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**Investigating Students' Learning Strategies: Usage, Motives, and
Perceptions of Effectiveness**

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Abstract

Investigating Students' Learning Strategies: Usage, Motives, and Perceptions of Effectiveness

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For many students, the first year of college presents a series of challenges because there is a gap between their high school experiences and college expectations. Students' first college exam often serves as a critical turning point in their education: they realize that they must improve the way they study in order to meet the demands of college learning. Thus, the objectives of the present research were to understand how students learn outside the classroom, the reasoning driving their decision to use specific learning strategies, and the source of their preferred strategies. I conducted a large-scale survey that was administered to 5,810 students from 99 high schools in Texas. In an open-ended question, students selected a former class they had taken and described the way they studied and prepared for that class. Students' strategy use was analyzed overall and also as a function of their demographic profile, parental education, and reasoning. Results from this survey suggest that students generally adopt similar strategies, regardless of

their diverse backgrounds and parents' level of education. The most commonly used strategies were rereading, help-seeking, and retrieval practice, whereas spacing, outlining, and summarizing were the least reported learning strategies. This research suggests that most students do not understand the conditions for learning that improve long-term retention of knowledge. Therefore, instructors should focus on promoting the use of effective learning techniques among all students.

Table of Contents

List of Tables	ix
Introduction.....	1
Students' Study Behaviors	3
Teachers' Knowledge of Effective Strategies.....	5
Effective Learning Strategies.....	6
Present Study	8
Method	10
Participants.....	10
MATERIALS Student's Nomination and Self-Description	10
Procedures.....	13
Results.....	14
Strategy-Use as a Function of Demographics.....	14
Overall Strategy Use and Strategies as a Function of Subject.....	15
Students' Estimate of Percent of Material They Will Learn on Their Own in College	17
Discussion	21
Practical Recommendations.....	27
Tables	28
Appendix A.....	39
References.....	44

List of Tables

Table 1. School District by Type	28
Table 2. Parent with Highest Level of Education	29
Table 3. Strategy Use as a Function of Gender and Race.....	30
Table 4. Strategy Use as a Function of Parents's Level of Education	31
Table 5. Overall Strategy Use and Strategy as a Function of Subject and Class Rigor	32
Table 6. Students' Estimate of Percent of Material That Will Be Covered in College	33
Table 7. Strategy Use as a Function of Perceived Effectiveness and Ease.....	34
Table 8. Source of Learning Strategies Dscribed in Response to Open-Ended Question	35
Table 9. Reasons for Using Learning Strategies Described in Response to Open- Ended Question	36
Table 10. Perceived Effectiveness of Learning Strategies.....	37
Table 11. Frequency of Strategy Use.....	38

Introduction

After completing twelve years of school, one would expect college freshmen to be expert learners—however, that is rarely the case. Students seldom receive explicit instruction about how to become efficient and independent learners (Durkin, 1979; Kistner et al., 2010), which often leads them to adopt ineffective learning strategies. Thus, students’ transition from high school to college becomes especially difficult because many students must “learn how to learn” in order to overcome the rigor of college coursework. Prior research, however, has shown that college students do not always select effective self-regulated study strategies indicating that they do not have a strong understanding of the practices that promote learning. Although previous studies provide extensive information about strategy choice among college students, less is known about the factors underlying students’ preferred learning strategies.

The vast majority of studies in the literature on learning techniques have investigated strategy use via in-class surveys consisting of Likert scale items to measure how frequently specific techniques are used. Although this approach to examining how students learn has contributed to the literature by offering a better understanding of the behaviors students engage in and their beliefs about learning, there are some limitations to consider. One critical drawback concerns the interplay between how general strategy use is measured and the context in which learning strategies surveys are administered. The majority of learning strategies surveys include decontextualized questions in efforts to measure how often students generally

use specific strategies. For example, surveys will include items such as “How often do you read your notes?” rather than “How often do you read your math notes?”. Considering that the majority of surveys have been administered in psychology courses, it is possible that students only reported the strategies they implement while studying for that particular class. Another notable limitation of prior studies is the absence of open-ended questions to capture a wider range of learning techniques described by students. Although Likert type-scale items enable researchers to easily compare strategy-use across different learners, this type of measurement is normally limited to a small number of strategies and misinterpretation of a question may go unnoticed.

Broadly, the purpose of the present study was to investigate the strategies that students implement in their learning outside of the classroom. Specifically, this research aimed to extend previous studies by examining the contextual factors (e.g., type of class, subject, class rigor) and student characteristics such as gender, race, and parental education level that might contribute to a student’s choice of learning techniques. I surveyed thousands of high school students from diverse cultural and socioeconomic backgrounds about their domain-specific learning strategies, reasons for strategy choice, source of strategies, general strategy use, and perceived effectiveness of nine strategies. To explore further students’ self-regulated learning, my survey was designed to encourage students to use their own language to explain how they study for a specific class with the goal of broadening our view of learning techniques, a component generally absent from past research.

STUDENTS' STUDY BEHAVIORS

Converging evidence from the literature of students' study behaviors indicates that strategies frequently used by students are ineffective; namely, they do not meet the conditions for long-term retention and transfer of knowledge. Common learning strategies among students include highlighting and rereading chapters (Bjork & Kornell, 2013; Chi, Bassok, Lewis, Reimann, & Glaser, 1989; Hartlep & Forsyth, 2000). Similarly, Gurung (2005) surveyed introductory psychology students on their use of eleven learning strategies and correlated each strategy to exam performance. The three most common strategies, namely reading the text, reading notes, and using mnemonics, were not the strongest predictors of exam performance. More challenging strategies, such as self-testing and connecting the information to their existing knowledge, were among the least used. Passive strategies like rereading often improve fluency because the material becomes familiar, resulting in the counterproductive illusion of competence (Koriat & Bjork, 2005). The ease and perceived effectiveness of these study techniques may explain their popularity among students.

Although individuals who are active participants in their own learning tend to have better educational outcomes than those who are not (Zimmerman & Martinez-Pons, 1990), there is evidence showing that not all learners who engage in self-regulated learning do so in ways that are optimal for learning (Winne, 1997). For instance, students who rely heavily on copying the steps from worked examples during studying without self-testing have committed two mistakes. The first mistake is their use of an ineffective strategy because they are simply copying steps from

worked problems without attempting to solve the problems themselves.

Consequently, their learning strategy prevents them from adequately monitoring their progress, or lack of.

A sizable literature suggests that students generally lack the metacognitive skills to monitor and assess their learning (Karpicke, Butler, & Roediger, 2009; McCabe, 2011). Learners tend to associate the ease of recall during initial learning with their ability to retrieve information successfully in the future. Slow and effortful learning is mistakenly associated with poor future performance whereas rapid gains in learning are considered indicators of knowledge acquisition. In reality, engaging in difficult tasks during learning can enhance long-term retention and understanding—a concept known as *desirable difficulties* (Bjork, 1994). For example, Kornell and Bjork (2008) instructed participants to learn the styles of different artists by either presenting participants with six paintings by each artist at the same time (blocked) or presenting paintings by various artists at once (interleaved). Despite the counterintuitive approach of mixing distinct material during study, results from a subsequent test revealed that participants were better at identifying the artist of each painting when learning was interleaved instead of blocked. Nevertheless, participants' natural approach of learning a single topic at a time led them to rate their learning as higher when the presentation of paintings was blocked rather than interleaved. The outcomes from the Kornell and Bjork experiment might mirror students' real-world learning experiences and the reasoning driving their choice of

strategies: study techniques that make learning conditions challenging are perceived to be ineffective, discouraging students from using those strategies in the future.

Similarly, several studies have shown that easy learning conditions produce higher judgments of learning relative to difficult learning conditions (Kornell & Bjork, 2008). In one study (Karpicke & Blunt, 2011), participants read science texts and then created concept maps or practiced retrieving information from the texts. After the learning phase, participants reported that concept mapping would produce better learning than retrieval practice. Yet, results from an assessment one week later revealed the opposite—retrieval practice produced better retention than concept mapping.

TEACHERS' KNOWLEDGE OF EFFECTIVE STRATEGIES

What accounts for students' use of ineffective study techniques and poor monitoring of their own learning? One explanation lies in the gap between cognitive research and educational practice. A policy report from the National Council on Teacher Quality (Pomerance, Greenberg, & Walsh, 2016) reviewed forty-eight textbooks commonly used in teacher preparation programs and found that none of the books in the sample covered more than two of six empirically supported learning principles. Because textbooks may be the primary source for information regarding learning techniques, these findings indicate the need to infuse evidence-based learning strategies to preservice preparation programs. Perhaps even more concerning than the lack of focus on effective learning strategies in teacher preparation textbooks is the pervasiveness of learning beliefs with little empirical basis, such as learning

styles. According to the notion of learning styles, educators should match their instruction to students' learning styles in order to maximize learning.

Notwithstanding the lack of evidence on this issue (Hattie, 2012; Kirschner & van Merriënboer, 2013), roughly three-quarters of teacher preparation programs endorse matching teaching to students' learning styles to promote superior learning (Greenberg, McKee, & Walsh, 2013).

As a result of insufficient training on empirically-based learning strategies, few instructors teach their students about effective learning strategies and how to employ them in during studying. There is little evidence to indicate that instructors at any level of education provide extensive training for students to build their repertoire of learning techniques. Durkin (1978-1979) observed over 7,000 minutes of reading and social studies instruction in elementary school classrooms and spotted only a few instances in which instructors provided explicit instruction in how to comprehend the content they were covering. Relatedly, an observational study of eleven middle school teachers showed that teachers only discussed learning strategies with their students in 9% of lessons (Hamman, Berthelot, Saia, & Crowley, 2000). With little to no formal training on how to use effective learning strategies, it is unsurprising that the vast majority of college undergraduates report that their instructors do not influence the way in which they study (Kornell & Bjork, 2007).

EFFECTIVE LEARNING STRATEGIES

Throughout the literature, three practices have received continuous empirical support: retrieval practice, spaced practice, and elaboration. Retrieval practice

involves retrieving information from memory through testing. Findings from Roediger and Butler (2011) revealed that retrieval practice improves long-term retention as well as transfer to new contexts. Spaced practice posits that distributing learning across multiple sessions leads to greater long-term retention than cramming (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013). Lastly, elaboration is a generative strategy in which individuals add meaning to the to-be-learned content by connecting it to their existing knowledge. The use of elaborative techniques during learning has been shown to improve the application of learned knowledge to new problems (Mayer, 1980). Regardless of the vast evidence supporting the efficacy of these strategies, many students remain unaware of how to use and apply these strategies in their own learning.

Although students appear to have a strong understanding of the behaviors that promote learning in the classroom, many have incorrect conceptions of how to properly supplement what they learned in class. Perlman, McCann, and Prust (2007) asked 658 undergraduates to rate the extent to which fifty-nine behaviors contributed to their academic performance. The highest ranked behaviors included attending class regularly, paying attention in class, and getting enough sleep. Study techniques such as making flashcards and studying the course information daily received low rankings (forty-seventh and fifty-third). It should be noted that only a few of the behaviors listed in Perlman et al. (2007) pertained to specific learning strategies. Yet, this study provides valuable information about how students relate the role of studying to their academic performance.

Studies examining strategy use among learners have mainly focused on undergraduates, largely excluding high school students. Even though there is no evidence in prior studies to suggest that learning strategies vary between high school students and college freshmen, observing learning strategies at the secondary school level enables researchers to compare strategy use between courses that vary in rigor. For instance, one can examine the similarities and differences between learning strategies used by students in a standard, honors, and advanced placement (AP) biology course.

PRESENT STUDY

The primary goal of this study was to obtain a comprehensive understanding of self-regulated learning by focusing on students' commonly used learning strategies, the variables that might influence their choice of learning strategies, and the motive(s) guiding strategy use. Unlike past research on learning strategies, this study openly asked students about their context-specific learning strategies as well as their overall strategy use. In addition, I wanted to examine whether students' strategy use varied as a function of domain and a variety of individual factors (e.g., gender, race, parent education level). High school students enrolled in a credit-based transition program were asked to rate the effectiveness of nine learning strategies and how often they used each of the nine strategies. Additionally, I asked students to pick a course that is representative of their high school experience and describe how they studied for it. Following their response, students provided information about who

taught them to use the strategies they listed, their reason(s) for choosing those strategies, and perceived effectiveness.

Method

PARTICIPANTS

Participants were 5,810 students (3,248 females, 2,532 males, and 30 other) from 99 high schools across Texas who were involved in a credit-based transition program. They completed the learning strategies survey as part of a required pre-course survey that collects demographic information, students' reasons for enrolling in the program, and their beliefs about learning. The majority of the students were juniors (49%) and seniors (43%), and the remainder of the students were freshmen (2%) and sophomores (6%). School districts were categorized using the descriptions from the Texas Education Agency. Information about the type of school districts in this sample is presented in Table 1. Data on age were not collected but one can conclude that ages ranged from 13 to 18, typical for the students' grade levels. Statistics on racial/ethnic diversity show that the sample was approximately 38% White/non-Hispanic, 36% Hispanic, 8% Black, 7% Asian, 2% American Indian, and 1% Native Hawaiian/Pacific Islander, and 8% identified as multiracial. Additionally, Table 2 presents the highest level of education by one parent.

MATERIALS

Student's Nomination and Self-Description

I created a 35-item survey that assessed a variety of aspects pertaining to students' learning strategies: preferred strategies for a specific class, source of strategies, reasons for strategy choice, and perceived effectiveness and usage of nine

particular learning strategies. Strategy use for a particular class was measured by using the following open-ended question: “Pick a course that is typical of your high school experience. How do you study outside of class? That is, what learning strategies did you use to prepare for class, complete assignments, and take tests? Give the name of the course and then list all the learning strategies that you used.” In addition to providing a broader view of how students study, the open-ended nature of the responses was intended to unveil strategies that have not been measured in other studies.

Coding

A research assistant and I scored the open-ended response using a 5-point rubric. Responses were coded for class, subject, course rigor (e.g., standard course, Honors, Advanced Placement), number of strategies mentioned, and types of strategies used. Overall, strategies reported by students were coded according to nine major categories: retrieval practice, notes, reread, help-seeking, summarize, highlight, spacing, outline, and other. *Retrieval practice* (RP) refers to any task that requires learners to retrieve information from memory, such as taking practice tests, reworking practice problems without looking at notes, and the use of flashcards. *Notes* refer to note-taking either from textbooks, assigned readings, educational videos, and rewriting class notes. Because the open-ended question specifically asked students to describe how they study *outside* of class, in-class note-taking was not considered in this analysis. Strategies such as reading (or rereading) a textbook, student-written notes, past assignments, supplemental materials, and teachers’ notes were all coded as

Reread. *Help-seeking* refers to any instance in which students sought help from a teacher, tutor, peers, or online resource (e.g., Khan Academy videos, educational tutorials on YouTube). Strategies coded as *Summarize* include any instance in which students put information from notes, textbook readings, or educational videos into their own words. *Highlighting* included strategies such as color-coding and underlining were also coded under this category. *Spacing* refers to distributing study over a period of time instead of “cramming.” Strategies coded as *Outline* relate to instances in which learners organize information in order or provide structure for information such as creating a template for an essay or making a timeline. Any strategies that did not fit into those seven categories were coded as *Other*.

Strategy Source(s) and Reasoning

Students then used an 8-item list to check all individuals who had taught them to use the strategies described in the open-ended response (see Appendix A). The list included teachers, parents, friends, siblings, tutors, other family members, nobody, and other. Additionally, students used a 5-item list to mark all of the reasons they chose the specific strategies described in the response to the open-ended question. The five reasons shown on the list were: They are effective; They are easy to use; I am just used to studying that way; I don't know any other strategies; my parents or teachers make me do it that way; Other.

Ratings of Perceived Effectiveness and Frequency of Strategy Use

Students were shown the descriptions of nine learning strategies (retrieval practice, spacing, elaboration, summarization, rereading, highlighting, variability,

note-taking, and outlining) and used a 6-point Likert scale to rate the effectiveness and how often they used each learning technique.

PROCEDURES

The learning strategies questions were included in a self-paced course survey that students completed the before the start of the semester. The survey was administered via computer using Qualtrics, an online survey software tool. Students accessed the survey by following the Qualtrics survey link embedded in a learning management system (Canvas).

Results

STRATEGY-USE AS A FUNCTION OF DEMOGRAPHICS

Table 3 shows the percentage of individuals in each gender and racial/ethnic who provided a description of their learning strategies. For the most part, strategy-choice did not differ as a result of students' gender but there are a few notable differences. Female students reported greater use of retrieval practice (45.4%) than other students, whereas students identifying as "Other" (65.2%) reported helps-seeking more than male (40.6%) and female (46.6%) participants. Additionally, race and ethnicity did not appear to influence the types of strategies students employed although students identifying as Native Hawaiian/Pacific Islander reported using "Other" strategies more than any other group (25%). However, it is important to note that Native Hawaiians/Pacific Islanders made up a small portion of the sample size.

STRATEGY USE AS A FUNCTION OF PARENTAL EDUCATION LEVEL

Next, I used the responses from the open-ended question to compare how the level of education completed by one parent influenced students' strategy use (see Table 4). Unexpectedly, the overall pattern of results showed that strategy use was fairly similar among all students, regardless of parental education level. That is, the learning strategies employed by students whose parents graduated from a 4-year university did not differ from those of students whose parents did not have a college education. In the literature on first-generation college students, a majority of studies provide extensive evidence showing that first-generation students differ from their

non-first-generation counterparts in a number of ways. A significant factor that commonly distinguishes first-generation and non-first-generation students pertains to parental involvement (McCarron & Inkelas, 2006). Namely, parents who did not earn a college degree tend to be less involved in preparing their children for college than parents who attended college. However, findings from the current study suggest that even parents with a college education do not teach their children about effective learning strategies, perhaps because they were never taught themselves about effective strategy when they were in school.

OVERALL STRATEGY USE AND STRATEGIES AS A FUNCTION OF SUBJECT

Of the original sample of 5,810 students, 5,018 completed all parts of the learning survey (open-ended response, source of strategies, reasons for strategy choice, and rating statements). The demographic composition of this sub-sample was similar to that of the overall sample of students. Based on students' self-description of strategy use, the three most commonly used strategies overall were rereading (52.9%), help-seeking (44.2%), and retrieval practice (39.6%). Strategies such as spacing (1.7%), outlining (1.4%), and summarizing (1%) were the least common. These percentages are represented in Table 5.

Strategy use among the 1,530 students who selected a social science class (e.g., world history, United States history, human geography, psychology, etc.) matched the pattern of strategies reported overall: the most commonly used learning strategies were rereading (65.1%), help-seeking (40.1%), and retrieval practice (36.2%). The three least common strategies across all six subjects were spacing,

outlining, and summarizing. For science courses ($n = 1,058$), the most common strategy was help-seeking (52.1%), closely followed by rereading (49.2%) and retrieval practice (42.1%). Similarly, students in math courses ($n = 1,195$) reported using help-seeking (53.6%), rereading (44.1%), and retrieval practice (37.9%) the most. The majority of students who selected English courses ($n = 532$) listed rereading (54.1%) as the most common learning strategy, followed by retrieval practice (41.2%) and help-seeking (33.1%). Interestingly, about 80% students who selected a foreign language course reported using retrieval practice twice as much as students as those who described studying for other subjects. The most reported strategies for “Other” subjects (e.g., engineering, art, technology, vocational) included rereading (48.1%), retrieval practice (35.9%), and help-seeking (34.9%).

These findings suggest that students generally do not tailor their strategy use to the domain area of their classes. Overall, retrieval practice, rereading, and help-seeking were the most commonly reported strategies across all subjects although their frequency of use varied slightly. That is, rereading was the most commonly used strategy used in some subjects whereas help-seeking was more common in others.

STRATEGY USE AS A FUNCTION OF CLASS RIGOR

Because learners might change their study strategies when they encounter more challenging material, students’ self-descriptions were also coded for class rigor. Surprisingly, responses from the open-ended question did not reveal any differences between the strategies used to study for standard and advanced courses (see Table 5). Students who described their learning techniques for standard classes reported

slightly higher rates of retrieval practice than students who selected an advanced course. These findings suggest that students do not feel the need to incorporate more effortful strategies even as learning becomes increasingly difficult.

STUDENTS' ESTIMATE OF PERCENT OF MATERIAL THEY WILL LEARN ON THEIR OWN IN COLLEGE

In order to establish a general understanding of students' expectations of learning in college, they were asked to estimate the percent of material they expected to be covered by their instructors and the percent of material they would be responsible for learning on their own. The percentages displayed in Table 6 reveal that 21.5% of students believed that coverage of course material would be equally distributed by teachers and themselves. Approximately half of the students in the sample expected the percentage of learning in the classroom to be fairly equivalent to the amount of learning taking place outside the classroom. Additionally, closely a third of students estimated that they would only be responsible for covering at most 30% of the class material whereas their teachers would cover the remainder. Moreover, the expectation that students would be responsible for learning at least 70% of the material on their own was supported by 18.7% of students. Although a relatively large portion of students underestimated the amount of individual learning that is required to succeed in college courses, these findings suggest that overall students expect to take responsibility for learning material on their own. An analysis of strategy use as a function of these expectations was also conducted but did not yield significant differences. In other words, students who expected their teachers to cover the majority of the material in class did not differ in their strategy use from those who believed that they will be primarily responsible for covering learning content.

STRATEGY USE AS A FUNCTION OF PERCEIVED EASE AND FREQUENCY

Students were given a list of reasons for choosing the strategies described in their response to the open-ended question and check all the reasons that applied.

Those responses were used to compare strategy use among students. Overall, students who chose learning strategies based on effectiveness did not differ in their strategy use from those who chose strategies due to their ease of use (see Table 7).

SOURCE OF STRATEGIES

Table 8 presents the count and percentage of people who taught students to use the learning strategies described in the responses to the open-ended question. Data on source of strategies were collected using a “check all that apply” question. Approximately 75% of students reported having learned their strategies from teachers. A small number of students reported learning their strategies from other family members (6.4%) and tutors (3.2%). These results further support the findings reported in Table 4 showing that parental education level has no influence on students’ learning strategies—teachers, not parents, were reported as the main source from which students learn about learning techniques.

REASONS FOR STRATEGY CHOICE

Table 9 displays the number and percentage of students’ reasons for choosing the learning strategies described in the open-response question. These data were collected using a “check all that apply” question. Effectiveness was the primary reason motivating students’ particular choice of strategies (83.8%), followed by ease of use (53.7%), and being accustomed to their use (47.1%). Roughly 11% of students

indicated that they did not know any other strategies aside from the ones described in their response to the open-ended question. A small portion reported that their learning of strategies had been determined by either their parents or teachers (8.1%).

PERCEIVED EFFECTIVENESS

Table 10 shows students' ratings of perceived effectiveness for nine learning strategies listed in the survey. In general, almost all students in the sample reported some knowledge of the nine strategies that were presented to them. Variability (40.3%), note-taking (40%), and summarization (32.2%) were believed to be extremely effective whereas rereading (10.6%), retrieval practice (9.5%), and highlighting (8.8%) were not perceived to be effective at all. Combined percentages of "very effective" and "extremely effective" ratings reveal that every strategy except for retrieval practice was endorsed by at least 50% of students as being effective. Only 37.1% of students rated retrieval practice as either being "very effective" or extremely effective. This outcome is especially interesting considering that retrieval practice was overall one of the most commonly reported strategies in students' descriptions of their learning. Furthermore, perceived effectiveness ratings for note-taking largely consisted of students who believed that taking notes is either moderately effective (36.6%) or extremely effective (40%).

FREQUENCY OF USE

The frequency of strategy use is presented in Table 11. Note-taking was the most common strategy used daily by students (62%), followed by summarization (36.6%), and elaboration (30.3%). The most common strategies used two to three

times a week were variable practice (36.3%) and spacing (34.3%). Approximately 30% of students reported engaging in retrieval practice two to three times a week whereas 28.3% of students incorporated retrieval practice in their learning once a week. The same pattern was observed in the use of other strategies, where nearly half of strategies were used either once a week or two to three times a week.

Discussion

SUMMARY

Past studies have mainly taken a broad approach to understanding strategy use by providing students with a list of strategies and asking them to select which ones they generally use, irrespective of learning domain. The purpose of the current study was to gain a better understanding of the strategies that students employ and the factors that influence their choice of learning techniques.

The current research had four primary research objectives. One objective was to investigate context-specific learning strategies among students. Next, this study sought to examine the individual factors of gender, race, and parental level of education that might influence the types of learning strategies chosen by students. A third goal for this research was to investigate the source and reasoning driving students' selection of learning strategies. Lastly, this study sought to understand students' perceived effectiveness of other strategies in addition to how frequently they use those strategies (general use).

With regard to the first objective, findings revealed that learning strategy use did not differ as a function of subject or class rigor. Namely, students reported using the same strategies when preparing for a standard math exam as they did when studying for test in their advanced placement science class. Overall, results were consistent with previous findings demonstrating that students commonly employ learning strategies that are not conducive to long-term retention, such as rereading

(Chi, Bassok, Lewis, Reimann, & Glaser, 1989; Gurung, 2005). This was supported by students' responses to the open-ended question about how they study for a particular class (context-specific) and their ratings of how frequently they use the nine strategies presented to them (general). Another commonly used strategy reported by students is help-seeking behavior. Although seeking help is normally viewed as an option available to learners when individual learning is not successful, it is evident that help-seeking plays a significant role in students' learning processes. Contrary to past research conducted by Hartlep and Forsyth (2000), only a small portion of the sample reported highlighting notes or text as a learning strategy when asked to describe their learning process for a specific class.

Additionally, responses to the open-ended question suggest that students engage commonly incorporate retrieval practice into their learning. Nearly 40% of students who answered the open-ended question described using some form or retrieval practice when they study, although no one used the term "retrieval practice" in their responses. For instance, some students mentioned that they take practice tests in preparation for an upcoming exam, others said that they have a friend quiz them, and many stated that they study using flashcards. Yet, one cannot assume that every student who reported taking a practice test is doing so without referring to their notes. Nonetheless, these findings present an optimistic view of individual learning by suggesting that some students understand that effortful tasks, such as retrieval practice, enhance learning.

One notable difference was the increased use of retrieval practice among students studying for a foreign language course relative to those preparing for other classes. It is possible that students have a “doer” versus “thinker” approach to learning, which might explain the discrepancy between the use of retrieval practice in foreign language learning and other subjects. For instance, individuals learning to play an instrument, throw a curveball, or speak another language understand that continuous practice is key to mastering a new skill. However, one can argue that some students do not have the same approach to learning new concepts, improving their writing, or knowing what formula to use in a math problem. These findings have implications for educators interested in helping students rethink their conceptions of classroom learning. Emphasizing how various strategies generalize across various contexts is a simple, yet powerful technique to make the underlying processes of learning salient to students.

Investigating the second research objective, strategy use was not influenced by individual differences such as students’ gender, race/ethnicity, or parental education level. Although unexpected, the lack of differences in strategies as a function of level of parental education is reasonable considering that three-quarters of students in the sample reported having learned their strategies from teachers. These results indicate that students are more similar than they are different in their approach to individual learning and that no single group of students is more susceptible to using ineffective learning strategies.

Contrary to findings in previous research (Kornell & Bjork, 2007) showing that only 20% of college students' study techniques were influenced by teachers, results from the current study are reversed: 75% of students indicated that they had learned their strategies from teachers. These findings, however, are consistent with research by Wissman, Rawson, and Pyc (2012) who surveyed college students about their use of flashcards. Of students, 75% reported having been taught how to study but only a small portion of teachers purportedly advocated the use of retrieval practice. What might account for these incongruous findings in the literature? One possible explanation might involve students' self-monitoring behavior. Like college students, students in high school are primarily responsible for their own learning and academic success. However, it is common for high school students to rely not only on themselves, but also their teachers and parents to monitor their academic performance. College students, by contrast, are often the sole monitors of their own learning because instructors at the college level rarely confront students to discuss their performance in class and parents do not have access to their children's grades. Thus, it is possible that high school teachers intervene at the sign of academic setback and provide suggestions to students to improve their learning.

Results indicated that effectiveness and ease of use were the two leading reasons that influenced students' strategy choices. Further analysis did not reveal a difference between students who chose strategies based on effectiveness relative to those who selected learning strategies due to their ease of use. These findings suggest that students might associate a strategy's effectiveness with its ease of use. This

association can be problematic because many effective learning strategies challenge learners, which can lead to inaccurate judgments of learning (Karpicke & Blunt, 2011).

Finally, students rated a list of nine learning strategies on effectiveness and how frequently they used each strategy. Overall, students' ratings of the effectiveness of these strategies were inconsistent with the strategies they reported in their open-ended responses. For example, summarization was rated as being "very effective" and "extremely effective" by over 60% of students; yet, responses from the open-ended question show that only 1% of students used summarization in their learning. Nevertheless, there is one key factor to take into consideration before drawing conclusions from these seemingly disparate findings: the measures were not equal. Students rated the effectiveness of nine strategies that were presented to them whereas their strategy use was measured using responses from an open-ended question. Strategies described in open-ended responses were subject to my interpretation (which may not coincide with that of students'), whereas the ratings included descriptors of each strategy. Consequently, these differences in language and measures can create ambiguity in the interpretation of these results.

Furthermore, relative to the 13% of students who endorsed note-taking in preparation for class, note-taking was rated as the most commonly used strategy from the list. An important distinction is that the open-ended question explicitly instructed students to describe the strategies they used outside of class whereas the rating

exercise was a general measure of strategy use. Despite the popularity of note-taking, students have mixed feelings about its effectiveness.

Students take notes daily irrespective of class or subject, but effective note-taking is typically not taught in school. The notes that students take in class often serve as the basis for the learning outside of class. For this reason, it is critical that students take the time to create meaning for their notes instead of feverishly copying down the information shown on the board in class. It can be challenging to convince students to adopt new learning strategies, especially when they require more effort. Accordingly, educators should focus on improving what students already do. Considering that a large number of students in this study rated summarization as a highly effective strategy, educators can introduce students to the Cornell note-taking method.

LIMITATIONS AND FUTURE DIRECTIONS

Although this research contributes to our understanding of students' learning strategies, this study has some limitations. First, due to an oversight on my part, students were only shown the descriptions of the nine strategies at the end of the survey. Therefore, it is likely that some ratings may not be accurate as a result of omitting the name of each strategy. Second, because students were not explicitly asked if they used the strategies described in their responses in all of their classes, I cannot conclude that learning strategies do not differ as a function of subject for each individual student. However, these limitations present a number of avenues for future research.

Future research on learning strategy use among students can incorporate more open-ended questions to obtain a deeper understanding of how students operationalize and apply various learning strategies to their learning. Seeing as the majority of students in this study reported engaging in help-seeking behavior, an additional suggestion for future research is to ask students about their role when they attend tutoring sessions or study groups. In other words, do they wait for others to give them the answer or do they actively construct knowledge with their peers?

PRACTICAL RECOMMENDATIONS

The results of the present research have implications for pedagogical practice for instructors at all levels of education, particularly in the context of teacher training programs. A large majority of students report having learned about study strategies, but research indicates that teachers receive insufficient training on effective learning techniques. If teachers are not taught about empirically-based learning principles, then what strategies do they promote in the classrooms and recommend for students' personal use? Although the delivery of content is important, instructors are also responsible for helping their students develop the skills to become lifelong learners, a concept that should be emphasized during their preservice training. Similarly, findings from the present study have critical implications for educational practice. All learners, regardless of their cultural background and parent' education level, can benefit from receiving explicit instruction in how study effectively. Educators need to focus on all students equally when it comes to expanding their repertoire of effective learning strategies instead of attempting to identify potentially "at-risk" students.

Tables

Table 1

School District by Type

District Type	<i>n</i>	%
Major Urban	1,191	20.5
Major Suburban	2,562	44.1
Other Central City	318	5.5
Other Central City Suburban	1,370	23.6
Independent Town	153	2.6
Non-Metropolitan: Stable	216	3.7

Table 2

Parent with Highest Level of Education

Education	<i>n</i>	%
No schooling	94	1.9%
High school diploma or less	1290	25.7%
Some college/some vocational training	787	15.7%
Post-graduate degree	1059	21.1%
Graduated from 2-year college	384	7.7%

Table 3

Strategy Use as a Function of Gender and Race

Variable	RP	Notes	Reread	Help-Seek	Summarize	Highlight	Spacing	Outline	Other
Gender (<i>n</i>)									
Females									
(2,959)	45.4% (1342)	14.9% (440)	52.8% (1562)	46.6% (1379)	1.1% (32)	7.1% (210)	1.7%(49)	1.6% (47)	13.2% (391)
Males									
(2,036)	31.4% (639)	10.1% (205)	52.9% (1077)	40.6% (826)	.9% (18)	2.2% (44)	1.9%(38)	1% (21)	1.1% (222)
Other									
(23)	26.1% (6)	21.7% (5)	52.2% (12)	65.2% (15)	0	0	0	0	17.4% (4)
Race/Ethnicity (<i>n</i>)									
White (1,908)	42.2% (806)	12.8% (244)	54.1%(1032)	43.7% (833)	.5% (10)	4.6% (88)	2.6% (50)	1.5% (29)	14.2% (270)
Hispanic									
(1,776)	35.6% (633)	13.2% (235)	53.8% (956)	45.3% (804)	4.1% (33)	5.7% (101)	.9% (16)	1.1% (19)	10% (178)
Black (373)	36.5% (136)	11.5% (43)	47.4% (177)	42.9% (160)	.3% (1)	4% (15)	1.1% (4)	.8% (3)	11.5% (43)
Asian (299)	42.1% (126)	12.7% (38)	53.1% (159)	47.1% (141)	0	3.3% (10)	4% (12)	2% (6)	13.7% (41)
American									
Indian (227)	43.6% (99)	16.7% (38)	45.8% (104)	38.8% (88)	2.6% (6)	6.6% (15)	1% (3)	1% (3)	8.8% (20)
Native									
Hawaiian/Pacific Islander (52)	38.5% (20)	1.9% (1)	48.1% (25)	46.2% (24)	0	5.8% (3)	1.9 (1)	0	25% (13)
Other (383)	43.6% (167)	13.3% (51)	51.7% (198)	44.4% (170)	0	5.7% (22)	.3% (1)	2.1% (8)	13.6% (52)

Table 4.

Strategy Use as a Function of Parent's Level of Education

Education (<i>n</i>)	RP	Notes	Reread	Help-Seek	Summarize	Highlight	Spacing	Outline	Other
No schooling (94)	33% (31)	12.8% (12)	46.8% (44)	41.5% (39)	2.1% (2)	5.3% (5)	2.1% (2)	1.1% (1)	9.6% (9)
High school diploma or less (1,290)	37.2% (480)	13.6% (175)	53.9% (695)	42.8% (552)	1.7% (22)	5.6% (72)	.9% (11)	1.5% (19)	9% (116)
Some college/vocational training (787)	40.5% (319)	13.1% (103)	49.9% (393)	42.2% (332)	1.4% (11)	5% (39)	1.9% (15)	1.1% (9)	13.6% (107)
Graduated from 2-year college (384)	35.1% (135)	13.8% (53)	49.7% (191)	48.2% (185)	0	6.5% (25)	2%% (8)	1.6% (6)	13% (50)
Graduated from 4-year college (1,404)	41% (576)	12.7% (179)	54.6% (766)	44.2% (621)	.5% (7)	5.3% (74)	2.3% (32)	1.4% (19)	13.9% (195)
Post-graduate degree (1,059)	42.1% (446)	12.1% (128)	53.1% (562)	46.4% (491)	.8% (8)	3.7% (39)	1.8% (19)	1.3% (14)	13.2% (140)

Table 5. Overall Strategy Use and Strategy as a Function of Subject and Class Rigor

Variable (n)	RP	Notes	Reread	Help-Seek	Summarize	Highlight	Spacing	Outline	Other
Overall (5,018)	39.6% (1987)	13.0% (650)	52.9%(2651)	44.2% (2220)	1.0% (50)	5.1% (254)	1.7% (87)	1.4% (68)	12.3% (617)
Subject									
Social Science (1,530)	36.2% (554)	21.9% (335)	65.1% (996)	40.1% (613)	1.6% (25)	6.9% (106)	2.7% (42)	1.7% (26)	13.7% (209)
Science (1,058)	42.1% (445)	11.2% (119)	49.2% (521)	52.1% (551)	.9% (9)	5.8% (61)	1.9% (20)	2.5% (26)	15.1% (149)
Math (1,195)	37.9% (453)	4.1% (49)	44.1% (527)	53.6% (640)	.1% (2)	1.8% (21)	.5% (6)	.3% (3)	13.3% (159)
English (532)	41.2% (219)	15.1% (75)	54.1% (288)	33.1% (176)	2.1% (11)	7.1% (38)	1.5% (8)	2.1% (11)	6% (32)
Foreign Language (147)	79.6% (117)	4.1% (6)	34.7% (51)	30.6% (45)	0	2% (3)	3.4% (5)	0	6.8% (10)
Other (555)	35.9% (199)	11.9% (66)	48.1% (267)	34.9% (194)	.5% (3)	4.3% (24)	1.1% (6)	.4% (2)	10.5% (58)
Rigor									
Standard (3,304)	40.3% (1333)	10.6% (351)	50.2% (1659)	41.5% (1370)	.96% (32)	4.7% (156)	1.1 (36)	1.2% (41)	11.5% (381)
Advanced (1,714)	38.1% (654)	17.4% (299)	57.9% (992)	49.6% (850)	1.1% (18)	5.7% (98)	3% (51)	1.6% (27)	14.8% (236)

Note. Percentages reflect the number of students within each subject who reported using each strategy.

Table 6.

Students' Estimate of Percent of Material That Will Be Covered in College

<i>% Covered by Teacher</i>	<i>n</i>
Less than 30%	1,086
Between 40-60%	3,012
More than 70%	1,712

Table 7.

Strategy Use as a Function of Perceived Effectiveness and Ease

Reason (<i>n</i>)	RP	Notes	Reread	Help-Seek	Summarize	Highlight	Spacing	Outline	Other
They are effective. (4,258)	24.4% (1041)	6.8% (291)	29.9% (1275)	26% (1108)	.5% (20)	3.1% (134)	1% (44)	.8% (35)	7.3% (310)
They are easy to use. (476)	22.3% (106)	7.8% (37)	31.1% (148)	26.1% (124)	.2% (1)	2.5% (12)	1.1% (5)	.8% (4)	8.2% (39)

Table 8.

Source of Learning Strategies Described in Response to Open-Ended Question

Source	<i>n</i>	%
Teachers	4368	74.8%
Friends	2290	39.2%
Parents	2253	38.6%
Nobody	1971	33.8%
Siblings	896	15.4%
Other	734	12.6%
Other family members	373	6.4%
Tutors	186	3.2%

Table 9.

Reasons for Using Learning Strategies Described in Response to Open-Ended Question

Reason	<i>n</i>	%
They are effective.	4869	83.8%
They are easy to use.	3120	53.7%
I am just used to studying that way.	2736	47.1%
I don't know any other strategies.	633	10.9%
My parents or teachers make me do it that way.	468	8.1%
Other.	114	2.0%

Table 10.

Perceived Effectiveness of Learning Strategies

Effectiveness	RP	Spacing	Elaboration	Summarize	Reread	Highlight	Variability	Notes	Outline
I don't know									
what it means	0.8% (47)	1.4% (80)	0.9% (50)	0.2% (14)	0.2% (13)	0.4% (21)	0.5% (29)	0.2% (9)	1.3% (77)
Not effective									
at all	9.5% (553)	3.7% (214)	1.7% (100)	2.5% (148)	10.6% (614)	8.8% (513)	1.3% (77)	0.8% (46)	3.2% (186)
Slightly									
effective	21.9% (1274)	13.5% (782)	8.4% (488)	9.9% (573)	27.9% (1622)	20.7% (1200)	7.8% (455)	4.6% (270)	11.2% (651)
Moderately									
effective	30.7% (1782)	30.1% (1747)	24.2% (1407)	22.4% (1303)	8.8% (509)	13.5% (782)	23.0% (1334)	36.6% (2129)	26.5% (1540)
Very effective	23.9% (1388)	33.9% (1969)	38.8% (2252)	32.7% (1909)	33.1% (1925)	29.8% (1734)	27.1% (1575)	17.7% (1031)	25.7% (1493)
Extremely									
effective	13.2% (766)	17.5% (1018)	26.0% (1513)	32.2% (1870)	19.4% (1127)	26.9% (1560)	40.3% (2340)	40.0% (2325)	32.1% (1863)

Table 11.

Frequency of Strategy Use

Frequency	RP	Spacing	Elaboration	Summarize	Reread	Highlight	Variability	Notes	Outline
I don't know									
what it means	0.9% (52)	1.3% (73)	0.8% (44)	0.3% (17)	0.3% (17)	0.3% (18)	0.6% (36)	0.2% (12)	1.2% (72)
Never	9.3% (542)	8.3% (481)	5.1% (299)	4.3% (247)	10.7% (620)	15.4% (892)	4.0% (232)	0.8% (49)	9.1% (526)
Once a month	16.7% (971)	13.9% (809)	10.8% (629)	9.0% (520)	18.5% (1073)	14.6% (847)	10.7% (620)	2.7% (159)	11.2% (652)
Once a week	28.3% (1642)	24.4% (1420)	24.2% (1406)	21.3% (1239)	27.2% (1580)	21.9% (1274)	25.0% (1455)	9.6% (559)	22.8% (1323)
2-3 times a									
week	29.6% (1719)	34.3% (1990)	28.5% (1655)	28.3% (1644)	28.1% (1632)	24.3% (1412)	36.3% (2109)	24.3% (1413)	28.1% (1633)
Daily	15.0% (869)	17.6% (1022)	30.3% (1762)	36.6% (2128)	15.0% (873)	23.3% (1352)	23.1% (1343)	62.0% (3603)	27.3% (1589)

Appendix A

Q16 In a college class how much of the material do you think will be covered by the teacher? And how much will you need to learn on your own? Use the boxes below to write two percentages that total to 100.

_____ Amount of the material that will be covered by the teacher

_____ Amount of the material that you need to learn on your own

Q29 Pick a course that is typical of your high school experience. How do you study outside of class? That is, what learning strategies did you use to prepare for class, complete assignments, and take tests? Give the name of the course and then list all the learning strategies that you used.

[open-ended]

Q30 Who taught you to use these learning strategies? Check all that apply.

- Teachers
- Parents
- Friends
- Siblings
- Tutors
- Other family members
- Nobody, I just figured it out
- Other, please explain: _____

Q31 Why did you use these learning strategies? Check all that apply.

- They are effective
- They are easy to use
- I am just used to studying that way
- I don't know any other strategies
- My parents or teachers make me do it that way
- Other, please explain: _____

Q32 Please rate the effectiveness of each of the following learning strategies:

	I don't know what it means (1)	Not effective at all (2)	Slightly effective (3)	Moderately effective (4)	Very effective (5)	Extremely effective (6)
Practicing retrieving information from memory without looking at notes or other materials (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Distributing study over time rather than doing it all at once (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Connecting new material to existing knowledge or experience (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Explaining the material in your own words (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q33 Please rate the effectiveness of each of the following learning strategies:

	I don't know what this means (1)	Not effective at all (2)	Slightly effective (3)	Moderately effective (4)	Very effective (5)	Extremely effective (6)
Reading a textbook or other materials over again (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Highlighting a textbook or other materials to identify important information (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Studying or practicing with different examples (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Writing down important information (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Writing out the order and organization of important information (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q34 How much do you use each of these strategies in your own learning?

	I don't know what this means (1)	Never (2)	Once a month (3)	Once a week (4)	2-3 times a week (5)	Daily (6)
Practicing retrieving information from memory without looking at notes or other materials (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Distributing study over time rather than doing it all at once (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Connecting new material to existing knowledge or experience (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Explaining the material in your own words (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q35 How much do you use each of these strategies in your own learning?

	I don't know what this means (1)	Never (2)	Once a month (3)	Once a week (4)	2-3 times a week (5)	Daily (30)
Reading a textbook or other materials over again (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Highlighting a textbook or other materials to identify important information (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Studying or practicing with different examples (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Writing down important information (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Writing out the order and organization of important information (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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