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ABSTRACT

This study examined the influence of learning goals and self-evaluation on college students' achievement outcomes during computer skill learning. The researchers hypothesized that providing students with learning goals would focus their efforts on the skills to be acquired, allow for assessment of learning progress, and enhance implementation of successful learning strategies. The research involved two studies of undergraduate preservice teachers enrolled in an introductory computer skills application course. Researchers randomly assigned students to one of four conditions (learning or performance goal conditions, with or without self-evaluation). Students were pretested and posttested during the Hypercard unit of the course. The testing included measures of self-regulation, self-efficacy, and achievement. Results found that providing students with learning goals enhanced their self-efficacy for successfully performing computer based tasks and their use of self-regulatory strategies better than did providing performance goals. Opportunities for self-evaluation also significantly affected self-efficacy. A followup study examined the idea that learning goals and self-evaluation operate through a common process of conveying to students information about their learning progress. Participants, procedures, and materials were similar, though students evaluated their learning progress at the end of each of three laboratory sessions. Results were similar to the results of the first study. The results indicated that providing college students with learning goals is an effective way to enhance achievement outcomes, and under certain conditions, opportunities for self-evaluation exert beneficial effects. (Contains 43 references.) (SM)

# Self-Evaluation and Self-Regulated Computer Learning

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**Self-Evaluation and Self-Regulated Computer Learning**

In this paper we describe research that examined the influence of learning goals and self-evaluation on college students' achievement outcomes during computer skill learning. Our conceptual focus was social cognitive theory, which postulates a critical role for self-regulation (Bandura, 1991; Zimmerman, 1998). Self-regulation refers to self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals (Zimmerman, 1989).

Social cognitive theory emphasizes the interaction of personal, behavioral, and environmental factors (Bandura, 1986; Zimmerman, 1994). Self-regulation is a cyclical process because these factors typically change during learning and must be monitored. Such monitoring leads to changes in an individual's strategies, cognitions, affects, and behaviors.

This cyclical nature is captured in Zimmerman's (1998) three-phase self-regulation model. The forethought phase precedes actual performance and refers to processes that set the stage for action. The performance (volitional) control phase involves processes that occur during learning and affect attention and action. During the self-reflection phase, which occurs after performance, individuals' respond to their efforts.

Social cognitive theory postulates that perceived self-efficacy, or personal beliefs about one's capabilities

to learn or perform actions at designated levels (Bandura, 1986, 1997), is a key variable that affects all phases of self-regulation (Zimmerman, 1990, 1998). Efficacious students are more likely to select challenging tasks, expend effort and persist when difficulties are encountered, and demonstrate higher achievement (Bandura, 1993, 1997; Pajares, 1996; Schunk, 1991, 1996). Individuals acquire information to appraise efficacy from their performances, vicarious (observational) experiences, forms of persuasion, and physiological responses (e.g., sweating, heart rate).

The process whereby self-efficacy affects phases of self-regulation is as follows (Schunk, 1996). Students enter learning situations with varying degrees of self-efficacy for learning (forethought). As they engage in the task (performance control), they use self-regulatory strategies based on their knowledge of them, their beliefs that the strategies are effective, and their efficacy for employing them skillfully (Zimmerman, 1989, 1998). During self-reflection, students evaluate their learning progress. Perceived progress sustains self-efficacy and motivation, which enhance learning.

The present research addressed all three phases. As part of the forethought phase we provided students with goals to pursue during subsequent learning. To assess performance control, we determined students' perceived competence and self-reported use of self-regulatory

strategies. During self-reflection, students evaluated their learning progress.

Goals

A substantial literature shows that goals affect motivation, achievement, and self-regulation (Bandura, 1988, 1991; Locke & Latham, 1990; Schunk, 1990). Goals provide standards against which students can compare learning progress. When students adopt a goal, they may experience a sense of self-efficacy for attaining it and be motivated to perform appropriate self-regulatory activities (Schunk, 1996). Self-efficacy is substantiated as students perceive their goal progress. Goals that incorporate specific performance standards, are close at hand and moderately difficult, are especially effective in raising motivation and achievement (Locke & Latham, 1990; Schunk, 1990, 1991).

Achievement outcomes also may depend on whether goals incorporate learning or performance outcomes (Ames, 1992; Meece, 1991; Pintrich & Schrauben, 1992; Urdan & Maehr, 1995). Learning goals refer to knowledge and skills to be acquires; performance goals denote tasks to be completed (Dweck & Leggett, 1988). Learning goals may help focus students' attention on the task and promote use of self-regulatory activities that enhance learning (Ames, 1992; Purdie, Hattie, & Douglas, 1996). The perception of goal progress substantiates students' self-efficacy for learning and promotes motivation and achievement (Schunk, 1996).

In contrast, performance goals focus students' attention on completing tasks (Ames, 1992). Performance goals may not highlight the importance of self-regulatory processes underlying task success or raise self-efficacy for learning (Schunk & Swartz, 1993). Rather than comparing present with past performance to assess progress, students may socially compare their work with that of others (Ames, 1992; Meece, 1991). Social comparisons can lower perceptions of competence and motivation among students who experience difficulties (Ames, 1992; Jagacinski, 1992).

A growing body of correlational research supports the hypothesis that learning goals relate positively to perceptions of competence, self-regulation and achievement (Meece, Blumenfeld, & Hoyle, 1988; Middleton & Midgley, 1997; Nolen, 1988, 1996; Pintrich & Garcia, 1991). Experimental studies have yielded benefits with children (Elliott & Dweck, 1988; Schunk, 1996; Schunk & Rice, 1989, 1991; Schunk & Swartz, 1993).

In the present research we explored the effects of learning goals on college students' achievement outcomes during computer skill learning. There is a lack of experimental research on learning-goal effects among postsecondary students during cognitive skill acquisition. Most of our participants were female undergraduate teacher education majors. Women often hold lower perceptions of competence for acquiring mathematical and scientific skills

than do men (Meece & Courtney, 1992; Meece & Jones, 1996); thus, we hoped to study the development of efficacy. We also thought that these college students would be knowledgeable of self-regulatory strategies (Pintrich, 1990), which would allow us to assess changes in their perceptions and use of strategies.

We hypothesized that providing students with learning goals would focus their efforts on the skills to be acquired, allow for assessment of learning progress, and enhance implementation of successful learning strategies. In contrast, we felt that providing performance goals would not highlight the importance of learning to the same degree, nor provide as valid a standard for gauging progress, or cue the necessity of using effective self-regulation strategies.

Self-Evaluation

Personal evaluation is an integral component of the self-reflection phase of self-regulation (Zimmerman, 1998). Positive evaluations substantiate self-efficacy for learning and motivate learners to work diligently because they believe they are capable of making further progress (Schunk, 1991). Low self-evaluations will not necessarily diminish self-efficacy or motivation if students believe they are capable of learning and can do so by using more-effective self-regulatory strategies (Zimmerman & Martinez-Pons, 1992).

Despite these theoretical benefits, there is little research exploring how self-evaluation affects achievement outcomes. Research with children during mathematical (Schunk & Hanson, 1985; Schunk, Hanson, & Cox, 1987) and writing-skill learning (Schunk & Swartz, 1993) found that self-efficacy for learning or improving skills assessed prior to children receiving instruction predicted subsequent motivation and achievement.

Research has obtained benefits of self-evaluation among adults (Bandura & Cervone, 1983, 1986; Cervone, Jiwani, & Wood, 1991). Schunk (1996) found differential effects of self-evaluation among children as a function of its frequency. Frequent opportunities for self-evaluation raised achievement outcomes regardless of whether students received learning or performance goals. Conversely, infrequent opportunities for self-evaluation raised self-efficacy and achievement only among students receiving learning goals. These results suggest that frequent self-evaluations of learning progress are powerful and can override effects of learning goals; however, when self-evaluation occurs less often it may complement learning goals better with corresponding benefits for achievement outcomes.

In our research we hypothesized that infrequent self-evaluation would complement learning goals and enhance self-efficacy, achievement, and self-regulation competence and frequency. Conversely, multiple self-evaluations were

hypothesized to outweigh benefits of learning goals and raise achievement outcomes for both learning- and performance-goal students.

## Research Evidence

We will describe two research studies. Participants were students in an undergraduate teacher education (elementary and secondary) program. Students were enrolled in an introductory course on computer skills applications (e.g., word processing, spreadsheets, telecommunications, Hypercard). They attended a lecture twice a week and a laboratory once a week.

Data were collected during the Hypercard unit. The objectives for this unit were substantially similar to those included in our self-efficacy and achievement tests. Students were pretested prior to the start of the unit. The research was conducted over the following three laboratory sessions. Posttesting occurred after the last session. Goal instructions were given at the start of each session. Study 1

The pretest included measures of self-regulation (perceived competence and frequency), self-efficacy, and achievement. The self-regulation test comprised 16 items that tapped the four self-regulation dimensions identified by Zimmerman (1994). Four items were included for each dimension. The four dimensions (and sample items) were: motives ("find ways to motivate myself to finish a lab project even when it holds little interest for me");

methods ("locate and use appropriate manuals when I need to accomplish an unfamiliar computer task"); performance outcomes ("set specific goals for myself in this course"); social/environmental resources ("find peers who will give critical feedback on early versions on my projects"). Students made competence and frequency judgments with the same 16 items. For the competence measure, students judged how well they thought they could perform each activity on a 7-point scale ranging from 1--not well, to 7--very well. For the frequency measure, students judged how often they actually performed each self-regulatory activity on a 7-point scale ranging from 1--never, to 7--all the time.

The self-efficacy test assessed students' perceived capabilities for performing 12 Hypercard tasks at an exemplary (accurate and neat) level of performance. Sample tasks were, "Use different fonts," "Add and format fields," "Use the background feature." Students judged their confidence for performing each task on a 7-point scale that ranged from 1--not confident, to 7--very confident. For the achievement test, students were asked to create a five-card HyperCard stack that required them to employ successfully the tasks listed on the efficacy measure. At the time of the pretest, students had not received instruction on HyperCard, and no student correctly performed any of the items. Consequently, pretest achievement scores were not used in the data analyses.

Procedure. Students were assigned randomly to one of four conditions according to a 2 (goal: learning/performance) x 2 (self-evaluation: yes/no) factorial design. At the start of each of the first three laboratory sessions the experimenter distributed to students assigned to learning-goal conditions a list of the course HyperCard objectives and verbalized to students the goal of trying to learn how to perform each of the tasks on the list. To students assigned to the performance-goal conditions, the experimenter verbalized the goal of trying to do their best to complete the assignments. To ensure that conditions were distinguished in students' minds, the experimenter gave the instructions at the start of each laboratory session, after which the experimenter asked students if the goal sounded reasonable. No student expressed dissatisfaction with the goal in any session.

Students assigned to the self-evaluation conditions judged their progress in acquiring HyperCard skills at the end of the second laboratory session. The materials and procedure were identical to those of the pretest self-efficacy assessment except that students judged the amount of progress they had made in learning to perform the HyperCard tasks. Students judged each of the tasks on a 7-point scale ranging from 1--none, to 7--quite a lot.

Students assigned to the no self-evaluation conditions did not complete the learning progress self-evaluation instrument; however, at the end of the second laboratory

session the experimenter gave them a single-item attitude questionnaire that asked how much they enjoyed HyperCard instruction and working on HyperCard assignments. These attitude scores are not otherwise relevant to this study and are not discussed further.

Posttest. The posttest was given during the week following the last laboratory session. It was identical to the pretest except that a different assignment was used on the achievement test to control for potential effects of students' selective memory of the pretest assignment.

Results. Pretest and posttest self-efficacy scores were analyzed with *t*-tests by condition to determine whether students in each condition experienced significant gains as a consequence of instruction and the intervention. These results were significant for students assigned to the learning-goal conditions.

Analysis of covariance was applied to posttest self-efficacy using pretest self-efficacy as the covariate. This analysis yielded significant effects due to goal and self-evaluation. Students who received learning goals plus self-evaluation scored higher on self-efficacy than did the other three conditions. Students in the learning goal/no self-evaluation condition judged self-efficacy higher than did students assigned to the performance-goal conditions. Posttest achievement was analyzed with analysis of variance. This result was nonsignificant.

Pre- and posttest self-regulation competence and frequency average scores were compared within conditions. Students who received learning goals without self-evaluation showed a significant increase on the competence measure. Analyses of covariance applied to posttest competence and frequency scores using the corresponding pretest scores as covariates yielded significant goal effects for each measure. The learning-goal conditions scored significantly higher than the performance goal/no self-evaluation condition on both measures.

Self-evaluation scores of the self-evaluation conditions were compared with analysis of variance; the result was significant. Students who received learning goals and self-evaluation judged their progress greater.

Correlational analyses among posttest measures showed that self-efficacy correlated significantly with achievement and self-regulation competence and frequency. The two self-regulation measures were significantly correlated. Among students assigned to self-evaluation conditions, self-evaluation score related positively to self-efficacy.

A stepwise multiple regression analysis was conducted with posttest achievement as the dependent variable. The predictors were posttest self-efficacy, posttest self-regulation competence and frequency scores, goal condition, and self-evaluation condition; the latter two were entered as categorical variables. Self-efficacy was the strongest

predictor of achievement, followed by goal condition. Collectively, the five predictors accounted for 73% of the variability in achievement.

Study 2

Study 1 showed that providing students with learning goals enhanced their self-efficacy for successfully performing computer-based tasks and their self-reported use of self-regulatory strategies better than did providing performance goals. We also found that providing a learning goal and an opportunity for self-evaluation exerted the greatest effect on self-efficacy. We did not, however, obtain evidence that learning goals or self-evaluation of progress enhanced achievement; students in all conditions achieved equally well.

We designed a follow-up study to investigate in greater depth the idea that learning goals and self-evaluation operate through a common process of conveying to students information about their learning progress. Our self-evaluation was minimal it occurred once. For learning-goal students, one self-evaluation may have been sufficient to convey progress because it was linked to their goals that reflected unit objectives. Performance goal students may have derived less-clear information about progress because the self-evaluation did not directly ask about their goals.

The participants, materials, and procedures of the second study were similar to those of the first except that

students evaluated their learning progress at the end of each of the three laboratory sessions. We felt this more-frequent self-evaluation would increase the likelihood of performance-goal students deriving progress information. We also dropped the performance goal/no self-evaluation condition because our first study and Schunk (1996) found that outcomes are not enhanced as well in the absence of learning goals and self-evaluation. We predicted that the three conditions would demonstrate comparable outcomes.

Results of t-tests by condition revealed that all three conditions experienced significant gains in self-efficacy. Analysis of covariance applied to posttest self-efficacy using pretest self-efficacy as the covariate and the three conditions as the treatment variable yielded a nonsignificant result. Analysis of variance of posttest achievement also was nonsignificant.

On the self-regulation measures, the two self-evaluation conditions demonstrated significant increases in self-regulation competence and frequency. Analysis of covariance on posttest scores using the corresponding pretest scores as covariates and the three conditions as the treatment factor yielded nonsignificant results. Analysis of variance applied to the self-evaluation scores (averaged across sessions) of the self-evaluation conditions yielded nonsignificant results. Correlational and regression analyses yielded results similar to those of the first study.

## Discussion

The results of these studies show that providing college students with learning goals is an effective way to enhance achievement outcomes and that under certain conditions opportunities for self-evaluation also exert beneficial effects. These studies represent one of the few empirical investigations into the influence of learning goals and self-evaluation during academic learning with postsecondary students. Most research is correlational or experimental laboratory investigations (Meece et al., 1988; Middleton & MIdgley, 1997; Nolen, 1988, 1996; Pintrich & Garcia, 1991; White, Kjelgaard, & Harkins, 1995).

An explanation for our findings based on social cognitive theory is as follows. Providing students with a goal to learn computer applications can increase their self-efficacy for learning, help focus their attention on the task, and motivate their use of effective self-regulatory activities (Ames, 1992; Purdie et al., 1996). Self-efficacy is substantiated and motivation and self-regulation are sustained as they perceive their progress in skill acquisition (Bandura, 1997; Schunk, 1996).

These studies also help clarify the role of self-evaluation during cognitive skill learning. In the first study, students engaged in self-evaluation once. Given that this assessment was closely tied to the learning goal because it called for self-evaluation of progress, it complemented that goal better than the performance goal.

With infrequent opportunities for self-evaluation, the assessment may have conveyed a clearer sense of progress to learning-goal students than to performance-goal students. Within the learning-goal condition, we found that students who engaged in self-evaluation judged self-efficacy higher than did no self-evaluation students. This finding supports the notion that even one opportunity for self-evaluation can raise self-efficacy when it is closely linked to the learning goal.

In contrast, the self-evaluation assessment in the second study was more powerful because it occurred weekly. Under these conditions, the type of goal may make little difference (Schunk, 1996). Our results are consistent with those of other investigations (Elliott & Dweck, 1988; Schunk, 1996).

We must qualify our results because students were acquiring skills and making positive self-evaluations. To be effective, self-evaluation should be linked with instruction so that students learn and perceive progress. Self-evaluation could exert negative effects on motivation and self-regulation if students encounter difficulties and conclude they are incapable of learning (Schunk, 1996).

In the first study we found that learning goals enhanced students' judgments of self-regulatory competence and frequency of strategy use while learning. Students who believe they are capable of learning are apt to focus on the task at hand, monitor their performances, assess their

progress, and employ effective learning strategies (Zimmerman, 1998; Zimmerman & Martinez-Pons, 1992). Learning goals can help focus students' efforts on the task and provide the motivation to engage in self-regulation (Schunk, 1996).

Another qualification involves our sample of college students who typically have a good repertoire of self-regulation strategies (Ertmer, Newby, & MacDougall, 1996; Pintrich, 1990). Learning goals and self-efficacy will have little effect on self-regulation if students are unaware of strategies, cannot employ them effectively, or question whether self-regulation improves learning (Borkowski, Johnston, & Reid, 1987; Schunk, 1991).

In contrast to the preceding benefits, neither study found that learning goals and self-evaluation enhance computer-skill achievement. We cannot determine the reasons for these nonsignificant results, which are inconsistent with those obtained by Schunk (1996) with children. One possibility is that the learning goal may have seemed too easy to students, because it was tied to the course objectives that students were expected to master. Easy goals can raise self-efficacy but not have much effect on performance if all students can accomplish the task (Bandura, 1988; Locke & Latham, 1990). This research should be replicated in a setting where mastery conditions do not exist to enhance variability of students' perceptions of the difficulty of the learning goal.

A second possibility is that despite our efforts to distinguish conditions, students may have implicitly held learning goals for the course and engaged in covert progress self-evaluation. We anticipated that, unlike children, our undergraduates would possess a good self-regulation skill repertoire (Ertmer et al., 1996; Pintrich, 1990). We nonetheless expected benefits of learning goals and self-evaluation on achievement because we felt that when learning-goal students evaluated progress during self-reflection they would continue to use effective strategies or switch to more-effective ones. If all students implicitly held learning goals and self-evaluated progress, then our learning-goal and self-evaluation conditions served to make those processes more salient. Such saliency can raise self-efficacy by highlighting progress, but not necessarily achievement if all students were motivated to succeed and employed effective strategies.

Future research might explore students' pre-existing goals and determine whether students adopt goals that diverge from their own. Thus, we might ask whether performance-goal students who held an implicit learning goal maintained their goal or switched based on our instructions.

The present results support the idea that self-efficacy is not merely a reflection of prior performances (Bandura, 1986, 1997). Students in all conditions received equal time on computer instruction and practice, yet self-

efficacy differences emerged in Study 1. These differences suggest that treatment conditions differed in the extent they conveyed a sense of learning progress to students, which enhanced their self-efficacy. This research also shows that capability self-perceptions help to predict skillful performance. Regardless of treatment condition, self-efficacy bore a strong, positive relation to achievement and self-judged strategy use. Other research shows that self-efficacy mediates the relation between prior academic experience and subsequent performance (Pajares, 1996; Pajares & Miller, 1994).

The results of these projects have implications for teaching students computer skills or other content where computers are employed. Making explicit the link between class objectives and learning goals raises students' perceptions of self-efficacy for success, which should enhance motivation and self-regulated learning. Opportunities for self-evaluation are easy to incorporate into teaching and the present results show that frequent self-evaluations are beneficial. Computers offer a desirable means for this because the goals and self-evaluation assessments can be included as part of the software. Although these studies do not suggest that learning goals and self-evaluation are necessary for achievement, they can facilitate achievement outcomes when integrated with sound instruction.

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