Available online at www.sciencedirect.com
SCIENCE DIRECT®
Contemporary Educational Psychology 30 (2005) 96–116
Contemporary Educational Psychology
www.elsevier.com/locate/cedpsych

Why study time does not predict grade point average across college students: Implications of deliberate practice for academic performance

E. Ashby Plant*, K. Anders Ericsson, Len Hill, Kia Asberg

Department of Psychology, Florida State University, Tallahassee, FL 32306-1270, USA

Available online 14 August 2004

Abstract

The current work draws upon the theoretical framework of deliberate practice in order to clarify why the amount of study by college students is a poor predictor of academic performance. A model was proposed where performance in college, both cumulatively and for a current semester, was jointly determined by previous knowledge and skills as well as factors indicating quality (e.g., study environment) and quantity of study. The findings support the proposed model and indicate that the amount of study only emerged as a significant predictor of cumulative GPA when the quality of study and previously attained performance were taken into consideration. The findings are discussed in terms of the insights provided by applying the framework of deliberate practice to academic performance in a university setting.

Keywords: Grade point average; Study time; Academic performance; Deliberate practice; Study habits

* Corresponding author. Fax: 1-850-644-7739.
E-mail address: plant@psy.fsu.edu (E.A. Plant).

0361-476X/$ - see front matter
doi:10.1016/j.cedpsych.2004.06.001

1. Introduction

The total amount of time that students report studying has often been examined as a potential predictor of success in school. It might seem that the more time that students spend studying, the better grades they should receive. Although students should increase their personal knowledge and skills by increasing the amount of time that they spend on relevant study activities, the relationship between the amount of study and achievement across students is less clear. Indeed researchers have consistently found a weak or unreliable relationship between the weekly amount of reported study time and grade point average (GPA) for college students (Allen, Lerner, & Hinrichsen, 1972; Beer & Beer, 1992; Gortner Lahmers & Zulauf, 2000; Hinrichsen, 1972; Michaels & Miethe, 1989; Schuman, Walsh, Olson, & Etheridge, 1985; Wagstaff & Mahmoudi, 1976).[1]

The most extensive study conducted on the issue, by Schuman et al. (1985) provides compelling evidence that "there is at best only a very small relationship between amount of studying and grades" (p. 945). In one of their studies, they found a weak, yet reliable relationship between reported study time and grades in the corresponding semester, but this relationship disappeared when students' SAT scores were statistically controlled. Schuman et al. (1985) argued that grades in college are primarily determined by aptitude measures, such as SAT, and attendance at lectures and classes.

Subsequent investigators largely accepted the findings of Schuman et al. (1985) but questioned the generalizability of the findings across educational contexts (Michaels & Miethe, 1989) and student populations (Rau & Durand, 2000). In their study, Michaels and Miethe (1989) found a small ($r = .18$, $p < .01$) relationship between reported study and GPA, which remained after controlling for a number of background variables, such as high school rank, attendance, and reported study habits. They also found that studying "without listening to radio and television (no noise)" predicted higher GPA. Rau and Durand (2000) argued that Schuman et al.'s (1985) findings were the result of their sample of undergraduates from the University of Michigan, which they posited are not representative of students in most large state universities. For example, they found that the students at University of Michigan reported studying an average of 25 h/week, whereas Illinois State University (ISU) students reported only 8 h/week (but see Schuman, 2001). Although Rau and Durand (2000) found that the amount of study was reliably related to GPA ($r = .23$, $p < .001$) for an ISU sample, the real benefits were only seen for students studying over 14 h/week (about 25% of the ISU students). Rau and Durand (2000) devised a variable of "academic ethic" to identify students who were committed to studying, which also predicted GPA, after controlling for high-school grades and scholastic aptitude (ACT) scores.

[1] For the current literature review, we chose to focus on research that used official records of GPA as opposed to self-reported GPA and that used samples of regular college students and not pre-selected special populations.

1.1. Deliberate practice and performance

In trying to understand the small or unreliable relationship between study time and GPA, it may be helpful to consider the emerging literature on deliberate practice. Research into deliberate practice indicates that the amount of high quality practice accumulated during individuals' careers is closely related to their attained performance in a wide range of domains (e.g., Ericsson, 2002; Ericsson & Lehmann, 1996). Studies of the acquisition of expert performance have shown that extensive experience is necessary for individuals to attain high levels of reproducibly superior performance in the domain of expertise (Ericsson & Lehmann, 1996; Simon & Chase, 1973). However, all experiences are not equally helpful and there are qualitative differences between activities loosely referred to as "practice" in their ability to improve performance.

There are clear limits on the benefits of experience. For example, many people know recreational golf and tennis players whose performance has not improved in spite of 20–30 years of active participation. The mere act of regularly engaging in an activity for years and even decades does not appear to lead to improvements in performance, once an acceptable level of performance has been attained (Ericsson, 2002). For example, if someone misses a backhand volley during a tennis game, there may be a long time before the same person gets another chance at that same type of shot. When the chance finally comes, they are not prepared and are likely to miss a similar shot again. In contrast, a tennis coach can give tennis players repeated opportunities to hit backhand volleys that are progressively more challenging and eventually integrated into representative match play. However, unlike recreational play, such deliberate practice requires high levels of concentration with few outside distractions and is not typically spontaneous but carefully scheduled (Ericsson, 1996, 2002). A tennis player who takes advantage of this instruction and then engages in particular practice activities recommended by the teacher for a couple of hours in deeply focused manner (deliberate practice), may improve specific aspects of his or her game more than he or she otherwise might experience after many years of recreational play.

Ericsson, Krampe, and Tesch-Römer (1993) proposed that the acquisition of expert performance was primarily the result of the cumulative effect of engagement in deliberate-practice activities where the explicit goal is to improve particular aspects of performance. These activities are typically designed by a teacher or by the elite performers themselves when they have reached a sufficiently high level of mastery. The specific goals of deliberate practice and the detailed nature of training activities will differ for a given person from practice session to practice session as it will from one person to another in a given domain and particularly across domains. However, the general goal of all forms of deliberate practice involves improving some aspect of performance in an effective manner and, thus, deliberate practice has a number of pre-requisites, including the capacity to sustain full concentration, a distraction-free environment, and access to necessary training resources. Hence to engage in deliberate practice the aspiring elite performers often need to travel to a training facility and to schedule the practice activity to assure the ability to sustain concentration during

the daily practice activity (Ericsson, 1996, 2002, 2003a). Ericsson et al. (1993) and Ericsson (1996, 2002, 2003a) demonstrated that the attained level of an individual's performance is closely related to the reported amount of deliberate practice, primarily solitary practice focused on improvement, that he or she has accumulated since the introduction to a domain, such as chess (Charness, Krampe, & Mayr, 1996), sports (Ericsson, 2001, 2003a, 2003b; Helsen, Starkes, & Hodges, 1998; Starkes, Deakin, Allard, Hodges, & Hayes, 1996), and music (Ericsson et al., 1993; Krampe & Ericsson, 1996; Lehmann & Ericsson, 1996; Sloboda, 1996).

In studies of college education, similar evidence has been accumulated for differential effectiveness of various learning activities. Inspired by Craik and Tulving's (1975) classic work on depth of processing, Schmeck and Grove (1979) found that college students with above average GPAs differed from students with below average grades in their reports of cognitive processes mediating their learning. The students with higher GPAs were found to endorse more inventory items about elaborative encoding and deep analysis and synthesis, but were not found to differ in their endorsement of traditional study and learning methods from the students with lower GPAs. In fact, they found that students' endorsement of traditional study was negatively related to their academic assessment tests (ACT). More recent research on effective learning (for reviews see Pintrich, 2000; Puustininen & Pulkkinen, 2001; Zimmerman, 2000) has explored successful students' reports of the regulation of learning activities and the study environment within educational settings. For example, Zimmerman and Bandura (1994) showed that self-efficacy (as rated by college students) and grade expectations predicted grades in a writing class. VanderStoep, Pintrich, and Fagerlin (1996) found that college students with low, medium, and high course grades differed in their reported learning characteristics for social and natural science but not humanities courses. Specifically, VanderStoep et al. (1996) showed that high achievers in social and natural science had more domain-specific knowledge, more adaptive motivational beliefs, and better self-regulation. More recently Zimmerman (1998, 2002) has developed a general framework for self-regulation in studying. He demonstrated close parallels between effective activities in studying in academic settings and self-regulated practice in the development of expert performance in many domains of expertise (Ericsson, 1996, 2002, 2003a, 2003b).

The current paper seeks to identify observable indicators of effective learning activities in the complex domain of academic performance in a university setting by extending the theoretical frameworks of deliberate practice and self-regulated learning. We propose that distinctions between deliberate practice and other types of practice can be applied to studying and that this distinction can, at least in part, explain why measures combining all types of study activities in the school system are not valid predictors of grades. Furthermore, we propose a few observable indicators that would reveal active efforts by some of the students to plan study activities in environments that are conducive to deliberate practice and self-regulated study activities in college. Of particular interest are learning activities reflecting deliberate and self-regulated practice that are related to increased performance (GPA). However, in addition to factors that are hypothesized to promote the quality of study, there are numerous other factors in the college environment that also influence GPA

and performance across a wide range of academic subjects (e.g., prior knowledge of subject, skills, and cognitive abilities). Therefore, our approach focuses on measuring a wide range of factors important for academic performance, so that we can statistically control for these factors and eventually estimate the relationship between study time and academic performance.

1.2. Toward a model of factors that determine grades during a semester in college

Common measures of performance in college are the cumulated GPA or the GPA for a given semester. These measures are averages of course grades, which are likely determined by two types of factors. The first type can be measured prior to the start of a targeted semester, such as the knowledge, abilities, and skills that had been acquired prior to the start of the semester. The second group of factors consists of the concurrent study and the learning and non-learning activities that take place during the semester. We consider each of these types of factors in turn.

1.2.1. Factors reflecting conditions prior to the start of a semester

Previously acquired knowledge, skills, and stable abilities relevant to a given course will directly affect performance on tests and the final examination. These factors will also have an indirect impact by influencing the amount and type of new learning that is necessary during the semester for a student to reach a given level of mastery. Based on a large body of research, the best measures of basic cognitive skills and abilities and prior learning are SAT scores, high-school GPA, and prior grades in college (e.g., Allen et al., 1972; Gortner Lahmers & Zulauf, 2000; Hinrichsen, 1972; Schuman et al., 1985). Allen et al. (1972), for example, found that high school rank was a better predictor of GPA than study time or test anxiety. Standardized assessments of aptitude such as SAT and ACT scores are also predictive of performance in college (Gortner Lahmers & Zulauf, 2000; Hinrichsen, 1972; Schuman et al., 1985). One might argue that the single best variable summarizing this information would be the cumulative GPA for college at the time of the start of the relevant semester. However, this measure also reflects many stable characteristics concerning quality and quantity of past study behaviors that are likely to be continued into the current semester.

1.2.2. Factors reflecting effective study during a semester

If the goal is to predict GPA and cumulative GPA for students, it is necessary to focus on information that students are capable of reporting accurately from memory about the entire current semester. Although it would be fascinating if students were willing to report their detailed study processes for every hour of study during the semester, it would be virtually impossible to validate this information, particularly retrospectively. Consequently, we chose to focus on observable characteristics of activities that students actively initiated to influence not only the amount of study time but also the quality of study. Based on the deliberate-practice framework, effective learning requires high levels of concentration and focus on the study activities (Ericsson, 1996, 2002; Ericsson et al., 1993). As a result, studying should be more

effective if it takes place in environments that allow full concentration (Zimmerman, 1998, 2002). Whereas some students may walk over to the library to study alone, others may study with friends and in settings with many potential distracters. However, studying is more likely to reach a quality consistent with deliberate practice and self-regulated academic learning if students schedule studying activities at suitable times and in locations where they would be unlikely to be interrupted and distracted.

Consistent with this argument, when researchers have taken steps to assess distractions or interruptions to studying, they are typically successful in predicting academic performance. For example, Michaels and Miethe's (1989) found that studying with the radio and TV was associated with a lower GPA. Hinrichsen (1972) found that the amount of effective study time (i.e., the number of uninterrupted minutes spent studying) predicted GPA. In addition, Allen et al. (1972) found that the number of interruptions that students reported during studying was negatively correlated with GPA. These findings suggest that students interested in excelling in school might be well served by choosing study environments with a low probability of distraction (e.g., studying alone in the library). We argue that such study environments are more likely to foster the kind of concentration and focus necessary for effective learning (i.e., deliberate practice and self-regulated learning).

Based on research on expert musicians and other elite performers, we know that engagement in deliberate practice is not generally spontaneous but that future expert performers habitually practice at regularly scheduled times (Ericsson, 1996, 2002). The factors that control engagement in deliberate practice thus differ from the unplanned and spontaneous engagement in more enjoyable and effortless activities, such as leisure activities with friends (Ericsson et al., 1993). The need for sustained concentration, appropriate environment, and sufficiently long uninterrupted time intervals for deliberate practice requires long-term time budgeting and active prioritization. Therefore, given the competing demands for time in college, deliberate practice among college students would require active planning of their time. Similarly, self-regulated, effective learning is argued to require careful forethought and planning (Zimmerman, 1998, 2002). Consistent with these propositions, Britton and Tesser (1991) argued that because of the multiple demands on students' time, careful planning of time is critical to success. They believe that good organization and goal setting (i.e., planning activities a week or more in advance) created a more focused approach to studying and more efficient monitoring of goal accomplishment. Such focus and monitoring are critical to deliberate practice. Consistent with their theorizing, they found that self-management practices such as prioritizing tasks were predictive of college students' GPAs even when controlling for their SAT scores (also see Gortner Lahmers & Zulauf, 2000).

In order for students to engage in the high quality of study necessary for deliberate practice, it is also important that students expend the effort to come to the classes and attend a large percentage of them. It is in the classroom where students receive instruction regarding what information and skills need to be studied and practiced for high levels of performance. Therefore, it is expected that a high level of attendance is required for optimal quality of studying. In addition, other demands or draws for students' time tend to influence the use of available time and, likely, energy

for studying. For example, students who work for pay for a large number of hours each week will have fewer hours available for studying and less freedom to choose when to study. As a result, instead of selecting study time based on motivation and level of energy, people working many hours for pay may be left with fewer options for when to study (e.g., late at night, between classes), which may lead to less effective and less focused studying. Similarly, students who choose to spend extensive time partying may also limit the available time for studying as well as the quality of their study time.

1.3. The current study

The current study examines those factors likely to indicate the high quality of study among college students, endemic to deliberate practice and self-regulated learning, in hopes that it will help to clarify the relationship between study time and GPA. Specifically, the current study examined a range of factors reflecting conditions prior to the current academic semester (i.e., high-school GPA, SAT scores) as well as factors from the current semester (i.e., study time, study environment, and planning) and attempted to predict college performance both cumulatively and for a current semester.

First, we assessed the relationship between estimated study time and cumulative GPA. We then controlled for previous performance in high school, college, and on standardized aptitude tests before examining the effects of factors from the current semester, including those related to quality of study on college GPA. Once previously acquired knowledge, skills, and abilities are statistically controlled, we predict that factors related to quality and quantity of study would emerge as predictors of college GPA. Therefore, in the current study, participants were asked about a range of their activities in order to gain a detailed picture of the characteristics as well as quantity of their study behavior. Across the factors assessed in the current study, we focused on objective and verifiable information, such as official university records (e.g., GPA, SAT scores). We selected quantifiable assessments that are verifiable in principle and minimally subjective. For example, the time spent studying in the library, attendance to classes, participation in parties, and outside employment can be validated in future studies by direct observation and interviews of close friends and roommates. We also collected information about studying and other activities in diaries. Similar methods have been used to validate concurrent and retrospective estimates of deliberate practice (Côté, Ericsson, & Beamer, 2004; Ericsson et al., 1993; Krampe & Ericsson, 1996). By examining a large range of factors simultaneously, the current work allows us to identify those factors that provide an independent contribution to grade point average.

We anticipated that students, who reported studying behaviors that reflect important aspects of deliberate practice (i.e., focused, uninterrupted, and carefully planned) (Ericsson, 1996, 2002, 2003a; Ericsson et al., 1993) and characteristics theoretically related to self-regulated learning (Zimmerman, 1998, 2002), would excel. Specifically, based on the findings regarding deliberate practice and the review of the literature on academic performance and self-regulated learning, we anticipated

that students who studied in a quiet environment with fewer distractions and who carefully organized their study time would achieve higher performance. Further, we expected that students who attended a large percentage of classes and had fewer outside competing demands for their time and energy, such as working for pay or frequently attending parties, would have higher GPAs.[2] Finally, when other factors that may influence the quality of study time (e.g., study environment, planning) are taken into account, we predicted that the amount of reported study time would emerge as a predictor of academic performance.

2. Method

2.1. Participants

Participants were 88 volunteer, undergraduate college students (49% male) from Florida State University in Tallahassee, Florida. Participants were required to have completed at least 1 year or 24 credit hours at the university (mean credit hours = 58.52, $SD = 27.39$) to insure that there were enough credit hours to produce a meaningful GPA. Participants were drawn from classes in the departments of Psychology and Education as well as from sports teams at the university. The mean age of the participants was 19.82 years ($SD = 1.19$). All participants signed informed consent documents and release forms for their official university records.

2.2. Procedure

Participation took place in group sessions (typically 15–20 students) in classrooms at the university. Participants were given a packet of materials including a Time Allocation and Academic Performance questionnaire, seven time log forms, and seven stamped and addressed envelopes. Participants were given an overall explanation of the study and the procedure to be followed for completing the time logs. Participants then completed the questionnaire, which took approximately 45 min. Participants were asked to complete the time logs on a day-to-day basis over the next week and mail the completed forms to the investigators daily. Most participants followed the instructions for remitting the completed forms, but some participants returned multiple completed forms at the same time. The overall purpose of the procedure was to maintain an awareness of their daily activities so that they could be accurately reported.

[2] Although these measures capture objective characteristics that make deliberate practice more likely, they do not directly measure the quality of study. We chose to focus on observable, objective behaviors that we believe to be associated with high quality deliberate practice as opposed to more direct assessments of self-reported quality of study in order to avoid potential subjective biases in the direct quality ratings.

2.3. Materials

2.3.1. Official university records

The University official records were used to acquire information regarding the participants' grade point averages from high school and college level courses accepted by the university prior to the current semester on a four-point scale (e.g., $A = 4.0$). In addition, participants' SAT/ACT scores were collected. To create a single standardized test score, students ACT scores were transformed into SAT scores using the University's equivalency formula. In addition, the GPA for the fall semester during which the study was conducted was obtained from the official university records after the end of the semester.

2.3.2. Time allocation and academic performance questionnaire

The questionnaire packet was designed to elicit information from the participants regarding their academic performance at the university and the factors that may influence their academic performance. The questionnaire assessed background information, academic history, university academic performance, time allocation, and study methodologies.

From the major categories listed above, questions bearing directly on the current investigation were selected for analysis. Participants reported the percentage of basic core classes (i.e., English, mathematics, and major courses) that they had attended. They were also asked to report the percentage of their most difficult class and their second most difficult class that they attended. These percentages were averaged to create the class attendance variable ($\alpha = .73$).

The time allocation section asked participants to report the number of hours a week they spent in a variety of activities. Relevant for the current investigation, participants were asked to report the number of hours a week they spent working for pay (hours of work) as well as the number of hours a week they spent at parties or clubs (hours partying). In addition, planning practices were obtained by examining how participants reported that they most often planned their time. Participants selected their method of planning from a list that included a computer planning program, a commercial planner, a calendar, a daily to-do list, and keeping it in their head. These responses were coded to create a planning variable. Participants who reported that they used long-term planning that included some advanced planning (e.g., a computer program, commercial planner, or calendar) were coded as having long-term planning (53%). If they used a daily list or kept their plan in their head, they were coded as not using long-term planning (47%).

The study methodologies section asked participants about their study habits including how much they studied, where they studied, and whether they studied alone. Participants reported the average number of hours they studied per week for their courses using two different approaches. First, they were asked to report the number of hours per week they studied for each of their classes. They were next asked the number of hours per week that they studied in a variety of locations (e.g., a home, library, etc.). The total number of hours that they reported studying across each of these measures was summed. These two measures of study time were strongly

correlated with each other ($r = .71$), and, therefore, the two totals were averaged to create a single measure of total study time.

To determine whether participants typically studied in a quiet, solitary environment, we examined the percentage of the time that they reported studying at the library versus at home and the percentage of time that they reported studying alone versus with other people present. Based on the concept of deliberate practice people should study most effectively if they study alone in a quiet environment with few distractions. Therefore, the two percentages were summed to create an index of the degree to which they typically studied in a quiet environment with few distractions (study environment) with higher numbers indicating a better environment.

2.3.3. Daily time logs

After completing the questionnaire, participants were requested to complete a daily time log for seven consecutive days. Space was provided to note the participant's activities (e.g., studying, sleeping, hanging out with friends) in 15-min segments throughout a 24-h day. Participants were instructed to note "Personal" in the time slots for those activities that they felt uncomfortable reporting. In addition, participants reported whether the week covered by the daily time logs was a typical or atypical week (for either academic or non-academic reasons). The number of hours that participants reported studying across the daily time logs was tallied as an additional assessment of study time. Unfortunately, the time logs were only completed by 60% of the participants and could not be universally compared to the questionnaire data.

3. Results

As a first step in understanding the factors that influence performance in college, we examined the zero-order correlations between the different assessments of college GPA (i.e., cumulative, fall semester) and the variables that we anticipated would predict college GPA. The full set of correlations between the measures can be found in Table 1. In general, the relationships between the different assessments of GPA and the predictors were quite similar across the measures of GPA. Whereas neither of the assessments of GPA was associated with the amount of time students studied, they were both positively associated with high-school GPA (and SAT scores for cumulative GPA). In addition, consistent with expectations, attending classes and having an organized approach to planning were associated with a higher cumulative GPA. Attending classes was also associated with a higher fall semester GPA. For fall semester GPA, studying in a quiet environment was related to a higher GPA. Further, across the assessments of GPA, working long hours at a job and spending more hours partying or at clubs were associated with a lower GPA.

It is also worth noting that the amount of time that students spent studying was negatively related to their SAT scores. This finding is consistent with the idea that students who have superior prior knowledge and skills coming into the college could

Table 1
Intercorrelations between measures

	2	3	4	5	6	7	8	9	10
1. GPA fall 2000	.55*	.02	.25*	.17	.27*	.17	.27*	−.24*	−.22*
2. Cumulative GPA	—	.11	.33*	.24*	.28*	.26*	.17	−.30*	−.28*
3. Study time		—	−.05	−.26*	.04	.20	−.21*	.14	.11
4. High-school GPA			—	.39*	.13	.01	−.01	−.17	−.19
5. SAT scores				—	−.07	.01	−.11	−.05	−.10
6. Attendance					—	.12	.03	−.06	−.31*
7. Planning						—	−.01	.10	.06
8. Study environment							—	−.05	−.03
9. Hours of work								—	−.03
10. Hours partying									—

Note. N ranges from 83 to 88 depending on missing data.
* $p < .05$.

attain a given GPA with less study time than those with weaker prior knowledge and skills. Also, students who studied in a quiet environment with few distractions tended to study for less time than those who studied in a less ideal environment. Not surprisingly, students who spent more hours at parties and clubs tended to attend a smaller percentage of their classes. Finally, high-school GPA and SAT were reliably correlated.

3.1. Examination of cumulative GPA

Having established that the zero-order correlations were consistent with predictions, we were interested in examining which of the potential predictors were independently associated with college GPA. To this end, a hierarchical regression analysis was conducted on participants' measures of GPA. As the more general measure of GPA, we first examined cumulative GPA up to the fall semester during which we collected the participants' responses to the questionnaire. In the first step of the regression, the average study time per week based on the questionnaire responses was entered into the equation to determine the impact of study time in the absence of the other potential predictors. Next, high-school GPA and SAT scores were entered into the regression as indicators of prior knowledge and skills. For the third step, other variables that were anticipated to influence academic performance (i.e., taking advantage of instruction and study quality) were entered. These variables included class attendance, planning, study environment, and hours of work per week. For the final step of the regression, high-school GPA and SAT scores were removed from the equation. This step allowed us to identify both the variance independently accounted for by prior knowledge and skills and the effect of the other predictors when the variance due to these variables was not removed from cumulative GPA.

The findings from the analyses can be found in Table 2. The results from the first step of the regression indicated that study time alone was not a significant predictor of cumulative GPA, $F(1,81) = 1.01$, $p = .32$ ($\beta = .11$). When high-school GPA and

Table 2
Hierarchical regression analyses across measures of GPA

	Cumulative GPA		Fall GPA		Fall GPA controlling for cumulative GPA	
	R^2	β	R^2	β	R^2	β
Step 1: Total Model R^2	.01		<.01		<.01	
Study time		.11		<.01		<.01
Step 2: Total Model R^2	.15*		.06		.31*	
Study Time		.15		.04		−.05
High-school GPA		.28*		.20		.04
SAT scores		.16		.09		<.01
Cumulative GPA up to fall		—		—		.54*
Step 2: Partial Correlations						
For variables not in equation		*pr*		*pr*		*pr*
Attendance		.29*		.25*		.12
Planning		.24*		.17		.05
Study environment		.27*		.31*		.21
Hours of work		−.29*		−.22*		−.09
Hours partying		−.26*		−.23*		−.11
Step 3: Total Model R^2	.41*		.29*		.37*	
Study time		.24*		.14		.05
High-school GPA		.15		.08		.02
SAT scores		.24*		.18		.10
Cumulative GPA up to fall		—		—		.38*
Attendance		.18		.17		.10
Planning		.21*		.15		.07
Study environment		.24*		.30*		.21*
Hours of work		−.28*		−.22*		−.11
Hours partying		−.18		−.16		−.10
Step 4: Total Model	.32*		.24*		.24*	
Study time		.18		.10		.10
Attendance		.15		.15		.15
Planning		.24*		.17		.17
Study environment		.18		.26*		.26*
Hours of work		−.30*		−.23*		−.23*
Hours partying		−.25*		−.21		−.21

Note. $N = 83$.
* $p < .05$.

SAT scores were included in the equation, the model accounted for 15% of the variance in GPA and the addition of high-school GPA and SAT scores constituted a significant change in the model's overall F score, $F_{\text{change}}(2, 79) = 6.33$, $p < .004$. However, examination of the independent influence of each of the predictors revealed that high-school GPA was the only significant predictor of cumulative GPA, such that a higher level of GPA in high school was associated with a higher cumulative college GPA, $F(1, 79) = 6.25$, $p < .02$ ($\beta = .28$). An examination of the partial correlations of

the variables not included in the regression equation at the second step showed that all of these variables (i.e., attendance, planning, study environment, hours of work, and hours partying) would predict reliable variance in GPA once the effects of SAT achievement and high-school GPA were statistically controlled.

At the third step of the regression, the overall model accounted for 41% of the variance in cumulative GPA and the addition of the variables in the third step resulted in a significant change in the model's overall F score, $F_{\text{change}}(5, 74) = 6.57$, $p < .001$. Examination of the independent influence of each of the variables revealed that when all of the predictors were included in the regression, study time emerged as a significant predictor of GPA, such that more study time was associated with a higher GPA, $F(1, 74) = 5.94$, $p < .02$ ($\beta = .24$). In contrast, high-school GPA no longer uniquely predicted college GPA, $F(1, 74) = 2.22$, $p = .14$, ($\beta = .15$). Further, SAT scores provided unique prediction of GPA with higher SAT scores associated with a higher cumulative GPA, $F(1, 74) = 5.32$, $p < .03$ ($\beta = .24$). In addition, several of the variables added to the regression at this step were significant unique predictors of cumulative GPA. Specifically, an organized approach to planning was positively associated with GPA, $F(1, 74) = 5.38$, $p < .03$ ($\beta = .21$). As anticipated, studying in a quiet, solitary environment was associated with a high GPA, $F(1, 74) = 6.28$, $p < .02$ ($\beta = .24$). The more hours a student worked per week, the lower his or her cumulative GPA, $F(1, 74) = 9.04$, $p < .005$ ($\beta = -.28$). Although attendance and hours partying approached significance, when the other factors were included in the regression, they did not reach significance.

When excluding high-school GPA and SAT scores, the regression equation accounted for 32% of the variance in GPA and the removal of these variables constituted a significant decrease in significance of the overall model, $F_{\text{change}}(2, 78) = 6.01$, $p < .005$. At this step of the regression, each of the other variables remained a significant predictor of cumulative GPA with the exception of study time, which dropped below significance.

We were interested in why the amount of study time was only a significant predictor of GPA when all of the other variables were included in the regression equation. Specifically, we wanted to determine which of the variables in our model influenced the effect of study time on GPA. The findings from the previous analysis indicated that high-school GPA and SAT scores influenced the effect of study time on cumulative GPA (i.e., study time was only a significant predictor when these variables were in the equation). In addition, because study time only emerged in the third step of the equation, it appeared that at least one of the variables that was entered in the third step (i.e., attendance, planning, study environment, and hours of work per week) influenced the effect of study time on GPA. Examination of the correlations between study time and the variables entered in the third step of the regression revealed that study environment was negatively related to study time, $r = -.21$, $p < .05$. It appears that students who study in a quiet, solitary environment tend to study for less time than those who study in more disruptive environments. We suspected that the change in the influence of study time on GPA was due to the relationship between study time and study environment.

To examine this possibility, we conducted a series of analyses to explore whether study environment suppressed the influence of study time on cumulative GPA. When study environment was not included in the regression but all of the other predictors were included, study time was not a significant predictor of cumulative GPA, $F(1,75) = 2.91$, $p = .09$ ($\beta = 0.17$). However, when study environment was included in the regression equation, study time emerged as a significant predictor, $F(1,74) = 5.94$, $p < .02$ ($\beta = 0.24$), such that more study time was associated with higher GPAs. A modified Sobel test indicated that the shift in the effect of study time across these regressions was significant, Sobel $z = 2.23$, $p < .03$.

3.2. Examination of GPA for the fall semester

Having examined the factors that predict cumulative GPA before the fall semester, we next turned to the factors that predict the GPA for the fall semester during which the data were collected. The same type of hierarchical regression analysis was conducted on participants' fall semester GPA. As shown in Table 2 the results are essentially parallel to those obtained in the previous analyses of cumulative GPA.

The results from the first step of the regression indicated that study time alone was not a significant predictor of fall GPA, $F(1,81) < 1$, $p = .97$ ($\beta < .01$). When high-school GPA and SAT scores were included in the equation, the model accounted for 6% of the variance in fall GPA, but the addition of high-school GPA and SAT scores did not constitute a significant change in the model's overall F score, $F_{\text{change}}(2,84) = 2.44$, $p = .06$. An examination of the partial correlations with the variables not in the equation showed the same pattern as in the previous analysis of cumulative GPA. However, the partial correlation for planning failed to reach the level of significance.

At the third step of the regression, the addition of the new variables led to a significant change in the model's overall F score, $F_{\text{change}}(5,74) = 4.78$, $p > .002$. The pattern of results was similar to the analysis of the cumulative GPA up to the fall, but seven of the eight regression coefficients were smaller in magnitude. Only two of the variables provided unique accounts of the variability in grades for the fall semester. Studying in a quiet, solitary environment was positively associated with fall semester GPA, $F(1,74) = 8.19$, $p < .006$ ($\beta = .30$). Furthermore, working was associated with a reduced level of fall GPA, $F(1,74) = 4.68$, $p < .04$ ($\beta = -.22$).

When excluding high-school GPA and SAT scores, the regression equation accounted for 24% of the variance in GPA. The removal of these variables was, however, not associated with a reliable decrease in significance of the overall model, $F_{\text{change}}(2,78) = 2.29$, $p = .11$.

3.3. Predicting fall GPA controlling for GPA from earlier semesters

The similar patterns of relationships for cumulative GPA up to fall and fall semester GPA led us to perform the same hierarchical regression analysis of fall GPA while controlling for the cumulative GPA for previous semesters.

The results from the first step of the regression are identical to those reported earlier. When high-school GPA, cumulative college GPA, and SAT scores were included in the equation in the second step (see Table 2), the model accounted for 31% of the variance in fall GPA and their addition constituted a significant change in the model's overall F score, $F_{\text{change}}(3, 78) = 11.70$, $p < .001$. However, examination of the independent influence of each of the predictors revealed that cumulative college GPA up to the fall semester was the only significant predictor of fall GPA, such that a higher level of GPA in college up to the fall semester was associated with a higher fall GPA, $F(1, 78) = 28.53$, $p < .001$ ($\beta = .54$).

The addition of the other variables in the third step did not result in a significant change in the model's overall F score, $F_{\text{change}}(4, 73) = 1.43$, $p = .22$. However, the overall model was highly significant, $F(9, 73) = 4.81$, $p < .001$, and it accounted for 37% of the variance in fall semester GPA. It is interesting to note that when the variables were added in the third step of the regression, cumulative college GPA remained a highly significant, but reduced, predictor of fall GPA, $F(1, 73) = 9.77$, $p < .002$, ($\beta = .38$). Further, examination of the independent influence of the variables added in the third step revealed that the only variable reliably associated with fall semester GPA was studying in a quiet, solitary environment, $F(1, 73) = 4.13$, $p < .05$ ($\beta = .21$).

When the high-school GPA, cumulative college GPA, and SAT scores were excluded in step 4, the regression equation accounted for 24% of the variance in fall GPA. The removal of these variables constituted a significant decrease in significance of the overall model, $F_{\text{change}}(3, 79) = 4.09$, $p < .002$, indicating that they had a significant independent influence on the fall semester GPA.

3.4. Diary analyses

Given that approximately a third of the participants did not complete the diary portion of the study, it was difficult to draw conclusions based on the responses to the diary. Further, over half of the participants who completed the diary reported that the week covered by the diary was unusual either for academic reasons (e.g., they had several exams, $n = 12$) or non-academic reasons (e.g., travel off campus, the homecoming game, $n = 17$). However, we were interested in whether the reported study time in the diary over the week covered by the diary was consistent with the average study time reported in the questionnaire. Supporting the validity of the study time reported in the questionnaire, a tally of the time spent studying over the course of the week covered in the diary was significantly correlated with the study time from the questionnaire, $r(53) = .61$, $p < .001$. As would be expected, this relationship was particularly strong for those students who reported that the week covered by the diary was typical, $r(22) = .74$, $p < .001$, but did not reach significance for the participants who reported the week was not typical for academic or non-academic reasons, both r's $< .38$, p's $> .24$.

For those participants who completed the diary and reported that the previous week had been typical, we examined whether their study time reported in the diary was related to their cumulative and fall semester GPAs above and beyond

high-school GPA and SAT scores. Regression analysis indicated that the number of hours that participants reported studying on the diary was significantly related to their fall semester GPA, $F(1, 18) = 8.11$, $p < .02$ ($\beta = .57$).[3]

4. General discussion

The current work drew upon the theoretical frameworks of deliberate practice and self-regulated academic learning in order to examine why the amount of study by college students has been found to have no, or a negligible, relationship to academic performance in a university setting. Previous research on the acquisition of expert performance has shown that the level of expertise in a domain is closely related to the amount of high quality, focused practice, termed deliberate practice, that individuals have accumulated during many years of committed training (Ericsson, 1996, 2002, 2003a; Ericsson et al., 1993). In applying this approach to performance in college, we sought to determine which characteristics of studying would help to identify people likely to be engaging in the type of high quality study, which would qualify as deliberate practice. We proposed a model where performance in college (GPA) was jointly determined by previously acquired knowledge, skills, and abilities (high-school GPA and SAT) as well as factors regulating the available time and resources for consistent well-planned studying and class attendance. Based on the tenets of deliberate practice and self-regulated learning, those who engage in deliberate studying take active steps to ensure their practice time will be of high quality and encourage the improvement of performance.

The results from the current study were generally consistent with predictions and previous findings. First, performance attained prior to college reliably predicted cumulative GPA and GPA in one semester, consistent with many previous investigators (e.g., Allen et al., 1972; Elliot, McGregor, & Gable, 1999; Gortner Lahmers & Zulauf, 2000; Hinrichsen, 1972; Schuman et al., 1985). Specifically, high-school GPA and SAT scores were both positively related to the cumulative university GPA, and SAT scores accounted for variability independent of all other variables. In addition, GPA in previous semesters of college appeared to capture the relevant variability associated with performance prior to entry in college when predicting GPA for a single semester.

When the influence of skills and abilities attained in high school was statistically controlled, many factors associated with current study behavior revealed reliable relationships with cumulative GPA and fall semester GPA. Of particular relevance to the theoretical framework of deliberate practice, students who indicated that they studied alone in an environment unlikely to contain distracters, tended to perform better both in the current semester and cumulatively. It is worth noting that study environment was a significant predictor of performance even after accounting for

[3] It should be noted that when we compared participants who completed the diary to those who did not complete the diary, the only significant difference between the groups was that the participants who completed the diary were more likely to report an organized approach to studying, $t(86) = -3.04$, $p < .004$.

previous performance. These findings are consistent with the importance of concentrated, deliberate practice for predicting high levels of performance (Ericsson, 1996, 2002; Ericsson et al., 1993) and self-regulated academic learning (Zimmerman, 1998, 2002). Further, when considering cumulative GPA, the overall amount of study time only emerged as a significant predictor of performance when the quality of the study environment and scholastic aptitude at entry to college (SAT) were included in the regression equation. Thus, it appears that the *quantity* of study time may only emerge as a reliable factor that determines performance when the *quality* of study time and the student's SAT scores are also taken into consideration. In fact, the amount of study time was negatively related to both the study environment and the SAT scores with no reliable evidence for a correlation between study environment and SAT scores.

This pattern of results suggests that students with higher SAT scores, most likely reflecting a higher level of previously attained relevant study skills and domain-specific knowledge, can attain the same or better grades with less study time. Independent of that effect, those who study alone in a quiet environment may study more effectively and, therefore, may attain a comparable performance with less overall study time than those who study in a more disruptive environment. This finding is consistent with previous studies of deliberate practice, where many activities within a domain, such as playing games of golf and playing music with friends are far less effective in improving performance than solitary deliberate practice (Ericsson, 1996; Ericsson & Lehmann, 1996). In fact, mere experience in a domain, such as playing chess games, does not reliably improve chess performance once the effects of solitary practice are accounted for (Charness et al., 1996).

The literature on deliberate practice and self-regulated learning by skilled and expert performers shows that engagement in deliberate practice and study is typically carefully scheduled (Ericsson, 1996, 2002; Zimmerman, 1998, 2002). Consistent with these findings our study found that the degree to which students used long-term planning was related to their cumulative GPA. In addition, this was the case even when high-school GPA and SAT scores were included in the analyses (also see Britton & Tesser, 1991). The evidence suggests that careful organization and goal setting created a focused approach to studying and effective monitoring of goal accomplishment, supporting deliberate-practice principles.

Our analysis also replicated the influence of other factors previously documented to influence GPA. For example, the percentage of classes attended was correlated with participants' current and cumulative GPA. That is, students who attended a higher percentage of their classes tended to achieve higher GPAs, which is consistent with the findings of Schuman et al. (1985). These findings are also consistent with the model of deliberate practice. Attending classes would be important for engagement in deliberate practice, since it is in the classroom where students receive instruction regarding what information and skills need to be studied and practiced for high levels of performance. In addition, many instructors design their tests based on the material presented during lectures. However, in the regression analyses, attendance was only a reliable predictor of GPA prior to the entry of other factors in the regression models. The inverse relationship between attendance and hours partying may

have accounted for the reduced independent influence of attendance on GPA. Because students who spent more time partying were less likely to attend their classes, these two variables may have been tapping into the same variance in performance and, thus, when both were included in the regressions predicting cumulative and fall semester GPA, their independent influence was reduced. A recent study manipulated attendance experimentally in a course and found suggestive improvements in grades and mastery of the material, even material not covered in the lectures (Shimoff & Catania, 2001). The number of hours students worked per week for pay was also related to their cumulative and current semester GPAs. That is, students who worked more hours per week had lower GPAs.

In sum, our study identified several characteristics of students' behavior in college that were correlated with their cumulative GPA and fall-semester GPA, even when the past performance (high-school GPA) and level of scholastic achievement (SAT) at their entry to the college were statistically controlled. Only one of these variables, namely study environment, had a direct relationship with the fall-semester GPA that was not explained by the accumulated GPA in college. Our interpretation of this pattern of results is that college students have established habits for studying in college, perhaps established in part in high school, that influence their tendency to attend classes, their tendency to use long-term planning techniques, the amount of time they spend partying, and their involvement in part-time work. These habits will influence past grades and the cumulative GPA will provide an aggregate reflection of these influences in a stable manner. If there were changes in these habits during the fall semester, the associated changes were most likely too small to allow our study to detect them.

Our current findings are also highly consistent with self-regulated learning approaches to academic performance (Pintrich, 2000; Puustininen & Pulkkinen, 2001; Schunk & Zimmerman, 1994; Zimmerman, 1998, 2000, 2002). However, these approaches tend to focus primarily on the motivational and cognitive factors that increase the likelihood of active and effective learning as opposed to identifying the characteristics of study and learning activities where increased duration of engagement leads to improved performance. Our focus on deliberate practice led us to describe many different factors related to academic performance (GPA) and to identify relations between characteristics and durations of study activities and performance. By focusing on observed engagement in these study activities, we can avoid the issues of the motivational and habitual factors that lead students to engage in them. However, a full understanding of academic achievement will likely require careful consideration of both the activities that increase the productivity and efficacy of study time (i.e., deliberate practice) as well as the social, cognitive, and motivational factors that lead certain students to engage in these effective study activities. By combining the deliberate-practice framework and the theoretical approaches of self-regulated learning, future work may gain deeper insight into these issues.

4.1. Limitations and future directions

Our estimated relationship between study time and GPA measures most likely reflects a lower bound and would increase with better estimates for study time. Our

measure of study behavior using daily diaries showed that for the sub-group reporting that the diary week was normal and representative, there was a high relationship ($r = .75$) between questionnaire reports of study and the hours of study reflected in the diaries. For this group we found reliable correlations between diary-reported study and fall-semester GPA. These findings suggest that the relationship between study and grades, especially in the associated semester, might be stronger when students keep diary reports of their actual study time for the whole semester rather than estimate the average study time for a questionnaire. Michaels and Miethe (1989) found the relationship between estimated study time and GPA to be much lower for students who primarily cram for exams ($r = .10$, $p > .05$) compared to students who have a sustained weekly study schedule ($r = .23$, $p < .01$).

More generally, we would expect that the relationship between quality of study time and grades would be much stronger when their relationship was examined for a specific course within a major. Ideally, one should measure prior knowledge and abilities relevant for a specific course at the beginning of classes and then use parallel tests to measure improvements during the course. Within the context of a particular course it would also be easier to assess the specific type of studying and practice that would be the most appropriate for improving specific skills and expanding and refining the desired knowledge. Research on self-regulated learning and deliberate practice would be even easier to conduct on specific learning goals within the context of a specific lecture topic or homework assignment. Consistent with these ideas, many of the recent studies of self-regulated learning in college students have focused on shorter-term activities with particular learning tasks that can be monitored under controlled conditions (Peverly, Brobst, Graham, & Shaw, 2003; Zimmerman & Kitsantas, 2002).

In addition, it is important to note that GPA is only one potential measure of academic performance in college. Further, as an outcome measure, GPA has clear limitations regarding what it can tell us about the academic experience, and it likely misses many important aspects of the educational process (e.g., mastery, interest). However, GPA is an easily quantifiable and domain-general measure that captures many general mechanisms and factors involved in learning. From a practical point of view, GPA is one of the few accepted measures of performance in college that is used for applications to graduate school and for job applications. As a result, GPA in a given semester and cumulatively have meaningful real-life implications for students' experiences and life outcomes. However, it is important for examinations of learning to explore a range of outcome measures assessing different aspects of learning. In future work it will be important to explore the current framework for some of these other assessments.

In conclusion, we believe that our review of the large body of research on the relationship between the study behavior in college and cumulative GPA, in light of characteristics of deliberate practice, reveals important similarities as well as differences. Even closer parallels are likely to emerge when we examine more specific learning activities in college, where students' performance is virtually continuously evaluated with informative personalized feedback and where detailed characteristics of the learning activity can be described. For these learning activities, the insights regarding the effectiveness of deliberate practice for expert performers should be transferable to

colleges and graduate schools, and they should offer a rich and convenient opportunity to test and discover new knowledge about more effective means to improve the trained performance. This work will also help students and teachers understand the pre-requisite need for extensive practice, even for the most "talented," to master new aspects of complex skills, and acquire extensive new knowledge.

References

Allen, G. J., Lerner, W. M., & Hinrichsen, J. J. (1972). Study behaviors and their relationships to test anxiety and academic performance. *Psychological Reports, 30*, 407–410.

Beer, J., & Beer, J. (1992). Classroom and home study times and grades while at college using a single-subject design. *Psychological Reports, 71*, 233–234.

Britton, B. K., & Tesser, A. (1991). Effects of time-management practices on college grades. *Journal of Educational Psychology, 83*, 405–410.

Charness, N., Krampe, R. Th., & Mayr, U. (1996). The role of practice and coaching in entrepreneurial skill domains: An international comparison of life-span chess skill acquisition. In K. A. Ericsson (Ed.), *The road to excellence: The acquisition of expert performance in the arts and sciences, sports, and games* (pp. 51–80). Mahwah, NJ: Erlbaum.

Côté, J., Ericsson, K. A., & Beamer, M. (2004). Tracing the development of athletes using retrospective interview methods: A proposed interview and validation procedure for reported information. *Journal of Applied Sport Psychology, 16*(4).

Craik, F. I., & Tulving, E. (1975). Depth of processing and the retention of words in episodic memory. *Journal of Experimental Psychology: General, 104*, 268–294.

Elliot, A. J., McGregor, H. A., & Gable, S. (1999). Achievement goals, study strategies, and exam performance: A mediational analysis. *Journal of Educational Psychology, 91*, 549–563.

Ericsson, K. A. (1996). The acquisition of expert performance: An introduction to some of the issues. In K. A. Ericsson (Ed.), *The road to excellence: The acquisition of expert performance in the arts and sciences, sports, and games* (pp. 1–50). Mahwah, NJ: Erlbaum.

Ericsson, K. A. (2001). The path to expert golf performance: Insights from the masters on how to improve performance by deliberate practice. In P. R. Thomas (Ed.), *Optimising performance in golf* (pp. 1–57). Brisbane, Australia: Australian Academic Press.

Ericsson, K. A. (2002). Attaining excellence through deliberate practice: Insights from the study of expert performance. In M. Ferrari (Ed.), *The pursuit of excellence in education* (pp. 21–55). Hillsdale, NJ: Erlbaum.

Ericsson, K. A. (2003a). The development of elite performance and deliberate practice: An update from the perspective of the expert-performance approach. In J. Starkes & K. A. Ericsson (Eds.), *Expert performance in sport: Recent advances in research on sport expertise* (pp. 49–81). Champaign, IL: Human Kinetics.

Ericsson, K. A. (2003b). How the expert-performance approach differs from traditional approaches to expertise in sports: In search of a shared theoretical framework for studying expert performance. In J. Starkes & K. A. Ericsson (Eds.), *Expert performance in sport: Recent advances in research on sport expertise* (pp. 371–401). Champaign, IL: Human Kinetics.

Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100*, 363–406.

Ericsson, K. A., & Lehmann, A. C. (1996). Expert and exceptional performance: Evidence on maximal adaptations on task constraints. *Annual Review of Psychology, 47*, 273–305.

Gortner Lahmers, A., & Zulauf, C. R. (2000). Factors associated with academic time use and academic performance of college students: A recursive approach. *Journal of College Student Development, 41*, 544–556.

Helsen, W. F., Starkes, J. L., & Hodges, N. J. (1998). Team sports and the theory of deliberate practice. *Journal of Sport and Exercise Psychology, 20*, 12–34.

Hinrichsen, J. J. (1972). Prediction of grade point average from estimated study behaviors. *Psychological Reports, 31*, 974.

Krampe, R. Th., & Ericsson, K. A. (1996). Maintaining excellence: Deliberate practice and elite performance in young and older pianists. *Journal of Experimental Psychology: General, 125*, 331–359.

Lehmann, A. C., & Ericsson, K. A. (1996). Music performance without preparation: Structure and acquisition of expert sight-reading. *Psychomusicology, 15*, 1–29.

Michaels, J. W., & Miethe, T. D. (1989). Academic effort and college grades. *Social Forces, 68*, 309–319.

Peverly, S. T., Brobst, K. F., Graham, M., & Shaw, R. (2003). College adults are not good at self-regulation: A study on the relationship of self-regulation, note taking, and test taking. *Journal of Educational Psychology, 95*, 335–346.

Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 451–502). San Diego, CA: Academic Press.

Puustininen, M., & Pulkkinen, L. (2001). Models of self-regulated learning; A review. *Scandinavian Journal of Educational Research, 45*, 269–286.

Rau, W., & Durand, A. (2000). The academic ethic and college grades: Does hard work help students to "make the grade?". *Sociology of Education, 73*, 19–38.

Schmeck, R. R., & Grove, E. (1979). Academic achievement and individual differences in learning processes. *Applied Psychological Measurement, 3*, 43–49.

Schuman, H. (2001). Students' effort and reward in college settings. *Sociology of Education, 74*, 73–74.

Schuman, H., Walsh, E., Olson, C., & Etheridge, B. (1985). Effort and reward: The assumption that college grades are affected by quantity of study. *Social Forces, 63*, 945–966.

Schunk, D. H., & Zimmerman, B. J. (1994). *Self-regulation of learning and performance: Issues and educational applications*. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Shimoff, E., & Catania, A. C. (2001). Effects of recording attendance on grades in introductory psychology. *Teaching Psychology, 28*(3), 192–195.

Simon, H. A., & Chase, W. G. (1973). Skill in chess. *American Scientist, 61*, 394–403.

Sloboda, J. A. (1996). The acquisition of musical performance expertise: Deconstructing the "talent" account of individual differences in musical expressivity. In K. A. Ericsson (Ed.), *The road to excellence: The acquisition of expert performance in the arts and sciences, sports, and games* (pp. 107–126). Mahwah, NJ: Erlbaum.

Starkes, J. L., Deakin, J., Allard, F., Hodges, N. J., & Hayes, A. (1996). Deliberate practice in sports: What is it anyway?. In K. A. Ericsson (Ed.), *The road to excellence: The acquisition of expert performance in the arts and sciences, sports, and games* (pp. 81–106). Mahwah, NJ: Erlbaum.

VanderStoep, S. W., Pintrich, P. R., & Fagerlin, A. (1996). Disciplinary differences in self-regulated learning in college students. *Contemporary Educational Psychology, 21*, 345–362.

Wagstaff, R., & Mahmoudi, H. (1976). Relation of study behaviors and employment to academic performance. *Psychological Reports, 38*, 380–382.

Zimmerman, B. J. (1998). Academic studying and the development of personal skill: A self-regulatory perspective. *Educational Psychologist, 33*, 73–86.

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 1–39). San Diego, CA: Academic Press.

Zimmerman, B. J. (2002). Achieving academic excellence: A self-regulatory perspective. In M. Ferrari (Ed.), *The pursuit of excellence in education* (pp. 85–110). Hillsdale, NJ: Erlbaum.

Zimmerman, B. J., & Bandura, A. (1994). Impact of self-regulatory influences on writing course attainment. *American Educational Research Journal, 31*, 845–862.

Zimmerman, B. J., & Kitsantas, A. (2002). Acquiring writing revision and self-regulatory skill through observation and emulation. *Journal of Educational Psychology, 94*, 660–668.