both descriptive and procedural learning, while animation did not help their learning. The researcher explained that, because of the limitations of their prior knowledge, much of their effort was spent in deciphering visual information and adapting to the presentation format and thus, they may not be able to simultaneously construct semantic structure and do problem solving. As for higher prior knowledge students, the results showed that there were no significant differences found among three types of presentation formats. The explanation was that for the experienced learners, the prior knowledge they possess (physics) can help “compensate for the difference in presentation formats (p 417).” The researcher stated in the end that designers of computer-based lessons should pay more attention to the use of presentation formats for novice learners.

Besides the afore mentioned research, prior knowledge also effects learners decisions on technology use (Baruchson-Arbib & Shor, 2002). A study of Israeli College Students’ use of electronic information sources (EIS) reported that students with prior computer knowledge tend to use EIS more than those with minimal prior knowledge.

The studies related to prior knowledge above investigated learners’ prior knowledge and how it affects the relationship between different formats of information presentation and learners’ performance. Likewise, the 4C/ID model also mentioned that prior knowledge is a factor of strategy selection for information presentation. Thus prior knowledge is a key variable that educators or instructional designers could or should take into consideration when making decisions on the design for information presentation.

## Computer Self-Efficacy

Self-efficacy, defined as “people’s judgments of their capabilities to organize and execute courses of action required to attain designated types of performances” (Bandura, 1986, p.391), is a key concept drawn from Social Cognitive Theory. In other words, self-efficacy is a self-judgment of whether one is capable of accomplishing a certain level of performance. Bandura explained that personal judgments of efficacy determine an individual’s effort expenditure, persistence when facing obstacles, thought patterns and emotional reactions to the environment. More importantly, self-efficacy judgments are highly related to one’s action and motivation.

Researchers have employed the concept of self-efficacy in the context of computer software training in the attempt to predict computer learning and computer performance (Yi & Im, 2004). A widely accepted definition of computer self-efficacy by Compeau and Higgins (1995b) is

computer self-efficacy represents an individual’s perceptions of his or her ability to use computers in the accomplishment of task (ie., using a software package for data analysis, writing a mailmerge letter using a word processor), rather than reflecting simple component skills (ie., formatting diskettes, booting up a computer, using a specific software feature such as “bold text” or “changing margins”) (p.191)

Compeau and Higgins (1995b) discussed three dimensions of computer self-efficacy judgments: magnitude, strength, and generalizability. The magnitude of computer self-efficacy refers to the level of computer task difficulty one believes is attainable and the support levels one needs to perform a task. Individuals with higher computer self-efficacy magnitude are those who perceive themselves more able to complete more difficult tasks with less support and assistance

than those with lower judgments of self-efficacy magnitude. The strength of computer self-efficacy refers to one's confidence in performing a computer task. Those with higher strength would show greater confidence in their ability to perform the tasks successfully. The generalizability of computer self-efficacy indicates the extent to which perceived abilities are limited to particular hardware and software. Individuals with high computer self-efficacy generalizability are those who perceive themselves as able to use different computer systems and software packages with competence.

Due to the burgeoning use of information technology, an increasing number of many research studies have investigated the effects of computer self-efficacy on computer use. The research findings can be discussed under two subcategories: factors influencing computer self-efficacy and factors that are influenced by computer self-efficacy.

### *Factors Influencing Computer Self-efficacy*

Researchers believed that computer self-efficacy can be used to predict computer task performance and thus many have devoted their efforts to find out what factors influenced computer self-efficacy judgments. For instance, factors that were discovered to play influential roles were prior computer experience (Compeau & Higgins, 1995a; Henry & Stone, 1994, 1995; Igboria & Iivari, 1995; Wu, 2002), behavior modeling (Compeau & Higgins, 1995a; Gist, Schwoerer, & Rosen, 1989), management support (Compeau & Higgins, 1995b; Henry & Stone, 1994, 1995), ease of system use (Henry & Stone, 1994, 1995), and computer anxiety (Havelka, 2003; Martocchio, 1992).



### Prior Computer Experience

Research has found a significantly positive relationship between prior computer experience and computer self-efficacy (Compeau & Higgins, 1995a; Henry & Stone, 1994, 1995; Igboria & Iivari, 1995; Wu, 2002). The information on trainees' prior computer experience was obtained through administering questionnaires asking subjects' familiarity with particular types of software or asking them to rate their level of experience ranging from novice to expert. In Compeau and Higgins' (1995a) study, there were two software training programs: Lotus and WordPerfect. The result of the study showed that prior experience only influenced self-efficacy for Lotus training. The researchers explained that people would form stronger self-efficacy judgments towards more familiar packages. Since Lotus was new to the subjects, they had to draw upon related experiences in order to guess their own ability. Both the findings of Yi and Im's study (2004) and Agarwal, Sambamurthy, and Stair's (2000) study were consistent with the findings of Compeau and Higgins (1995a) that an "individual's past interactions with the target performance behavior help shape self-efficacy beliefs" (p.428).

### Management Support

Henry and Stone (1994; 1995) studied the influence of management support on computer self-efficacy and found a positive relationship between this two. However, in Compeau and Higgins' (1995b) study, a significantly negative relationship was found between support and self-efficacy. The researchers explained that the causal relationship between computer self-efficacy and support may be reversed. With a higher organizational support system, individuals with lower self-efficacy may be very dependent on it. This may result in people believing that they are

not capable of doing such work. Thus, the existence of higher support may hinder the development of high self-efficacy judgments.

### Behavior Modeling

Gist, Schwoerer, and Rosen (1989) and Compeau and Higgins (1995a) studied the role of behavior modeling in software training. The importance of behavior modeling applied in the context of computer technology was that, by observing someone else performing the target behavior, the subjects' perceptions of their own ability to successfully perform the same target behavior would be raised. In both studies, subjects in the modeling condition developed higher self-efficacy as well as higher performance. As expected, behavior modeling positively influenced computer self-efficacy.

### *Factors Influenced by Computer Self-efficacy*

Computer self-efficacy was demonstrated to be a crucial factor in the promotion of information technology. It has direct impact on people's decisions towards using computers. Research found that computer self-efficacy could influence the performance outcomes of using computers (Agarwal et al., 2000; Compeau & Higgins, 1995a; Henry & Stone, 1995; Tam, 1996; Wu, 2002), individuals' acceptance to using information technology (Agarwal et al., 2000; Morris & Turner, 2001; Pan, 2003), intention to use computers (Liaw & Huang, 2001), personal goal (Wu, 2002; Yi & Im, 2004), outcome expectance (Collins, Caputi, Rawstorne, & Jayasuriya, 1999; Compeau & Higgins, 1995a; Henry & Stone, 1995), and individuals' level of anxiety

toward computer use (Compeau & Higgins, 1995b). A detailed discussion of some of the most studied factors follows.

### Performance

Computer self-efficacy is an essential factor that affects an individual's computer performance (Yi & Im, 2004). Tam (1996) found computer self-efficacy to be a significant predictor of computer skills learning outcomes for 31 individuals with physical disabilities. Tam mentioned that individuals who are physically disabled are more likely to have low self-efficacy with regard to learning computer skills. Thus by raising their self-efficacy and helping them believe in their ability to acquire computer skills, they will have more chance to successfully learn the skills and become more independent in the technology-intensive society.

In Wu's (2002) study of 170 Taiwanese learners learning Visual Basic, he found that computer self-efficacy had a positive influence on learners' goal commitment and computer performance. He also indicated that the higher an individual's self-efficacy, the stronger the goal commitment, which in turn leads to higher computer performance.

In 1999, Collins, Caputi, Rawstorne, and Jayasuriya conducted a study to investigate the validity of Henry and Stone's (1995) model that indicated management support, ease of use, computer experience effected job performance through the mediating factor computer self-efficacy and outcome expectancy. Through an experiment of 40 undergraduate students using a statistical software package, the authors found that computer self-efficacy could predict test performance such as task completion rate, number of adjustments, task completion rate, task error rate, and time taken to complete task.

### Technology Acceptance

Research by Agarwal, et al (2000) showed that one's computer self-efficacy determines one's technology acceptance. Individuals who have higher computer self-efficacy tend to accept technology use more. Thus Agarwal, et al. recommended while IT managers recruit people, they should target individuals who exhibits stronger computer efficacy because the particular personal trait increases the likelihood of ones' acceptance in the use of technology.

### Intention to Use Computers

Liaw and Huang (2001) conducted a study that consisted of 402 faculty and staff in a medical college in Taiwan by looking at the relationship between their computer self-efficacy and intention to use computers. The results showed that learners' computer self-efficacy could be divided into two levels, basic and advanced computer self-efficacy, based on their computer experiences. In addition, they also addressed that computer self-efficacy influenced learners' intention to use computers. When learners had higher computer self-efficacy, they had more intention to use computers.

### Personal Goal

Yi and Im (2004) conducted a study on predicting computer task performance with personal goal setting and self-efficacy. The researchers tried to validate goal setting theory in the context of computer software training. They stated that "individuals with more challenging goals exert more effort in line with the demands of the higher performance standards and maintain effort over more extended time than individuals with less challenging goals, thereby producing

higher performance.” The results showed that computer self-efficacy was significantly related to personal goals and that both personal goal settings and computer self-efficacy are significant predictors of computer task performance. The study supported the basic premise that self-efficacy affects performance through personal goal settings. The researchers suggested that one’s personal goals might be an even more powerful predictor to successful computer performance than computer self-efficacy or prior experience. The findings of the study are congruent with that of Wu’s (2002): one’s goal commitment has a significant impact on one’s computer performance; one’s computer self-efficacy positively influences one’s goal commitment and computer performance.

### Outcome Expectance

Compeau and Higgins (1995a) stressed the importance of self-efficacy to the development of computer skills. The researchers conducted a research based on Social Cognitive Theory comparing behavior modeling (having subjects watch a software demonstration videotape) with traditional lecture type of software training. The recruited subjects were managers and professionals with little prior computer experience. They participated in a two day training course covering Lotus 1-2-3 and WordPerfect 5.1. The results showed that individuals who had higher computer self-efficacy had higher outcome expectations and better performance than those who had lower computer self-efficacy. In other words, individuals who had confidence in their ability to accomplish tasks using the unfamiliar software, had higher expectations of outcomes associated with computer use, including enhanced quality of work output, and increased productivity. Also, individuals who had higher computer self-efficacy

scored higher in their performance in the two hands-on exercises. The study suggested that “self-efficacy represents a unique and important contribution to the development of computing skills” (p.136). That is, in order to assist individuals in acquiring computing skills, it is necessary to consider helping them to develop a positive perception of their ability to use the skills. In addition, Henry and Stone’s (1995) study and Collins et al.’s study (1999) also showed that computer self-efficacy could predict outcome expectancy.

### Summary

Software training is one of the key determinants of success for today’s high technology society. This is because business sectors have had great demands in the use of a variety of application software to promote high quality, efficiency, reliability, and productivity in their workplace. Also, educators have been trying to incorporate computer technology to advance students’ learning. Thus, finding a relationship between information presentation types in software training and learner characteristics is crucial to effective software training.

Four strategies for information presentation, namely, deductive-inquisitory strategy, deductive-expository strategy, inductive-inquisitory strategy and inductive-expository strategy were introduced by van Merriënboer (1997) in his Four-Component Instructional Design (4C/ID) model. The 4C/ID model suggests three factor-criteria to select strategy for information presentation: (a) availability of instructional time, (b) learners’ prior knowledge about the content, and (c) the required level of understanding. Research have been done in using information presentation strategies similar to what the 4C/ID model suggested, and have found partial support to van Merriënboer’s view in using the availability of instructional time and learner’s

prior knowledge as strategy selection criteria. Rieber and Kini (1995) stated that the deductive-expository strategy worked better than the inductive-inquisitory strategy to help students learn Newton's laws of motion. They suggested that the way information should be presented based on students' prior knowledge, motivation in task learning, ability to monitor comprehension, as well as the amount of time provided for a task. Al-Kharrat (2000), on the other hand, suggested that students are encouraged to use more thinking skills in the inductive-inquisitory strategy than in the deductive-expository strategy; however, explained that the effectiveness of different strategy use depended upon how the instruction was delivered.

Another factor for effective software training is learners' characteristics, namely, learners' computer self-efficacy and prior knowledge. Computer self-efficacy, a judgment of whether one is capable of using computers to accomplish a task, has been found to have effects on outcome expectations, personal goal setting, technology acceptance, intention to use computers, and learners' performance. Learners' prior computer knowledge may be an important factor in considering how much information should be presented at a time (redundancy of information presentation), what type of feedback should be given, and format of presentation.

This chapter introduced the 4C/ID model along with its' four strategies for information presentation. Also research conducted on the four strategies, as well as computer self-efficacy and prior knowledge has been reviewed. This leads us to the following chapter introducing the heart of the study in investigating the influence of learners' computer self-efficacy and prior computer knowledge in the relationship between learner outcomes and various instructional strategies of information presentation in computer-based software training.

## **CHAPTER 3**

### **METHOD**

This chapter presents the study population, sample selection, research design, instrumentation, data collection procedures, data analysis technique, assumptions and limitations.

#### **Study Population and Sample Selection**

This study was conducted at a large public university in the southeastern United States during the fall semester in 2004. The target population of the study was undergraduate education majors taking an introductory computer course designed for teacher candidates (EME2040 classes). The aim of the course is to prepare education majors, or pre-service teachers, to become computer literate and prepare them to incorporate technology in the classroom. The curriculum includes teaching education majors how to integrate instructional technology into their classroom by exploring a variety of technical topics including classroom management tools, multimedia, communication networks, interactivity, and educational software. Also addressed were legal, ethical, and social issues related to the use of information technology. The study was conducted in the middle of the semester so that, by the time the study was conducted, students had already learned about computer operating systems (Microsoft Windows), word processing, spreadsheets, and database programs in class. The course was a traditional class face-to-face instruction. The class has never experienced computer-based instruction before the present study was introduced. For student participants, this was a new experience for them to learn software through a computer-based tutorial.



Initially there were 81 students from three classes voluntarily participated in the study. The final sample size was 78 students. Three students were removed from the sample because they had previously used Netscape Composer 7. The participating students were informed that participation in this study was voluntarily and would not affect their grades. Participants had the right to withdraw from the study at anytime without consequence. In addition, student identities remained confidential (Appendix H). Of the 78 students participating, 19 students (24.4 %) were male and 59 students (75.6 %) were female. A summary description of the sample is shown in Table 2.

Table 2

## Description of Sample

<b>Variable</b>	<b>Total</b>	<b>Percent of Sample</b>
	78	
<b>Gender</b>		
Male	19	24.4
Female	59	75.6
<b>Age</b>		
Under 20	34	43.6
21 -- 25	38	48.7
26 -- 30	4	4.7
34	1	1.3
37	1	1.3
<b>Ethnicity</b>		
African-American	4	5.1
Asian or Pacific Islander	1	1.3
Caucasian	68	87.2
Hispanic	4	5.1
Other	1	1.3
<b>Occupation Status</b>		
Works Full time (over 20 hours a week)	19	24.4
Works Part Time (no more than 20 hours a week)	30	38.5
Unemployed	29	37.2
<b>Have used computer</b>		
1 to 3 years	2	2.6
4 to 6 years	17	21.8
Over 6 years	59	75.6

## Research Design

A posttest-only experimental research design was used to test the hypothesis and answer the research question posed in this study (Figure 3).

**R O<sub>1</sub> X<sub>1</sub> O<sub>2</sub> O<sub>3</sub> O<sub>4</sub>**  
**R O<sub>1</sub> X<sub>2</sub> O<sub>2</sub> O<sub>3</sub> O<sub>4</sub>**  
**R O<sub>1</sub> X<sub>3</sub> O<sub>2</sub> O<sub>3</sub> O<sub>4</sub>**  
**R O<sub>1</sub> X<sub>4</sub> O<sub>2</sub> O<sub>3</sub> O<sub>4</sub>**

Each line of R, Xs and Os represents a group

Figure 3: Research Design Form.

Symbol R indicates random assignment to separate treatment groups. In order to randomly assign three classes of students into four groups (deductive-expository, deductive-inquisitory, inductive-expository, and inductive-inquisitory groups), each student's network ID (NID, issued by the university to identify students to several central computing systems) was used as identification. Those NIDs were randomly divided into four groups by the researcher in advance. Each group was assigned only one computer-based tutorial of Netscape Composer 7. The steps described above were stored in the beginning of a tutorial program (which will be explained later). It meant that as soon as the students login using their NIDs, the tutorial program automatically assigned the students to the specific groups they belonged to and provides related tutorial.

Symbol Xs indicates treatment. X<sub>1</sub> indicates the deductive-inquisitory strategy. X<sub>2</sub> indicates the deductive-expository strategy. X<sub>3</sub> indicates the inductive-inquisitory strategy. X<sub>4</sub>

indicates the inductive-expository strategy. The details and differences among each treatment are explained in the “Instructional Material” section of this chapter.

Symbol Os indicates test, pretest or posttest. O<sub>1</sub> represents the measurement of participants’ computer self-efficacy and computer knowledge. According to review of the literature, prior computer experience is positively correlated to computer self-efficacy. To reduce the influence of prior computer experience on computer self-efficacy, O<sub>1</sub> was setting before treatment Xs in this study. O<sub>2</sub> represents the measurement of participants’ satisfaction towards treatment Xs. O<sub>3</sub> represents the multiple choice posttest to measure the immediate retention of the concepts after accepting treatment Xs. Similarly, O<sub>4</sub> represents the hands-on posttest to measure the application of the concepts after accepting treatment Xs. The design of each measurements and posttest are clearly explained in the “Measurement Instrument” section of this chapter.

### Instructional Material

To learn how to build a web page is a part of the introductory computer course requirement. Netscape Composer 7 is a basic web page editing and publishing utility included in Netscape 7. It can be downloaded from the Internet free. The researcher designed and developed four types of computer-based Netscape Composer 7 tutorials. The four computer-based tutorials differed from each other only in the way information was presented, namely, deductive-inquisitory strategy, deductive-expository strategy, inductive-inquisitory strategy, and inductive-expository strategy. All four tutorials covered the same content using the different information presentation approaches. The contents of the tutorials were designed based on the course

textbook entitled “Integrating Technology in the Classroom” (Shelly et al., 2002); but were modified by the researcher to meet the particular requirements of both the course and present study. The coordinator of the introductory computer courses reviewed the contents of the tutorials to assure the tutorials were easy for beginners to follow and that most of the objectives that should be taught in class were covered.

Before making distinctions among the four instructional strategies, it is necessary to understand how to represent the four approaches, which are deductive, inductive, expository, and inquisitory, on computer-based software training (Netscape Composer 7). Each tutorial consisted of two parts. One was an instance which showed learners how to create a basic web page step by step through Netscape Composer 7 (example). The other one showed learners how each tool or command in Netscape Composer 7 work (function). Based on review of literature, the following methods could appropriately represent the four approached on computer-base software training.

1. Deductive approach: present function first then present example.
2. Inductive approach: present example first then present function.
3. Expository approach: either function of example is explicitly presented to learners.
4. Inquisitory approach: through leading questions such as “please briefly describe how to insert an image in a web page”, the learners were asked to explore Netscape Composer 7 on their own and then to key in the answers they found.

The four tutorial were designed based on the combination of the above four approaches. The differences among the four tutorials are shown in Table 3. The structures of the four tutorials are shown in Figures 4, 5, 6, and 7.

Table 3

Differences among Four Tutorials with Different Instructional Strategies

	Inquisitory	Expository
Deductive	Explain individual function of Netscape Composer 7 tools first, and then show an image of Web page and request learner to key in essential steps of how to reproduce the Web Page.	Explain individual function of Netscape Composer 7 first, then show an image of Web page as example and present required action steps to reproduce the Web page.
Inductive	Show an image of Web page as example and present required action steps to reproduce the Web page first, then show several Netscape Composer 7 tools and request learner to key in each function.	Show an image of Web page as example and present required action steps to reproduce the Web page, and then explain individual function of Netscape Composer 7 tools.

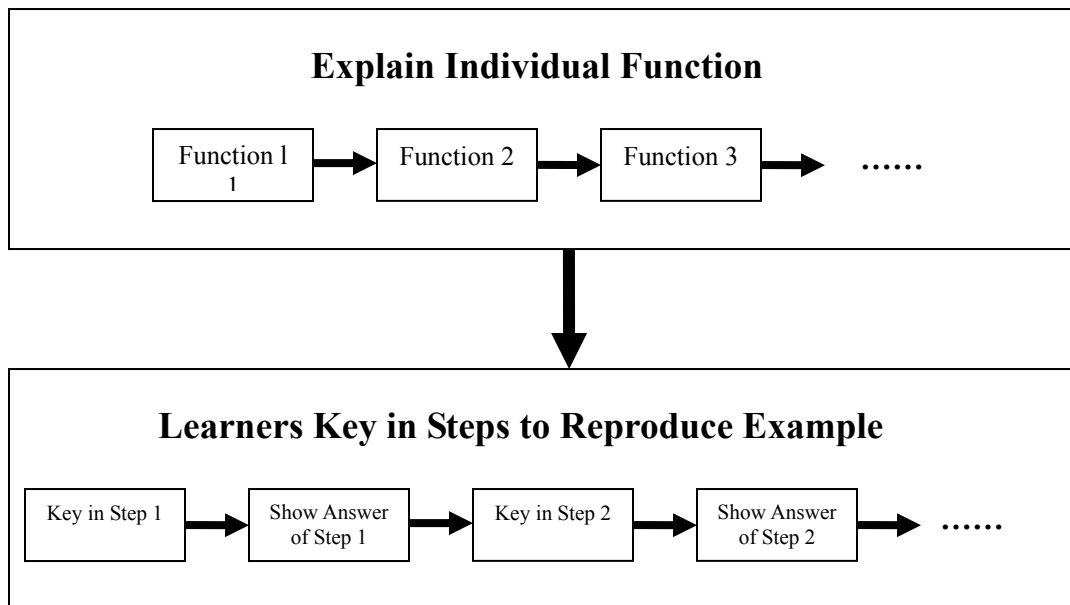


Figure 4: The Structure of Deductive-Inquisitory Strategy.

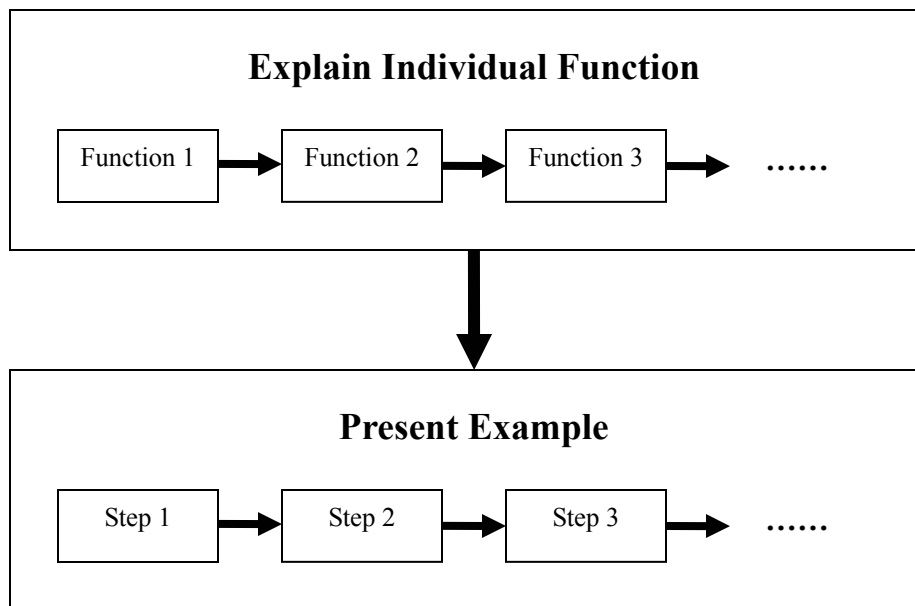


Figure 5: The Structure of Deductive-Expository Strategy.

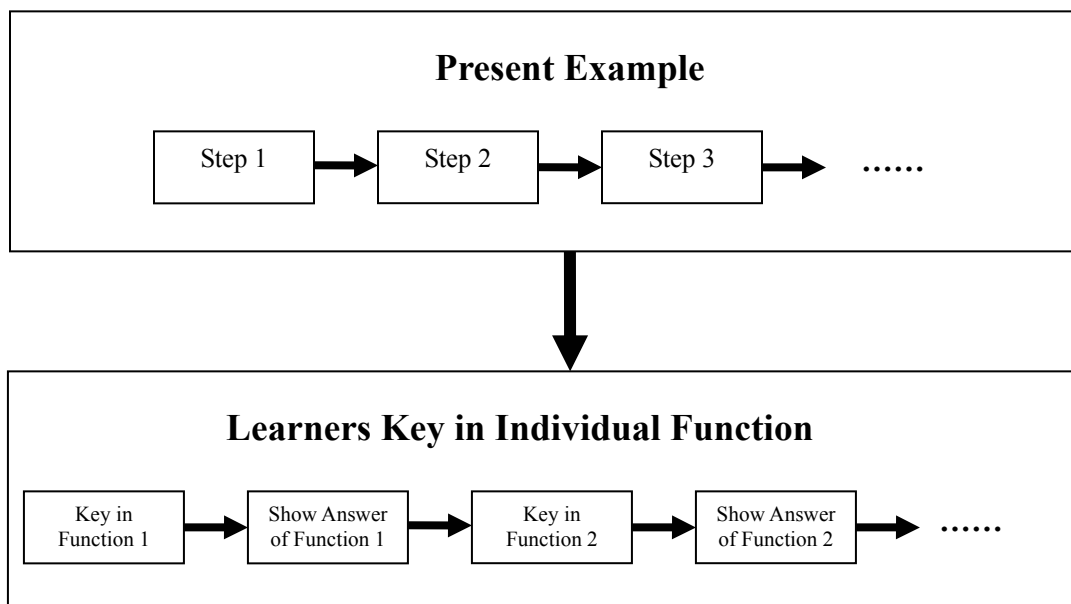


Figure 6: The Structure of Inductive-Inquisitory Strategy.

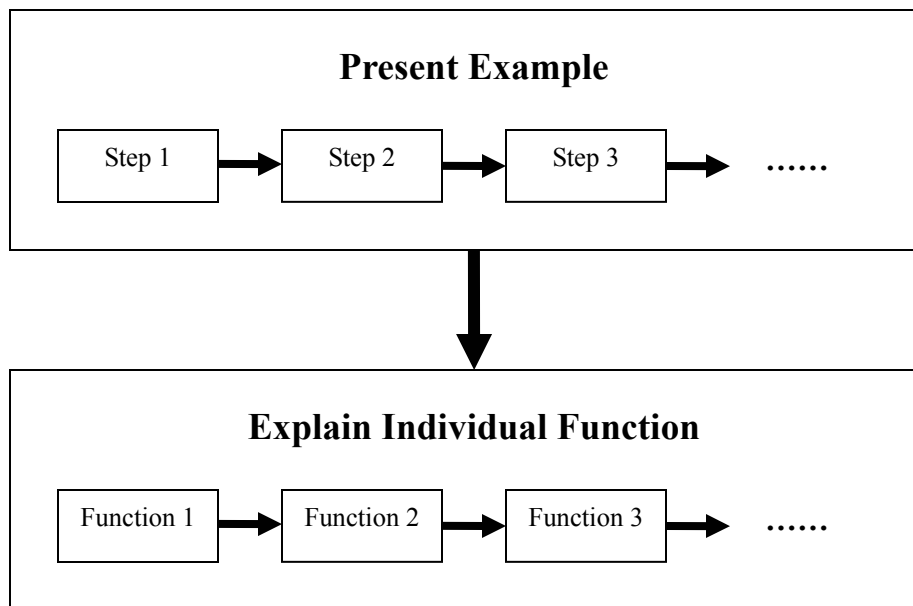


Figure 7: The Structure of Inductive-Expository Strategy.

#### Measurement Instrument

In this study, two posttests and one survey were used as measurement instruments. They are described in the following sections.

#### *Design of the Posttests*

Two posttests were administered to the participants at the end of this study to gauge two types of students' performance. One was a multiple-choice test and the other one was a hands-on application test to measure learner performance. The two posttests were different in nature in that the former tested student performance by how well they memorized what they learned, and the latter tested student application of the knowledge they learned. The posttests, based on the



instructional content of the Netscape Composer 7 tutorial, were designed and developed by the researcher.

### Multiple Choice Posttest

The multiple choice posttest was created to measure the immediate retention of the concepts covered by the tutorial. The test comprised 10 questions and offered four possible answers for each question. Each correct answer was awarded one point (See Appendix F). The multiple choice posttest was examined by the subject matter expert, the coordinator of the introductory computer course. Reliability analysis (Cronbach's coefficient alpha) indicated that the reliability was .49 for the 10 questions. According to Kehoe (1995), values of as low as .5 are satisfactory for 10 to 15 multiple choice questions.

### Hands-on Posttest

The hands-on test was designed to measure the application of what the participants learned from the tutorial. The hands-on test showed participants a web page image and then requires them to reproduce the sample web page. There were 17 requirements for finishing the sample web page and they were clearly indicated on the image file of the sample web page (See Appendix E). One point was given for successful completion of each requirement for the web page. The hands-on posttest was also examined by the coordinator of the introductory computer course.

### *Design of the Survey*

The survey in the study was used to measure the participant demographic information, computer self-efficacy, prior computer knowledge, and satisfaction toward the tutorial. The survey consisted of four questionnaires: (a) Demographic Information, (b) Computer Self-Efficacy, (c) Computer Knowledge, and (d) Satisfaction.

The blueprint table of the initial survey design is shown in Table 4.

Table 4

Blueprint Table of Initial Survey Design

<b>Category</b>	<b>Number of Items</b>
<b>Demographic Information</b>	<b>7</b>
<b>Computer Self-Efficacy</b>	<b>8</b>
<b>Computer Knowledge</b>	<b>48</b>
1. Basic Computer Operations	10
2. Set up, Maintenance, and Trouble Shooting	5
3. Word Processing	8
4. The Internet	13
5. Media/Presentation Tools	12
<b>Satisfaction</b>	<b>20</b>
<b>Total</b>	<b>83</b>

The survey items were tested in a pilot study, which involved 95 student participants, conducted by the researcher during the spring 2004 semester to measure the validity and reliability for each questionnaire. The 76 survey items, which demographic information questionnaire was not included, were factor analyzed to examine correlation among variables in order to identify latent factors. First, the maximum likelihood estimation procedure was used to

extract the factors with eigenvalue is higher than 1.0 from the variable data. Second, the varimax method was used for factor rotation. Third, each coefficient in rotated factor matrix represents the partial correlation between the item and the rotated factor. In the study, only the coefficients with absolute values of more than 0.5 were maintained. Fourth, the researcher removed the rotated factors with only 2 items or less. The result of factor analysis yielded 5 factors. The total variance accounted for by the five factors is 63.97%. Each factor's number of items, variance and reliability (Coronbach's  $\alpha$ ) are shown in Table 5.

Table 5

Result of Factor Analysis

<b>Category</b>	<b>Number of Items</b>	<b>Variance (%)</b>	<b>Coronbach's <math>\alpha</math></b>
<b>Computer Self-Efficacy</b>	<b>8</b>	6.48%	0.92
<b>Computer Knowledge</b>	<b>24</b>		0.90
1. Basic Computer and Internet Operations	14	26.52%	
2. Set up, Maintenance, and Trouble Shooting	6	11.22%	
3. Intermediate Computer Operations	4	3.32%	
<b>Satisfaction</b>	<b>20</b>	16.43%	0.88

The design of each questionnaire as well as its validity and reliability are described in the following.

### Demographic Information Questionnaire

The questionnaire included seven items in order to obtain participants' personal and background information (See Appendix A). It was designed based on a questionnaire created by Pan (2003). Besides items on general information, such as "Age," "Gender," and "Ethnicity," participants were asked whether they had ever used Netscape Composer 7. Since one of the purposes of this study was to determine the relationship between the different strategies and learner performance in software training, people who have used Netscape Composer 7 before would be removed from the sample, thus, controlling for student prior experience.

### Computer Self-Efficacy Questionnaire

The questionnaire, consisted of eight items with an 11 point Likert-scale, and was adopted from Compeau & Higgins (1995a). The purpose of the questionnaire was to assess participant self-efficacy towards using an unfamiliar software package to complete a task. For each item, participants first needed to answer whether they could use a software package to complete a job with differing levels of assistance. If the answer was "yes," they needed to indicate how confident they were to finish the job. The scale was from "Not confident at all" (1 point) to "Totally confident" (10 points). If the answer was "no," they got zero point on the item (See Appendix B).

According to Bandura (1986, 1997), self-efficacy is people's perception of their own ability to perform behavior in order to achieve their expected outcome. In applying self-efficacy in software training, computer self-efficacy is operationalized as people make judgments about using their computer ability to operate new software to become proficient in that software. Thus,

the computer self-efficacy questionnaire was designed to ask people as to their ability to complete a task using unfamiliar software with different levels of help (Compeau & Higgins, 1995a). This is the content validity of computer self-efficacy questionnaire.

The questionnaire initially consisted of eight items and was not removed any item after factor analysis of the pilot study. Reliability analysis (Cronbach's coefficient alpha) indicated that the reliability was .92 for the eight items (see Tables 4 and 5).

### Computer Knowledge Questionnaire

The questionnaire was used to investigate participant computer knowledge. It included questions concerning basic computer operations, word processing, and the Internet. It was consisted of 30 four-point Likert-scaled items (See Appendix C). The questions involved three sub-domains: (a) Basic Computer and Internet Operations, (b) Set up, Maintenance, and Trouble Shooting, and (c) Intermediate Computer Operations. Each sub-domain was preceded by the phrase "Do you know how to ...". From each item, participants were asked to indicate their status from "I can't do this at all," "I can do this but need more instruction," "I can do this but can't show others," "I feel comfortable with this and could teach it to others."

The computer knowledge questionnaire was designed by the researcher based on studies of Constantine and Lockwood (1999) and Salmon (2000). According to the studies, computer knowledge included several skills people assessed for themselves in understanding (a) computer's hardware and software, (b) basic computer-related terminology, (c) word processor, (d) Internet use, and (e) multimedia. For this reason, the computer knowledge questionnaire was classified into five categories: (a) Basic computer operations included questions about basic

computer skill such as the ability to use the copy, cut and paste commands, the ability to save a document file, and file management; (b) The Set up, Maintenance, and Trouble Shooting part consisted of computer hardware and software questions; (c) Word Processing included questions on basic word operations; (d) The Internet included questions on the ability to connect to the Internet, to browse the World Wide Web (WWW), to use e-mail, and to communicate on the web via a discussion board or chat room; (e) Media/Presentation Tools included questions on the ability in computer media use such as the ability to use a digital camera and scanner, to edit pictures/photos, to create and use multimedia presentation. This is the content validity of the computer knowledge questionnaire.

The initial questionnaire for computer knowledge consisted of 48 items. For the final version of the present computer knowledge questionnaire, 24 items were removed after the factor analysis of the pilot study. Reliability for the final 24 items was .92 and was administered in the present study (see Tables 4 and 5).

### Satisfaction Questionnaire

The questionnaire, modified from Lee (1998), was composed of twenty five-points Likert-scale items and one open-ended question (See Appendix D). The questionnaire seeks to assess participants' satisfaction towards the tutorial. Sample items included statements such as "I would tell other students to use this tutorial if they want to learn about Netscape Composer 7.1," "The tutorial made it possible for me to learn quickly," and "I would like to study another topic using a computer-based tutorial like this again." For each item, participants were asked to answer from "Strongly Disagree" (1 point) to "Strongly Agree" (5 points).

In terms of Chin and Lee's study (2000), the participants' satisfaction toward the tutorial in this study is operationalized as "the overall affective evaluation an end-user has regarding his or her experience related with" the tutorial (p. 554). That's the reason the satisfaction questionnaire was modified from Lee (1998), which assessed students' enjoyment and overall use of a computer software tutorial. This is the content validity of the satisfaction questionnaire. Reliability analysis (Cronbach's coefficient alpha) indicated that the reliability was .88 for the 20 items (see Tables 4 and 5).

#### Procedures and Data Collecting

This study was done during class time, in which students learned how to build a web page by completing the tutorial created by the researcher.

To ensure the smooth flow of the study process and the accuracy of the measurement instrument, a computer-based tutorial program was developed by the researcher. Figure 8 illustrates the data collection procedure.

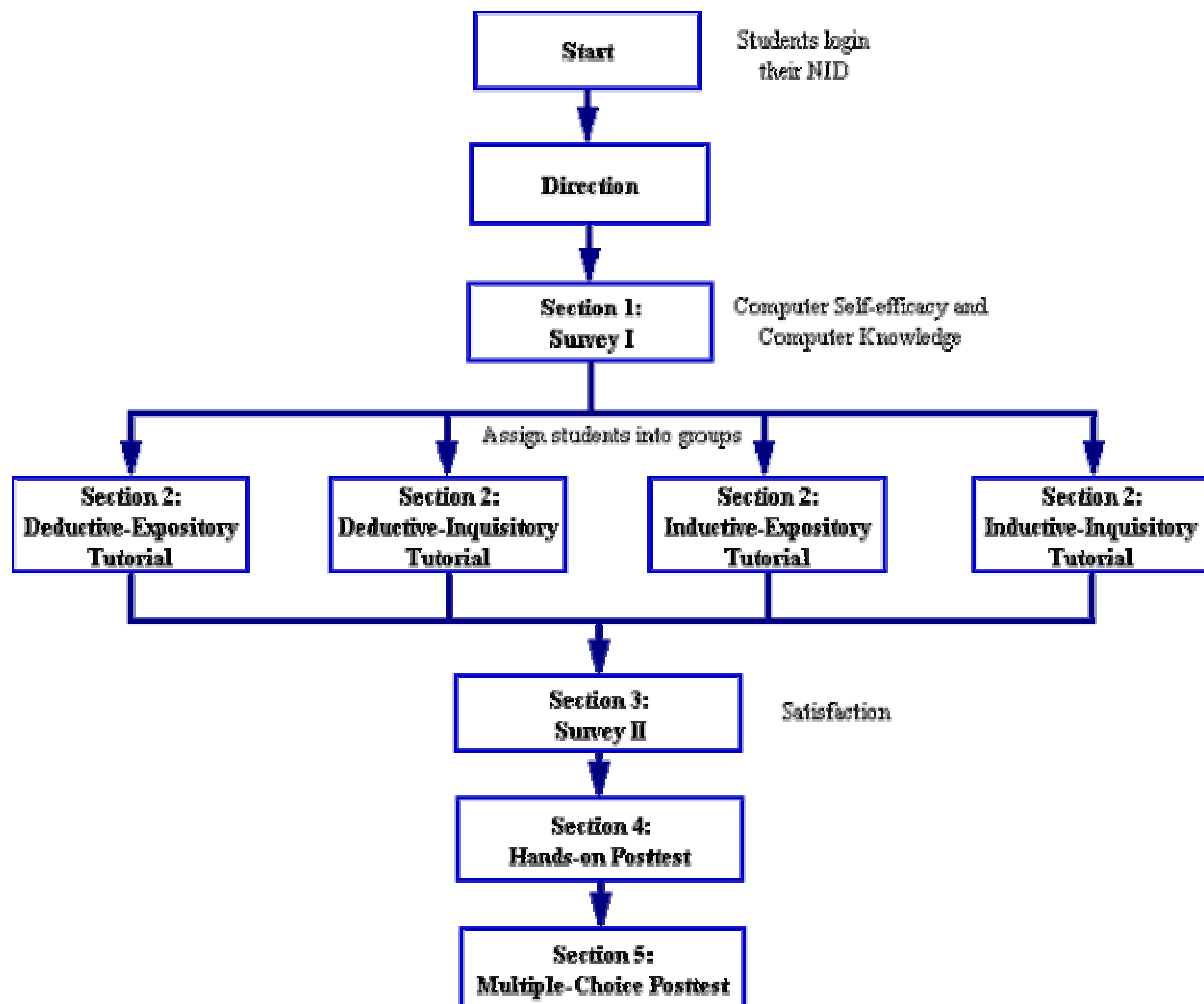


Figure 8: Data Collection Procedure.

The following is the experimental procedure:

1. Before the class started, the researcher installed Netscape Composer 7 and the tutorial program on each computer.
2. At the beginning of the class, students were informed about the purpose of this study. A floppy disk was distributed to each student for data collecting.
3. The researcher showed the consent form at the beginning of the tutorial and explained that



participation in this study was voluntary and students could quit at any time without consequence.

4. Students followed the sequence of the tutorial program to complete the Netscape Composer 7 tutorial, two posttests and the survey by themselves. Students' progresses using the tutorial, their answers on the multiple-choice test, and their responses on the survey were recorded on the floppy disk provided by the researcher. Students were also requested to save their sample web page to the floppy disk for their hands-on test.
5. Students had about three hours to finish the tutorial program. To ensure there was adequate time for all students to wend their way through the tutorial, students were also verbally informed that they would have one extra hour to finish the whole task if the class hours were not sufficient.

### Pilot Study

A pilot study for the current research was conducted over a three-day period in the spring semester of 2004. Ninety-five (95) students who took EME2040 class that semester participated in the study, with approximately 30 students participated each day. With the approval of the EME2040 coordinator, the study was conducted in class. There was a difference in instructional material between the pilot study and the final version. The instructional material used in the pilot study did not contain the inquisitory approach which required participants to explore Netscape Composer 7 themselves and key in the answers they found. The objectives of the pilot study were to (a) ensure the quality of the tutorial program, (b) observe the research process to minimize the number of errors as students go through the tutorial program, (b) measure the

anticipated time required to undertake the tutorial, (d) examine both posttests, and (e) measure the validity and reliability of the survey questionnaire.

From the pilot study, the following problems were found and solved.

1. Problem: At the beginning of the study, the researcher verbally informed the participants as to the purpose and process of the study. It was found that some students did not fully understand the process of the study. The situation could influence the accuracy of the study.

Solution: In addition to verbally informing students about the purpose and process of the study, the researcher also included essential information in the beginning of the tutorial program to enable students to follow the procedures.

2. Problem: Some bugs, including misspelled words and unclear directions, were found in the tutorial program.

Solution: The tutorial program was revised immediately after each day's experiment to ensure the accuracy of the tutorial program. For example, there were five sections in the tutorial programs. At the end of each section, the researcher initially set up an "END THE SECTION" button for students to go to the next section. Some students were misled by the button and thought they had finished the study. The final version used "NEXT" instead of "END THE SECTION" to solve the misleading problem.

3. Problem: For the convenience of data collection, the computer self-efficacy and computer knowledge questionnaires were initially placed on the Internet; the satisfaction questionnaire and the multiple-choice posttest were placed at the end of the tutorial program. Both data were identified by students' network ID. It was noticed that some data collected from the Internet did not match the data collected from the tutorial program because some students

did not input the same network ID.

Solution: The computer self-efficacy and the computer knowledge questionnaires were also moved into the tutorial program.

4. Problem: Some students felt nervous about the posttests because they thought the results of the posttest would affect their grades for their EME 2040 class.

Solution: The researcher verbally informed the participants and emphasized repeatedly that the results would never affect their grades. The information was also incorporated into the tutorial program.

### Data Analysis

One-way analysis of variance and effect size calculation was performed on research questions 1 and 2. Moderated multiple regression (MMR) was performed on research questions 3 and 4.

### Assumptions

1. Software training in this study is considered complex cognitive skills which could apply the four strategies of information presentation the 4C/ID model proposed.
2. The participants in this study understood the instruction and terminology provided in the tutorial.
3. The participants completely followed the direction of the tutorial program.
4. The participants were motivated and had sufficient time to complete their tutorials.
5. The participants finished the tutorial individually without any help from others.

6. The participants responded to the questionnaire with honesty.
7. The structure tutorial made by the researcher represented the four strategies of information presentation in the 4C/ID model, i.e., a deductive-expository strategy, a deductive-inquisitory strategy, an inductive-expository strategy and an inductive-inquisitory strategy.

#### Limitations

1. A self-reported study may not portray the full picture of the students' prior computer knowledge, computer self-efficacy, and satisfaction toward computer-based software training due to the imperfections of quantitative research.
2. Validity of the study relies on participants' actually doing the computer-based instruction and honest responses to the questionnaire and posttests.
3. The researcher didn't have full control over participants' gender, characteristics, and motivation toward software learning which might have affected the students' performance in software learning.

## **CHAPTER 4**

### **RESULTS**

#### Introduction

The purpose of this study was to identify relationships among various instructional strategies of information presentation, computer self-efficacy, prior computer knowledge, learner's performance and learner's satisfaction in computer-based software training. Four research questions were constructed: research questions 1 and 2 were answered using one-way analysis of variance (ANOVA) and effect size calculation; questions 3 and 4 were answered using moderated multiple regression (MMR).

The chapter includes descriptive statistics and findings for each research question. Table 6 shows the descriptive statistics for all variables.

Table 6

Descriptive Statistics of Variables among Whole Participants (Total N=78)

<b>Variable</b>	<b>Mean</b>	<b>SD</b>	<b>Minimum</b>	<b>Maximum</b>	<b>N</b>
<b>Computer Self-Efficacy</b>					
Deductive-Inquisitory Group	50.65	16.14	24	80	20
Deductive-Expository Group	58.70	15.69	16	76	20
Inductive-Inquisitory Group	47.47	19.03	14	75	19
Inductive-Expository Group	53.74	13.96	29	79	19
<b>Prior Computer Knowledge</b>					
Deductive-Inquisitory Group	80.75	8.37	56	92	20
Deductive-Expository Group	82.35	9.19	68	96	20
Inductive-Inquisitory Group	77.95	8.44	58	92	19
Inductive-Expository Group	79.74	8.43	57	95	19
<b>Multiple Choice Posttest</b>					
Deductive-Inquisitory Group	7.80	1.47	5	10	20
Deductive-Expository Group	8.10	1.37	5	10	20
Inductive-Inquisitory Group	7.53	1.31	4	10	19
Inductive-Expository Group	8.21	1.48	4	10	19
<b>Hands-On Posttest</b>					
Deductive-Inquisitory Group	13.30	3.67	5	17	20
Deductive-Expository Group	14.55	3.09	6	17	20
Inductive-Inquisitory Group	14.63	1.89	11	17	19
Inductive-Expository Group	14.21	2.80	7	17	19
<b>Satisfaction Score</b>					
Deductive-Inquisitory Group	75.90	12.03	52	94	20
Deductive-Expository Group	76.90	11.52	47	96	20
Inductive-Inquisitory Group	74.53	10.89	57	93	19
Inductive-Expository Group	78.68	9.14	58	95	19

## Research Question 1

*To what extent will different instructional strategies for information presentation affect learner performance in software training?*

One-Way ANOVA was used to answer the question for both the multiple choice and the hands-on posttests. An alpha of 0.05 was set for the significance level. The results for the multiple choice posttest revealed there was no statistically significant difference in multiple choice posttest scores ( $F_{3, 74} = 0.78, p > .05$ ) among the deductive-inquisitory, the deductive-expository, the inductive-inquisitory, and the inductive-expository groups. Likewise, the results for the hands-on posttest showed there was no statistically significant difference in hands-on posttest scores ( $F_{3, 74} = 0.85, p > .05$ ) among all groups.

Effect size is a way of quantifying the meaningfulness of the difference between the means of two groups. Cohen (as cited in Shavelson, 1996) defined a “small effect” as  $d = .2$ , “medium effect” as  $d = .5$ , and “large effect” as  $d = .8$ . The effect size of the difference in means for any two of the four groups in multiple choice posttest score and hands-on posttest score are shown in Tables 7 and 8.

Table 7

Effective Size (Cohen’s  $d$ ) Calculation Per-Pairs for Multiple Choice Posttest Score

	Deductive-Inquisitory	Deductive-Expository	Inductive-Inquisitory	Inductive-Expository
Deductive-Inquisitory	--	--	--	--
Deductive-Expository	.211	--	--	--
Inductive-Inquisitory	.194	.425	--	--
Inductive-Expository	.278	.077	.487	--

Table 8

Effective Size (Cohen's  $d$ ) Calculation Per-Pairs for Hands-on Posttest Score

	Deductive-Inquisitory	Deductive-Expository	Inductive-Inquisitory	Inductive-Expository
Deductive-Inquisitory	--	--	--	--
Deductive-Expository	.368	--	--	--
Inductive-Inquisitory	.452	.031	--	--
Inductive-Expository	.278	.115	.176	--

Tables 7 shows that the effect size calculation of the deductive-expository vs. the inductive-inquisitory groups ( $d = .425$ ), and the inductive-inquisitory vs. the inductive-expository groups ( $d = .487$ ) in multiple choice posttest reached nearly medium proportions. In addition, the effect size calculation of the deductive-inquisitory vs. the deductive-expository groups ( $d = .211$ ), and the deductive-inquisitory vs. the inductive-expository groups ( $d = .278$ ) in multiple choice posttest reached small to medium proportions. This indicates that there was a meaningful difference in mean multiple choice score between (a) the deductive-expository and the inductive-inquisitory, (b) the inductive-inquisitory and the inductive-expository, (c) the deductive-inquisitory and the deductive-expository, and (d) the deductive-inquisitory and the inductive-expository groups.

Tables 8 shows that the effect size calculation of the deductive-inquisitory vs. the inductive-inquisitory groups ( $d = .452$ ) in hands-on posttest reached nearly medium proportions. The effect size calculation of the deductive-inquisitory vs. the deductive-expository groups ( $d = .368$ ), and the deductive-inquisitory vs. the inductive-expository groups ( $d = .278$ ) in hands-on posttest also reached small to medium proportions. This indicates that there was a difference in



mean hands-on posttest scores between (a) the deductive-inquisitory and the inductive-inquisitory, (b) the deductive-inquisitory and the deductive-expository, (c) the deductive-inquisitory and the inductive-expository groups.

In order to investigate the reasons which may have caused the differences between groups in multiple choice and hands-on posttests, the effect size for any two of the four groups in computer self-efficacy and prior computer knowledge are also calculated in Tables 9 and 10.

Table 9

Effective Size (Cohen's d) Calculation Per-Pairs for Computer Self-Efficacy

	Deductive-Inquisitory	Deductive-Expository	Inductive-Inquisitory	Inductive-Expository
Deductive-Inquisitory	--	--	--	--
Deductive-Expository	.506	--	--	--
Inductive-Inquisitory	.181	.646	--	--
Inductive-Expository	.204	.333	.376	--

Table 10

Effective Size (Cohen's d) Calculation Per-Pairs for Prior Computer Knowledge

	Deductive-Inquisitory	Deductive-Expository	Inductive-Inquisitory	Inductive-Expository
Deductive-Inquisitory	--	--	--	--
Deductive-Expository	.182	--	--	--
Inductive-Inquisitory	.333	.498	--	--
Inductive-Expository	.120	.296	.212	--

Tables 9 shows that there was a meaningful difference in mean computer self-efficacy score between the deductive-inquisitory and the deductive-expository ( $d = .506$ ), the deductive-inquisitory and the inductive-expository ( $d = .204$ ), the deductive-expository and the inductive-inquisitory ( $d = .646$ ), the deductive-expository and the inductive-expository ( $d = .333$ ), and the inductive-inquisitory and the inductive-expository ( $d = .376$ ) groups. Tables 10 also shows that there was a difference in mean prior computer knowledge score between the deductive-inquisitory and the inductive-inquisitory ( $d = .333$ ), the deductive-expository and the inductive-inquisitory ( $d = .498$ ), the deductive-expository and the inductive-expository ( $d = .296$ ), and the inductive-inquisitory and the inductive-expository ( $d = .212$ ) groups.

#### Research Question 2

*To what extent will different instructional strategies for information presentation affect learner satisfaction toward software training?*

One-Way ANOVA was used to answer the question. An alpha of 0.05 was set for the significance level. The result showed there was no statistically significant difference in satisfaction scores toward software training ( $F_{3, 74} = 0.49, p > .05$ ) among all groups.

The effect size for any two of the four groups in satisfaction score are shown in Table 11.

Table 11

Effective Size (Cohen's d) Calculation Per-Pairs for Satisfaction Score

	Deductive-Inquisitory	Deductive-Expository	Inductive-Inquisitory	Inductive-Expository
Deductive-Inquisitory	--	--	--	--
Deductive-Expository	.085	--	--	--
Inductive-Inquisitory	.119	.211	--	--
Inductive-Expository	.259	.171	.413	--

Tables 11 shows that the effect size calculation of the inductive-inquisitory vs. the inductive-expository groups ( $d = .413$ ) in satisfaction score reached nearly medium proportions. In addition, the effect size calculation of the deductive-inquisitory vs. the inductive-expository groups ( $d = .259$ ), and the deductive-expository vs. the inductive-inquisitory groups ( $d = .211$ ) in satisfaction score reached small to medium proportions. This indicated that there is a difference in mean satisfaction scores between (a) the inductive-inquisitory and the inductive-expository, (b) the deductive-inquisitory and the inductive-expository, (c) the deductive-expository and the inductive-inquisitory groups.

### Research Question 3

To what extent is the impact of instructional strategies for information presentation on learner performance in software training moderated by learner computer self-efficacy and learner prior computer knowledge?

### *Correlation*

Moderated multiple regression (MMR) was used to answer research questions 3 and 4. Before attempting to use regression analysis to answer research questions, a bivariate zero-order correlation matrix was performed among continuous independent variable (computer self-efficacy, prior computer knowledge) and dependent variable (multiple choice score, hands-on test score, and satisfaction score). Table 12 displays the results of the analysis. According to Table 12, computer self-efficacy and prior computer knowledge are positively related to multiple choice scores ( $p \leq .01$ ). In addition, there is a positive correlation between prior computer knowledge and satisfaction scores ( $p < .05$ ).

Table 12

Correlation Matrix among Independent Variables and Dependent Variables

	CSE	PCK	Multiple choice	Hands-on test	Satisfaction
<b>CSE</b>	--	.552*	.401*	.112	.191
<b>PCK</b>	--	--	.316*	.114	.278*
<b>Multiple choice</b>	--	--	--	.194	.149
<b>Hands-on test</b>	--	--	--	--	.223*
<b>Satisfaction</b>	--	--	--	--	--

CSE: Computer self-efficacy; PCK: Prior computer knowledge

\*Correlation is significant at the 0.05 level (2-tailed)

### *Dummy Coding*

Since the categorical independent variable “groups” cannot be entered directly into a regression model and be meaningfully interpreted, the variable “groups” need to be dummy coded.

In this question, three different dummy coding methods were used to understand the

relationship between different groups. Table 13 shows the first dummy coding method to compare the deductive-inquisitory with the deductive-expository groups (Dum12), and the inductive-inquisitory with the inductive-expository groups (Dum34).

Table 13

Dummy Coding for Comparing Deductive and Inductive Approaches

	<b>Dum12</b>	<b>Dum34</b>	<b>Dum12n34</b>
<b>1. Deductive-inquisitory group</b>	1	0	1
<b>2. Deductive-expository group</b>	-1	0	1
<b>3. Inductive-inquisitory group</b>	0	1	-1
<b>4. Inductive-expository group</b>	0	-1	-1

Table 14 shows the second dummy coding method to compare the deductive-expository with the inductive-expository groups (Dum24), and the deductive-inquisitory with the inductive-inquisitory groups (Dum13).

Table 14

Dummy Coding for Comparing Expository and Inquisitory Approaches

	<b>Dum24</b>	<b>Dum13</b>	<b>Dum24n13</b>
<b>1. Deductive-inquisitory group</b>	0	1	1
<b>2. Deductive-expository group</b>	1	0	-1
<b>3. Inductive-inquisitory group</b>	0	-1	1
<b>4. Inductive-expository group</b>	-1	0	-1

Table 15 shows the third dummy coding method to compare the deductive-inquisitory with the inductive-expository groups (Dum14), and the deductive-expository with the inductive-inquisitory groups (Dum23).

Table 15

Dummy Coding for Comparing Group 1 with Group 4, and Group 2 with Group 3

	<b>Dum14</b>	<b>Dum23</b>	<b>Dum14n23</b>
<b>1. Deductive-inquisitory group</b>	1	0	1
<b>2. Deductive-expository group</b>	0	1	-1
<b>3. Inductive-inquisitory group</b>	0	-1	-1
<b>4. Inductive-expository group</b>	-1	0	1

To represent the interaction between groups and the moderating factors (computer self-efficacy and prior computer knowledge), the variables were first centered and then multiplied together.

*Multiple Choice Posttest*

Computer self-efficacy (CSE) as a moderating factor

1. The resulting regressing model based on the first dummy coding was:

$$\text{Standardized values of multiple choice scores} = 6.309 - .005 (\text{Dum12}) - .2 (\text{Dum34}) - .031 (\text{Dum12n34}) + .032 (\text{CSE}) + .009 (\text{Dum12}) * (\text{CSE}) + .025 (\text{Dum34}) * (\text{CSE}) + .003 (\text{Dum12n34}) * (\text{CSE})$$

2. The resulting regressing model based on the second dummy coding was:

$$\text{Standardized values of multiple choice scores} = 6.305 - .129 (\text{Dum24}) + .066 (\text{Dum13}) - .102 (\text{Dum24n13}) + .032(\text{CSE}) + .011 (\text{Dum24}) * (\text{CSE}) - .005 (\text{Dum13}) * (\text{CSE}) + .017 (\text{Dum24n13}) * (\text{CSE})$$

3. The resulting regressing model based on the third dummy coding was:

$$\text{Standardized values of multiple choice scores} = 6.309 - .134 (\text{Dum14}) + .071 (\text{Dum23}) + .097 (\text{Dum14n23}) + .032(\text{CSE}) + .020 (\text{Dum14}) * (\text{CSE}) - .014 (\text{Dum23}) * (\text{CSE}) - .008 (\text{Dum14n23}) * (\text{CSE})$$

The above three equations can be seen as the same equation because they used the same data but different dummy coding methods to investigate the relationship among different groups. The equation accounts for 21.2% of the variance in multiple choice scores, multiple R=.46. The common significant variable in the above equations is the main effect: computer self-efficacy because the 95% confidence interval for regression coefficient of computer self-efficacy (.03) is from .011 to .052 which doesn't include zero. This indicates the same result in correlation table (Table 12) that there was a positive relationship between computer self-efficacy and multiple choice scores.

#### Prior computer knowledge (PCK) as a moderating factor

1. The resulting regressing model based on the first dummy coding was:

$$\text{Standardized values of multiple choice scores} = 3.576 - .105 (\text{Dum12}) - .294 (\text{Dum34}) - .014 (\text{Dum12n34}) + .054 (\text{PCK}) + .006 (\text{Dum12}) * (\text{PCK}) - .013 (\text{Dum34}) * (\text{PCK}) - .019 (\text{Dum12n34}) * (\text{PCK})$$

2. The resulting regressing model based on the second dummy coding was:

$$\begin{aligned} \text{Standardized values of multiple choice scores} = & 3.576 - .108 (\text{Dum24}) + .081 (\text{Dum13}) - \\ & .199 (\text{Dum24n13}) + .054(\text{PCK}) - .029 (\text{Dum24})*(\text{PCK}) - .01 (\text{Dum13})*(\text{PCK}) - .004 \\ & (\text{Dum24n13})*(\text{PCK}) \end{aligned}$$

3. The resulting regressing model based on the third dummy coding was:

$$\begin{aligned} \text{Standardized values of multiple choice scores} = & 3.576 - .213 (\text{Dum14}) + .186 (\text{Dum23}) \\ & + .095 (\text{Dum14n23}) + .054(\text{PCK}) - .023 (\text{Dum14})*(\text{PCK}) - .016 (\text{Dum23})*(\text{PCK}) + .01 \\ & (\text{Dum14n23})*(\text{PCK}) \end{aligned}$$

Again, the above three equations can be seemed as a same equation. The equation accounts for 13.7% of the variance in multiple choice scores, multiple  $R=.37$ . The only significant variable in the equation is the main effect: prior computer knowledge because the 95% confidence interval for the regression coefficient of prior computer knowledge (.054) is from .015 to .094 which doesn't include zero. The also indicates the same result in correlation table (Table 12) that there was a positive relationship between prior computer knowledge and multiple choice scores.

#### Computer self-efficacy (CSE) and prior computer knowledge (PCK) as moderating factors

1. The resulting regressing model based on the first dummy coding was:

$$\begin{aligned} \text{Standardized values of multiple choice scores} = & 4.651 - .009 (\text{Dum12}) - .248 (\text{Dum34}) - \\ & .054 (\text{Dum12n34}) + .025 (\text{CSE}) + .025 (\text{PCK}) + .006 (\text{Dum12})*(\text{CSE}) + .041 \\ & (\text{Dum34})*(\text{CSE}) + .010 (\text{Dum12n34})*(\text{CSE}) + .011 (\text{Dum12})*(\text{PCK}) - .060 \\ & (\text{Dum34})*(\text{PCK}) - .022 (\text{Dum12n34})*(\text{PCK}) \end{aligned}$$



Two significant variables are found in the equation. One variable is the main effect: computer self-efficacy which the 95% confidence interval for the regression coefficient of CSE (.025) is from .0004 to .051 and doesn't include zero. It is predictable that the main effect: computer self-efficacy will also be found in the second and third dummy coding methods.

The other significant variable only for the equation is Dum34\*CSE because the 95% confidence interval for the regression coefficient of Dum34\*CSE (.041) is from .008 to .075 which doesn't include zero. This can be interpreted that computer self-efficacy moderated the effect of the inductive-inquisitory and the inductive-expository groups on multiple choice scores when both computer self-efficacy and prior computer knowledge are considered as moderating factors.

In order to focus on interaction of Dum34 and computer self-efficacy, PCK is set to zero. Then for the inductive-inquisitory group, the previous equation becomes:

$$\text{Standardized values of multiple choice scores} = 4.457 + .056 * \text{CSE}$$

For the inductive-expository group, the previous equation becomes:

$$\text{Standardized values of multiple choice scores} = 4.953 - .026 * \text{CSE}$$

Figure 9 shows computer self-efficacy moderated the effect of the inductive-inquisitory group and the inductive-expository group on multiple choice scores.

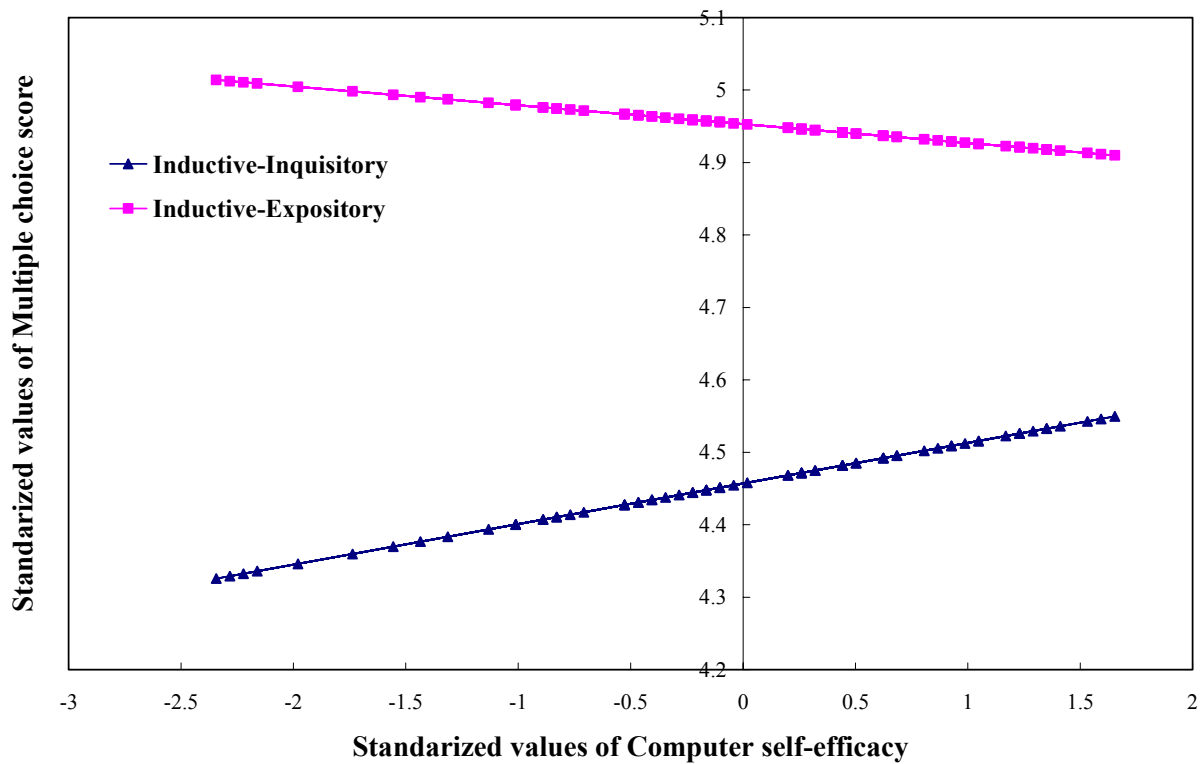


Figure 9: The Effect of Computer Self-efficacy on Multiple Choice Scores between Inductive-Inquisitory and Inductive-Expository Groups.

2. The resulting regressing model based on the second dummy coding was:

$$\begin{aligned} \text{Standardized values of multiple choice scores} = & 4.646 - .173 (\text{Dum24}) + .065 (\text{Dum13}) - \\ & .128 (\text{Dum24n13}) + .026 (\text{CSE}) + .025 (\text{PCK}) + .027 (\text{Dum24}) * (\text{CSE}) - .008 \\ & (\text{Dum13}) * (\text{CSE}) + .024 (\text{Dum24n13}) * (\text{CSE}) - .057 (\text{Dum24}) * (\text{PCK}) + .013 \\ & (\text{Dum13}) * (\text{PCK}) - .024 (\text{Dum24n13}) * (\text{PCK}) \end{aligned}$$

In this equation, only the main effect: computer self-efficacy was found as significant variable.

3. The resulting regressing model based on the third dummy coding was:

$$\begin{aligned} \text{Standardized values of multiple choice scores} = & 4.651 - .182 (\text{Dum14}) + .075 (\text{Dum23}) \\ & + .119 (\text{Dum14n23}) + .025 (\text{CSE}) + .025 (\text{PCK}) + .033 (\text{Dum14}) * (\text{CSE}) - .014 \\ & (\text{Dum23}) * (\text{CSE}) - .018 (\text{Dum14n23}) * (\text{CSE}) - .046 (\text{Dum14}) * (\text{PCK}) + .002 \\ & (\text{Dum23}) * (\text{PCK}) + .035 (\text{Dum14n23}) * (\text{PCK}) \end{aligned}$$

In this equation, only the main effect: computer self-efficacy was found as being a significant variable.

The equation accounts for 28% of the variance in multiple choice scores,  $R=.53$ .

### *Hands-on Posttest*

#### Computer self-efficacy (CSE) as a moderating factor

1. The resulting regressing model based on the first dummy coding was:

$$\begin{aligned} \text{Standardized values of hands-on scores} = & 13.021 - .433 (\text{Dum12}) + .208 (\text{Dum34}) - .315 \\ & (\text{Dum12n34}) + .02 (\text{CSE}) - .013 (\text{Dum12}) * (\text{CSE}) + .0003 (\text{Dum34}) * (\text{CSE}) + .021 \\ & (\text{Dum12n34}) * (\text{CSE}) \end{aligned}$$

2. The resulting regressing model based on the second dummy coding was:

$$\begin{aligned} \text{Standardized values of hands-on scores} = & 13.031 + .006 (\text{Dum24}) - .635 (\text{Dum13}) - .113 \\ & (\text{Dum24n13}) + .020 (\text{CSE}) + .028 (\text{Dum24}) * (\text{CSE}) + .014 (\text{Dum13}) * (\text{CSE}) - .006 \\ & (\text{Dum24n13}) * (\text{CSE}) \end{aligned}$$

3. The resulting regressing model based on the third dummy coding was:

$$\begin{aligned} \text{Standardized values of hands-on scores} = & 13.021 - .428 (\text{Dum14}) - .202 (\text{Dum23}) - .321 \\ & (\text{Dum14n23}) + .021(\text{CSE}) + .015 (\text{Dum14})*(\text{CSE}) + .028 (\text{Dum23})*(\text{CSE}) - .007 \\ & (\text{Dum14n23})*(\text{CSE}) \end{aligned}$$

The equation accounts for 6.0% of the variance in multiple choice scores,  $R=.24$ . No significance was found in the above equations.

#### Prior computer knowledge (PCK) as a moderating factor

1. The resulting regressing model based on the first dummy coding was:

$$\begin{aligned} \text{Standardized values of hands-on scores} = & 10.841 - .56 (\text{Dum12}) - .252 (\text{Dum34}) - .315 \\ & (\text{Dum12n34}) + .041 (\text{PCK}) - .024 (\text{Dum12})*(\text{PCK}) + .003 (\text{Dum34})*(\text{PCK}) + .0002 \\ & (\text{Dum12n34})*(\text{PCK}) \end{aligned}$$

2. The resulting regressing model based on the second dummy coding was:

$$\begin{aligned} \text{Standardized values of hands-on scores} = & 10.841 + .091 (\text{Dum24}) - .721 (\text{Dum13}) - .154 \\ & (\text{Dum24n13}) + .041(\text{PCK}) + .014 (\text{Dum24})*(\text{PCK}) - .013 (\text{Dum13})*(\text{PCK}) - .010 \\ & (\text{Dum24n13})*(\text{PCK}) \end{aligned}$$

3. The resulting regressing model based on the third dummy coding was:

$$\begin{aligned} \text{Standardized values of hands-on scores} = & 10.841 - .469 (\text{Dum14}) - .161 (\text{Dum23}) - .406 \\ & (\text{Dum14n23}) + .041(\text{PCK}) - .01 (\text{Dum14})*(\text{PCK}) + .011 (\text{Dum23})*(\text{PCKE}) - .013 \\ & (\text{Dum14n23})*(\text{PCK}) \end{aligned}$$

The equation accounts for 5.1% of the variance in hands-on scores,  $R=.23$ . No significance was found in the above equations.

Computer self-efficacy (CSE) and prior computer knowledge (PCK) as moderating factors

1. The resulting regressing model based on the first dummy coding was:

$$\begin{aligned} \text{Standardized values of hands-on scores} = & 11.349 - .429 (\text{Dum12}) + .221 (\text{Dum34}) - .342 \\ & (\text{Dum12n34}) + .025 (\text{CSE}) + .025 (\text{PCK}) - .016 (\text{Dum12}) * (\text{CSE}) - .001 (\text{Dum34}) * (\text{CSE}) \\ & + .030 (\text{Dum12n34}) * (\text{CSE}) + .006 (\text{Dum12}) * (\text{PCK}) + .009 (\text{Dum34}) * (\text{PCK}) - .033 \\ & (\text{Dum12n34}) * (\text{PCK}) \end{aligned}$$

2. The resulting regressing model based on the second dummy coding was:

$$\begin{aligned} \text{Standardized values of hands-on scores} = & 11.364 - .017 (\text{Dum24}) - .667 (\text{Dum13}) - .104 \\ & (\text{Dum24n13}) + .014 (\text{CSE}) + .025 (\text{PCK}) + .038 (\text{Dum24}) * (\text{CSE}) + .023 (\text{Dum13}) * (\text{CSE}) - \\ & .009 (\text{Dum24n13}) * (\text{CSE}) - .031 (\text{Dum24}) * (\text{PCK}) - .034 (\text{Dum13}) * (\text{PCK}) + .007 \\ & (\text{Dum24n13}) * (\text{PCK}) \end{aligned}$$

3. The resulting regressing model based on the third dummy coding was:

$$\begin{aligned} \text{Standardized values of hands-on scores} = & 11.349 - .447 (\text{Dum14}) - .238 (\text{Dum23}) + .325 \\ & (\text{Dum14n23}) + .015 (\text{CSE}) + .025 (\text{PCK}) + .022 (\text{Dum14}) * (\text{CSE}) + .039 (\text{Dum23}) * (\text{CSE}) - \\ & .007 (\text{Dum14n23}) * (\text{CSE}) - .025 (\text{Dum14}) * (\text{PCK}) + .040 (\text{Dum23}) * (\text{PCK}) + .001 \\ & (\text{Dum14n23}) * (\text{PCK}) \end{aligned}$$

No significance was found in the above equations.

The equation accounts for 7.0% of the variance in hands-on posttest scores,  $R=.26$ .

#### Research Question 4

*To what extent is the impact of instructional strategies for information presentation on learner satisfaction regarding software training moderated by learner computer self-efficacy and learner prior computer knowledge?*

Moderated multiple regression (MMR) and the three dummy coding methods in research question 3 were used to answer this question. To represent the interaction between groups and the moderating factors (computer self-efficacy and prior computer knowledge), the variables were first centered and then multiplied together.

#### Computer self-efficacy (CSE) as a moderating factor

1. The resulting regressing model based on the first dummy coding was:

$$\text{Standardized values of satisfaction scores} = 71.938 + .622 (\text{Dum12}) - 1.662 (\text{Dum34}) - .967 (\text{Dum12n34}) + .084 (\text{CSE}) - .14 (\text{Dum12}) * (\text{CSE}) + .271 (\text{Dum34}) * (\text{CSE}) + .129 (\text{Dum12n34}) * (\text{CSE})$$

The only significant variable in this equation is Dum34\*CSE because the 95% confidence interval for the regression coefficient of Dum34\*CSE (.271) is from .053 to .489 which doesn't include zero. This can be interpreted that computer self-efficacy moderated the effect of the inductive-inquisitory and the inductive-expository groups on satisfaction scores when only computer self-efficacy is considered as a moderating factor.

For the inductive-inquisitory group, the previous equation becomes:

$$\text{Standardized values of satisfaction scores} = 71.243 + .484 * \text{CSE}$$

For the inductive-expository group, the previous equation becomes:

$$\text{Standardized values of satisfaction scores} = 74.567 - .316 * \text{CSE}$$

Figure 10 shows computer self-efficacy moderated the effect of inductive-inquisitory group and inductive-expository group on satisfaction scores.

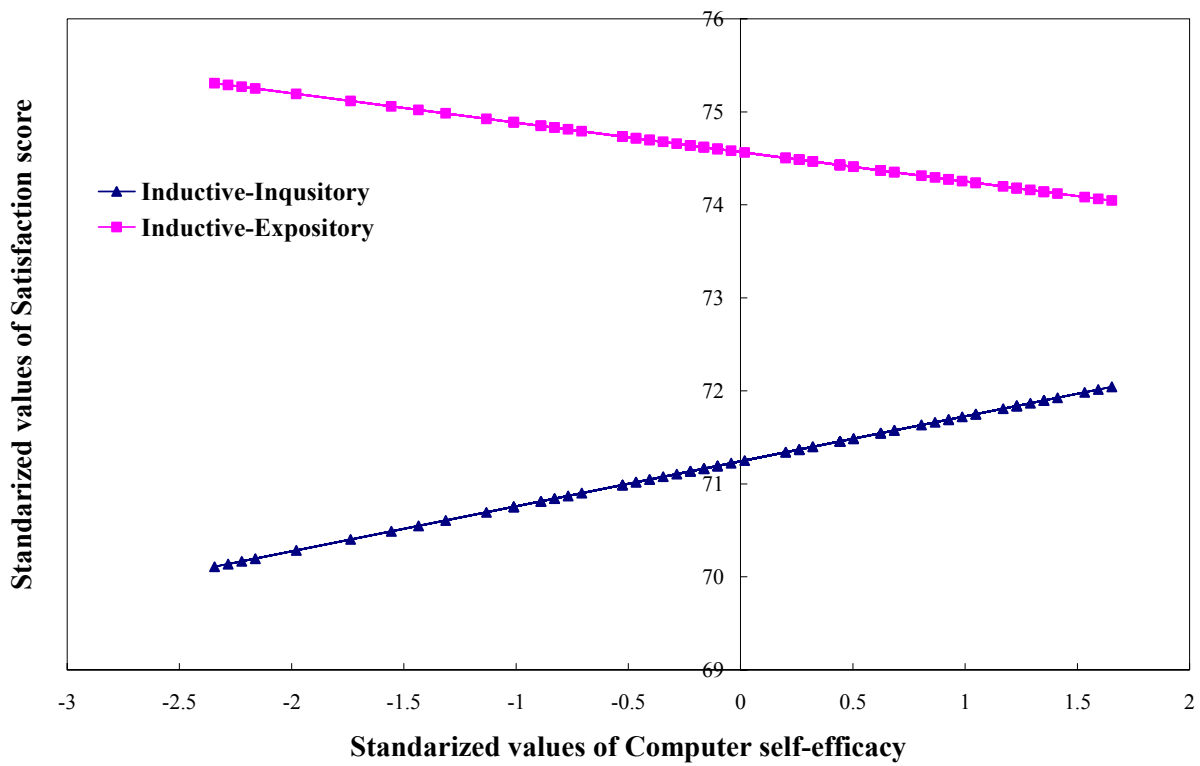


Figure 10: The Effect of Computer Self-efficacy on Satisfaction Scores between Inductive-Inquisitory and Inductive-Expository Groups.

2. The resulting regressing model based on the second dummy coding was:

$$\text{Standardized values of satisfaction scores} = 71.887 - 2.109 (\text{Dum24}) + .175 (\text{Dum13}) - .520 (\text{Dum24n13}) + .085(\text{CSE}) + .334 (\text{Dum24})*(\text{CSE}) - .077 (\text{Dum13})*(\text{CSE}) + .066 (\text{Dum24n13})*(\text{CSE})$$

The only significant variable in this equation is Dum24\*CSE because the 95% confidence interval for the regression coefficient of Dum24\*CSE (.334) is from .102 to .567 which doesn't include zero. This can be interpreted that computer self-efficacy moderated the effect of the deductive-expository group and the inductive-expository group on satisfaction scores when only computer self-efficacy is considered as a moderating factor.

For the deductive-expository group, the previous equation becomes:

$$\text{Standardized values of satisfaction scores} = 70.298 + .353*\text{CSE}$$

For the inductive-expository group, the previous equation becomes:

$$\text{Standardized values of satisfaction scores} = 74.516 - .315*\text{CSE}$$

Figure 11 shows computer self-efficacy moderated the effect of the deductive-expository and the inductive-expository groups on satisfaction scores.



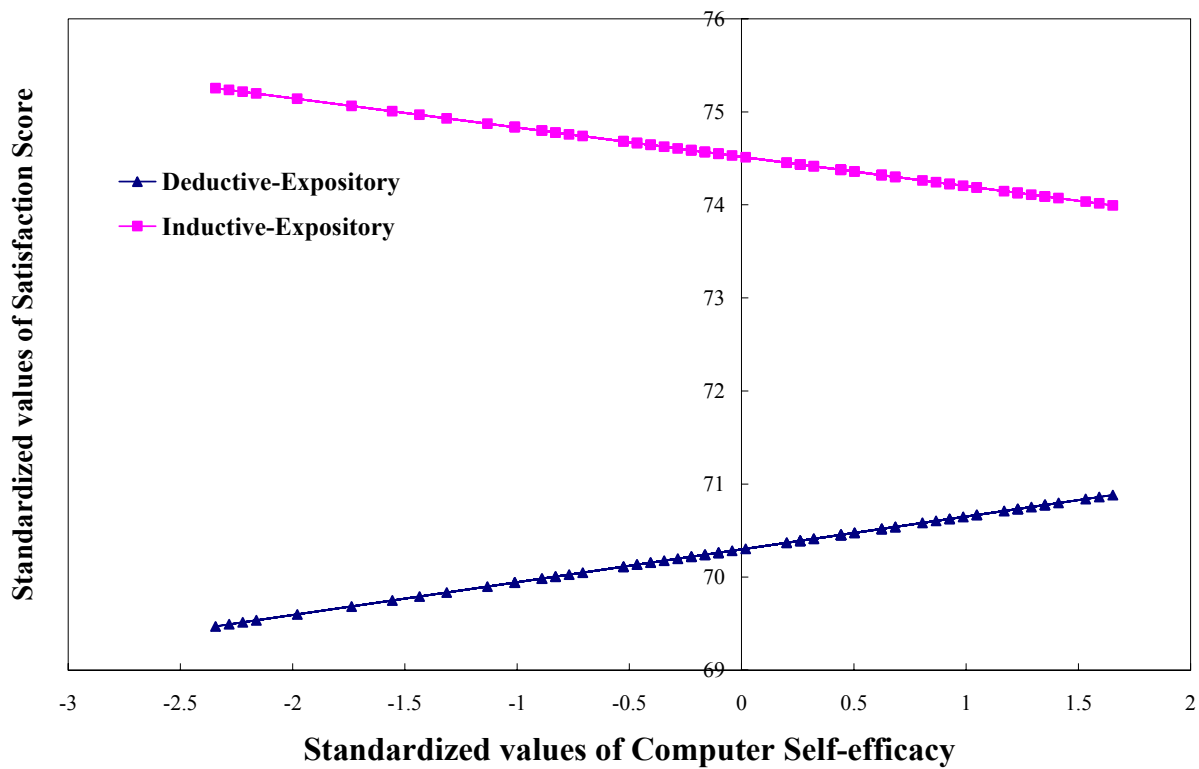


Figure 11: The Effect of Computer Self-efficacy on Satisfaction Scores between Deductive-Expository and Inductive-Expository Groups.

3. The resulting regressing model based on the third dummy coding was:

$$\begin{aligned} \text{Standardized values of satisfaction scores} = & 71.938 - 1.487 (\text{Dum14}) - .447 (\text{Dum23}) \\ & + 1.142 (\text{Dum14n23}) + .084(\text{CSE}) + .194 (\text{Dum14}) * (\text{CSE}) + .063 (\text{Dum23}) * (\text{CSE}) - .205 \\ & (\text{Dum14n23}) * (\text{CSE}) \end{aligned}$$

No significance was found in the equation.

This equation accounts for only 16 % of the variance in satisfaction scores,  $R=.40$ .

Prior computer knowledge (PCK) as a moderating factor

1. The resulting regressing model based on the first dummy coding was:

$$\begin{aligned} \text{Standardized values of satisfaction scores} = & 49.148 + .01 (\text{Dum12}) - 1.525 (\text{Dum34}) - .715 \\ & (\text{Dum12n34}) + .340 (\text{PCK}) - .119 (\text{Dum12}) * (\text{PCK}) + .249 (\text{Dum34}) * (\text{PCK}) + .104 \\ & (\text{Dum12n34}) * (\text{PCK}) \end{aligned}$$

2. The resulting regressing model based on the second dummy coding was:

$$\begin{aligned} \text{Standardized values of satisfaction scores} = & 49.148 - 1.482 (\text{Dum24}) + .053 (\text{Dum13}) - \\ & .758 (\text{Dum24n13}) + .340 (\text{PCK}) - .288 (\text{Dum24}) * (\text{PCK}) - .080 (\text{Dum13}) * (\text{PCK}) + .065 \\ & (\text{Dum24n13}) * (\text{PCK}) \end{aligned}$$

3. The resulting regressing model based on the third dummy coding was:

$$\begin{aligned} \text{Standardized values of satisfaction scores} = & 49.148 - 1.472 (\text{Dum14}) + .043 (\text{Dum23}) \\ & + .767 (\text{Dum14n23}) + .340 (\text{PCK}) + .169 (\text{Dum14}) * (\text{PCK}) + .039 (\text{Dum23}) * (\text{PCKE}) - .184 \\ & (\text{Dum14n23}) * (\text{PCK}) \end{aligned}$$

This equation accounts for 12.3% of the variance in satisfaction scores,  $R=.35$ . The common significant variable in the above equations is prior computer knowledge because the 95% confidence interval for regression coefficient of computer self-efficacy (.34) is from .052 to .628 which doesn't include zero. This also indicates the same result in correlation table (Table 12) that there was a positive relationship between prior computer knowledge and satisfaction scores.

### Computer self-efficacy (CSE) and prior computer knowledge (PCK) as moderating factors

1. The resulting regressing model based on the first dummy coding was:

$$\begin{aligned} \text{Standardized values of satisfaction scores} = & 53.439 + .414 (\text{Dum12}) - 1.636 (\text{Dum34}) \\ & - 1.125 (\text{Dum12n34}) + .005 (\text{CSE}) + .284 (\text{PCK}) - .111 (\text{Dum12}) * (\text{CSE}) \\ & + .274 (\text{Dum34}) * (\text{CSE}) + .125 (\text{Dum12n34}) * (\text{CSE}) + .031 (\text{Dum12}) * (\text{PCK}) \\ & + .001 (\text{Dum34}) * (\text{PCK}) - .002 (\text{Dum12n34}) * (\text{PCK}) \end{aligned}$$

The only significant variable in this equation is Dum34\*CSE because the 95% confidence interval for the regression coefficient of Dum34\*CSE (.274) is from .019 to .529 which doesn't include zero. This can be interpreted that computer self-efficacy moderates the effect of the inductive-inquisitory and the inductive-expository groups on satisfaction scores when both computer self-efficacy and prior computer knowledge are considered as moderating factors.

In order to focus on interaction of Dum34 and computer self-efficacy, PCK is set to zero. Then for the inductive-inquisitory group, the previous equation becomes:

$$\text{Standardized values of satisfaction scores} = 52.928 + .154 * \text{CSE}$$

For the inductive-expository group, the previous equation becomes:

$$\text{Standardized values of satisfaction scores} = 56.2 - .394 * \text{CSE}$$

Figure 12 shows computer self-efficacy moderated the effect of the inductive-inquisitory group and the inductive-expository group on satisfaction scores.

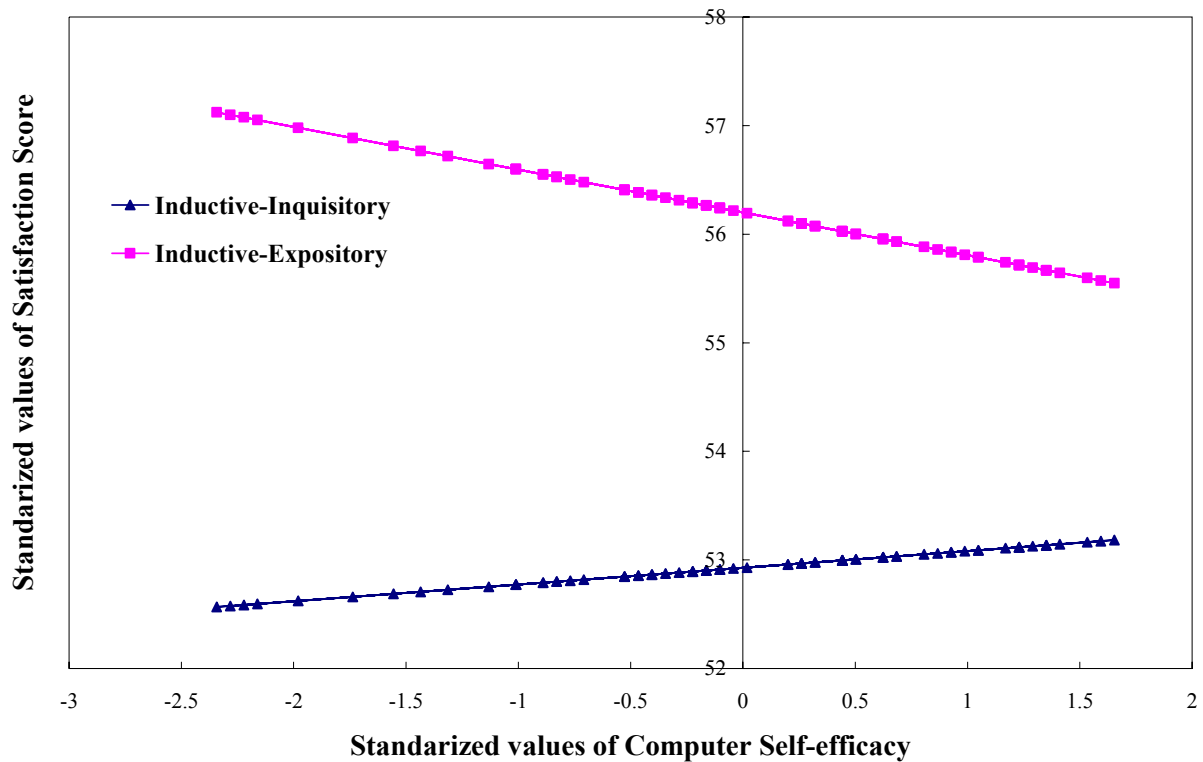


Figure 12: The Effect of Computer Self-efficacy on Satisfaction Scores between Inductive-Inquisitory and Inductive-Expository Groups.

2. The resulting regressing model based on the second dummy coding was:

$$\begin{aligned} \text{Standardized values of satisfaction scores} = & 53.393 - 2.150 (\text{Dum24}) - .100 (\text{Dum13}) - \\ & .611 (\text{Dum24n13}) + .006 (\text{CSE}) + .284 (\text{PCK}) + .318 (\text{Dum24}) * (\text{CSE}) - .068 \\ & (\text{Dum13}) * (\text{CSE}) + .081 (\text{Dum24n13}) * (\text{CSE}) - .018 (\text{Dum24}) * (\text{PCK}) + .013 \\ & (\text{Dum13}) * (\text{PCK}) + .016 (\text{Dum24n13}) * (\text{PCK}) \end{aligned}$$

The only significant variable in this equation is Dum24\*CSE because the 95% confidence interval for the regression coefficient of Dum24\*CSE (.318) is from .007 to .628

which doesn't include zero. This can be interpreted that computer self-efficacy moderates the effect of the deductive-expository and the inductive-expository groups on satisfaction scores when both computer self-efficacy and prior computer knowledge are considered as moderating factors.

In order to focus on interaction of Dum24 and computer self-efficacy, PCK is set to zero. For the deductive-expository group, the previous equation becomes:

$$\text{Standardized values of satisfaction scores} = 51.854 + .243 * \text{CSE}$$

Then for the inductive-expository group, the previous equation becomes:

$$\text{Standardized values of satisfaction scores} = 56.154 - .393 * \text{CSE}$$

Figure 13 shows computer self-efficacy moderated the effect of the deductive-expository group and the inductive-expository group on satisfaction scores.

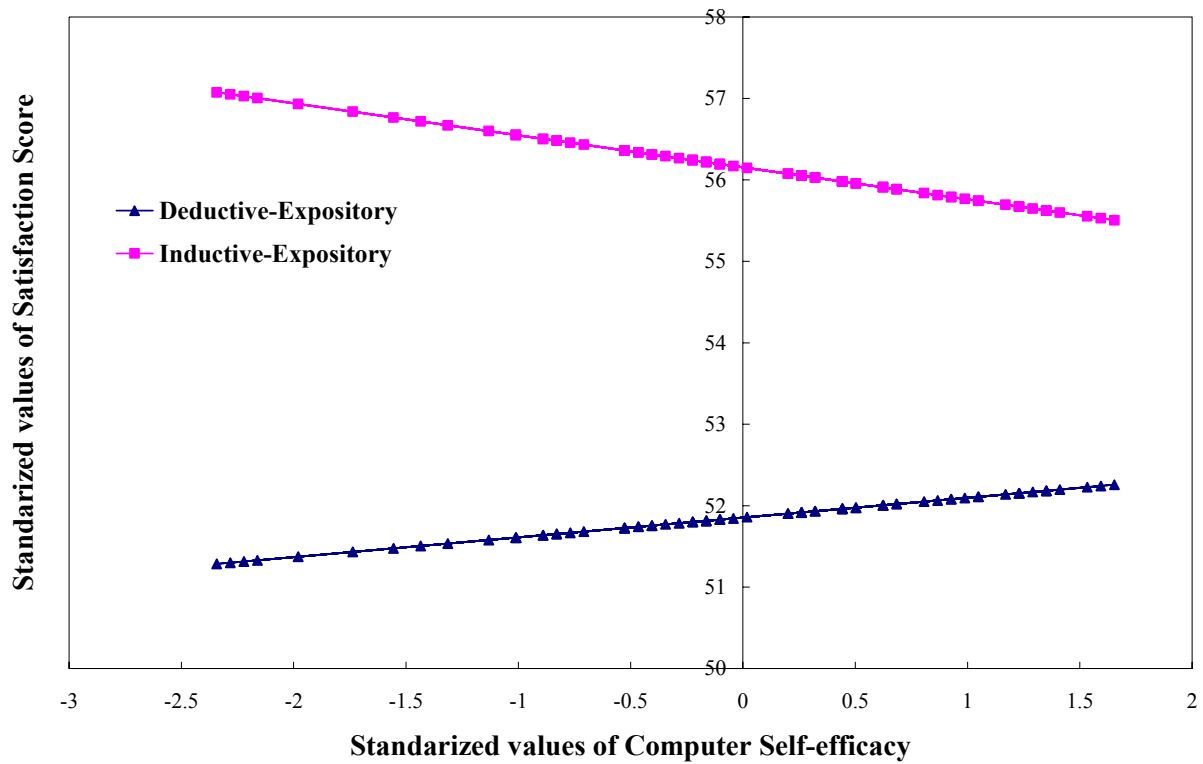


Figure 13: The Effect of Computer Self-efficacy on Satisfaction Scores between Deductive-Expository and Inductive-Expository Groups.

3. The resulting regressing model based on third dummy coding was:

$$\begin{aligned} \text{Standardized values of satisfaction scores} = & 53.439 - 1.736 (\text{Dum14}) - .514 (\text{Dum23}) \\ & + 1.025 (\text{Dum14n23}) + .005 (\text{CSE}) + .284 (\text{PCK}) + .206 (\text{Dum14}) * (\text{CSE}) + .044 \\ & (\text{Dum23}) * (\text{CSE}) - .193 (\text{Dum14n23}) * (\text{CSE}) + .014 (\text{Dum14}) * (\text{PCK}) - .018 \\ & (\text{Dum23}) * (\text{PCK}) + .015 (\text{Dum14n23}) * (\text{PCK}) \end{aligned}$$

No significant variables were found in the equation.

This equation accounts for 19.8% of the variance in satisfaction scores,  $R=.45$ .

## Summary

The findings regardless of different strategies for information presentation in this study indicated the following:

1. There was a positive relationship between computer self-efficacy and multiple choice scores.
2. There was a positive relationship between prior computer knowledge and multiple choice scores.
3. There was a positive relationship between prior computer knowledge and satisfaction scores.

The findings related to different strategies for information presentation in this study indicated the following:

1. Computer self-efficacy moderated the effect of the inductive-inquisitory group and the inductive-expository group on multiple choice scores when both computer self-efficacy and prior computer knowledge are considered as moderating factors.
2. Computer self-efficacy moderated the effect of satisfaction score on both the inductive-inquisitory and the inductive-expository groups when only computer self-efficacy is considered as a moderating factor, and both computer self-efficacy and prior computer knowledge are considered as moderating factors.
3. Computer self-efficacy moderated the effect of satisfaction score on both the deductive-expository and the inductive-expository groups when only computer self-efficacy is considered as a moderating factor, and when both computer self-efficacy and prior computer knowledge are considered as moderating factors.

## **CHAPTER 5**

### **DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS**

This chapter is divided into four sections. The first section presents an overview of the study. The second section discusses the results from the data analysis in chapter four according to each research question. The third section presents the conclusion of the study. The fourth section presents the recommendation for further research.

#### Study Overview

The purpose of this study was to investigate whether learners' computer self-efficacy and prior computer knowledge influence their performance and satisfaction when presented with various instructional strategies of information presentation in computer-based training. The posttest-only experimental study was conducted at a large public university in the southeastern United States during the fall semester in 2004. Seventy-eight participants were separated into four groups: (a) deductive-inquisitory, (b) deductive-expository, (c) inductive-inquisitory, (d) inductive-expository strategies. The data were collected through (a) a computer self-efficacy instrument, (b) a computer knowledge instrument, (c) a student satisfaction instrument after finishing various tutorials, and (d) two posttests including multiple choice and hand-on test as students' performance. Quantitative statistical analysis was used to investigate the impact of computer self-efficacy and prior computer knowledge as moderating factors on different strategies of information presentation and students' performance and satisfaction in computer-based software training.



## Discussion

This section summarizes the results of data analysis presented in chapter four and discusses the importance of the findings.

Prior to the discussions of each research question, several general findings are briefly discussed. First, in the present study, there was a positive relationship between prior computer knowledge and learners' satisfaction. In other words, learners with high prior computer knowledge were more satisfied with the tutorial regardless of different strategies for information presentation than those with lower prior computer knowledge. The possible reason is that learners with higher prior computer knowledge are more ready to accept and adapt to computer-based instruction; thus, their satisfaction is higher. Second, there was a positive relationship between learners' computer self-efficacy and their performance on multiple choice posttest. Learners with high computer self-efficacy outperformed learners with low computer self-efficacy regardless of different types of information presentation. The finding is congruent to the findings of Yi and Im (2004), Tam (1996), Wu (2002), and Collins et al (1999) that computer self-efficacy is an important determining factor that affects an individual's computer performance. Third, there was a positive relationship between learners' prior computer knowledge and their performance on the multiple choice posttest. The learners with higher prior computer knowledge performed better on multiple choice posttest. Those with lower prior computer knowledge did not perform as well as their higher prior knowledge counterparts.

### *Research Question 1*

*To what extent will different instructional strategies for information presentation affect a learner performance in software training?*

The analysis of variance results show that there were no statistically significant differences in both multiple choice and hands-on posttest scores among the deductive-inquisitory, the deductive-expository, the inductive-inquisitory, and the inductive-expository groups. One possible reason might be the setting of the study. According to van Merriënboer (1997), the selection of an appropriate strategy for information presentation depends on three factors; availability of instructional time, learners' prior knowledge about the content, and required level of understanding. If learners have absolutely no prior knowledge about the skills they are going to learn, an inductive approach is more appropriate than a deductive approach. If there is limited instructional time and a deep level of understanding is not necessary, the use of an expository approach instead of an inquisitory approach is recommended.

It appears that the above three factors had minimal relationships to this study considering that the research question focused on investigating the difference among the four groups. First, participants were homogeneous in each group after they were randomly assigned into four groups. In other words, participants with different prior computer knowledge or different computer self-efficacy were evenly distributed in each group. Second, the objective for the participants in the class was to learn how to create a web page through Netscape Composer 7 and apply the skill immediately. It was not necessary for participants to understand every function (or command) in Netscape Composer. Third, and this is the most important point, there is no time limitation for the participants to finish the tutorial. Since there is sufficient time, participants in

different groups eventually received the same information provided by the tutorial whether through inductive, deductive, expository or inquisitory approaches. As a result, there is no difference in participants' immediate retention of concept (multiple choice test) and application performance (hands-on test) among different groups.

The other possible reason which caused no differences among groups might be that the sample size is not big enough to recognize the differences between groups because there was a different result when using effect size calculation. According to effect size calculations in multiple choice and hands-on posttests (see Tables 7 and 8), there were meaningful differences in mean multiple choice scores and hands-on posttest scores among groups. The possible reasons causing the differences can be discussed in two ways. First, the differences might be caused by the different strategies (or treatments); that means, one strategy was superior to the other. However, it is difficult to determine which strategy was superior to the other in this study because of the second reason; the differences might be caused by the groups' heterogeneity in computer self-efficacy and prior computer knowledge. Based on effect size calculation (Tables 9 and 10), any two of the four groups were different in either computer self-efficacy or prior computer knowledge after the random assignment. Besides, computer self-efficacy and prior computer knowledge are two factors hypothesized in this study which might influence the results of posttests.

Here is an example to verify the previous points. According to Tables 7 and 8, there was a difference between the deductive-inquisitory and the deductive-expository groups in mean multiple choice scores ( $d = .211$ ) and mean hands-on posttest scores ( $d = .368$ ). One possible reason causing the difference in multiple choice scores between the two groups might be that the

deductive-expository strategy (mean score = 8.1) is superior to the deductive-inquisitory strategy (mean score = 7.8). In the same way, the possible reason caused the difference in hands-on posttest scores between the two groups might be that the deductive-expository strategy (mean score = 14.55) is superior to the deductive-inquisitory strategy (mean score = 13.3). However, since the two groups are different in computer self-efficacy ( $d = .506$ ), it become difficult to conclude that the deductive-expository was better than the deductive-inquisitory strategy. It is also possible that the deductive-inquisitory was better than the deductive-expository strategy, but the effect of participants' difference in computer self-efficacy was larger than the effect of different strategies to result that the mean scores of the deductive-expository strategy in performance was higher than the deductive-inquisitory strategy. It is recommended that conclusive results be further confirmed using homogenous groups in future research.

### *Research Question 2*

*To what extent will different instructional strategies for information presentation affect a learner satisfaction regarding software training?*

Although the mean scores of learners' satisfaction for four instructional strategies are all higher than average (see Table 6, the mean score = 60), the analysis of variance result showed that there was no statistically significant difference in learners' satisfaction regarding software training among different information presentation groups. Learners seemed to be overall quite satisfied with the computer-based tutorial. This is supported by some of the learners' feedback as obtained through an open-ended question in the survey given at the end of the study. One of the students indicated that the tutorial "was very informative on showing how to create a webpage."

A similar voice from a different treatment group was that “the tutorial was very informative, yet easy to understand. The animation that showed the actual processes of clicking through menus and submenus was very helpful.” Another learner expressed that the tutorial “was easy to understand and complete” and that it gave her/him confidence to create a webpage after following instructions in the tutorial. Still another student from the third group explained why she liked the tutorial: “I am a step by step person and the tutorial was a perfect instruction guide for me. I would strongly suggest this to anybody.” A couple of students from the fourth group expressed that the tutorial was “easy to understand” and “very straightforward.” There were some negative voices; however, they were not so negative after all: “I thought it was a very long tutorial, but I did learn information,” and “the tutorial was good, overall. It had its moments where it lagged, when you had to answer with the different steps, it felt redundant. However, using the tutorial could be a great way to teach students.”

Overall, a common theme across the different treatment groups was that the tutorial was easy to understand and very informative. This may be part of the reason why there was no significant difference in satisfaction among the four groups.

One reason that may lead to the result of no significant difference when using the analysis of variance is the four treatment groups may consist of learners with mixed levels of computer self-efficacy and a mixed level of prior computer knowledge after randomly assigned into four treatment groups. They may be four homogeneous groups in terms of learner characteristics, thus, the average satisfaction score for homogeneous groups may not be so different after all.

The other reason might be the sample size is not big enough to recognize the differences in satisfaction scores between groups because the effect size calculation (see Table 11) shows

there was a meaningful difference in mean satisfaction score between (a) the inductive-inquisitory and the inductive-expository, (b) the deductive-inquisitory and the inductive-expository, and (c) the deductive-expository and the inductive-inquisitory groups. Researcher speculates the two possible reasons are, as mentioned in research question one, (a) one strategy was superior to the other; (b) the heterogeneity in computer self-efficacy and prior computer knowledge among groups. The conclusive results also need to be further confirmed using homogenous groups in future research.

### *Research Question 3*

*To what extent is the impact of instructional strategies for information presentation on learner performance in software training moderated by learner computer self-efficacy and learner prior computer knowledge?*

The only significant result showed in this research question is that there was a positive relationship between their performance on the multiple choice posttest, and the interaction effect between the inductive-inquisitory group (present examples first then require learners to discover functions) and computer self-efficacy when both computer self-efficacy and prior computer knowledge are considered as moderating factors. Conversely, there was a negative relationship between their performance on the multiple choice posttest, and the interaction effect between the inductive-expository group (present examples first then also present functions to learners) and computer self-efficacy. In other words, for the learners in the inductive-inquisitory group, those with higher computer self-efficacy had better performance in immediate retention of the concepts than those who had lower computer self-efficacy. For learners in the inductive-expository group,

those with lower computer self-efficacy had better performance in immediate retention of the concepts than those with high computer self-efficacy. The researcher speculates a possible reason is that higher computer self-efficacy learners can adapt to an inductive-inquisitory strategy more easily than lower computer self-efficacy learners can. In order to perform well when the inductive-inquisitory strategy was used, learners need to have stronger capabilities to self-explain new information they discovered and to make connections and establish relationships between the new information and prior information. Learners with higher computer self-efficacy in software training believed they could use an unfamiliar software package to complete a task with minimum help. They were also expected to have stronger ability required in the inductive-inquisitory strategy than those learners with lower computer self-efficacy. On the contrary, since learners with lower computer self-efficacy were expected to have lower abilities in self-explaining new information and establishing relationship with prior information, expository information presentation is appropriate for them to acquire new information.

There are two variables that were found to have non significant results. One was a dependent variable: hands on posttest; the other one was an independent variable, prior computer knowledge. The researcher speculates that the reason for the findings of non significant difference in the hands-on posttest was that learners were informed that this was an experimental study and their performance would not affect their grade; therefore, the learners did not give it their best effort in doing the hands-on posttest. As evidence was that a student typed “this is only a test” in the web page they created, which did not quite follow the instruction as directed in the tutorial, thus influencing the accuracy of the hands-on posttest. While students other than those who showed their impatience about the hands-on posttest made no comment, it did not mean that

they were more devoted and put more effort into finishing the test. Compared to the multiple choice posttest, the hands-on posttest took students more time to finish and was more time-consuming. If the hands-on posttest could be incorporated as part of the course requirement and be counted towards their final grades for the course, this type of situation may improve.

As for the non significant findings for prior computer knowledge, the researcher offers two possible reasons. First, in the prior computer knowledge survey, there were only general questions about learners' computer skills. The questionnaire did not focus on questions related to learners' prior knowledge about specific software Netscape Composer. In this study, because learners needed to learn how to use Netscape Composer to create a web page, it would be better if the questionnaire included both portions on learners' prior knowledge on computer skills and their knowledge about web page design, i.e. the components and structures of a webpage. The researcher put his emphasis on the fact that possessing computer skill prior knowledge, learners can transfer what they have known to the new software they are to learn and failed to take notice of learners' prior software knowledge. Thus, when measuring prior knowledge in the content of computer applications, it would be better to differentiate prior computer knowledge to prior software knowledge. Second, the self report questionnaire used in this study as a measure of prior knowledge may not have sufficiently captured the information about the learners' ability. The researcher would suggest using a test to gauge students' prior knowledge or prior performance in stead of a self-reported measure. The reason why a test on prior knowledge was not incorporated for the present study was because it was time consuming and would affect the real focus of the study.



#### *Research Question 4*

*To what extent is the impact of instructional strategies for information presentation on learner satisfaction regarding software training moderated by learner computer self-efficacy and learner prior computer knowledge?*

The first significant result in this research question showed that there was a positive relationship between their satisfaction towards the tutorial, and the interaction effect between the inductive-inquisitory group (present examples first then require learners to discover functions) and computer self-efficacy when both computer self-efficacy and prior computer knowledge are considered as moderating factors. However, there was a negative relationship between their satisfaction towards the tutorial, and the interaction effect between the inductive-expository group (present examples first then also present functions to learners) and computer self-efficacy. In other words, for the learners in the inductive-inquisitory group, those with higher computer self-efficacy were more satisfied with the tutorial than those who had lower computer self-efficacy. There are several possible explanations to the result. First, an inductive-inquisitory strategy for information presentation requires learners to make discoveries and organize new information by themselves. This requirement matches the characteristics of higher computer self-efficacy learners. They are the ones who had better ability for self-explanation of new information, and it was easier for them to make connections between new and prior information. Thus, an inquisitory strategy fits their learning style, which would explain why they were more satisfied towards the tutorial than those who had low computer self-efficacy. Second, learners with low computer self-efficacy are those who perceive themselves less able to complete difficult tasks. They are the ones who need more support and assistance. Thus in this study, it was too

demanding for learners with low computer self-efficacy to have to sort out the functions of each web page editing tool; they are more comfortable when the functions are provided and defined for them.

The second significant finding is that when computer self-efficacy alone is considered as a moderating factor, or when both computer self-efficacy and prior computer knowledge are considered as moderating factors, a positive relationship exists between the learners' satisfaction, and the interaction effect between the deductive-expository group (present functions first then present examples to learners) and computer self-efficacy. In other words, within the deductive-expository group where functions of the web page editing tools were presented first and examples presented later, learners with high computer self-efficacy indicated higher satisfaction towards the computer-based tutorial than learners with low computer self-efficacy. However, there was a negative relationship between the learners' satisfaction, and the interaction effect between the inductive-expository group (present examples first then also present functions to learners) and computer self-efficacy. This means that, for the group where examples are presented first then present function later, learners with low computer self-efficacy had higher satisfaction with the tutorial than those with higher computer self-efficacy.

The researcher speculates the possible reasons for such findings are: It may be that the learners with lower computer self-efficacy prefer to learn by having an example provided to them first so that they can build schema and relate the new information to what they already know. Then followed by the example, clear detailed explanations of each function of the web page tool may help them with how the example was created. Learners with low computer self-efficacy were more comfortable with the way of presenting new information. In contrast, learners

with high computer self-efficacy appear to be more able to accept the deductive approach, which presents general information first, followed by examples to demonstrate general information. Second, it can be explained by one of three dimensions of computer self-efficacy mentioned by Compeau and Higgins (1995b), who defined computer self-efficacy generalizability as “the degree to which the judgment is limited to a particular domain of activity” (p.192). Thus, those with higher computer self-efficacy possess higher generalizability skills, which could explain why they can easily adapt to a deductive approach. Learners with high generalizability are able to competently use different software; therefore, when functions of the tools are provided to them first, they can easily relate the functions to similar software functions. However, with low computer self-efficacy learners having low generalizability, they can be easily overwhelmed by the list of functions provided in the beginning.

### Conclusions

This study has attempted to demonstrate whether learners’ computer self-efficacy and prior computer knowledge had influence (served as a moderator) of the relationship between the instructional strategies for information presentation on computer based software training and learners’ performance and satisfaction towards the computer based tutorial. The findings of this study can be summarized in three ways:

First, present research supported the literature in the area that both computer self-efficacy and prior computer knowledge influenced learners’ performance. Besides this, the present study also found that prior computer knowledge had influence over learners’ satisfaction. Learners with higher prior computer knowledge were more satisfied with computer based software training

regardless of the different instructional strategies for information presentation. The learners with higher prior computer knowledge were more familiar with computers and thus more comfortable with computer-based training.

Second, learners with higher computer self-efficacy not only performed better but also were more satisfied towards an inductive-inquisitory strategy for information presentation. An inductive-inquisitory strategy required learners to make discoveries, reconstruct and organize new information by themselves, which had good match with their learning style. This could be explained in terms of one of the dimensions of computer self-efficacy: magnitude. Higher computer self-efficacy learners generally had higher computer self-efficacy magnitude. They perceived themselves as more able to accomplish difficult computer tasks and they could usually complete the tasks with less support or assistance than those who had lower computer self-efficacy. Therefore, learners with high computer self-efficacy were more ready to discover new information without detailed lists of explanations. On the other hand, learners with low computer self-efficacy benefited more from the inductive-expository approach of information presentation. This is because those low computer self-efficacy learners needed more support and assistance to complete computer tasks; therefore, more explicit explanations as provided in the inductive-expository strategy helped them with their software learning better.

Third, learners with high computer self-efficacy performed better in a deductive-expository strategy, while learners with low computer self-efficacy benefited more in an inductive-expository strategy. This may be explained by another dimension of computer self-efficacy mentioned by Compeau and Higgins (1995b): Generalizability. Learners who had high computer self-efficacy generalizability perceived that they have no problem using different

software and computer systems. Thus when information was presented using a deductive-expository strategy, learners were able to refer to their experience with similar software. They could easily learn particular software by understanding the tool functions and therefore providing examples first may be redundant to them. However, learners with low computer self-efficacy had low generalizability and their abilities were limited to certain software or computer systems. Thus they would be easily overwhelmed when a list of tool functions were presented to them first, when what they needed most was to make each tool functions relevant to them by providing examples first.

#### Recommendations

1. A larger sample size with more classes is suggested for the generality of the findings of this study.
2. This study focused on immediate performance. Therefore, another posttest is suggested one week or one month after the experiment day to measure how different instructional strategies of information presentation affect the learners' long term memory.
3. In this study, considering the learners' cognitive load, only one example was presented in inductive approach. It is suggested to use more examples in inductive approach for the learners to easily find the relationships between those examples.
4. When designing computer based instruction, it is recommended that instructional designers measure learner characteristic as part of the instruction, and then use computer to automatically select appropriate strategies for information presentation to facilitate learning.

5. The researcher recommended future research to explore other possible moderating factors besides computer self-efficacy and prior computer knowledge, as well as other strategies for information presentation that has positive impact on learners' performance in and satisfaction towards computer based software training.

**APPENDIX A**  
**DEMOGRAPHIC INFORMATION QUESTIONNAIRE**

## Demographics

Based on your individual information, please select the best answer to each question.

### 1. Gender

- Male  Female

### 2. Age

▶

### 3. Ethnicity

- African  African-American  Asian or Pacific Islander  
 Asian-American  Caucasian  Hispanic  
 Native American  Other

Next

## Demographics

### 4. Occupational Status

- Full-time worker (over 20 hours a week)  
 Part-time worker (no more than 20 hours a week)  
 None of the above

### 5. In general, how long have you used the computer

- Less than 1 year  
 1 to 3 years  
 4 to 6 years  
 over 6 years

### 6. Have you ever used Netscape Composer?

- No  
 Yes

Next



## Demographics

7. Have you ever used other web page authoring software ( Front Page, Dreamweaver, etc)?

- No
- Yes

Next

**APPENDIX B**  
**COMPUTER SELF-EFFICACY QUESTIONNAIRE**

Instructions:

1. This part of the questionnaire asks you about your ability to use an unfamiliar piece of software. Often in our jobs we are told about software packages that are available to make work easier. For the following question, imagine that you were given a new software package for some aspect of your work. It doesn't matter specifically what this software package does, only it is intended to make your job easier and that you have never used it before.
2. The following questions ask you to indicate whether you could use this unfamiliar software package under a variety of conditions. For each of the conditions, please indicate whether you think you would be able to complete the job using the software package. Then, for each condition that you answered "yes", please rate your confidence about your first judgment, by clicking a number from 1 to 10, whether 1 indicates "Not at all confident", 5 indicates "Moderately confident", and 10 indicates "Totally confident".

**Self-efficacy**

1. This part of the questionnaire asks you about your ability to use an unfamiliar piece of software. Often in our jobs we are told about software packages that are available to make work easier. For the following questions, imagine that you were given a new software package for some aspect of your work. It doesn't matter specifically what this software package does, only that it is intended to make your job easier and that you have never used it before.

	No	Yes									
<b>I could complete the job using the software package...</b>		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
1. ...if there was no one around to tell me what to do as I go.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. ...if I had only the software manuals for reference.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. ...if I had seen someone else using it before trying it myself.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Next

**I could complete the job using the software package...**

	No	Yes									
		1	2	3	4	5	6	7	8	9	10
4. ...if I could call someone else using it before trying it myself.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. ...if someone else had helped me get started.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. ...if I had a lot of time to complete job for which the software was provided.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. ...if I had just the built-in help facility for assistance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. ...if someone showed me how to do it first.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Next

**APPENDIX C**  
**COMPUTER KNOWLEDGE QUESTIONNAIRE**

## Computer Knowledge

1. Please answer the following questions based on your computer knowledge and skills.
2. Click the number that mostly describes your ability level.  
1= I can't do this at all.  
2= I can do this but need more instruction.  
3= I can do this but can't show others.  
4= I feel comfortable with this and could teach it to others.

### Basic Computer and Internet Operations

Do you know how to:

9. Start up and shut down computer systems and peripherals.
10. Work with windows/icons.
11. Name, save, retrieve, revise and rename a document.



1	2	3	4
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Next

### Basic Computer and Internet Operations

Do you know how to:

12. Copy, save, and print documents.
13. Open and work with many applications at once.
14. Enter, edit, copy and move text.
15. Change font, margins, alignment, tabs.
16. Use word count, spell checker, thesaurus.
17. Insert page numbers, headers and footers.



1	2	3	4
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Next

### Basic Computer and Internet Operations

Do you know how to:

- 18. Compose, send, forward, and reply to e-mail.
- 19. Send and open E-mail attachments.
- 20. Save, print, and delete e-mail.
- 21. Connect to the Internet.
- 22. Use web search engines.

I can't do this at all      I need more instruction      I can do but can't show      I could teach this

1      2      3      4

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Next

### Setup, Maintenance, and Trouble Shooting

Do you know how to:

- 23. Create and work with sub-directories/folders.
- 24. Setup a computer system.
- 25. Use self-help resources to correct common hardware, software and printing problems.
- 26. Reboot a "crashed" computer.
- 27. Guard against computer viruses.
- 28. Install/upgrade an application.

I can't do this at all      I need more instruction      I can do but can't show      I could teach this

1      2      3      4

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Next

### Intermediate Computer Operations

Do you know how to:

29. Initialize, name, and rename floppy disk/hard drive.

30. Understand storage and memory capacities of disks, hard drives, and CD-ROMS.

31. Make backup copies of key applications and documents.

32. Insert, resize, and move clip art in a document.

I can't do this at all    I need more instruction    I can do but can't show    I could teach this

1    2    3    4

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Next



**APPENDIX D**  
**SATISFACTION QUESTIONNAIRE**

Please read each statement and indicate the extent to which you are comfortable or uncomfortable, with **5 being very comfortable** and **1 being very uncomfortable**. Click your response.

Very uncomfortable					Very Comfortable
↓					↓
1	2	3	4	5	

- |   |                       |                       |                       |                       |                       |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. When you work with computer, how comfortable are you?  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. When you work with computer-based program like this tutorial, how comfortable are you?                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. When you work with any kind of webpage authoring software like Netscape Composer 7.1, how comfortable are you? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Next

Please read each statement and indicate the extent to which you agree or disagree, with **5 being strongly agree** and **1 being strongly disagree**. Click your response.

Strongly Disagree					Strongly Agree
↓					↓
1	2	3	4	5	

- |  |                       |                       |                       |                       |                       |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 4. I would tell other students to use this tutorial if they wanted to learn about Netscape Composer 7.1. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5. While taking this Netscape Composer tutorial I felt challenged to do my best work.                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 6. I was aware of efforts to customize the tutorial to fit my learning style.                            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 7. I found myself just trying to get through the lesson rather than trying to learn.                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 8. I was concerned that I might not understand the material.   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Next

	Strongly Disagree				Strongly Agree
	↓				↓
	1	2	3	4	5
9. As a result of having studied some material in this tutorial, I am interested in trying to find out more about Netscape Composer 7.1.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. I felt I could work at my own pace with this tutorial.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. I was more involved in running the computer than in understanding the material.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. This tutorial made it possible for me to learn quickly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. I felt frustrated by this tutorial.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly Disagree				Strongly Agree
	↓				↓
	1	2	3	4	5
14. This tutorial was an inefficient use of students' time.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. I found the presentation of knowledge and skills in this tutorial interesting.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. I would like to study another topic using a computer-based tutorial like this again.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. This tutorial was boring.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. This tutorial was inflexible.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Strongly Disagree      Strongly Agree

↓                                      ↓

**1   2   3   4   5**

19. I would like to learn more about Netscape Composer 7.1.     

20. Overall, I liked this tutorial.   

What do you think about this Netscape Composer 7.1 tutorial? Please type your opinions in the following box, then press "Enter".

▶

Next

**APPENDIX E**  
**HANDS-ON POSTTEST**

Netscape Composer 7.1 Hands-On Test (total 17 points)

The screenshot shows the Netscape Composer 7.1 interface with a web page template. The page is titled "Your NID - Netscape" and contains the following elements:

- 1**: Title bar: "Your NID - Netscape"
- 2**: Background: A light blue floral pattern.
- 3**: Text: "Mr./Mrs./Miss Your NID's Homepage" (Heading), "School Name", "Address", "City, State, zip code", "Subtitle" (Form fields).
- 4**: Horizontal Line: A red horizontal line.
- 5**: Text: "Please type a paragraph describing something about yourself here. Please type a paragraph describing something about yourself here. Please type a paragraph describing something about yourself here. Please type a paragraph describing something about yourself here. Please type a paragraph describing something about yourself here."
- 6**: Table and Link: A 4x2 table with 75% width of window, centered, invisible, containing hyperlinks "Your favorite links".
- 7**: Image with Email Link: A small cartoon character with an email link "Image with Email Link (make up email address)".

Instructions and callouts:

- 1**: Title: Your NID (1 pt)
- 2**: Background (1 pt)
- 3**: Text: Two Heading (2 pt), Color (1 pt)
- 4**: Horizontal Line (1 pt)
- 5**: Text: Paragraph (1 pt)
- 6**: Table and Link: 4x2 table (1 pt), 75% of window (1 pt), Centered (1 pt), Invisible (1 pt), Hyperlinks (4 pt)
- 7**: Image with Email Link: Image (1 pt), Email Link (1 pt)

Additional instructions:

- Please leave this page open, and follow this format to create your own web page.
- Type a paragraph describing something about yourself here
- 4x2, 75% width of window, Centered, Invisible Table and Hyperlinks
- Image with Email Link (make up email address)

At the bottom, there is a checkbox:  I have saved my webpage onto the floppy disk and I am ready to go to next section. A "Next Section" button is also present.

1. Title: Your NID (1 pt).
2. Background (1 pt)
3. Text: Two Heading (2 pt)  
Color (1 pt)
4. Horizontal Line (1 pt)
5. Text: Paragraph (1 pt)
6. Table and Link: 4x2 table (1 pt)  
75% of window (1 pt)  
Centered (1 pt)  
Invisible (1 pt)  
Hyperlinks (4 pt)
7. Image with Email Link: Image (1 pt)  
Email Link (1 pt)

**APPENDIX F**  
**MULTIPLE CHOICE POSTTEST**

**1. Netscape Composer is**

- A. a webpage creation tool
- B. a web browser
- C. a presentation creation software
- D. both A and B

Next Question

**2. What is the name of this button?**



- A. Link
- B. Image
- C. Table
- D. Publish

Next Question



**3. What command allows viewers to send an email message directly to the designated email address from a webpage?**

- A. 

Enter a web page location, a local file, or select a Named Anchor or Heading from the popup list:
- B. 




Enter a web page location, a local file, or select a Named Anchor or Heading from the popup list:
- C. 

Enter a web page location, a local file, or select a Named Anchor or Heading from the popup list:
- D. 

Enter a web page location, a local file, or select a Named Anchor or Heading from the popup list:

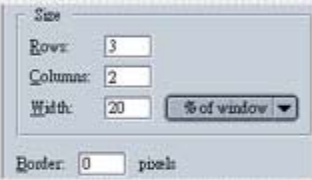
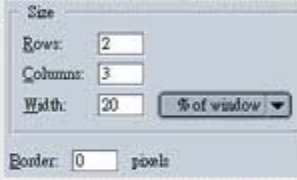


Next Question

**4. Which of the following tools is not in Composer?**

- A. 
- B. 
- C. 
- D. 

Next Question

5. Which is the possible setting of this table showing in Netscape composer 7.1?


- A. 
- B. 
- C. 
- D. 





Next Question

6. When adding an image to a web page, which of the following statements is true?

- A. You can either add an image from your floppy disk or from the Internet
- B. You must either type in "Alternate text" or select "Don't use alternate text"
- C. The image format can be either GIF or JPEG
- D. All above

Next Question

7. Based on the setting in horizontal line properties, which of the following horizontal line is correct?

- A. 
- B. 
- C. 
- D. 

**Horizontal Line Properties**

Dimensions

Width: 70 % of window

Height: 2 pixels

3-D Shading

Alignment

Left  Center  Right

Next Question

8. Which of the following buttons means "Browser"?

- 
- 
- 
- 

Next Question

9. To make an invisible table, enter "0" to which of the following?

- A. Width
- B. Row
- C. Column
- D. Border

Next Question

10. You can create a link

- A. For selected text
- B. For background
- C. For a selected image
- D. Both A and C

Next

**APPENDIX G**  
**IRB APPROVAL FORM**



Office of Research

December 18, 2003

Ming-hsiu Tsai  
11025 Pondview Dr. Apt. G  
Orlando, FL 32825

Dear Mr. Tsai:

With reference to your protocol entitled, "The Effects of Different Strategies of Information Presentation in Software Training," I am enclosing for your records the approved, executed document of the UCFIRB Form you had submitted to our office.

Please be advised that this approval is given for one year. Should there be any addendums or administrative changes to the already approved protocol, they must also be submitted to the Board. Changes should not be initiated until written IRB approval is received. Adverse events should be reported to the IRB as they occur. Further, should there be a need to extend this protocol, a renewal form must be submitted for approval at least one month prior to the anniversary date of the most recent approval and is the responsibility of the investigator (UCF).

Should you have any questions, please do not hesitate to call me at 823-2901.

Please accept our best wishes for the success of your endeavors.

Cordially,

A handwritten signature in black ink, appearing to read "Chris Grayson".

Chris Grayson  
Institutional Review Board (IRB)

Copies: Dr. Richard Cornell  
IRB File

**APPENDIX H**  
**CONSENT FORM**

## PARTICIPANTS INFORMED CONSENT FORM

Dear Fellow Students

My name is **Michael Tsai** and I am a graduate student working under the supervision of a faculty member, **Dr. Richard Cornell**. I would like to invite you to participate in my study on different strategies of information presentation in software training that I am conducting at the University of Central Florida as part of my doctoral studies. This study was designed solely for research purposes, and no one except myself will have access to your responses. All responses will remain confidential to the extent provided by law. Your identity will be kept confidential using your **Network ID (NID)**. The results of this study will be coded in such a way that your identity will not be attached to the final data that you produce.

The purpose of this study is to examine your responses to a computer-based instruction. You will be asked to complete a questionnaire in class and to take a computer-based tutorial. You will also be asked to take two exercises and to complete another questionnaire concerning your reaction after taking the computer-based instruction.

Your participation in this study is voluntary. You may choose not to participate in this study, and you may withdraw from this study at any time without consequences. Participation in this study will not affect your grades. There are no anticipated risks associated with participation.

If you have any questions or comments about this research, please contact **Michael Tsai** ([mtsai@ucf.edu](mailto:mtsai@ucf.edu), 407-282-7110) or his supervisor, **Dr. Richard Cornell** ([cornell@mail.ucf.edu](mailto:cornell@mail.ucf.edu)), College of Education, Orlando, FL. Questions or concerns about research participants' rights may be directed to the UCFIRB office, University of Central Florida Office of Research, Orlando Tech Center, 12443 Research Parkway, Suite 207, Orlando, FL 32826. The phone number is (407) 823-2901.

Thank you for agreeing to assist in this study.

Sincerely,  
Ming-hsiu Tsai  
Ph. D. Candidate

---

I have read the above information and understand that participation is voluntary and I may discontinue participation at any time without consequences. After clicking "I Agree" below means that I have freely agreed to participate in this research study.

I Agree

Close Window



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