In Their Own Words

What Scholars and Teachers Want You to Know About Why and How to Apply the Science of Learning in Your Academic Setting

Editors
Catherine E. Overson
Christopher M. Hakala
Lauren L. Kordonowy
Victor A. Benassi

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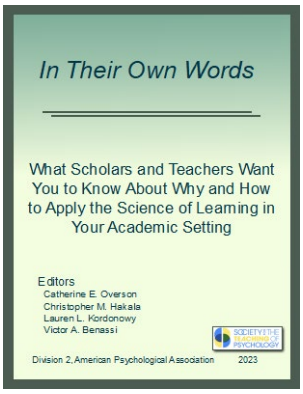

Are Study Strategies Universal? A Call for More Research With Diverse Non-WEIRD Students

Roberta Ekuni
Universidade Estadual do Norte do Paraná

Sabine Pompeia
Universidade Federal de São Paulo

Pooja K. Agarwal
Berklee College of Music

Findings from a growing body of research on students' preferred study strategies are clear: students overwhelmingly report rereading textbooks, notes, and course materials as their primary approach to studying (Dunlosky et al., 2013; Ekuni et al., 2020; Miyatsu et al., 2018). What remains unclear, however, is whether these study strategy preferences are universal. Research on students' study strategy preferences is largely limited to WEIRD student populations (Western, Educated, Industrialized, Rich, and Democratic; e.g., Agarwal et al., 2014, Hartwig & Dunlosky, 2012; Karpicke et al., 2009; Kornell & Bjork, 2007), which represent only a small portion of humanity (Henrich et al., 2010). If we are to inform students and teachers about effective strategies to improve learning, it is critical to take diversity into account and determine whether students' selection and implementation of study strategies is culturally, economically, and/or demographically dependent.

First, we present an overview of what is known about students' preferred study strategies, based on research conducted with WEIRD student populations. Second, we discuss students' perceptions about the effectiveness of their preferred strategies compared to demonstrated benefits of less popular strategies. Third, we review findings from the limited research currently available with non-WEIRD student populations. Finally, we offer future directions and recommendations for conducting inclusive research with diverse populations to better understand students' study strategy preferences and implementation.

Study Strategy Preferences in WEIRD Student Samples

In order to achieve good grades, students must make several decisions about which study strategies to use (e.g., rereading textbook chapters or their own notes, highlighting parts of the material that they think are important, testing themselves, rewatching video lectures, etc.), when they will implement them (e.g., a little every day, the night before a test, etc.), and for how long (e.g., 30 minutes per study session; Gettinger & Seibert, 2002). How and when students study have large effects on what information they retain (Anthenien et al., 2018; Geller et al., 2017; Gurung, 2005).

In addition, how students study encompasses many factors, such as self-regulation of learning, motivation to learn, and attitudes towards learning, all of which are associated with academic success (Credé & Kuncel, 2008). Therefore, we will focus here on learning strategies discussed in the seminal study by Dunlosky et al. (2013), which describes ten strategies (henceforth referred to as study strategies) because they are clearly defined and their individual effectiveness has been established. Additionally, these strategies can be easily taught and have minimal costs, so they can be implemented widely to improve academic outcomes.

Study strategy preferences have been mostly investigated among students from the United States of America (USA) using a variety of techniques: rank ordering a list of study strategies (Karpicke et al., 2009), selecting strategies from a list that they use *regularly* (Hartwig & Dunlosky, 2012), and reporting all study strategies that they use regularly without providing a list to choose from (Morehead et al., 2015). As an added complication, "study strategies" are often ill-defined in survey research, which could involve a wide variety of conditions, such as when, where, and with whom studying occurs, as well as how long students study (Dunlosky et al., 2013). Although researchers have used a wide variety of techniques to inquire about study strategy use among USA populations, rereading and highlighting tend to be the most popular study strategies (Karpicke et al., 2009).

In one survey of WEIRD undergraduates from the USA (Karpicke et al., 2009), students ranked 11 study strategies in order of preference, resulting in the following order: 1. rereading notes or textbook; 2. doing practice problems; 3. using flashcards; 4. rewriting notes; 5. studying in groups; 6. memorizing; 7. using mnemonics; 8. making outlines; 9. self-testing; 10. highlighting; and 11. thinking of real-life examples. Using the same list of study strategies and a few others, Persky & Hudson (2016) similarly found that students preferred studying by rereading, rewatching lecture videos, and completing practice problems. Additional studies carried out in the USA show that students report using self-testing strategies, followed by rereading, flashcard use, making outlines, and highlighting (Hartwig & Dunlosky, 2012; Morehead et al., 2015; Miyatsu et al., 2018). Recopying notes, asking questions or verbally participating during class, and making diagrams, charts or pictures were reported as being used least often (Morehead et al., 2015). Strategies of repeated exposure to content, such as rereading, were also found to be the primary way of studying among Canadian high school and University students (Wood et al., 1998).

An overview about study strategies conducted by Blasiman et al. (2017) included 13 studies (and one meta-analysis), all of which involved students from the USA, with the exception of one study from Canada. They found that most studies assessed, cross-sectionally, which strategies are used (±50% of study strategies; discussed above), when (±30%; most students study just before exams), or for how long (±40%; most students study less than they believe is necessary). These authors then conducted a longitudinal analysis on USA undergraduates and found that students who were finishing a course studied less often than expected with 10 techniques (mostly the same ones cited above) than they had initially reported they intended to use. Students also studied for less time than intended, except for just before exams (Blasiman et al., 2017).

The only study to assess ways of studying in a WEIRD population, but outside the USA and Canada, was conducted in Italy (Poscia et al., 2015) and inquired about different aspects of ways of studying. The researchers found, for instance, that students reported higher rates of studying in groups compared to studying alone, and they preferred using books/papers to study compared to the internet (Poscia et al., 2015).

Reasons for Use of Effective and Ineffective Study Strategies in WEIRD Student Samples

Although rereading notes or texts is mostly the first or second most preferred study strategy among the majority of students drawn from WEIRD USA samples, Dunlosky et al. (2013) rated it as a low utility strategy. In other words, rereading was found to be less effective than other strategies that promote long-term learning, such as retrieval practice (Dunlosky et al., 2013). Retrieval practice is one of the most effective strategies to increase students' long-term memory of academic material (Agarwal & Bain, 2019; Agarwal, et al., 2013, Yang et al., this volume). Students can use retrieval practice by studying with flashcards, answering quizzes, testing themselves, explaining what they learned to other parties, or in

other similar ways (Agarwal et al., 2021). There is a consistent body of evidence that retrieval practice promotes: 1) transfer (Pan & Rickard, 2018), that is, the capacity to apply knowledge in contexts that differ from the one in which information was learned, and 2) long-term retention (for a recent review, see Agarwal et al., 2021; McDermott, 2021), through various processes such as strengthening of semantic memory representations and inhibiting irrelevant associations (van den Broek et al., 2016). Furthermore, academic advantages are observed when retrieval practice is distributed over time, a strategy known as spaced retrieval practice (Kang et al., 2014).

Yet, the majority of students in the USA claim to learn better when they use ineffective strategies such as rereading (Kornell & Son, 2009; Son, 2004). For example, students predict that they would perform better on an exam after rereading content than after being tested on the content, that is, after engaging in retrieval practice activities (Agarwal et al., 2008; Blasiman et al., 2017; Karpicke & Roediger, 2008). This finding may occur because the more students reread the material, the more fluent and familiar it seems to them, which elicits a feeling that the content will be easy to retrieve at will. This is known as the illusion of competence (Koriat & Bjork, 2005) because familiarity does not facilitate recall of information. Consequently, students' test performance turns out to be lower than they expect.

Another phenomenon that leads students to use rereading or similar low utility study strategies is the misinterpreted-effort hypothesis (Kirk-Johnson et al., 2019): the false perception that the higher the effort engaged in studying, such as is required for actively trying to recall information (retrieval practice), the lower its effectiveness for learning (see also Blasiman et al., 2017; Palmer et al., 2019). This perception leads students to prefer strategies that involve less effort, such as passively rereading texts or notes or rewatching lectures, even though they generally result in lower levels of long-term retention (Kirk-Johnson et al., 2019). Additionally, students often believe that their peers use ineffective study strategies more often than they actually do, so some researchers suggest that this may influence them to use counterproductive ways of studying (e.g., Anthenien et al., 2018). It seems that, overall, WEIRD students prioritize studying with the least effort to maximize their short-term goals, which include performing well on exams (see Kornell & Bjork, 2007).

Apart from the high effectiveness of retrieval practice, Dunlosky et al. (2013) identified distributing study (spaced learning, rather than cramming; Cepeda et al., 2006; Smolen et al., 2016) as a high utility and effective study strategy for a wide range of student ages. Controlled studies have shown that content learned by cramming or massed studying is forgotten sooner compared to when students space out their study over the course of days or longer even when the total study time is equivalent in both conditions (Hartwig & Dunlosky, 2012; Kornell & Bjork, 2007; Morehead et al., 2015).

Despite such findings, data from USA undergraduates show that about 50% or more of students reported that they prefer cramming instead of spacing their study sessions over time (Kornell et al., 2010; Susser & McCabe, 2013; Persky & Hudson, 2016; Morehead et al., 2015). The same pattern was found in a more diverse sample in the USA (non-students recruited by M-Turk; Yan et al., 2014). However, cramming can lead to good grades when exams take place soon after studying (Cepeda et al., 2006), which might encourage students to persist in this habit, even though people often forget the information over the long term.

When students report using retrieval practice, they do so to check how well they know or have learned pieces of information, not because this strategy promotes long-term learning (Morehead et al., 2015; Kornell & Son, 2009). Thus, most people are not aware of the benefits of spacing study sessions and of using retrieval as a *learning* strategy, but rather use it as a formative assessment strategy to check for understanding. Many teachers suggest students use retrieval practice to assess their learning (Morehead et al., 2015).

How do students form study strategy preferences in the first place? Most students report that their choice of how to study is based on their own experience (Karpicke et al., 2009; Kornell & Bjork, 2007). Studies in the USA find that only a small set of students report being explicitly taught about study strategies (Hartwig & Dunlosky, 2012; Morehead et al., 2015), in contrast to the majority of teachers who profess they provide study tips to their students (Morehead et al., 2015).

Study strategy preferences may also change according to students' academic experience. A longitudinal study across four years with USA undergraduate students (Persky & Hudson, 2016) found that as they advanced in their courses, they tended to use less effective study strategies than first-year students. Although this seems to indicate that they progressively choose the less effective ways of studying, it cannot be excluded that they may have learned to change the *way* they use these strategies, doing so in a more efficient manner (see Dunlosky et al., 2013; Miyatsu et al., 2018). For example, underlining is regarded as a relatively ineffective technique, but more experienced students may learn how to select passages in texts that are more important and underline them, which might be helpful in directing their attention to these passages when they study for exams.

Apart from this, data on WEIRD educators suggest they are not prone to teaching the best study strategies. According to Morehead et al. (2015), when teachers do suggest high utility ways of studying that involve retrieval practice, most do so not because they think students will learn better, but because they think that this will allow students to find gaps in their knowledge that require further attention, mirroring the reason students use this type of strategy, as mentioned above. Instead, the focus of education seems to be on providing academic content and not on preparing students to study in ways that will lead them to retain information for longer periods (Dunlosky, 2013).

Based on research conducted primarily in the USA using a WEIRD sample, students often study by rereading, and many do not use high-utility strategies such as distributed/spaced study and retrieval practice. In addition, students' beliefs about how learning works (e.g., less effort equals more learning) differ from well-established findings that challenging strategies improve learning (e.g., more effort equals more learning; Agarwal & Bain, 2019). However, it is unclear whether students' preferences regarding study strategies, their use of ineffective strategies, and their beliefs about effective strategies are specific to WEIRD samples or whether they are universal phenomena. Next, we review findings from the limited research currently available on study strategy preferences with non-WEIRD student samples.

Study Strategy Preferences in Non-WEIRD Student Samples

Our exploration of the research literature on study strategies use identified only a small number of relevant studies conducted outside the USA, specifically Italy (Poscia et al., 2015), Brazil (Ekuni et al., 2020), India (Chamundeswari et al., 2014; Chand, 2013), and Nigeria (Ebele & Olofu, 2017; Fakeye & Amao, 2013). The single study conducted in Brazil was the only one which investigated the same study strategies inquired about in WEIRD samples reviewed above. The other studies did not investigate study strategies *per se*, having instead described aspects of "study habits" more generally (e.g., study environment, level of concentration).

In research carried out in Brazil, a non-WEIRD developing nation, Ekuni et al. (2020) inquired about the frequency of use among pre-college students of the same study strategies listed by Karpicke et al. (2009). They found that the pattern of the most to least frequently used strategies was similar to that found in the studies conducted in the USA: rereading content came first, closely followed by doing practice exercises, highlighting texts, and summarizing. Next, came thinking about real life examples, self-testing/practicing recall, rewriting content, memorizing, and using mnemonics. Studying in groups came last (Ekuni et al., 2020), which was the only strategy preference that contrasted with results from most USA-based studies (Karpicke et al., 2009; Morehead et al., 2015) and from Italy (Poscia et al.,

2015), which reported higher rates of studying in groups. Brazil ranks very low on collaborative problem solving in the Program for International Student Assessment (PISA), a factor that varies significantly among nations (OECD, 2019), pointing to a possible cultural reason for differences in the use of this particular strategy, which must therefore be explored in contexts other than WEIRD populations.

There are some additional examples of studies in non-WEIRD samples that focused on study habits more generally. Unfortunately, these studies conducted with non-WEIRD student samples did not report results regarding students' preferences for specific study strategies. In two studies from Nigeria (Ebele & Olofu, 2017; Fakeye & Amao, 2013) and two studies from India (Chamundeswari et al., 2014; Chand, 2013), researchers found that some study habits (e.g., higher levels of self-reported engagement or concentration) were positively associated with academic achievement.

Based on this very limited research with student populations outside the USA, it is not possible to draw conclusions about whether study strategy preferences are universal. Studies are needed which include standardized ways of inquiring about study strategies use. Surveys regarding students' and teachers' *beliefs* about study strategies were also lacking in non-WEIRD samples. Likewise, information about factors that might affect preference and use of study strategies (e.g., socioeconomic status, ethnicity, sex, gender, age, grade) were rare or non-existent in both WEIRD and non-WEIRD samples.

Potential Moderator Variables in Study Strategy Preferences

Students' study strategy preferences may differ between WEIRD and non-WEIRD countries due to several factors, such as being from a minority and minoritized group, and/or being from different socioeconomic backgrounds. Ethnicity, culture, and socioeconomic status vary widely around the world, not only between developed and developing nations, but also within nations (for social inequality information in the USA, see Saez & Zucman, 2016; Gibson-Davis & Hill, 2021). Until additional research is conducted in non-WEIRD countries and results from both WEIRD and non-WEIRD student samples are stratified by demographic and cultural factors, we cannot state with certainty that study strategy preferences are universal.

For example, the effects of being from underrepresented or minoritized groups are typically not addressed in studies with WEIRD samples (see Buchanan et al., 2021), even though there are studies that show that some minority students from the USA can have lower academic success compared to their White and Asian peers (Rodriguez et al., 2018). The effects of socioeconomic status are also largely unexplored in WEIRD samples, possibly due to the misconception that high income disparities are present only in developing countries, even though the unequal distribution of wealth in the USA today is extremely high, especially in households with children, which has wide implications, including academic achievement (Gibson-Davis & Hill, 2021).

Critically, minority status and lower socioeconomic status have been linked with lower academic outcomes (Farah, 2017; OECD, 2019; Thompson, 2018; Sirin, 2005), lower executive functioning, and lower working memory capacity (Farah, 2017; Lawson, Hook, & Farah, 2018; Leonard, Mackey, Finn, & Gabrieli, 2015), which may affect–or be affected by–students' study strategy preferences and use. For example, researchers have found that the lower the socioeconomic status, the lower the students' self-perception of how well they did academically (Poscia et al., 2015). At the same time, Brazilian students' study strategy preferences did not differ based on socioeconomic background (Ekuni et al., 2020), whereas Indian students with higher socioeconomic status demonstrated more frequent use of effective study habits (Chamundeswari et al., 2014).

Until additional research on students' study strategy preferences is conducted in non-WEIRD countries and also cross-culturally, this "chicken or the egg" situation will remain problematic. To speculate,

minority status and lower socioeconomic status may result in lack of access to information about effective study strategies, lack of motivation while studying, and differential benefits from study strategies. Alternatively, study strategy preferences of students from marginalized backgrounds may, in turn, lead to lower academic achievement.

Furthermore, it is premature to conclude that study strategy preferences are universal until sex and gender are taken into account (for the difference between sex and gender, see Johnson et al., 2007). Consider that women are known to consistently outperform men academically (O'Dea et al., 2018; OECD, 2019; Voyer & Voyer, 2014), and research suggests that younger girls and boys may study differently (Agarwal et al., 2014), which might be partly explained by the use of different strategies per sex/gender. However, in some studies, the number of men and women in samples is not even quantified (e.g., Karpicke et al., 2009), nor data on other inclusive or diversity-related information (see Buchanan et al., 2021). Other researchers provide data on the number men and women, but do not report results pertaining to each gender/sex (e.g., Anthenien et al., 2018).

Data from one USA study suggest that both middle and high-school girls and boys may indeed study differently. When asked what strategies they use to study outside of class, the most frequent option was reviewing materials (girls - 50%, boys - 39%), followed by repeating facts (girls - 47%, boys - 37%), and being tested by someone else (girls - 39%, boys - 31%) (Agarwal, et al., 2014). However, there was no statistical comparison between answers by gender in this study, nor an analysis determining whether different ways of studying influenced students' grades depending on their gender.

In terms of sex/gender differences in non-WEIRD populations, the study with the Brazilian sample described above found that young women reported higher frequency of use of ineffective strategies (highlighting, summarizing class material, and use of mnemonics) than their male peers, but effect sizes were small (Ekuni et al., 2020). Chamundeswari et al. (2014) found that girls from India reported better study habits than boys. However, no details of the study habits scale were made available for readers. In addition, compared to their male peers, female students from Italy preferred studying alone compared to studying in groups (Poscia et al., 2015), so these results are not very informative with respect to sex differences regarding study strategies.

Future Directions and Recommendations for Inclusive Research

Although some researchers recognize the importance of taking diversity into account, not only among samples but also among researchers, in terms of minority status, socioeconomic status, sex/gender, etc., this is usually considered only within WEIRD countries (Buchanan et al., 2021). Diversity, in terms of representation of different populations and research carried out in non-WEIRD nations, must also be addressed in the literature on student study strategy preferences. Most research on study strategies has been restricted to WEIRD student populations, particularly from the USA. The literature is in need of exploring cross-cultural similarities and differences, replicating studies in different samples (Klein et al., 2018), and determining the factors that may influence study strategy use, such as sex/gender, socioeconomic status, minority and minoritized status, and age.

To this end, some issues must be considered in future research. There are many differences between studies that investigate study strategies, even in WEIRD samples. For instance, researchers have asked students to rank order a list of study strategies (Karpicke et al., 2009), select strategies from a list that they use *regularly* (Hartwig & Dunlosky, 2012), report all study strategies that they use regularly without providing a list from which to choose (Morehead et al., 2015), and indicate the frequency of study strategies they use from a list (Ekuni et al., 2020). Furthermore, study strategies (individually and as a whole) are often ill-defined in the existing studies. They involve techniques, habits, when, where, and with whom to study, study session length, people's attitudes, motivations, and many other factors. For

this field to advance, it is paramount that a framework be proposed as to how these factors are associated with each other and with academic outcomes, with accompanying standardized and validated scales that can be adapted for use in different populations.

Another issue that needs addressing is that the literature has practically ignored *how* students use different types of study strategies. For example, Dunlosky et al. (2013) posited that, although highlighting is not an effective study strategy, it can be highly effective if students are trained to identify the most important aspects of a text (see also Miyatsu et al., 2018). Indeed, probing for more detail about how students study can alter results (Wood et al., 1998), suggesting that framing questions in more specific ways can be advantageous in terms of obtaining more accurate information on how and why people study the way they do. Thus, researchers should investigate not only preferred study strategies, but also inquire in detail about *how* they are used, for how long, if in a spaced manner, etc. It will be important to relate differences in responses to such measures with student academic performance.

In light of the findings discussed here, it is still not possible to determine if study strategies preferences are universal because this has practically only been studied in USA-based samples. Yet, the high prevalence of ineffective strategies (e.g., rereading) in USA samples was also reported in Brazil (Ekuni et al., 2020), so such findings may well be generalizable to other populations. Additional factors that could alter preferences for study strategies, such as minority status, socioeconomic status, and sex/gender, must also be further investigated.

Maximizing the use of evidence-based effective learning strategies, such as retrieval practice and distributed practice (i.e., spacing learning sessions), requires debunking myths and beliefs about learning. Cognitive scientists must investigate this issue in a more detailed and inclusive manner cross-culturally and better communicate their findings, especially to educators (Vaughn & Kornell, 2019; Rowe & Hattie, this volume) regarding how best to study to promote lasting learning. Initiatives like the *Cognition Toolbox* can be helpful in this respect; they not only promote a dialogue between researchers and educators, but they also allow them to work together to develop research in classrooms and to test and analyze their results based on evidence-based interventions to promote lasting learning (Benassi et al., this volume; Benassi et al., 2014). Approaches must also be developed to increase students' willingness to engage in the strategies that required higher effort to study more effectively (see the chapters in Part 4 of this volume).

This is no easy endeavor. Teachers and students may persist in recommending and using relatively ineffective strategies, because it is hard to ascertain that some ways of studying do not work well in each persons' particular experience (Fiorella, 2020). This type of evidence can only be obtained in controlled experiments, including participants who are randomly assigned to different study strategy conditions using the same measure or assessment of learning. Diversifying the characteristics of the students (different cultures, backgrounds, etc.) is also essential to further our understanding about how factors that relate to academic success might also relate to students´ study strategy preferences and implementation.

Notwithstanding the difficulties in reaching these goals, there are some positive examples of interventions in the USA that promote effective study strategies. For instance, students who attend activities (e.g., workshops, meetings with faculty) on how best to study subsequently report less frequent use of rereading compared with students who do not take part in these activities (Persky & Hudson, 2016). In another study, students were provided with a reading assignment about learning strategies (distributed practice, rereading, retrieval practice, or thinking about mental images) to make them aware of their effects, which decreased the use of low-utility strategies compared to peers who did not complete the assignment (Brown-Kramer, 2021; Brown-Kramer, this volume). Therefore, simple,

inexpensive interventions can be developed to help students avoid using low-utility study strategies, and this can and should be implemented in non-WEIRD samples as well to determine if they improve learning. Initiatives, like providing tips for optimizing the use of study strategies, are also important, such as those proposed by Miyatsu et al. (2018). Additionally, these strategies can be easily taught, so they can be implemented widely by a diversity of students to improve academic outcomes.

Take-Home Message

It is unclear if students from WEIRD and non-WEIRD countries choose similar or different study strategies. Several USA-based studies demonstrate that students tend to use ineffective study strategies, and only one similar investigation was conducted in the non-WEIRD country of Brazil (Ekuni et al., 2020). At present, there is no clear definition in the literature on what constitutes study strategies. Also, there is little evidence regarding the role of factors that differ among WEIRD and non-WEIRD students—such as ethnicity, culture, and socioeconomic status—that could influence the way students study and academic consequences. Researchers should standardize the way they inquire about study strategies using a consistent theoretical framework and scales or instruments that are adaptable to many cultures, taking diversity into account. Equipped with more study strategy research that includes diverse non-WEIRD students, researchers can more appropriately develop effective studying interventions and improve academic outcomes worldwide.

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Email of corresponding author: robertaekuni@uenp.edu.br

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