Chapter 7

INTERPRETATIONS, LIMITATIONS, FUTURE RESEARCH, AND CONCLUSION

Based on the analyses conducted in Chapter 6, this chapter discusses the results and their contributions to the Social Cognitive theory. A discussion of limitations and plausible explanations for unexpected results also are presented. Finally, this chapter highlights some avenues for possible future research based on the implications of this study.

7.1 INTERPRETATIONS

Hypotheses 1 through 9 were based on the original C&H study, which demonstrated ambiguous results across software packages among many of the relationships in the Social Cognitive model. It may be recalled that C&H hypothesized behavior modeling to outperform lecture-based training in all relationships in their model. They found anomalies in their data whereby behavior modeling exhibited positive significant relationships with self-efficacy and performance for only Lotus 1-2-3. These same significant relationships were not found for Word Perfect tasks. Given these results, the first nine hypotheses in this dissertation attempt to replicate the C&H findings. The remaining hypotheses are designed to explain the cause of the C&H anomalies by the introduction of a moderating variable, task complexity.

7.1.1 Hypotheses 1 through 9

In an attempt to replicate C&H's original hypotheses, the data in this study were collapsed across levels of complexity for analysis. Using a univariate approach, a significant difference for measures of self-efficacy was found between training methods (p=.035). Surprisingly, though, this difference was not in the direction predicted by hypothesis 1. Lecture-based training resulted in significantly higher self-efficacy scores than behavior modeling at an alpha level of .10. Thus, in this experiment, hypothesis 1 was not supported.

It should be noted that in the C&H study, this hypothesis was only partially supported. That is, behavior modeling demonstrated a significantly greater effect on self-efficacy than lecture-based training for Lotus tasks, but the opposite effect was found for WordPerfect tasks. It is perhaps this latter effect that is witnessed in the current experiment whereby lecture-based training produces higher self-efficacy scores than behavior modeling. One should also note that C&H did not present the results of Lotus combined with WordPerfect. Because Lotus and WordPerfect are not used in this study, direct comparison of hypothesis 1 in the C&H study to hypothesis 1 in this dissertation is not possible. It must be emphasized, however, that the primary purpose of this dissertation is to introduce a moderating variable, task complexity, in an attempt to identify the cause of the ambiguous results exhibited by this and other hypotheses. As will be discussed in the next section, separating the data into levels of high and low complexity as proxies for Lotus and WordPerfect does not explain the differences found across software packages in the C&H study.

Hypothesis 2 predicted a significant positive relationship between behavior modeling and outcome expectations. This hypothesis was supported in this study (p=.094) at an alpha level of .10. In the C&H study, it produced confounding results: In one Lotus session, a positive significant relationship was found, and in the other Lotus session, a negative significant relationship was revealed. Likewise, in one WordPerfect

session, a positive significant relationship was demonstrated, while in another WordPerfect session, no significant path coefficient was exhibited at all. Again, because Lotus and WordPerfect were not manipulated in this dissertation, direct comparisons cannot be made between the two studies. It may be recalled, however, that the original Outcome Expectations instrument that was used in the C&H study was an eleven item questionnaire, with six items representing performance expectations and the remaining five items tapping personal outcome expectations. In this study, only the six performance items were used. Thus, this more refined measure could have accounted for the significance found in this study that was not demonstrated in the C&H study.

Hypothesis 3, which predicted that behavior modeling would significantly outperform lecture-based training on measures of final performance, was supported in this study ($p = .056$) at an alpha level of .10. In the C&H study, this hypothesis, like hypothesis 1, produced confounding results. Behavior modeling demonstrated a significant relationship with performance for only Lotus tasks. Although different from the C&H study, the results in this dissertation are consistent with results found in the GSR experiment, which found behavior modeling to significantly influence performance.

Hypotheses 4 and 5, which predicted relationships between self-efficacy and outcome expectations ($CR = 0.704$) and self-efficacy and performance ($CR = -0.121$), respectively, were not supported in this study. These findings are in sharp contrast to the C&H study in which these relationships were supported in most training sessions. Additionally, Bandura (1978) suggests a strong positive relationship between self-efficacy and performance. Because this study employed the same instrument to measure self-efficacy as was used in the C&H study, and because both construct validity and reliability were determined to be sufficient for this instrument, it is surprising that the relationships between self-efficacy and the other endogenous constructs in the model were not supported. A plausible explanation for this finding is a possible multi-dimensionality of the self-efficacy instrument. This supposition is discussed in greater detail in a subsequent section entitled "Limitations".

Hypothesis 6 predicted a significant relationship between outcome expectations and performance. In this dissertation, as in the C&H study, this hypothesis was not supported (CR = -0.004). C&H surmised that the lack of support for this hypothesis was caused by the nature of the outcome expectations variable. They defined outcome expectations as a long-term measure, whereas performance was a short-term measure. Thus, in the absence of a longitudinal methodology, this relationship could not be captured accurately. In this study, the lack of uni-dimensionality also might have been a factor in concealing the significance of this relationship. The Limitations section of this chapter discusses this possibility in greater detail.

Hypotheses 7, 8, and 9, which predicted that prior performance would influence self-efficacy (CR = 3.348), outcome expectations (CR = 1.964), and performance (CR = 2.311), were supported in this dissertation. In the C&H study, only hypothesis 9 (prior performance --> performance) was fully supported. In the C&H study, these hypotheses were not tested to the same extent as the other hypotheses in the model. That is, performance from Day 1 of the training provided the prior performance measure for the Day 2 sessions. Thus, no measure of prior performance was available for the Day 1 analyses. In this dissertation, only subjects with existing knowledge of Microsoft Excel were used, providing a sound measure of prior performance in all analyses.

7.1.1.1 Summary of Hypotheses 1 through 9

Some differences in results were found between the C&H study and this dissertation. Most predominant were those involving self-efficacy's influence on outcome expectations and performance. Because Bandura (1978) strongly alleges the validity of these relationships and because they were supported in the C&H study, additional tests of these constructs, although beyond the current scope of this dissertation, may be warranted.

The differences between studies involving hypotheses 7 and 8 reinforce the validity of the current research design. That is, prior performance has consistently been shown to exert significant influence on final performance in numerous Social Cognitive studies, and any evidence to the contrary might have been cause for concern. In view of the current findings, however, support for these hypotheses alludes to a possible problem in the C&H experiment that was remedied in this study.

7.1.2 Hypotheses 10 through 12 (Task Complexity)

Hypotheses 10 through 12 involved the task complexity moderator introduced in this study. Hypothesis 10, which predicted that behavior modeling would outperform lecture-based training when task complexity was high, was not supported (p=.567). As discussed above, hypothesis 3 revealed that behavior modeling produced higher performance scores than lecture-based training when data were collapsed across levels of complexity. This was in contrast to the C&H study, which demonstrated inconsistent results across the two software packages. Based on conjecture as well as theory, task complexity was presumed to be a valid surrogate to explain the differences found between software packages. In this study, however, the existence of an overall main effect with no differences between levels of complexity suggests the need to examine a different moderator.

Hypothesis 11 predicted that behavior modeling would result in higher self-efficacy scores than lecture-based training when task complexity was high than when task complexity was low. This hypothesis also was not supported (p=.348). Again, as with hypothesis 10, absence of support for this hypothesis may indicate a need to examine another construct as a potential moderator in this relationship.

Hypothesis 12, which predicted that self-efficacy would have a stronger influence on performance when task complexity was high than when it was low, was not supported (CR = 0.041). This hypothesis was based predominantly on a theory proposed by Gist

and Mitchell (1992). Given that the C&H study found self-efficacy to positively influence performance in three of the four training sessions, and in this study, self-efficacy demonstrated no influence on performance, a problem may exist in the current study with respect to testing this relationship. That is, because the original results were not replicated, it is possible that a flaw exists in the measurement, testing, or analysis of this relationship. Thus, lack of support for hypothesis 12 is not conclusive without additional tests of this relationship.

7.1.3 Hypotheses 13 and 14 (Avoidance Behavior)

Hypothesis 13, which predicted that subjects who received behavior modeling training would use Solver more often than subjects who received lecture-based training, was fully supported (p=.008) in this study. This finding has significant implications for both academic and professional educators in that the type of training employed may affect a user's willingness and/or ability to use a given technology.

Hypothesis 14 predicted that subjects who received the low complexity task would elect to use Solver more frequently than subjects who received the high complexity task. Again, this hypothesis was not supported (p=.965). A plausible explanation for this result is that the relationship between avoidance behavior and task complexity may be U-shaped. That is, at the low level of complexity, the task may have been too simple to justify using Solver. Conversely, the high complexity task may have been so difficult that the additional burden of using Solver was overwhelming, resulting in a failure to use Solver. For future studies, a more comprehensive test of this relationship might include an additional level of complexity between the low and high levels used in this study.

7.1.4 CAI Empirical Investigation

Although no formal hypotheses were stated for the CAI training method, all paths that were analyzed in the behavior modeling and lecture-based sessions were tested for the

CAI method. Surprisingly, only the relationship between prior performance and self-efficacy was deemed significant. Because prior performance is an exogenous variable and supposedly unaffected by the type of training method, no apparent reasons exist to explain the lack of significance for the relationships between prior performance --> outcome expectations and prior performance --> performance.

7.1.5 Comparison of Training Methods

To put into perspective the effectiveness of the three training methods examined in this study, all three techniques were analyzed and ranked in terms of their effects on the endogenous variables in the model: self-efficacy, outcome expectations, and final performance. In terms of performance, behavior modeling resulted in higher performance scores than both lecture-based training and CAI. Conversely, CAI resulted in higher outcome expectations than behavior modeling and lecture-based training. No differences were found between methods for self-efficacy scores.

Tests of interactions also were conducted for the three training methods. No complexity interactions were found for self-efficacy or outcome expectations. The complexity X performance analysis, however, revealed differences between training methods at both levels of complexity. At the high complexity level, behavior modeling and CAI outperformed lecture-based training. At the low complexity level, behavior modeling outperformed both lecture and CAI, with lecture significantly outperforming CAI.

In summary, Behavior modeling resulted in higher performance scores than the other non-modeling methods, regardless of the level of complexity. For complex tasks, CAI was the preferred non-modeling technique, and for simple tasks, lecture-based training was the preferred non-modeling technique.

7.2 LIMITATIONS

Various limitations may exist in this study. Sample composition, which is one of the most frequently cited threats to external validity, is not considered a limitation in this study. This is a study of cognitive processes, and such processes are normally generalizable across populations within a culture. As stated previously, because the purpose of this study is to generalize the significance of path coefficients (rather than actual parameter estimates), the use of student subjects is not considered a hindrance to validity.

The primary limitation of this study, then, is the potential multi-dimensionality of the self-efficacy and outcome expectations constructs. Although Cronbach's alpha, variance extracted, construct reliability, and factor analyses indicate acceptable degrees of construct validity and reliability of the instruments, examination of the correlation matrix reveals mixed results. That is, because various indicators on the self-efficacy and outcome expectations questionnaires exhibit relatively low intercorrelations, it is feasible that additional constructs are represented by these measures. Thus, in the absence of these additional constructs, parameter estimates, significance levels, and overall model fit may be understated.

7.3 FUTURE RESEARCH

Because some of the predicted relationships in this study were not supported, future research projects may determine the cause of these anomalies. For example, to determine if a relationship exists between outcome expectations and performance, a longitudinal study may provide additional insights into outcome expectations as a long-term variable and performance as a short-term measure.

Additionally, because none of the hypotheses involving self-efficacy were supported, and because the Social Cognitive literature predicts relationships between self-

efficacy and the other constructs in the model, additional tests should be conducted to verify the validity of the results obtained in this study. These additional tests may require a refinement of the self-efficacy instrument to account for the possible multi-dimensionality limitations discussed above.

As none of the hypotheses involving task complexity were supported, future projects may identify alternative task dimensions to test as potential moderators. Also, as mentioned above, the existing study may be expanded to include more levels of task complexity to identify any curvilinear (U-shaped) relationships.

7.4 IMPLICATIONS AND CONCLUSION

In light of the results presented above, various implications are present for academia as well as industry. Because behavior modeling has repeatedly been shown to enhance performance on computer tasks, professors and trainers should take advantage of its effectiveness in designing and teaching classes. Also, as increasing emphasis is placed on using Computer Assisted Instruction as an alternative to costly seminars in an effort to train employees on new software packages, employers should consider the type of task to be performed. Although behavior modeling produced the best performance results at all levels of task complexity, CAI was equally effective when the level of complexity was high. For low complexity tasks, however, CAI was the least effective method examined.

An additional product of this study highlights the role of prior performance on final performance in acquiring computer skills. Clearly, prior performance is a determinant of final performance, and this relationship indicates a potential need for employers to closely scrutinize the prior computer experience of potential employees when making hiring decisions and of current employees when assigning tasks.

Given today's rapidly changing world of technology, industry is inundated with opportunities to improve employee productivity through implementation of new systems

and software. To maximize potential gains, however, employees must be trained to use new technologies via methods that are within budget limits and, at the same time, effective. It is the goal, then, of researchers to identify appropriate training methods and the conditions under which they are most effective. As research is conducted in this area, the Social Cognitive model of learning provides a plethora of theory upon which to build, test, and apply existing methodologies to new domains. It has, therefore, been the purpose of this dissertation to enhance this theory, expound upon its role in information systems, and identify its applicability in specific situations.