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ABSTRACT

This study examined the effects of goals--such as denoting learning and performance outcomes--and self-evaluation on the acquisition of computer skills, efficacy in performing computer tasks, perception of competence for the use of self-regulatory strategies, and frequency of strategy use while learning computer skills. Subjects were 44 college students enrolled in an "Introduction to Computers in Education" course. Subjects' learning goal was the use of specific HyperCard tasks, and their performance goal was to do their best at the tasks. Results showed that when goals are combined with self-evaluation of progress, the students' perception of efficacy and competency for the use of self-regulatory strategies when learning computer skills was raised, and the frequency of strategy use increased. This combination, however, did not lead to a significant increase in other outcome measures. There were no definite results for self-evaluation. (AS)

# Self-Regulation during Computer Skills Learning: The Influence of Goals and Self-Evaluation

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Abstract

This study examined the effects of goals (denoting learning or performance outcomes) and self-evaluation of learning progress on college students' acquisition of computer skills, efficacy for performing computer tasks, perceived competency for using self-regulatory strategies, and frequency of self-regulatory strategy use. Forty-four students enrolled in an *Introduction to Computers in Education* course participated in the study. Students worked under the conditions of learning specific HyperCard tasks (learning goal) or a goal of doing their best (performance goal). Midway through the instruction, half of the students in each condition evaluated the progress they were making on learning the HyperCard tasks. Results suggest that combining goals with self-evaluation of progress may be an effective way to raise college students' perceptions of efficacy and competency for using self-regulatory strategies during computer skill learning and also may increase the frequency of strategy use. Implications for educational practice are discussed.

Self-Regulation during Computer Skills Learning:

The Influence of Goals and Self-Evaluation

In response to recent calls for educational reform, educators are beginning to stress the importance of developing students' self-regulatory competence in addition to subject-area knowledge and skills. Zimmerman and Paulsen (1995) noted, "Today's information-rich environment can be a huge resource for students who are able to seek information from diverse sources, think critically about what they find, and select and integrate knowledge" (p. 13). These characteristics are commonly attributed to self-regulated learners, or learners whose self-generated thoughts, feelings, and actions are systematically oriented toward goal attainment (Schunk & Zimmerman, 1994). Although there are numerous definitions of self-regulated learning, most stress that self-regulated learning involves the personal activation and sustaining of goal-directed cognitions and behaviors (Zimmerman, 1989; 1990). Cognitive researchers emphasize such mental activities as attention, rehearsal, use of learning strategies and comprehension monitoring, along with such beliefs as self-efficacy, outcome expectations, and value of learning (Schunk, 1996). Behavioral researchers focus on overt responses involved in self-monitoring, self-instruction, and self-reinforcement. Regardless of theoretical tradition, however, self-regulation fits well with the notion that students contribute actively to their learning goals and are not passive recipients of information.

The central thesis of this paper is that effective self-regulated learning depends on periodic self-evaluation of one's progress toward specified learning goals. The self-evaluation process comprises both self-judgments of present performance through comparisons to one's goals and self-reactions to these judgments by regarding current performance as noteworthy, satisfactory, unacceptable, and so forth (Schunk, 1996). As students monitor their task performance, they evaluate whether they are making satisfactory progress toward their goals. Judgments of acceptable progress result in continuation of their current task approach; self-evaluations of unacceptable progress may lead students to alter their strategy to one they believe has a better chance of resulting in goal attainment. For example, students may initiate new approaches to a study task such as outlining or analogizing, or may alter their self-regulatory processes by working harder, persisting longer, or seeking help from teachers and peers. The use of these and other cognitive and self-regulatory strategies is likely to lead to success, which strengthens students' self-efficacy for learning and motivation for goal attainment (Schunk & Zimmerman, 1994).

In this paper we describe a research study in which we examined the influence of goals and self-evaluative processes during computer skill learning. We begin by summarizing theoretical ideas involving self-regulation, self-efficacy, and achievement goals.

Social Cognitive Theory of Self-Regulation

According to Bandura's (1991) social cognitive theory, self-regulation involves three components: 1) self-observation (purposively attending to aspects of one's behavior), 2) self-judgment (comparing present performance to one's goals), and 3) self-reaction (judging performance as good or bad, acceptable or unacceptable). Self-evaluative activities involve self-judgments of progress and reactions to those judgments. The belief that one is making progress, along with the anticipated satisfaction of goal attainment, enhances self-efficacy and sustains motivation (Schunk, 1996).

At the start of learning activities students may have such goals as acquiring skills and knowledge, finishing work, and making good grades. As they work, students observe, judge, and react to their perceptions of goal progress. These self-regulatory processes interact with one another. As students observe aspects of their behavior they judge them against standards and react positively or negatively. These judgments and reactions set the stage for additional observations of the same behaviors or of others. These processes also interact with the environment (Zimmerman, 1989). Students who judge their learning progress as inadequate may react by asking for assistance from their teachers or peers.

Teachers then may demonstrate more efficient strategies which students use to achieve their learning goals.

Self-Efficacy

Effective self-regulation depends on students developing a sense of self-efficacy for learning and performing well. Self-efficacy refers to personal beliefs about one's capabilities to learn or perform behaviors and skillful actions at designated levels (Bandura, 1986). Self-efficacy can influence learners' choices of tasks and strategies, effort, persistence, and skill acquisition (Schunk, 1990). Compared with students who doubt their learning capabilities, those with high self-efficacy for accomplishing a task participate more readily, work harder, persist longer when they encounter difficulties, and achieve at a higher level.

Bandura (1986) describes the formation of self-efficacy as a dynamic process involving self-referent thoughts, affects, and actions. According to Bandura, learners acquire information from four sources to appraise their self-efficacy: performances (test results, successful task completion), vicarious experiences (observing models, watching television, reading), social persuasion from others ("I know you can do this"), and physiological reactions (emotional arousal, relaxation). Information acquired from these sources does not influence self-efficacy automatically but rather it is cognitively appraised (Bandura, 1986). Learners weigh and combine perceptions of their ability, task difficulty, amount of effort expended, amount and type of assistance received from others, similarity to models, and persuader credibility, when forming efficacy judgments (Schunk, 1990).

Effective self-regulation depends on holding an optimal sense of self-efficacy for learning (Bandura, 1986; Zimmerman, 1989). Students who feel efficacious about learning choose to engage in tasks, select effective strategies, expend effort, and persist when difficulties are encountered (Bandura, 1991; Schunk, 1991; Zimmerman, 1989). As students work on a task they compare their performances to their goals. Self-evaluations of progress enhance self-efficacy and keep students motivated to improve.

Achievement Goals

Goals are important for self-evaluation because they provide standards against which students compare their current performances (Bandura, 1986; Locke & Latham, 1990). Both goal-setting and self-evaluation are hypothesized to increase self-efficacy. Learners who adopt a goal may experience a sense of efficacy for attaining it, which motivates them to attend to instruction, persist, and expend effort. Self-efficacy is substantiated as students observe their goal progress because perceptions of progress convey that they are becoming more skillful. Positive self-evaluations indicating progress may also increase self-efficacy because learners believe they can continue to improve. Negative evaluations will not decrease motivation if individuals believe they are capable and can learn with greater effort or better strategies (Schunk, 1991).

The effects of goals depend on the properties of specificity, proximity, and difficulty (Bandura, 1988; Locke & Latham, 1990). Goals that incorporate specific performance standards, are close at hand, and are moderately difficult, are more likely to enhance performance than goals that are general, extend into the distant future, or are perceived as very easy or overly difficult (Schunk, 1990). Goal effects also may depend on whether the goal denotes a learning or performance outcome (Meece, 1991). A learning goal refers to what knowledge and skills students are to acquire; a performance goal denotes what task students are to complete (Dweck & Leggett, 1988). Goal research typically has focused on such goals as rate or quantity of performance, but educators increasingly are emphasizing that students become proficient in the use of learning strategies (Weinstein, Goetz, & Alexander, 1988).

Learning and performance goals may exert different effects on self-regulatory activities and achievement beliefs even when their goal properties are similar. Learning goals focus students' attention on processes and strategies that help them acquire competencies (Ames, 1992). Students who pursue a learning goal are apt to experience a sense of efficacy for attaining it and be motivated to engage in task-appropriate activities (Schunk, 1996). Self-efficacy is substantiated as they work on the task and note progress. Perceived progress in skill acquisition and a sense of efficacy for continued learning sustain self-regulatory activities and enhance skillful performance.

In contrast, performance goals focus students' attention on completing tasks. Such goals may not highlight the importance of the processes and strategies underlying task completion or raise efficacy for learning (Schunk, 1996). As students work on tasks, they may not compare present and prior performances to determine progress. Performance goals can lead to social comparisons of one's work with that of others to determine progress (Ames, 1992). Such comparisons can result in low self-evaluations of ability among students who experience difficulties, which may then retard motivation (Meece, 1991).

The Present Study

The present study examined the effects of goals (denoting learning or performance outcomes) and self-evaluation on college students' acquisition of computer skills, efficacy for performing computer tasks, perceived competence for using self-regulatory strategies, and frequency of strategy use during computer skill learning. Schunk (1996) obtained benefits of learning goals and self-evaluation on achievement outcomes among elementary students; however, research is lacking on the effects of goal setting and self-evaluation on skill acquisition among older students during computer skill learning. The present study addressed this need by examining the effects of goals and self-evaluation among college students who were learning HyperCard application skills. Based on the preceding theoretical considerations, it was predicted that students who pursued learning goals, with or without the additional component of self-evaluation, would show higher skill attainment, self-efficacy, and competency and frequency of self-regulatory strategy use, compared to students who did not make use of course goals. Learning goals focus on progress in skill acquisition and the importance of strategies for improving skills.

It also was predicted that self-evaluation of performance capabilities would result in similar benefits. In the absence of explicit self-evaluation, students may be less likely to assess their capabilities and be uncertain of their learning progress, which would not promote these outcomes as well. Finally, to the extent that learning goals produce a focus on skill improvement, self-evaluations should complement this focus and highlight that students are making progress in acquiring skills. If students who receive performance goals do not develop a similar focus on skill improvement, self-evaluations of capabilities will not complement the goal or enhance motivation and self-efficacy for further learning. Thus, we hypothesized that students who received learning goals and self-evaluation would attain the highest levels of skills, efficacy, and competency and frequency of use of self-regulatory strategies.

## Method

### Participants

Forty-four students (42 female, 2 male) enrolled in an *Introduction to Computers in Education* course at a large midwestern university participated in the study. Students ranged in age from 18 to 39 years (M=21 years). All students attended a large lecture session two times a week and an instructional lab once a week. Lab projects were explained and outlined in the lecture session and completed in the lab sections under the direction of teaching assistants. Students were assigned to one of six lab sessions by the registrar's office prior to the start of the semester.

### Measures

Approximately halfway through the 1996 spring semester (and prior to instruction on HyperCard), students completed four pretest measures that assessed their skills and efficacy for completing HyperCard tasks (e.g., create a button, link two or more cards, use the background feature) and for using self-regulatory strategies while learning these skills. Measures included students': 1) perceived capability for performing specific self-regulatory activities while learning computer applications (*competency*), 2) perceived frequency of use of these same self-regulatory strategies while learning (*frequency*), 3) perceived capability for performing specific HyperCard tasks (*self-efficacy*), and 4) task performance (*skills*).

The competency and frequency measures each comprised 16 items that asked students to indicate how well and how often, respectively, they performed specific self-regulatory activities in the areas of motives (e.g., "find ways to motivate myself to finish a lab project even when it holds little interest for me"), methods (e.g., "locate and use appropriate manuals when I need to accomplish an unfamiliar computer task"), performance outcomes (e.g., "set specific goals for myself in this course"), and social/environmental resources (e.g., "find peers who will give critical feedback on early versions of my projects") while learning computer application skills. These items were designed to represent the self-regulation dimensions identified by Zimmerman (1994). Students judged competency and frequency of use on a scale from 1 (not well/never) to 7 (very well/all the time).

The efficacy measure asked students to rate their confidence for performing HyperCard tasks at an exemplary level of performance, as reflected in the model projects that had been demonstrated in class. Students judged their level of confidence for performing 12 HyperCard tasks (e.g., add and format buttons, use HyperCard clip art) on a scale from 1 (not confident) to 7 (very confident). The 12 items on this measure corresponded closely to items on the skills test.

For the skills test, students were asked to create a 5-card HyperCard stack that required them to employ the skills listed on the efficacy measure. There were a total of 15 items on the skills test. Because students had not yet received instruction in HyperCard, they were not able to complete the HyperCard tasks.

Procedure

The course was designed such that students were expected to master basic objectives for each unit. The HyperCard unit was one of several in the course and extended over a period of three weeks. This unit included objectives that were substantially similar to those on the self-efficacy and skills test.

Following the pretest, students were randomly assigned (by lab sections) to one of four conditions: Learning Goals/Self-Evaluation (LG-SE), Learning Goals/No Self-Evaluation (LG-NoSE), Performance Goals/Self-Evaluation (PG-SE), or Performance Goals/No Self-Evaluation (PG-NoSE). Over the next month, all students in the course received instruction on HyperCard from the course instructor and lab teaching assistants. The week following completion of the pretest measures, students in the two Learning Goal conditions ($n$=22) were advised to adopt a goal of learning those skills identified as objectives for the HyperCard unit, which were reiterated. The other half of the students (Performance Goals) were not reminded of these goals but were advised to "do their best" as they worked on their lab assignments..

The following week (midway through the instruction), students in the two Self-Evaluation conditions ($n$=22) assessed the progress they were making in learning to perform HyperCard tasks, which corresponded to the course goals. The format and items of this assessment measure were similar to those of the pretest efficacy measure except that students judged how much progress they had made in acquiring the various HyperCard skills since the instruction began, on a scale ranging from 1 (None) to 7 (Quite a lot). Students in the No Self-Evaluation conditions (n=22) rated their level of satisfaction for performing the same HyperCard tasks. This latter assessment, which was included to control for potential effects of making judgments included in the Self-Evaluation conditions, has no relevance to the study and is not discussed further. Following the completion of HyperCard instruction, all students completed posttest measures similar to the pretest (competency, frequency, efficacy, and skills).

## Results

Posttest data were analyzed with a 2x2 ANOVA with the factors of goals (learning, performance) and self-evaluation (yes, no). Three measures (efficacy, competency, and frequency) yielded significant differences due to goals ($\underline{F} < .01$, $\underline{F} < .02$, $\underline{F} < .01$, respectively); self-efficacy also yielded a significant goals x self-evaluation interaction ($\underline{F} < .01$). Post hoc tests using Dunn's Multiple Comparison procedure were conducted to determine differences between conditions (see Table 1). Results indicated that students who received learning goals, with or without self-evaluation (LG-SE and LG-NoSE conditions), judged efficacy, strategy frequency, and strategy competency significantly higher than students assigned to the PG-NoSE condition. Students assigned to the LG-SE condition also judged efficacy significantly higher that those in the LG-NoSE and PG-SE conditions. LG-NoSE students judged efficacy higher than PG-SE students. Analyses of the self-regulation competency and frequency subscales revealed the greatest differences in the areas of motives, methods, and performance outcomes; the environment subscale yielded nonsignificant results.

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Insert Table 1 about here

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<u>Competency measures</u>. Learners assigned to the self-evaluation conditions, with learning or performance goals (LG-SE and PG-SE conditions), judged their competency for using <u>motive</u> strategies (e.g., find ways to motivate myself to finish a lab project even when it holds little interest for me) significantly higher than students in the no evaluation conditions (LG-NoSE and PG-NoSE). Students who received goals and/or opportunities

to evaluate their progress (LG-SE, LG-NoSE, PG-SE) judged their competency for using self-regulatory methods (e.g., locate and use appropriate manuals when I need to accomplish an unfamiliar computer task) significantly higher than PG-NoSE students. Students who received learning goals, with or without self-evaluation, judged their competency to use outcome (or goal-directed) strategies (e.g., set specific goals for myself in this course) significantly higher level than PG-NoSE students.

Frequency measures. Results on the frequency of use of self-regulatory strategies indicated that students assigned to the LG-SE and LG-NoSE conditions judged their frequency of use of motive, method, and outcome strategies significantly higher than students in the PG-NoSE conditions. There were no significant differences in judgments for use of environmental regulatory strategies (e.g., find peers who will give critical feedback on early versions of my projects).

Correlational analyses revealed significant and positive correlations between perceived competency and frequency of self-regulatory strategy use and self-efficacy ($r = .40$ and $r = .46$, respectively). Perceived competency and perceived frequency of strategy use were also highly correlated ($r = .90$).

Skills measures. There were no significant differences between the four conditions for the skills measure. Skill attainment did not significantly correlate with any of the other posttest measures, possibly because the instructional unit was mastery oriented; consequently, posttest skill scores were high and variability was low. Students' averaged 12.2 (out of a possible 15) items correct.

## Discussion

This study suggests that combining goals with self-evaluation of progress may be an effective way to raise college students' perceptions of efficacy and competency for using self-regulatory strategies during computer skill learning and also may increase the frequency of strategy use. In addition, we found benefits of learning goals without self-evaluation as a means for raising self-efficacy. When students adopt the goal of learning to perform HyperCard tasks, it appears as though they work diligently to master these skills and regulate their learning efforts to complete the computer tasks. As they observe their progress, self-efficacy is increased which sustains motivation and skillful performance (Schunk, 1991).

A number of researchers have described the relationship between learning goals and students' selection and use of learning strategies (Ames, 1992; Meece, 1991). Ames suggested that mastery goals (analogous to learning goals) increase the quality of students' engagement in learning. Active engagement is characterized by the application of effective learning and problem solving strategies. Schunk and Zimmerman (1994) described how students regulate their thoughts and behaviors to accomplish the goals they have set through a process that involves a dynamic interaction between goals and other regulatory processes (e.g., achievement values, efficacy for goal attainment, selection and use of learning strategies, self-evaluation of progress). In this study, students who adopted learning goals reported higher perceived competency to use regulatory learning strategies and indicated that they used these regulatory strategies more frequently than students who were not provided with explicit learning goals.

We did not obtain definitive results for self-evaluation although it is not clear why this was the case. One possibility is that these college students may have already been carefully monitoring their progress. Other research (Schunk, 1996) suggests that directed self-evaluation is beneficial when it is done frequently or when students do not engage in it spontaneously. In this study, formal self-evaluation was completed only once but students may have assessed their progress on their own by referring to explicit project requirements. We presently are conducting follow-up research that further explores the role of self-evaluation.

The combination of learning goals and self-evaluation is powerful when self-evaluation is linked directly to the goals and other factors may preclude self-evaluation (e.g., context provides few cues about performance, young children may not spontaneously evaluate their learning progress). Results from this study suggest that combining a learning goal with self-evaluation raises efficacy more than does combining a performance goal with self-evaluation. Specific learning goals provide students with readily available standards against which to evaluate their increasing skill level. When students assess their progress it becomes clear that they are becoming more competent; this perception strengthens self-efficacy and keeps students working productively.

In this study, the combination of learning goals and self-evaluation did not lead to significant increases in other outcome measures (skill, competency and frequency of regulatory strategy use). It is possible that our skill posttest did not adequately differentiate between various levels of skill due to the mastery orientation of the instruction. The other two measures (competency and frequency) were not closely linked with the HyperCard project goals, and it is possible that students did not perceive the connection between them. Furthermore, students did not assess their progress in using regulatory strategies, only in mastering the HyperCard skills. Perhaps a greater effect could be achieved if students evaluated their progress on using these strategies while learning computer skills. It might also be useful to make students more aware of the potential benefits to applying these regulatory strategies.

The results of this study have implications for classroom teachers. Learning goals can easily be incorporated into instruction. Furthermore, it is easy to remind students of goals and to obtain a commitment from them to try to achieve them. To ensure that all students engage in self-evaluation, teachers can provide opportunities for students to assess the progress they are making. Initially teachers may need to point out student progress, perhaps by showing them how their writing, spelling, or arithmetic performance has improved over a period of time. Student portfolios, that include samples of work that have been completed over the course of a semester or a year, offer one means of capturing and illustrating such progress.

Incorporating these suggestions into computer instruction seems easily accomplished. When students begin a new lesson, the computer can remind them of the instructional goals; following the lesson, students can be prompted to evaluate their progress. Once goals are attained, students can select a new goal that builds on the completed tasks. The results of this study suggest that such an approach may increase students' perceptions of self-efficacy and competency for using regulatory strategies during computer skill learning.

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Table 1

Significant ANOVA and Post Hoc Test Results

| Measure | Effect | F (1,40) | Post Hoc |
|---|---|---|---|
| **Self-Efficacy** | Goals | 148.03** | LG-SE>LG-NoSE |
| | Goal x Self-Evaluation | 7.17** | LG-SE>PG-SE |
| | | | LG-SE>PG-NoSE |
| | | | LG-NoSE>PG-SE |
| | | | LG-NoSE>PG-NoSE |
| **Skills** | | Nonsignificant | |
| **Competency** (total) | Goals | 5.96* | LG-SE>PG-NoSE |
| | | | LG-NoSE>PG-NoSE |
| *Motives* | Self-Evaluation | 21.89** | LG-SE>LG-NoSE |
| | Goals | 6.19* | PG-SE>PG-NoSE |
| | | | LG-SE>PG-NoSE |
| *Methods* | Goals | 6.21* | LG-SE=LG-NoSE= |
| | | | PG-SE >PG-NoSE |
| *Outcomes* | Goals | 10.74** | LG-SE>PG-NoSE |
| | | | LG-NoSE>PG-NoSE |
| *Environment* | | Nonsignificant | |
| **Frequency** (total) | Goals | 9.45** | LG-SE>PG-NoSE |
| | | | LG-NoSE>PG-NoSE |
| *Motives* | | Nonsignificant | |
| *Methods* | Goals | 8.51** | LG-SE>PG-NoSE |
| | | | LG-NoSE>PG-NoSE |
| *Outcomes* | Goals | 9.38** | LG-SE>PG-NoSE |
| | | | LG-NoSE>PG-NoSE |
| *Environment* | | Nonsignificant | |

** $p < .01$ * $p < .05$

Note. $N = 44$; $n = 11$ per condition. LG = learning goal; PG = performance goal; SE = self-evaluation; NoSE = no self-evalution

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