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Faculty and Student Perceptions of Study Strategies in the Biology Department

A thesis submitted in partial satisfaction of the requirements for the degree Master of Science

in

Biology

by

Alexander De La Cruz

Committee in charge:
Professor Lisa McDonnell, Chair
Professor Claire Meaders Professor
Melinda Owens

2021

The thesis of Alexander De La Cruz is approved, and it is acceptable in quality and form for publication on microfilm and electronically.

University of California San Diego
2021

DEDICATION

In recognition of raising me, ingraining my core values, and supporting me on any endeavor in my path I would like to acknowledge my mother and father, Maria Leon and Ramiro De La Cruz. Without their support, I would not have been able to reach my goals and strive for goals that are commonly unimaginable. In recognition of the battles, the arguments, but most importantly, the love and affection that has been given over the course of a lifetime but most importantly during the process of this thesis, I would like to thank my siblings Carol De La Cruz, Samantha De La Cruz, and Jeffrey Gouker. In recognition of pushing me, supporting me, and understanding the time it takes to develop into the student I have become I would like to recognize Angela Monique Ayala. Most importantly, in recognition of the countless hours, meetings, and flexible understanding of my schedule, I would like to recognize Lisa McDonnell, Claire Meaders, and Melinda Owens for helping me navigate this foreign path in this thesis completion.

EPIGRAPH

"Education is the foundation upon which we build our future."

-   Christine Gregoire

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I would like to acknowledge those who have shown support in my past endeavors and hope to continue to make you all proud in my future endeavors.

ABSTRACT OF THE THESIS

Faculty and Student Perceptions of Study Strategies in the Biology Department

by

Alexander De La Cruz

Master of Science in Biology

University of California San Diego, 2021

Professor Lisa McDonnell, Chair

Students' preparation for their courses varies depending on their background. Previous work has found that certain types of study strategies are correlated with success, but it hasn't been done across multiple biology courses, at various levels, nor have the reasons for perceiving strategies as useful been identified or faculty perceptions. The goal of this study was to examine student perspectives of study strategies, which they find effective and ineffective and why. A second goal was to compare student perceptions to those of faculty and learn more about the communication of study strategies from professors to students. Students and faculty

members were asked to rank, in a survey, what they perceived to be the most effective and ineffective study strategies, explain why the strategies are the most and least effective, whether or not faculty encouraged study strategies and if self-testing was among those recommended study strategies. Students and faculty both agreed that cramming, flashcards, quizlet, and recopying your notes are the least effective study strategies. Students appear to be more oriented towards more individual based work and faculty rank peer communication-based strategies higher. This is an indication that the perception of what makes a study strategy effective is somewhat different among students and faculty. Students and faculty both agree that learning and understanding is the biggest reason for the effectiveness of a study strategy. Perception of study strategies should align more between faculty and students which may lead to improved performance in UCSD biology student's coursework.

Introduction

  Students in STEM come from a variety of diverse educational backgrounds. Depending on the student's background, including students racial/ ethnic background, students are more likely to drop out of STEM related tracks (Riegle-Crumb et al., 2019). For example, STEM students who identify as Latin/ Hispanic or are Black have about a 37% and 40% probability of switching majors when compared to their White and Asian/ Asian American student counterparts at 29% (Riegle-Crumb et al., 2019). There is also a higher rate of dropping out of school as a STEM major among Latin/ Black students (20% and 26%) when compared to their white classmates at 13% (Riegle-Crumb et al., 2019). Because underrepresented minority (URM) students are not as likely to finish their initial career goals in the STEM field this has led to fewer underrepresented minority students becoming professionals in the STEM field (Riegle-Crumb et al., 2019). There are multiple approaches to increasing persistence in STEM, and for faculty in particular there are strategies for helping students in the classroom.

  Because students do not all grow up with the same resources and experiences while receiving their education, there could be variation when it comes to what students know when they enter university. Students may have been taught the importance of self-testing and spacing while other students may have been taught that using flashcards and using quizlet were optimal for studying. Generally, if one is underprepared to take on a task, one is less likely to be successful accomplishing that task. Looking into study strategy use and perceptions among students and faculty in the STEM field may provide insights that faculty can use to help all students, and URM students.

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In past research, there have been different approaches to finding what strategies are the most successful and which strategies are most appropriate for given settings. In a study by Jodi Holschuh (2014), there was a focus on separating study strategies into two groups: deep level study strategies and surface level study strategies. Deep level study strategies included strategies like self-testing. A deep level study strategy was defined in this research as more analytical thinking and connection forming when thinking about problems to solve. Surface level study strategies are different because they involve strategies like flashcard utilization. This set of study strategies focuses more on fact and term memorization versus connection based analytical thinking. This set of study strategies will lead to memorization of various terms that can be recognized during exams especially if it is multiple choice. Labeling strategies as deep versus surface was relevant because they were looking at patterns of strategy use and performance between the two categories. An interesting discovery that came with Holschuh's (2014) research was the correlation between study strategies and the recommendation students gave to their peers. Holschuh (2014) found that lower performing students more often choose the wrong study strategy for their course (e.g., surface level strategies), and yet they recommend deep strategies to a peer. If deep level strategies are more likely to lead to success, course faculty may want to consider spending more time promoting those strategies and supporting students, especially those lower performing students, to use them.

Correlations between surface level and deep level study strategies and performance have been studied by others. For example, Hattie et al (1996) conducted a

meta-analysis of 51 different studies with the goal of finding if there are any patterns comparing study strategies and performance across primary through university courses.

They found that when students were using strategies like creating mnemonic devices (classified as a surface level study strategy), the strategies helped improve memorization but not the transfer of knowledge (Hattie et al., 1996). Research conducted by Marissa Hartwig and John Dunlosky 2011 were able to find that students taking an introductory level psychology course at Kent State University using self-testing as a primary form of preparation had higher scores than the control group that did not use this strategy. Generally, students who can connect various concepts and have a deeper understanding of the subject they are studying may be able to have more academic success than their counterparts who are choosing to use study strategies that are not as demanding. This connects back to Holschuh's research finding that deep level study strategies should be preferred when deciding what kind of strategies should be used to prepare for a task in a course.

More recent studies have also looked at student use of strategies and how they impact performance. Study strategies like self-testing have been linked to improved performance and using flashcards has been linked to decreased performance (Williams et al., 2020). Students who choose fewer effective strategies are more impacted if they are women, first generation students, and historically disadvantaged students (Williams et al., 2020). There was a paper that was written by Rodriguez et al in 2018 which looked at how students' study in STEM courses and the relationship between underrepresented minority (URM) status and absence of proper study strategy use. The

goal was to increase awareness of the merits of beneficial study strategies especially for those students who are typically underrepresented in STEM disciplines (Rodriguez et al., 2018). In this study, students in the experimental group were asked to self-test and those in the control group did not self-test. Self-testing is the study strategy that operates by facilitating a simulated exam environment. This includes taking time to work on a set of problems, given a certain amount of time to complete them and observing how much knowledge you are missing when completing these problems. This method allows for the user to identify what areas of learning they need to strengthen and what areas they have a good grasp on. After the intervention, students classified as URM and students who are not were both scored on performance on an exam. The result showed that there was a drop off in performance in both the URM group and the non-URM group when they did not use self-testing. The difference was that the URM group that did not self-test performed significantly worse than those who were non-URM and did not self-test. As faculty can promote study strategies, this might be an easy way for faculty to help all students but URM students in their courses. Self-testing is one of many effective ways to prepare for academic tasks, for example, exams. Increasing student awareness of study strategies when taking these courses at the university level could be an approach that would improve success of students.

Although student perspectives on which strategies are useful have been studied somewhat (Rodriguez et al 2018, Williams et al 2020), a study across multiple biology courses, at various levels, as well as exploring student reasons why they hold these perceptions has not been done. Additionally, if faculty are potential sources for advice on which strategies to use, it is valuable to know which strategies they perceive useful

and if faculty are recommending specific study strategies. To examine student and faculty perspectives in more detail, and communication about study strategies across various biology courses, we designed a study to address the following research questions:

1. What strategies do students and faculty perceive as effective and ineffective at helping one succeed in various biology courses?

2. What are the reasons *why* students and faculty perceive certain strategies as effective and ineffective?

3. Do students recall receiving information to use certain strategies, including self-testing? How often do faculty report encouraging certain strategies, including self-testing?

Having students and faculty perceptions of study strategies align would add more clarity on how students should prepare and may increase overall success for students in the biology department. If there is misalignment, one might wonder if that has an increased chance of students not doing as well as they could, perhaps because they are preparing in the wrong way for the course. Knowing that self-testing can be correlated with improved performance, we hope to see this encouraged often.

Methods

Setting the stage

Data collected for this study was survey responses from students and faculty attending and teaching in biology, respectively, at the University of California, San Diego in the Fall of 2020. Approximately 90% of the students attending UCSD are students who live in California and 25% of the student population are transfer students (Data USA, 2020). In the biology department, there are 52% Asian/ Asian American students, 21% White/ Caucasian students, and 24% Hispanic/ Latino students, 3% Black/African American, less than 1% that identify as American Indian/Alaskan Native, and less than 1% that identify as Native Hawaiian/Pacific Islander (UCSD, 2019).Student survey data was collected from 13 different biology course sections taught by 13 different faculty members, representing nine unique biology courses; seven were upper division courses and six lower division courses. Collecting data from different courses in the department allows the research to capture the perspectives of students at various points of their academic career.

Survey Development

The goal of the survey was to ask students and faculty questions to probe what study strategies they perceived to be most effective or ineffective for success in their courses and why, as well as if recommendations about study strategies were being communicated from faculty to students. Both faculty and students from each course section were surveyed. By surveying both students and faculty we could examine if there were any differences or similarities in their perspectives on study strategies.

Students and faculty were given a pilot survey in summer 2020. In the pilot we collected data from 145 students and 10 faculty in 10 sections from biology courses. The survey was also presented to peers and colleagues in the Bio/Chem education journal club at UCSD to gain additional feedback to improve the clarity of questions. Analysis of the pilot data in combination with feedback from the journal club resulted in revisions to question wording and the types of questions we asked. The final survey included 19 questions, 11 open ended questions and 8 multiple choice style questions. Themes that were addressed were ranking the study strategies listed as effective or not effective, providing reasons why they were effective or not effective, whether study strategies were encouraged in class and if self-testing was one of those study strategies encouraged in these courses. The list of study strategies students ranked came from looking at previous research. A parallel survey was also developed for the faculty addressing the same themes from the perspective of the faculty. Complete surveys can be found in Appendix 1 and 2. Although there are multiple questions on the survey, the following questions are the focus of this thesis:

1. Rank each study strategy 1-5 indicating which study strategy would best aid in high achievement in BILD 3. (5 being the most effective). If you have not used the following strategies, indicate how effective/ ineffective you think the strategy would be.

2. For the strategies you ranked 5 (most effective), choose which one you think would be the most effective strategy and explain why this has or would have helped you succeed in this course.

3. For the strategies you ranked 1 (least effective), choose which one you think would be the least effective strategy and explain why this strategy was or would not be helpful in this course.

4. Did your professor explicitly encourage specific study strategies during the quarter for your course?

5. Was "Self-testing" a specific study strategy that was encouraged by the faculty in this course?

Participants

In the official data collected in the fall of 2020 term, the survey was distributed to students and faculty in 13 course sections during week 10 of the 10-week quarter, and students had approximately one week to complete the survey. Section instructors were allowed to add an incentive (e.g., small amount of extra credit) to increase student participation in the survey. In these instances, students also had the option to complete a short alternative assignment instead of the survey to receive extra credit. The survey and surveying protocols were approved by our institutional research board (IRB approved project #200798XX). Participation ranged from 7-88% across courses, and a complete list of student participation rates are listed in Table 1 below.

Table 1. Student response rate for 13 course sections. Students from six lower and seven upper division courses participated in the survey with an average participation rate of 50%.

Course #	Level	# Registered in the course	# Responded to survey (After deletions)	% Responded (out of total registered)
1	lower	199	40	20%
2	lower	422	165	39%
3	lower	144	47	33%
4	lower	116	84	51%
5	lower	72	31	43%
6	lower	337	123	36%
7	upper	207	88	43%
8	upper	48	42	88%
9	upper	466	364	78%
10	upper	45	39	87%

Table 1. Student response rate for 13 course sections. Students from six lower and seven upper division courses participated in the survey with an average participation rate of 50% (Continued).

Course #	Level	# Registered in the course	# Responded to survey (After deletions)	% Responded (out of total registered)
11	upper	311	21	7%
12	upper	323	224	70%
13	upper	85	51	60%
TOTALS	Upper - 7 Lower - 6	2697	Students - 1319 (1319 viable responses) Faculty - 13	Avg: 50%

Data Analysis

There were two phases of analysis, quantitative analysis and qualitative analysis. An overview of analysis is presented in Table 2. Analysis was done using programs like google sheets, excel, and R. Student responses that were deleted included duplicates, and incomplete survey attempts. If a student began the survey and then completed it later on a second attempt, the original entry was deleted.

Table 2. Questions addressed in this thesis and brief description of analysis methods.

Question	Number of responses and Analysis
Rank each study strategy 1-5 indicating which study strategy would best aid in high achievement in Course 123. (5 being the most effective). If you have not used the following strategies, indicate how effective/ ineffective you think the strategy would be.	1319 from across all courses; frequency of rankings at each level
For the strategies you ranked 5 (most effective), choose which one you think would be the most effective strategy and explain why this has or would have helped you succeed in this course.	Used inductive coding; frequency of codes among responses (see Tables 3 and 4)
For the strategies you ranked 1 (least effective), choose which one you think would be the least effective strategy and explain why this strategy was or would not be helpful in this course.	Use inductive coding; frequency of codes among responses (see Table 3 and 4)

Table 2. Questions addressed in this thesis and brief description of analysis methods (Continued).

Question	Number of responses and Analysis
Did your professor explicitly encourage specific study strategies during the quarter for your course?	Quantitative data, frequency of "yes" and "no" responses
Was "Self-testing" a specific study strategy that was encouraged by the professor in this course?	Quantitative coding; frequency of "yes" and "no" responses

For the free response questions (why students perceived study strategies as effective or ineffective) we used inductive analysis to identify themes in student responses (Braun and Clarke, 2006) which evolved into a detailed codebook (Table 3 and 4). The codebook was developed through taking pilot data (surveying 10 courses in summer session 1 and 2) and observing common answers that were given in order to develop thematic categories. Initially all researchers involved took a subset of responses to identify what themes they saw emerge in the data, with one researcher (A. De La Cruz) developing the first list of themes, and the other researchers helping refine themes based on their own analysis. After a codebook was established, the researcher team independently coded, and discussed all coding to reach 100% consensus. This cycle

was repeated, with slight revisions to the codebook (e.g., collapsing some codes) as more responses were reviewed, always discussing to reach 100% consensus.

Table 3. Effective Code Book. This code book was used to categorize the reasons students gave for the following question: "For the strategies you ranked 5 (most effective), choose which one you think would be the most effective strategy and explain why this has or would have helped you succeed in this course".

Thematic Codes	Definitions	Example of coded answers
Learning and understanding	Comments related to learning, strengthening, deepening, clarifying understanding. This can come in the form of applying knowledge, focusing on concepts (rather than memorizing facts), forming connections between concepts. This can include reinforcing or refining material/understanding.	The most effective strategy is drawing out diagrams and cycles because drawing out these processes enables a better understanding of the cycle itself and how manipulating or changing the reactants or conditions might affect other reactions downstream

Table 3. Effective Code Book. This code book was used to categorize the reasons students gave for the following question: "For the strategies you ranked 5 (most effective), choose which one you think would be the most effective strategy and explain why this has or would have helped you succeed in this course,"(Continued).

Thematic Codes	Definitions	Example of coded answers
Exam prep and/or mirrors exam content/format/circumstance	Strategy aids familiarity with the exam content/question style/exam circumstances	Reviewing the learning objectives/study list was the most effective strategy for me as these were the topics that we knew we would be tested on, so being able to know these concepts and understand them was beneficial.
Retain information	Retaining information (short or long-term) is defined by being able to withhold the material (does not need to explicitly say they will use it later). Synonyms are recall, cement, remember, consolidate my memory.	I think spacing out your studying will help you feel less stressed and retain more information.

Table 3. Effective Code Book. This code book was used to categorize the reasons students gave for the following question: "For the strategies you ranked 5 (most effective), choose which one you think would be the most effective strategy and explain why this has or would have helped you succeed in this course,"(Continued).

Thematic Codes	Definitions	Example of coded answers
Memorization based course	This indicates that there is a favor for memorization for this course, or that a strategy aids in memorization, or that memorization is needed for the course.	Recopy notes: since this class is so memorization heavy, copying the notes really help. Also, because personally, I think there is less understanding and more memorizing necessary
Time and content management	Any description of managing the amount of course material over time or organizing material to make more sense or make it more manageable. Has to focus on managing the amount of time as a factor or amount of content.	spacing studying would have helped me succeed because I had poor time management due to having a part time job

Table 3. Effective Code Book. This code book was used to categorize the reasons students gave for the following question: "For the strategies you ranked 5 (most effective), choose which one you think would be the most effective strategy and explain why this has or would have helped you succeed in this course," continued.

Mental Health	This is a code for various mental health or affective descriptions, such as depression and anxiety, feelings of stress or feeling overwhelmed.	spacing studying because filling out the study guides and re-watching lectures does take up a lot of extra time and allows your brain to understand the material better with less stress
Statement we were unable to code	Something in a student response that might have been too vague for us to feel confident using an existing code, but one we might want to revisit later,	
Delete from analysis	Did not provide a strategy or did not specify which strategy they were talking about	

Table 4. Ineffective Code Book. This code book was used to categorize the reasons students gave for the following question: "For the strategies you ranked 1 (least effective), choose which one you think would be the least effective strategy and explain why this strategy was or would not be helpful in this course

Thematic Codes	Definitions	Example of coded answers
Time and content management	Time/ lecture/course material management, can include statements about the strategy takes too much time, or there is too much information to make this strategy useful	cramming the information, the night before because there's so much course content it is impossible
Memorization not helpful/not a memorization based course	This indicates that this is not a favor for memorization-based tasks. Quizlet and flashcards would not be favored	Quizlet has its strengths for memorization, but I think rote memorization only goes so far and isn't very beneficial

Table 4. Ineffective Code Book. This code book was used to categorize the reasons students gave for the following question: "For the strategies you ranked 1 (least effective), choose which one you think would be the least effective strategy and explain why this strategy was or would not be helpful in this course," continued.

Thematic Codes	Definitions	Example of coded answers
Prone to distractions	Describing that they tend to lose focus because of something related to the strategy or while using said strategy	I don't think asking questions or participating during class is effective. In my opinion, it takes time away from teaching and is really distracting. Sometimes questions aren't relevant to what we are learning.
Lack of understanding concepts or inability to apply knowledge	Failure to help develop a conceptual understanding/focus, not providing a chance to apply knowledge, includes inability to consolidate	cramming right before a test is not effective for this class especially due to the high amount of information presented, it is not possible to fully understand the pathways without constant practice

Table 4. Ineffective Code Book. This code book was used to categorize the reasons students gave for the following question: "For the strategies you ranked 1 (least effective), choose which one you think would be the least effective strategy and explain why this strategy was or would not be helpful in this course," continued.

Thematic Codes	Definitions	Example of coded answers
Lack of retention	Does not promote ability to remember material (and use it later, but using it later was not necessary to be coded as lack of retention)	Cram information the night before the test because you will not retain the knowledge and will be tired.
Passive/mindless activity	Descriptions about how the strategy does not engage them, that they feel it is very passive or mindless	Rewatching podcasts because I am not actively processing the materials, I am just listening passively

Table 4. Ineffective Code Book. This code book was used to categorize the reasons students gave for the following question: "For the strategies you ranked 1 (least effective), choose which one you think would be the least effective strategy and explain why this strategy was or would not be helpful in this course," continued.

Thematic Codes	Definitions	Example of coded answers
Mental health/stress	Comments about how the strategy led to feelings of stress, anxiety, and feeling overwhelmed.	Cramming would not be helpful because studying is already stressful and to have time be added as an extra stressor would not help my nerves

Table 4. Ineffective Code Book. This code book was used to categorize the reasons students gave for the following question: "For the strategies you ranked 1 (least effective), choose which one you think would be the least effective strategy and explain why this strategy was or would not be helpful in this course," continued.

Not helpful for identifying what to focus on	Not helpful to identify what is important (what course/instructor deems important) that they need to learn (if related to distracted/cannot focus on what is needed that is "prone to distraction")	I do not think Recopying notes would be effective for me personally because I would rather focus on learning the information I do not know/have not learned yet to prepare. Also, after I learn information, I would rather do a worksheet to know when and where to apply a concept.
Not helpful to self-diagnose	Cannot figure out where understanding is weak	Office hours for the professor are too large to address misconceptions of the material.
Delete response for analysis	No answer or reason given	

Results

<u>Student and Faculty Rankings</u>

In order to investigate student and faculty perspectives on which study strategies they think are effective and ineffective for helping them learn and succeed, they were asked to rank a variety of strategies for effectiveness on a student and faculty survey. During the survey, students were asked to rank various study strategies on a scale from 1 to 5, with 1 representing least effective and 5 representing most effective. If a student ranked a 3, they indicated that they feel neutral towards the study strategy. Across 13 course sections we received 1319 student responses to the survey. A summary of student rankings is plotted in Figure 1. The top four ranked as effective study strategies were self-testing, spacing, making diagrams, and attending review sessions (Figure 1). The most common highly ranked strategy was self-testing, with 1121 students (85%) ranked it as effective (4 or 5). Roughly 989 students (75%) identified spacing as an effective strategy. Similarly, 963 students (73%) ranked making diagrams as an effective strategy and 910 students (69%) ranked attending review sessions as an effective strategy (Figure 1).

The four study strategies most identified as ineffective (ranking 1 or 2) were: cramming, quizlet, flashcards, and recopying your notes. Over half of the respondents, 752 students (57%), ranked cramming as the least effective strategy. A nearly equal proportion of students labeled quizlet and flashcards as the least effective strategy (44 and 42%, respectively), and recopying notes was ranked as the least effective by 501 students (38%) (Figure 1).

When looking at the most highly ranked effective strategies, students and faculty only had one study strategy in common; like students, faculty ranked self-testing as a very effective strategy; 100% of faculty ranked it at the highest level of effectiveness, 5 (Figure 2). However, in comparison to students, the next most commonly high ranked strategies by faculty were attending office hours and studying with a peer (93%). Faculty ranked office hours (93%) and studying among peers (93%) very highly in contrast to students who ranked office hours and studying among peers much (49% and 44% students ranked as effective, respectively).

Like students, faculty also ranked cramming, quizlet, flashcards, and recopying your notes as the least effective strategies.

The student population is much more diverse in perspectives - where many strategies have 40-60% of the students ranking as effective and 60-40% as ineffective, but faculty, albeit a much smaller population, are much more unified in perspectives (comparing distributions in Figure 1 to those in Figure 2).

Reasons why (effective and ineffective)

To understand the reasons why students and faculty perceive certain strategies as effective and ineffective, both were asked an open-ended question to explain their top-ranked and lowest-ranked strategy choices. The codes used to evaluate responses and their definitions can be in table 3 and 4. In total, 625 student responses and 13 faculty responses were coded. The most frequent reason provided for an effective strategy was that it improved or contributed to learning and understanding (48% of responses, Figure 3). For example, a student response that would fall under the code

Learning and Understanding would include something like,

"Self-testing because it helped to cement my knowledge
and clarify what I know and what I need to focus on." Here this student's
response would be coded under *learning and understanding* to "cement
my knowledge" and would also be coded for *identifying what is important*
for "clarify what I need to focus on."

An example of an ineffective response would be,

"Cramming does not allow you to understand and apply the material."
Under our table 4 codes, this would be coded as *Lack of understanding or inability
to apply knowledge* for, "understand and apply the material."

Retaining information was mentioned by 143 students (22% of responses) and exam
preparation was mentioned by 134 students (21%). Self-diagnosing weaknesses was
mentioned by 130 students (20%). These were the four most common reasons
provided. Mental health reasons, such as reducing anxiety or stress was only
mentioned by 34 students (5%).

In this same question, students mentioned what individual study strategy they
believed to be the most effective along with their reason why. To identify if there were
differences in reasons depending on the strategy, reasons were compared for those
that specifically identified self-testing as the most effective to the reasons provided from
students that identified either flashcards, quizlet, or cramming as the most effective.

Observing figures 4 and 5, trends are shown by looking at what students identify
is the reason behind the effectiveness. When students are ranking *self-testing* as
effective, Students primarily mention *self-diagnosing weaknesses*, *exam preparation*,

and *learning and understanding*. Students who rank surface level strategies as effective rank *memorizing*, *learning and understanding*, and *retaining information* as the reasons for effectiveness. Students identify that surface level strategies are better for memorization and *retaining information* and *self-testing* is ideal for *self-diagnosing weaknesses* and *exam preparation*. Students indicate that both strategies aid in l*earning and understanding*.

The reasons why faculty believe a study strategy is effective align well with the reasons the students gave. Developing *learning and understanding* was also the most common reason why a certain strategy was perceived as useful by faculty (Figure 3). There were 10 of the 13 faculty members that indicated *learning and understanding* as the reason why the strategy was effective. *Time and content management, retaining information*, and *self-diagnosing weaknesses* all were reported once.

Similarly, we coded responses for why certain strategies were perceived as ineffective for learning and success. From the 300 coded student responses, the most frequent reasons provided for why a strategy was ineffective were related to t*ime and content management* (20%, Figure 6), for example

"Rewriting notes because it is time consuming,"

This was coded under time and content management because of the mention of time consumption. Another top reason students listed was having a *lack of understanding* of concepts and application-based thinking 29% (Figure 6). Two interesting codes that came up were being *prone to distractions* and *mental health/ stress* (each 6%).

In this same question, students mentioned what study strategy they believed to be the least effective along with their reason why. From the 300 responses analyzed, 103 students reported that cramming was the least effective study strategy (39%), and

the next most common ineffective strategy listed was quizlet (39 students, 13%). Next, I explored the relationship between the two least effective strategies (cramming and quizlet) and the reasons that students gave for the inefficiency (Figure 6). The most common reasons were *lack of understanding concepts* , *lack of retention* , *time and content management*.

The faculty were also asked to explain why they felt certain strategies were ineffective, and to indicate which strategy they were explaining. Like the rankings, many faculties explained that cramming and quizlet were ineffective. The reasons provided by faculty were like the students (Figure 6); the majority of faculty (8/13) explained that the least effective strategies did not help students develop or improve understanding and ability to apply knowledge during coursework. For example,

"Cram information the night before. There is a lot of material covered in this course, so studying the night before and really understanding concepts is not likely to happen. The exams test understanding of concepts and problem solving, rather than memorization."

Time and content management was mentioned by two faculty members. *Not being able to retain material, passive learnin*g, and *not being a memorization-based course* all received a mention from one faculty member.

Encouraging Study Strategies to Students (Including Self Testing)

A goal with this research is to examine the communication between faculty and students about study strategies. We asked students if they received encouragement to use certain strategies. About 78% of the students in the surveyed upper division courses and 76% of the students in the lower division courses reported that the faculty

did encourage specific study strategies (refer to Figure 7). There was a range across the courses from very large proportions of the surveyed class recalling receiving encouragement, to less than half of the surveyed class recalling encouragement; 90% of students from Course 9 (an upper division course) reported encouragement from the faculty to use certain study strategies, whereas 42% of students in Course 13 (an upper division course) reported receiving encouragement. In general, there was more variability among student recollections in upper division classes compared to lower division classes (Figure 10). Faculty were asked if they encouraged study strategies to the students as well. Twelve out of 13 surveyed faculty answered that they did encourage specific study strategies (Figure 10). The faculty member teaching Course 9 reported that they did encourage study strategies to their students and course 13's faculty member reported that they did not encourage specific study strategies.   Given that self-testing can be a very useful study strategy we also wanted to know if self-testing was specifically encouraged. Students were asked if self-testing specifically a study strategy was recommended by their course instructor and analysis revealed that 63% of the upper division and 61% lower division of students reported that self-testing was a study strategy that was encouraged by the faculty (refer to figure 10). Course 8 (an upper division course) had the highest number of reported students indicating that the faculty member encouraged self-testing (95%). Course 13 had the lowest rate of faculty members encouraging self-testing (18%). Faculty were asked if they encouraged self-testing as a study strategy and the results showed that about 79% (11/14) of the faculty reported that they did encourage self-testing. Students in Course 4 indicated a high amount of self-testing when the professor indicated that they did not encourage self-testing. Students in Course 13 were more consistent with the faculty

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response by indicating that there was no self-testing encouragement (85% of students) in course 13.

Discussion

What strategies do faculty and students rank as the most and least effective?   The top four most highly ranked study strategies were different for the students and the faculty (Figure 1 and 2). The students ranked the most effective strategies as self-testing, spacing, making diagrams, and attending review sessions. In Rodriguez et al. 2018, the study observed spacing, self-testing, and rereading chapters as the study strategies that were most frequently used by the students. Rodriguez et al. research results could be due to the types of courses surveyed. If there were more courses that focus on application-based problem solving, students may not use strategies like using flashcards to aid base memorization. Students are aware of the value of deeper learning strategies (Holschuh 2014) and other research shows a relationship between some of these strategies and success (Rodriguez et al., 2018). Although students could be aware of the proper or most effective study strategies that should be used in their courses, ultimately it is still up to the student to use the proper study strategy, which has been shown to be an issue in the past (Holschuh 2014).

There were several strategies that were ranked effective by nearly half of the students and ineffective by the other half of the students. This suggests that the students have varying perceptions of these strategies listed. For example, figure 1 indicated that 38% of students find that the strategy recopy your notes is ineffective while 39% of the students find it effective. This could be a function of students still

exploring what strategies work for them. This may also be due to having a variation of courses with different demands. Different courses require different study strategies, so it is possible that students are listing the proper effectiveness level for their course.

The faculty ranked asking questions, self-testing, attending office hours, and studying among peers as the most effective study strategies. Among the top 4 effective strategies, only self-testing was the common ground that students and faculty could agree on as the most effective study strategy that would aid in high achievement for a course. Faculty are ranking peer-oriented study strategies as extremely effective while a smaller proportion of the student population ranked these strategies as effective (asking questions 52%, attending office hours 49% and studying among peers 44%). Students and faculty holding different perceptions regarding which study strategies they should be using in their course could lead to students' mis-using strategies, or it could also lead to faculty not promoting strategies that students are likely to use, and that would be beneficial. This could lead to improper preparation when it comes to coursework and tasks like examinations. The faculty may have a different expectation of how the student is preparing for their course because they feel like the students should be working among each other and formulating questions to identify any issues they have in the content they are studying but students have low uptake of these strategies. This difference in perspectives could also be related to the fact that many students may be still working out which strategies work best for them while faculty already have the experience to know which strategies would work best for their course. The conditions for learning during fall 2020 were also not typical. Students in the fall of 2020 were doing emergency remote learning. This could possibly explain why faculty value peer work highly and students did not. Students did not necessarily have easy access to that peer

experience at the university level therefore were not able to meet new peers in person. Students may have not understood the value of peer communication since they were working from home in the fall 2020 quarter. However, Rodriguez et al. (2018) and Williams et al. (2020) also found that "studying with friends" was typically not reported as a used strategy by many students, so peer-oriented studying may not be something students typically see as useful regardless of mode of learning.

Students and faculty also ranked the most ineffective strategies. Students and faculty aligned very well because both the students and the faculty ranked cramming, quizlet, flashcards, and recopying notes as the least effective study strategies to use (Table 5). The strategies that were commonly negatively ranked were strategies that aid with memorization and fact recall. These strategies were also reported to not be used often by students in other studies (Rodriguez et al., 2018; Williams et al., 2020). However, just because the students report certain strategies are not effective does not mean they do not use these strategies. Research by Holschuh (2014) showed that students who used surface level strategies were at a disadvantage in terms of preparation. Our results may indicate that students and faculty both agree that these biology courses may demand more analytical and critical problem solving therefore memorization-focused strategies are not enough to ensure success in these courses.

<u>What reasons do students and faculty have for perceiving strategies as effective and ineffective?</u>

The most common reason for ranking a particular strategy as effective was because students and faculty perceived the strategy as useful for developing or improving *learning and understanding*. This may indicate that the student's approach to

learning is more application based. Applying knowledge and connecting concepts is important for developing a deeper understanding of the material that is needed for success. Students and faculty differed when it came to the second most common reason for a strategy being perceived as effective. A little over 20% of students indicated *retaining information* as a reason why a study strategy was effective, but only one faculty member provided this same reason. It appears that the students are focusing more on the need for retaining information for coursework and exams while the faculty may be less in tune with the students' need or desire to retain information. It was surprising that more students did not indicate *time and content management* as a reason for a strategy being effective (a little over 10% of responses). This could indicate that they are not often using strategies that aid in efficiency, such as spacing. This could be because students are not incentivized to be efficient, or do not always know how to be efficient. Students are rewarded for the result (the grade) and not the path it takes to get there. Students who do not have other responsibilities to juggle along with schoolwork may not be as careful about time and content management since they have so much more time available. This ties back into the work by Rodriguez et al. (2020); their research found that spacing was correlated with improved performance. Spacing, in combination with retrieval practice (like self-testing) has also been correlated with improved performance in psychology studies (example, Soderstrum et al., 2016). So, both an improvement in efficiency and outcomes could be an indicator that spacing, and self-testing, should be a study strategy that is promoted more.

Students and faculty agreed that ineffective strategies do not provide the same opportunity to learn and develop understanding (the lack of being able to learn and understand was the top reason for why a study strategy was ineffective). This gives rise

to the same trend that was observed earlier showing that student and faculty perception of study strategies are more closely aligned when it comes to identifying ineffective study strategies. Students agree with faculty on what study strategies they should not be using, and improvements can be made in the agreement between students and faculty for which study strategies should be used to lead to success in their courses. After observing the reasons why students and faculty identify a study strategy as effective or ineffective we looked at reasons provided when students ranked strategies previously correlated with improved performance and ranked highly by the majority of students and faculty (self-testing) versus what are perceived to be surface learning strategies (Holschuh 2014) and were largely ranked as ineffective by students and faculty (quizlet, flashcards, cramming), although in this case were indicated as the "most effective" s Self testing for example could be perceived as more useful than memorizing because self-testing provides opportunities to realize weaknesses, and if remedied can result in deepening understanding of material, which could lead to higher performance (Rodriguez et al 2018). Students reported that the active strategy self-testing and the surface strategies were both useful because they improved learning and understanding. However, students who ranked self-testing as effective often cited the ability to *selfdiagnose weaknesses* and prepare *for exams* as reasons why this was a useful strategy, and in comparison, students reported that surface learning strategies were effective because they *facilitate memorization*. This is an indicator that students may have varied perceptions of what learning and understanding means. For some students it means applying knowledge to solve problems, form connections, understand concepts, for others it may mean understanding some ideas/information well enough to

identify correct answers on a multiple-choice test, or reporting back information but not needing to apply it to novel problems.

Do students recall receiving encouragement from the course faculty to use certain study strategies, including self-testing? How often do faculty report encouraging certain strategies, including self-testing?

In previous studies, there has not been much done to understand the communication about study strategies between students and faculty, aside from when an intervention to promote certain strategies is tested (Rodriguez et al. 2018, Williams et al 2020). To understand the basics of communication we wanted to know how often students recalled receiving advice about study strategies in their courses. Students were asked if faculty were encouraging study strategies during the duration of their course. In most courses surveyed, most students reported that study strategies were encouraged, however in any given course there was always a fraction of students (550%) that did not recall receiving a recommendation from the faculty. This was observed more in upper division courses versus the lower division courses. Course 13, which was a single upper division course, had a low response rate for those reporting "yes" to receiving encouragement. While Course 9, another single upper division course, had a high response rate for those reporting "yes" to receiving encouragement. This indicates that the faculty of Course 9 successfully relayed information about study strategies to students in a way they were able to recognize. In contrast, the lower student recollection of receiving encouragement about study strategies in Course 13 does not necessarily mean that the faculty ignored encouraging study strategies but may indicate that the communication was not clear or frequent enough.

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All the course faculty for the lower division courses reported they did encourage study

strategies, but on average 25% of students reported "no" to receiving encouragement;

so, we need to look more closely at how this communication happened to understand

why it might not be effective. There may be some miscommunication if the information

is listed in the syllabus and students did not take the time to read through it. Another

interesting point is that in Course 13, the faculty indicated that they did not provide

encouragement, but nearly 50% of the students responded feeling that they received

encouragement. This may be an indicator of misleading or unintentional messages that

are being relayed in this course environment. If students are receiving mixed signals for

study strategies, they might be attempting strategies that are not beneficial for the

course environment. This could also be that students are inclined to say yes, that they

heard something. Another interesting discussion point is looking at if students are

getting different advice from their IA's. This could be leading to miscommunication

during the survey for those students who are reporting that there were study strategies

reported in the course, but the faculty indicated that they did not (Course 4, figure 10).

This has been proven successful for improving learning and understanding

(Rodriguez et al 2018). For this reason, we wanted to know if faculty members were

specifically encouraging self-testing. Despite most faculty reporting that they promoted

self-testing, there was an average of 30% of students (from both upper and lower

division courses) that reported they did not receive encouragement to use this strategy.

Once again there is a greater variation among the students in upper division

courses compared to lower division courses. The high variation in the upper division

courses may indicate that these course faculty were not making recommendations

frequently enough for the students to absorb. Could this be because upper division course faculty members have a higher expectation for the students as to what previous knowledge about effective study habits they come in with? Are lower division faculty members recommending strategies more often because students are typically younger in their academic careers? They may recommend more often because they perceive lower division students need more support. Eleven out of the 13 surveyed faculty report that they encouraged self-testing in their course. This is indicative that there are some faculty members that are not encouraging self-testing and pairing this along with the faculty members (1 in our study) that do not report giving and study strategies to their students could lead to a disadvantage for the students taking the course with this faculty member. Creating an environment where study strategies are encouraged often can create a more equitable learning environment across courses. There is also the aspect of communication. For example, despite two faculty saying they did not encourage students' self-testing, there were students who still thought they received self-testing advice (Course 13 and Course 4). Once again, there could be the possibility of influence coming from IA's. There could be some unintended messaging from the faculty to the students, or students and faculty have different ideas of what self-testing means. Course 8 had a high rate of students reporting that they received self-testing advice and this course stood out among the rest. This faculty and the way they communicated self-testing to their students could be used as the recommendation template to other faculty.

Future Directions

Future directions for this research first include addressing the other 14 questions that were asked in the survey. There were points of the survey that looked at how confident the students were in their faculty, how confident they were in themselves, and vice versa for the faculty survey. There were other points in the survey that were looking into how students perceive self-testing and a variation of asking what study strategy they perceive to be most and least effective. We wanted to look to see what students would report as a study strategy before looking at the rankings list. We want to look to see if there is a difference between the answers prior to the rankings list and during the rankings list. There is also demographic data that was collected. It would be interesting to see how underrepresented minority students and non-underrepresented minority students compare in our data and comparing it to previous research like Rodriguez et al. 2018. It would be interesting to see how income level, race, ethnicity, whether a student is a transfer, and class status could show any trends that either oppose or are like previous research like Rodriguez et al.

Conclusion

Our study identified that the students and faculty members do not always have aligned perceptions of what the most effective study strategies are for their courses. Although they do not align in their perspectives for effective study strategies, they align well in their perception of what an ineffective study strategy is. In addition, students and faculty both indicate that improving learning and understanding, which includes application-based problem solving and critical thinking, is the biggest reason to rank a study strategy as effective not. Most students can recognize that their faculty members leading their courses are recommending study strategies, but there are a group of students who report that they were encouraged to self-test, when their faculty member did not encourage self-testing. There were 2 of these cases and we infer that there is some misleading communication occurring between the faculty and the students which is leading to the perception of students recalling certain study strategies being recommended when faculty members did not recommend the study strategies. Although there is evidence of misalignment of perception of study strategies between faculty and students, this shows there is room for improvement in the UCSD biology education community. Improving the ability for students to learn and understand material with proper study strategies in their courses will improve the culture and community that is being built and help students strive to reach their goals in STEM, regardless of their backgrounds.

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Figures

Figure 1. Proportions of students who ranked strategies as very effective at helping them succeed (5) and effective (4) are on the right side of the plot, with the proportion of students ranking the strategy 4 + 5 indicated. On the left are the proportional distributions of students ranking the strategies 2 (ineffective) and 1 (very ineffective), with the proportion of students ranking the strategy 1 + 2indicated. Rank 3 is not plotted but is determined by subtracting the value on the right plus left from 100%. There were 1319 student responses from 13 different biology course sections included. Self-testing, spacing, making diagrams, and attending review sessions were among the top 4 for the most effective study strategies. Cramming, quizlet, flashcards, and recopying your notes were among the bottom 4 ranked strategies.

Ranking most effective study strategies Faculty (All Courses)
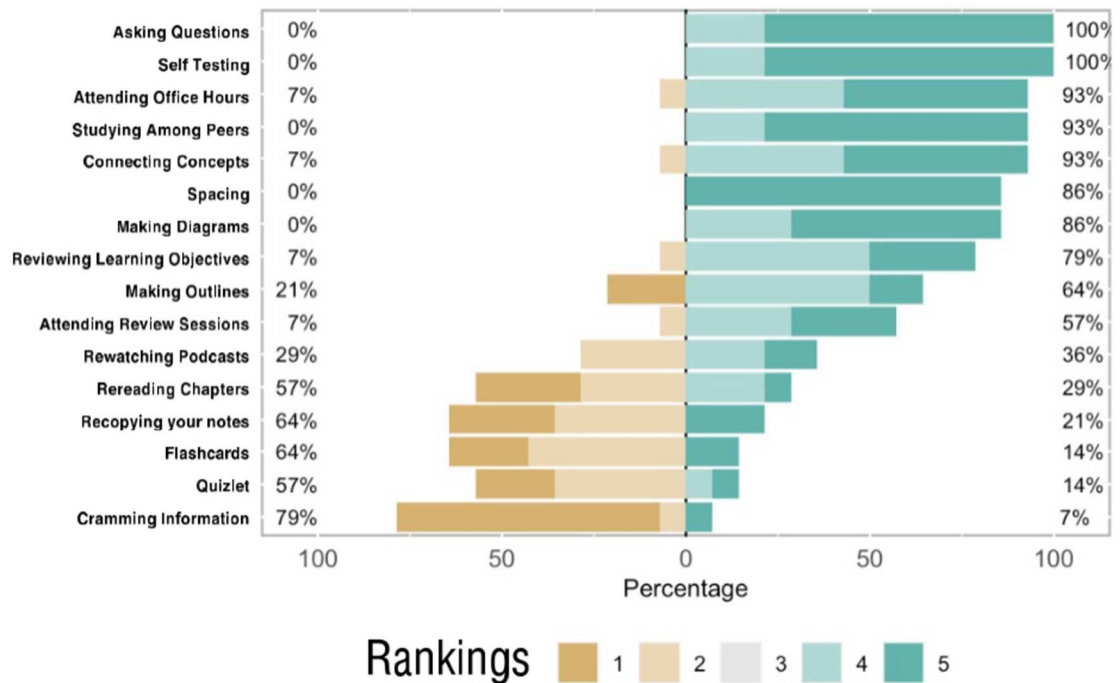
Figure 2. Ranking Most Effective Study Strategies: Faculty from All Courses. Proportions of faculty who ranked strategies as very effective at helping them succeed (5) and effective (4) are on the right side of the plot, with proportion of faculty ranking the strategy 4 + 5 indicated. On the left are the proportion of faculty ranking the strategies 2 (ineffective) and 1 (very ineffective), with the proportion of faculty ranking the strategy 1 + 2 indicated. Rank 3 is not plotted but is determined by subtracting the value on the right plus left from 100%. There were 14 faculty responses for the survey. Asking questions, self-testing, attending office hours, and studying among peers were ranked as the top 4 effective strategies for faculty. Cramming information, quizlet, flashcards, and recopying your notes were ranked as the bottom 4 effective strategies.

Table 5. The data in this table shows the top 4 strategies ranked as effective and bottom 4 study strategies ranked as ineffective for both the students and the faculty. The value in parenthesis in the faculty column is the percent of students who ranked the study strategy as effective, presented for comparison.

	Student	**Faculty** (Value in parentheses is the percentage of students who ranked strategy as effective)
Effective, top 4	Self-testing	Ask questions (52%)
	Spacing	Self-testing (85%)
	Making diagrams	Attending office hours (49%)
	Review Sessions	Study among peers (44%)
Ineffective, bottom 4	Cramming	Cramming
	Quizlet	Quizlet
	Flashcards	Flashcards
	Recopy notes	Recopy notes
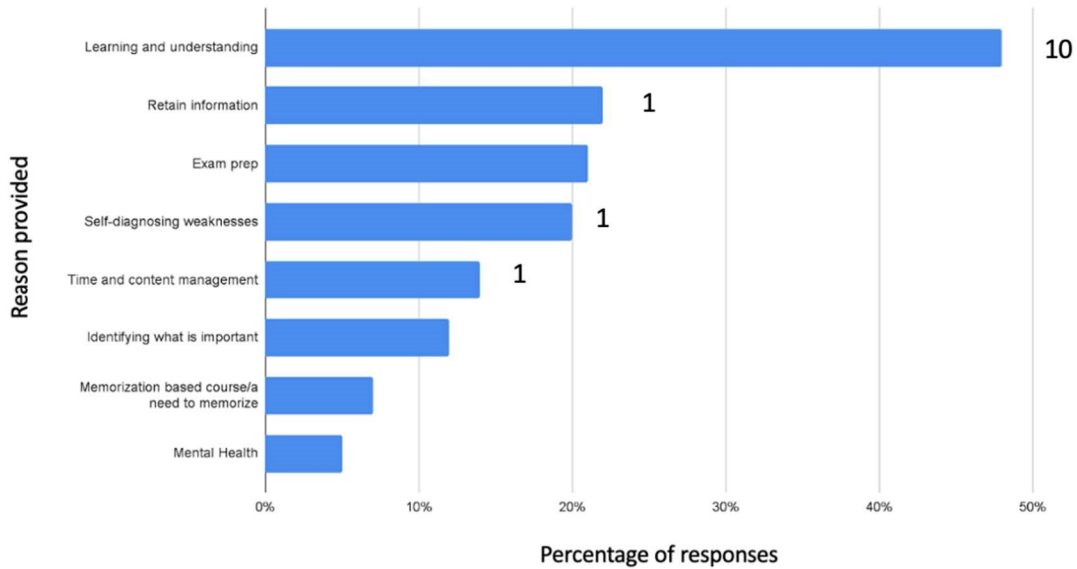
Figure 3. Why do students believe the various study strategies are effective? 891 responses were coded, with 1217 different reasons that were given (hence total percentage adds up to more than 100). The x-axis represents the percentage of students' answers given to a particular reason. The y-axis represents the various reasons that were given (refer to codebook, Table 3). The ability to improve learning and understanding, which includes application and connection-based thinking, was the most frequent reason a strategy was perceived to be effective (48% of responses). The values on the right of the bar indicate the number of faculty members whose response was coded under the corresponding reason for an effective strategy.

Effective Reasons Among Self-Testing
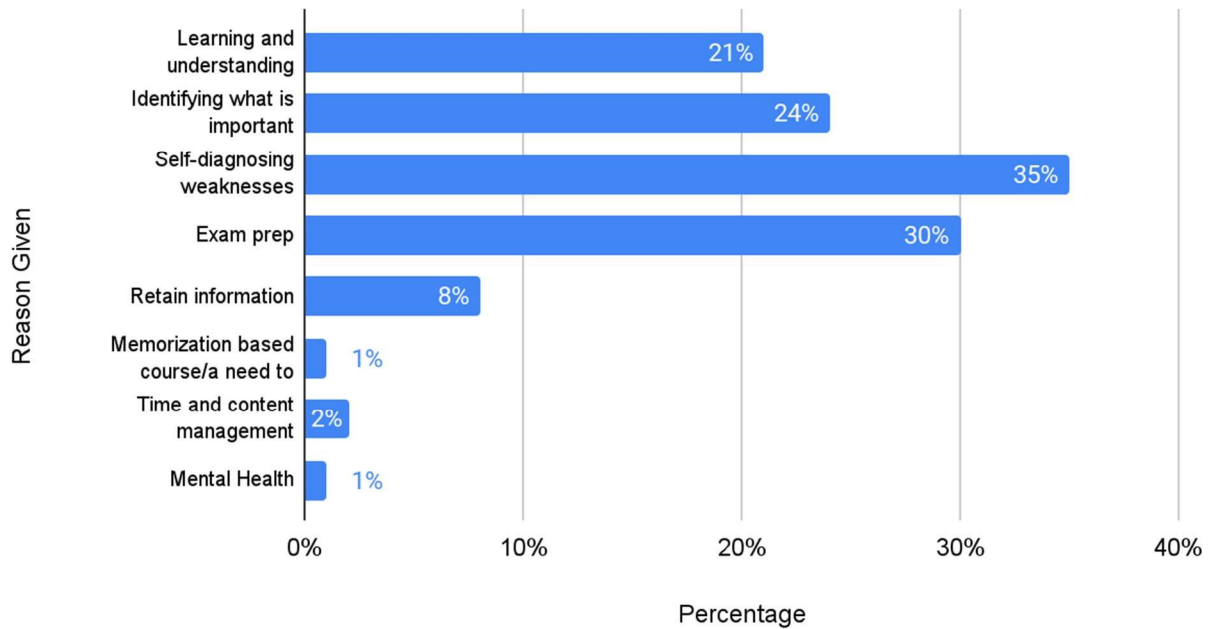
Figure 4. The reasons why self-testing is an effective strategy varies, but the two most common reasons were that the strategy aided in self diagnosing weaknesses (or strengths), exam preparation, and learning and understanding. There were 122 responses coded under this strategy. These did not include those whose answers were not able to be coded and those who did not give a reason.
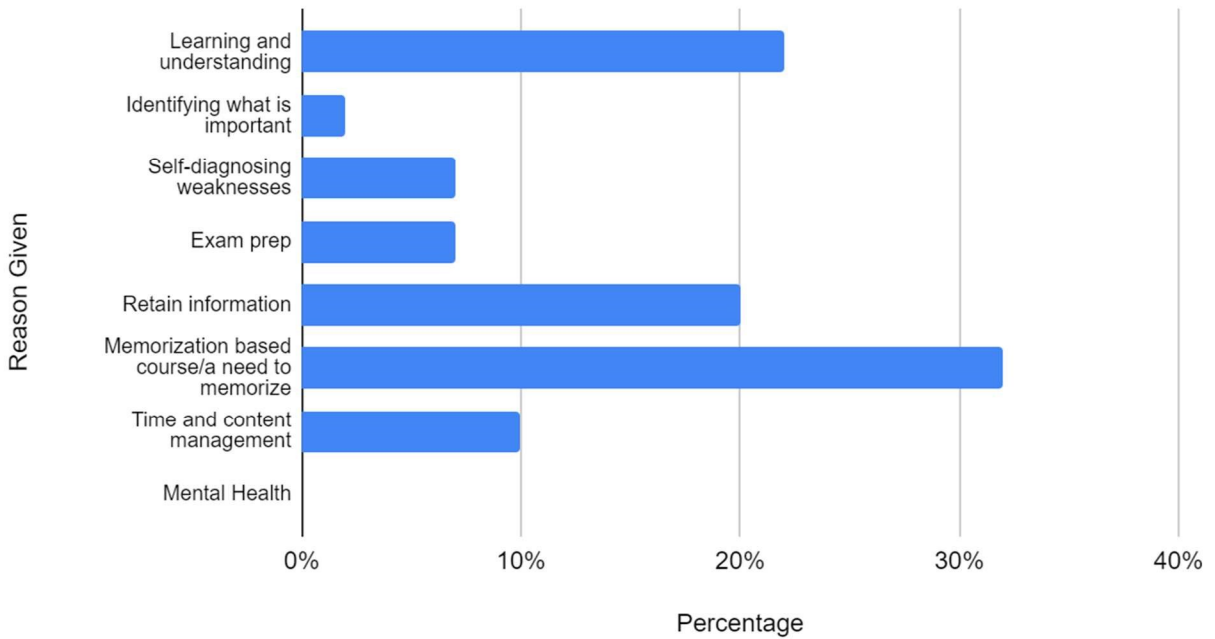
Figure 5. Learning and understanding, memorizing, and retaining information were all reasons why strategies that are considered surface learning (cramming, quizlet, flashcards) were rated as effective. There were 41 responses total coded under these strategies. These did not include those whose answers were not able to be coded and those who did not give a reason.
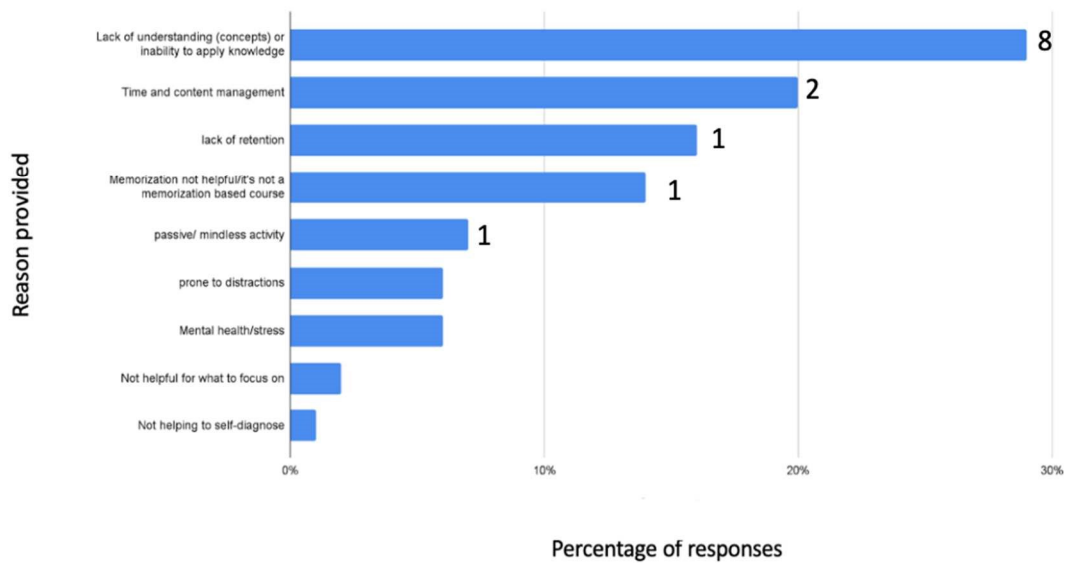
Figure 6. Why do students believe the various study strategies are ineffective? 296 responses were coded, with 274 different reasons that were given. The x-axis represents the percentage of students' answers given to a particular reason. The y-axis represents the various reasons that were given (refer to codebook, table 4). The inability to improve learning and understanding, which included application and connection-based thinking, was the most frequent reason a strategy was perceived to be ineffective. The values on the right of the bar indicate the number of faculty members whose response was coded under the corresponding reason for an ineffective strategy.

Did your professor explicitly encourage
specific study strategies during
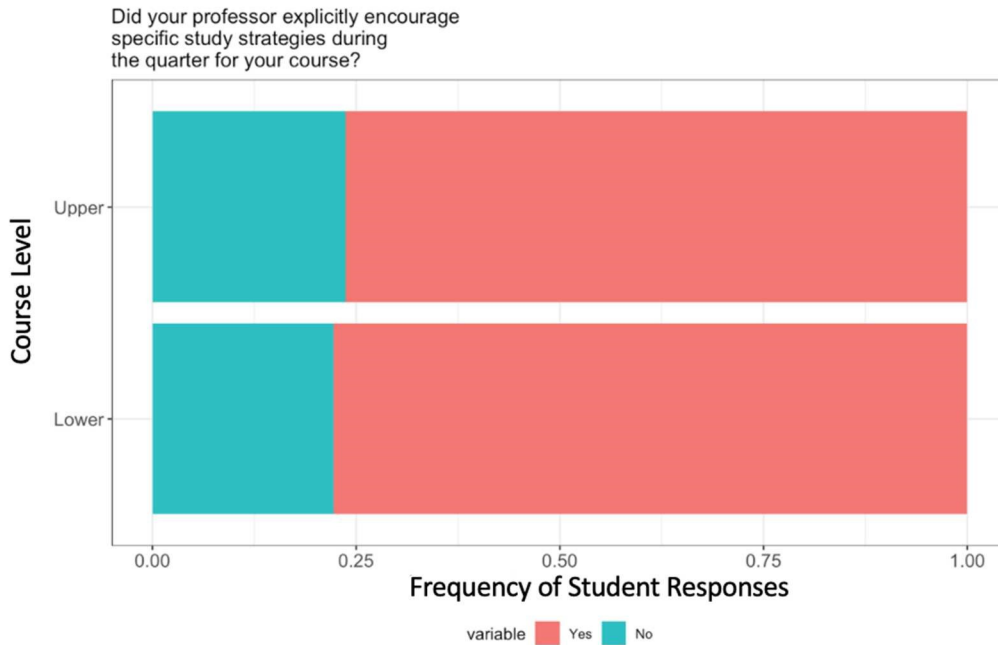the quarter for your course?

Figure 7. Did your professor explicitly encourage specific study strategies during the quarter for your course? There was a student pool of 1319 with 489 samples lower division and 830 upper division students. The students reported that in both upper division and lower division courses, the professors were promoting specific study strategies at an average rate of 76% for the lower division courses and 78% for the upper division courses.
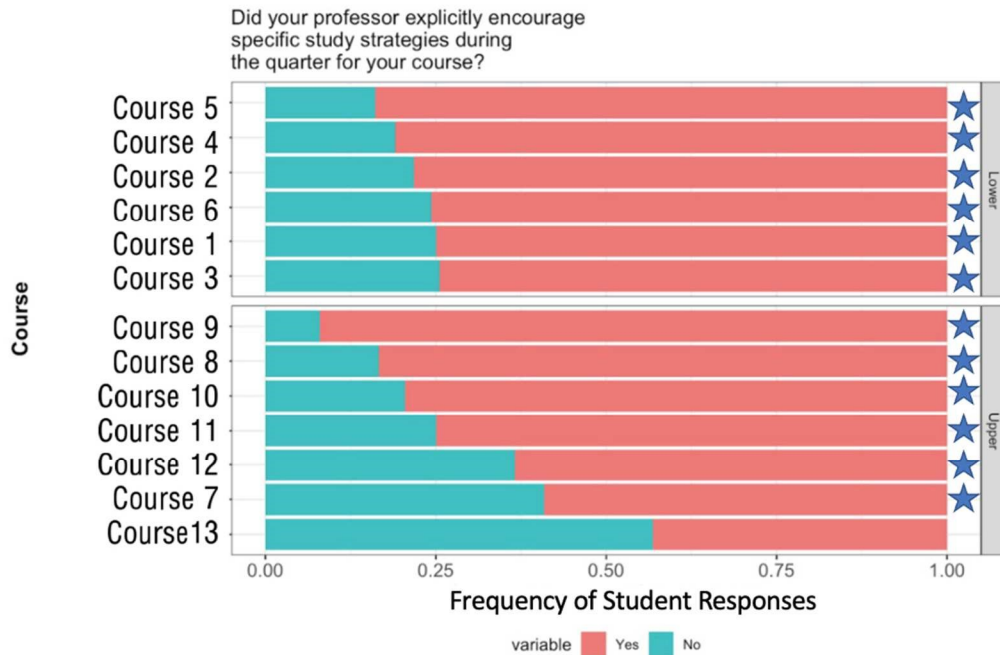
Figure 8. Did your professor explicitly encourage specific study strategies during the quarter for your course? This data was broken down via course. The x axis contained the percent of student responses, and the y axis contained the various courses. Courses 13, 7 and 12 had large rates of student responses indicating that there was a lack of study strategies being explicitly recommended by their professor. Course 9 had a high percentage of students indicating that study strategies were encouraged in the course. The star indicates that the faculty member teaching this course reported that they encouraged study strategies (12/13 faculty reported "yes").

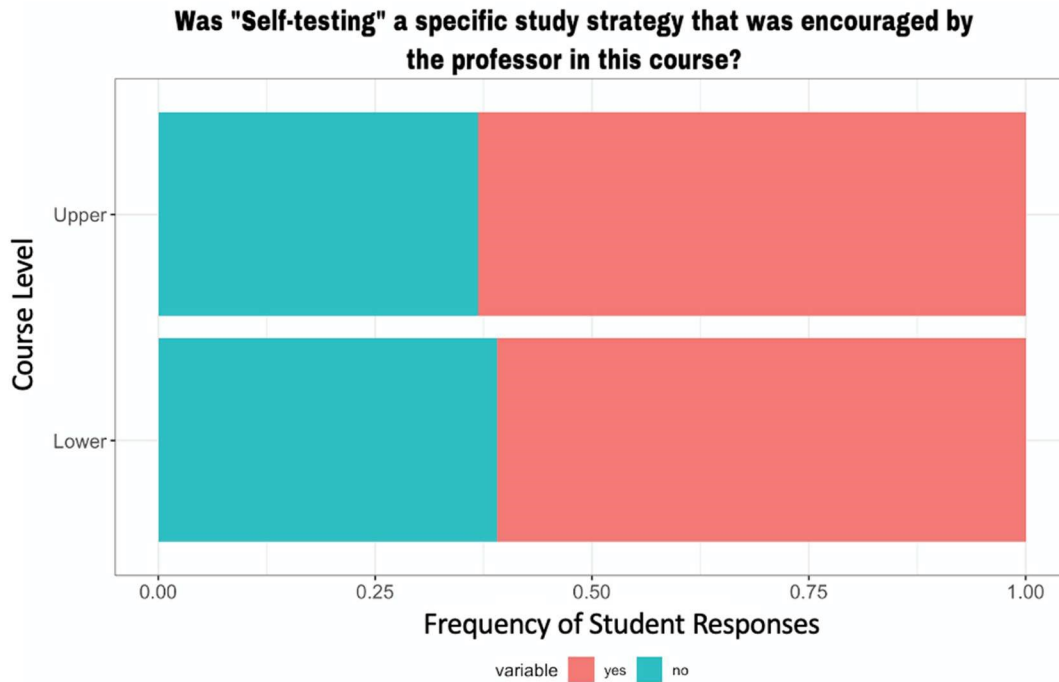Was "Self-testing" a specific study strategy that was encouraged by the professor in this course?

Figure 9. The majority of students in surveyed courses reported that the professor specifically recommended self-testing as a study strategy. The average reported answer for self-testing being encouraged by faculty in the student's courses was 63.2% for the upper division and 60.9% for the lower division.
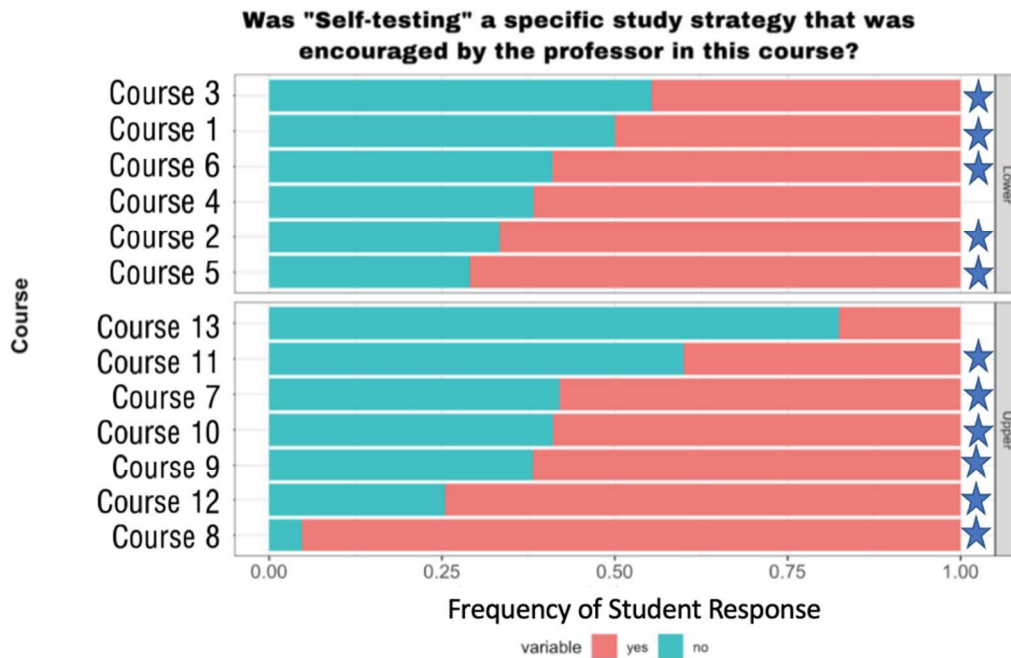
Figure 10. The data in this figure was broken down course by course. Course 8 stood out because the faculty member did a fantastic job of letting their students know that self-testing would be a great way of preparing for success in their course. Course 13 also stands out because over 85% of the students indicate that there was no attempt of including self-testing in the study regiment recommended by professors. The star indicates that the faculty member in this course reported encouraging self-testing as a study strategy (11/13 faculty reported "yes").

Appendix

Faculty Survey:

Intro You are being invited to participate in a research study titled "Exploring instructor and student perspectives of study strategies". This study is being done by Dr. Lisa McDonnell from the University of California - San Diego (UCSD).

The purpose of this research study is to gain a better understanding of what students and instructors perceive as the most useful study strategies for various biology courses. If you agree to take part in this study, you will be asked to complete an online survey/questionnaire. This survey/questionnaire will ask about what study strategies you think are useful, which ones you use, and what instructions on studying you recall receiving from the instructor, and it will take you approximately 10 minutes to complete.

There may or may not be any direct benefit to you from this research. By taking this survey you may have a chance to reflect on what study strategies you share with your students, and if there are additional ways you can support your students to adopt the best strategies for your course. The investigator may learn about how to better support instructors and students to teach about and use the best study strategies for various courses.

There are no known risks associated with this research study. The survey is anonymous, and all records will be kept confidential to the extent allowed by law and may be reviewed by the UCSD Institutional Review Board.

Your participation in this study is completely voluntary and you can withdraw at any time by simply exiting the survey. Choosing not to participate or withdrawing will result in no penalty or loss of benefits to which you are entitled. You are free to skip any question that you choose. If you have questions about this project or if you have a research-related problem, you may contact the researcher, Dr. j McDonnell, 858-246-0890. If you have any questions concerning your rights as a research subject, you may contact the UCSD Human Research Protections Program Office at 858-246- HRPP (858-246-4777).

By clicking "You agree" below you are indicating that you are at least 18 years old, have read this consent form, and agree to participate in this research study. Please print a copy of this

page for your records. ⚪ You agree (1)

⚪ You do not agree (2)

Page Break

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1a. Please indicate your name and which course you are teaching

Page Break

1   What study strategies do you believe are essential for **learning** in this course? (List any that are applicable)

_____

_____

_____

_____

_____

Page Break

2   What study strategies do you believe are essential for **exam preparation and success** in this course? (List any that are applicable)

_____

Page Break

3   Rank each study strategy 1-5 indicating which study strategy would best aid in high achievement in this course (5 being the most effective).

	1 (Least Effective) (6)	2 (2)	3 (3)	4 (4)	5 (Most Effective) (5)
Quizlet (https://quizlet.com/) (1)	O	O	O	O	O
Reviewing learning objectives (2)	O	O	O	O	O
Self-testing through problem sets, practice exams, etc. (3)	O	O	O	O	O
Connecting concepts to real life applications (4)	O	O	O	O	O
Re-watching podcasts (5)	O	O	O	O	O
Studying among peers (more than 1 student collaborating with each other) (6)	O	O	O	O	O
Use flashcards (8)	O	O	O	O	O
Recopy your notes (9)	O	O	O	O	O

Item					
Reread chapters, articles, notes, etc. (10)	○		○	○	○ ○
Make outlines, underline or highlight while reading (11)	○	○ ○ ○ ○			
Make diagrams, charts or pictures (12)	○		○	○	○ ○
Cram information the night before the test (13)	○		○	○	○ ○
Spacing studying (e.g. studying for time every day, or multiple times spread over a week, all quarter) some amount of (14)	○ ○ ○ ○ ○				
Ask questions or verbally participate during class (15)	○ ○ ○ ○ ○				
Attending office hours (16)	○		○	○	○ ○
Attending review sessions (17)	○		○	○	○ ○

4   For the strategies you ranked 5 (most effective), choose the **most** effective strategy and explain why this would help students succeed in this course.

_____

5   For the strategies you ranked 1 (least effective), choose the least effective strategy and explain why this would not help students succeed in this course.

_____

Page Break

6   Did you explicitly encourage specific study strategies during the quarter that you believed would help facilitate academic success?

O Yes (1)

O No (2)

Page Break

55

7   How did you try to convince your students that these specific study strategies would be effective in this course?

_____

7a Please explain why you did not encourage specific study strategies in this course.
_____

Page Break

10 Consider the study strategy, "Self-Testing," Describe what a typical study session using Self-Testing looks like. Please go into detail about what materials are needed and how students should do self testing.

_____

Page Break

11 Was "Self-Testing" a specific study strategy that you encouraged in this course?

○ Yes (1)

○ No (2)

12 Were the following resources available to your class? If so, how often?

	Provided Weekly (1)	Provided Only Before Tests (2)	Not Provided (3)

Lecture slides (1)

O   O   O

Readings (2)

O   O   O

Podcasts (video +

sound) (3) O   O   O

Problem sets (4)

O   O   O

Answer keys to

problem sets (5) O   O   O

Practice exams
(6)

O   O   O

Answer keys to

practice exams (7) O   O   O

Learning
objectives

(8) O   O   O

Studying in groups

(9) O   O   O

Providing office

hours (10) O   O   O

Hosting Review

sessions (11) O   O   O

13   If there are other resources provided within the framework of the course not listed above that you felt were impactful in the course, please list them below (Please include the timeframe the resource was provided for example: Provided Weekly).

_____

14   How confident are you that you know the best study strategies for success in this course?

O not confident (1)

O somewhat confident (2)

O confident (3)

15   How confident are you that your students know the best study strategy for success in this course?

O not confident (1)

O somewhat confident (2)

O confident (3)

17   Please upload a copy of your course syllabus for this course. This is used to verify the answers students give in their survey **about course structure/ resources.**

18   Thank you for taking this survey. If you have any additional comments or questions about study strategies, please share!

_____

End of Block: Default Question Block

Student Survey:

Intro You are being invited to participate in a research study titled "Exploring instructor and student perspectives of study strategies". This study is being done by Dr. Lisa McDonnell from the University of California - San Diego (UCSD). You were selected to participate in this study

because you are in [course code and instructor name]. There may or may not be any direct benefit to you from this research. By taking this survey you may have a chance to reflect on what study strategies you use, and if you think they are effective at helping you succeed. This can be useful when considering what strategies to use in future courses. The investigator may learn about how to better support instructors and students to teach about and use the best study strategies for various courses.

There are no known risks associated with this research study. The survey is anonymous and all records will be kept confidential to the extent allowed by law and may be reviewed by the UCSD Institutional Review Board.

Your participation in this study is completely voluntary and you can withdraw at any time by simply exiting the survey. Choosing not to participate or withdrawing will result in no penalty or loss of benefits to which you are entitled. You are free to skip any question that you choose.

If you have questions about this project or if you have a research-related problem, you may contact the researcher, Dr. Lisa McDonnell, 858-246-0890. If you have any questions concerning your rights as a research subject, you may contact the UCSD Human Research Protections Program Office at 858-246-HRPP (858-246-4777).

By clicking "You agree" below you are indicating that you are at least 18 years old, have read this consent form, and agree to participate in this research study. Please print a copy of this

page for your records. ◯ You agree (1)

◯ You do not agree (2)

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1	While enrolled in [COURSE CODE], what study strategies do you believe were essential for **learning in this course**? (List any that are applicable e.g. study strategy X, study strategy Y).

_____

2   While enrolled in [COURSE CODE], what study strategies do you use to **prepare for exams** in order to have the most success? (List any that are applicable e.g. study strategy X, study strategy Y).

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3   Rank each study strategy 1-5 indicating which study strategy would best aid in high achievement in [COURSE CODE]. (5 being the most effective). If you have not used the following strategies, indicate how effective/ ineffective you think the strategy would be.

	1 (Least Effective) (1)	2 (2)	3 (3)	4 (4)	5 (Most effective) (5)
Quizlet (https://quizlet.com/) (1)	O	O	O	O	O
Reviewing learning objectives (2)	O	O	O	O	O

Self-testing through problem sets, practice exams, etc. (3)	O	O	O	O	O
Connecting concepts to real life applications (4)	O	O	O	O	O
Re-watching podcasts (5)	O	O	O	O	O

Studying among peers (more than 1 student collaborating with each other) (6)   O   O O O   O

Use flashcards   (8) O   O O O   O

Recopy your notes   (9) O   O O O   O

Reread chapters, articles, notes, etc. (10)   O   O O O   O

Make outlines underline or O   O O O   O highlight while reading (11)

Make diagrams, charts or pictures (12)   O   O O O   O

Cram information the night before the test (13)   O   O O O   O

Spacing studying (e.g. studying for time every day, or multiple times spread over a week, all quarter) (14)   O O O O   O some amount of

Ask questions or

verbally participate ○　　○ ○ ○ ○ during class (15)

Attending office

hours (16) ○ | 　　　　　○ ○ ○ ○ Attending review

sessions (17) ○ 　　　　　○ ○ ○　　　　○

4　　For the strategies you ranked 5 (most effective), choose which one you think would be the **most** effective strategy and explain why this has or would have helped you succeed in this course.

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5　　For the strategies you ranked 1 (least effective), choose which one you think would be the **least** effective strategy and explain why this strategy was or would not be not helpful in this course.

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6	Did your professor explicitly encourage specific study strategies during the quarter for your course? ⭘ yes (1)

⭘ no (2)

Skip To: 8 If 6 = no

7	How did the professor try to convince you that these specific study strategies would be effective in this course?

_____

8	Do you feel these strategies, recommended by your professor, helped you succeed or improve your test score performance in this course?

⭘ Yes, I tried them and they helped (1)

O No, I tried them and they did not help (2)

O Did not try them (3)

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9   Please explain how these study strategies encouraged by your professor helped achieve success during the course.

_____

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9a Please explain how these study strategies encouraged by your professor did not help you achieve success during the course.

_____

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9b Please explain why you did not choose to try the study strategies provided to you in this course.

_____

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10 Describe what a typical study session using the study strategy "Self-testing" looks like. Please go into detail about what materials are needed and how you use this strategy. If you don't use this study strategy, please explain why you decided not to use "Self-testing."

_____

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11 Was "Self-testing" a specific study strategy that was encouraged by the professor in

this course? ○ yes (1)

○ no (2)

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12 Were the following resources available to your class? If so, how often?

	Provided Weekly (1)	Provided Only Before Tests (2)	Not Provided (3)
Lecture slides (1)	O	O	O

Readings (2)

○ ○ ○

Podcasts (video +

sound) (3) ○ ○ ○

Problem sets (4)

○ ○ ○

Answer keys to

problem sets (5) ○ ○ ○

Practice exams
(6)

○ ○ ○

Answer keys to

practice exams (7) ○ ○ ○

Learning
objectives

(8) ○ ○ ○

Studying in groups

(initiated by ○ ○ ○

Professor) (9)

Studying in groups

(initiated by peers) ○ ○ ○
(10)

Attending a review

session (11) ⃝   ⃝   ⃝

Consulting IA's via

email or office hours ⃝   ⃝   ⃝
(12)

Going to office

hours (13) ⃝   ⃝   ⃝

13 If there are other resources provided within the framework of the course not listed above that
    you felt were impactful in the course, please list them below (Please include the timeframe
    the resource was provided for example: Provided Weekly).

_____

_____

_____

_____

_____

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14 How confident are you that **you** know the best study strategies for success in this course?

⃝ not confident (1)

O somewhat confident (2)

O confident (4)

Page Break

15 How confident are you that your professor knows the best study strategies for

success in this course? O not confident (1)

O somewhat confident (2)

O confident (4)

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16 Were there any strategies you learned in this course, that you didn't know about or
use previously? Please explain:

    _____

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17
We are curious to know if you would have been interested in a study strategy workshop at the start of the quarter. Which opportunities below apply to you?

☐ I would likely have attended a workshop on study strategies specific to my course (1)

☐ I would likely have attended a workshop on general study strategies (2)

☐ I would likely not have attended either workshop (3)

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Demographics The following questions are demographic questions to understand the population being surveyed. You may select "prefer not to answer" for any question you wish to decline answering.

10 What is your ethnicity? Choose what applies to you:

☐ African American/Black (1)

☐ American Indian/Alaska Native (2)

☐ Asian Indian (3)

☐ Chinese (5)

☐ European/White/Other Caucasian (6)

☐ Filipino (7)

☐ Japanese (8)

☐ Korean (9)

☐ Latin American/Latino (10)

☐ Mexican/Mexican American/Chicano (11)

☐ Native Hawaiian/Pacific Islander (12)

☐ North African (13)

☐ Other Asian (14)

☐ Other South Asian (15)

☐ Other Southeast Asian (16)

☐ Pakistani (17)

☐ Southwest Asian (18)

☐ Taiwanese (19)

☐ Vietnamese (20)

☐ Unknown or Decline to State (21)

☐ Other _____ (22)

11 Are you Spanish, Hispanic, or Latinx? Check all that apply.

☐ Spanish (1)

☐ Hispanic (2)

☐ Latinx (3)

☐ None (4)

☐ Prefer not to answer (5)

12 Roughly estimate how much income your household earns in one calendar year. ⭘ Less
    than $10,000 (1)

    ⭘ $10,000 to $29,999 (2)

    ⭘ $30,000 to $49,999 (4)

    ⭘ $50,000 to $69,999 (6)

    ⭘ $70,000 to $99,000 (8)

    ⭘ $100,000 to $149,999 (11)

    ⭘ $150,000 or more (12)

    ⭘ Prefer not to answer (13)

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13 To which gender identity do you most identify? (Leave blank if you prefer not to
    answer)

    _____

14 What class will you graduate from UCSD?

○ Class of 2020 (1)

○ Class of 2021 (2)

○ Class of 2022 (3)

○ Class of 2023 (4)

○ Other (5)

○ Prefer not to answer (6)

15 Are you a transfer student? (Someone who has transferred from one University or College to UC San Diego)

○ yes (1)

○ no (4)

16 What is your overall GPA (make an approximation)?

○ 0.0–1.6 (1)

○ 1.7–2.1 (6)

○ 2.2–2.6 (7)

○ 2.7–3.1 (8)

○ 3.2–3.6 (9)

○ 3.7–4.0 (10)

○ Prefer not to answer (11)

17 What is your Upper Division GPA (make an approximation)? ○ 0.0–1.6 (1)

○ 1.7–2.1 (4)

○ 2.2–2.6 (5)

○ 2.7–3.1 (6)

○ 3.2–3.6 (7)

○ 3.7–4.0 (8)

○ Not yet in upper division (10)

○ Prefer not to answer (9)

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18 Do you consider yourself a first generation college student? (comes from a family

where neither of their parents/guardians gained a four-year degree) ○ Yes (1)

○ No (2)

○ Prefer not to answer (3)

Page Break

Q29 Thank you for taking this survey. If you have any additional comments or questions about study strategies, please share! Or, if you have any suggestions to improve this survey, please let us know.

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