

# UC Riverside

## UCR Honors Capstones 2022-2023

### Title

The Access To Academic Resources And Successes Of Biochemistry Students During The Covid-19 Pandemic

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THE ACCESS TO ACADEMIC RESOURCES AND SUCCESSES OF BIOCHEMISTRY  
STUDENTS DURING THE COVID-19 PANDEMIC

By

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A capstone project submitted for Graduation with University Honors

May 12, 2023

University Honors  
University of California, Riverside

APPROVED

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ABSTRACT

One of the unfortunate consequences of the COVID-19 pandemic is the difficulty in accessing academic resources by underserved college students. Resources such as recorded lectures, online notes, and office hours are key for online learning. However, the availability of these necessary materials to the underserved community may be impeded, perhaps by lack of access to high-speed internet and/or adequate devices such as computers or tablets, which may lead to decreased course performance and overall learning. These difficulties may be less of an issue during in-person teaching, as students can take written notes and attend lectures in person. My research will explore whether a lack of access to academic resources for underserved students in a large-enrollment biochemistry course affected their academic performance during the COVID-19 pandemic, compared to the performance of students who are not underserved.

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## ACKNOWLEDGEMENTS

I would like to thank Dr. Dingwall for distributing my survey to Biochemistry students and providing me with guidance on survey creation and conducting background research.

## **Introduction**

Imagine these scenarios during the recent COVID-19 pandemic: a student attempting to join a class via Zoom cannot enter due to poor Wi-Fi connectivity. Perhaps the student experiences lag time in the synchronous lecture and therefore missed questions that were asked, or is unable to participate in class discussion. Or, a student could not even access lecture slides for a class because they had no access to a computer at home. This is the reality that many students faced when they tried to learn and adapt to the unexpected pivot to online education. Students who are unable to obtain high speed Wi-Fi or have access to appropriate electronic devices, such as laptops and computers, are students who will struggle with accessing online resources, and hence not be able to join synchronous lectures and/or discussions. For example, Bourns College of Engineering (BCOE) students must have laptops that meet specifications such as having at least 8 GB RAM and other more technical computational requirements (“Computer Requirement.”, 2020), because many of their classes require these devices for their curriculum. Hindering students; access to their educational resources can affect their ability and possibly even their willingness to learn. This research study will explore whether a lack of access to academic resources for underserved students in a large-enrollment introductory biochemistry course affected their academic performance during the COVID-19 pandemic compared to the performance of students who are categorized in higher socioeconomic brackets.

### **Significance**

Using the results of this study, we hope to be able to determine the impact of being part of the underserved student population and how it may relate to student success. In this case, students who are underserved are those that do not have access to adequate academic resources, for example, an electronic tablet or laptop. A positive correlation would indicate that access to academic resources contributed to better academic performance. A negative correlation would imply that access to academic resources was not related to students' academic performance. We

hypothesize that underserved students - due to lack of access to resources - would not perform as well as their peers who have better access. These results may also elucidate resources can be provided to all students, regardless of their socioeconomic status, for increased academic performance. Knowing what resources work for students will help guide efforts to increase the access to the underserved population and/or students who may not be performing at their academic peak.

### **Background**

Past research has found that there is a disparity in how economic wealth has affected students' performance. The journal article *Online Learning: Implications for Higher Education Pedagogy and Policy* discussed that online learning has created an environment that is unpredictable, and hence there needs to be alternate avenues to support student learning (Picciano, Anthony G, 2006). It emphasized that by creating a content management system (CMS), instructors can provide alternative resources to students that will help students stay current in their academic progress (Picciano, Anthony G, 2006). Having various methods available to access resources in case a student's device is not compatible with the class activity is essential to helping students learn and perform well academically. A separate study found that performance of students in an English polytechnic studies course dropped when resources available to the students were altered from their normal setting (Lindsay, R. O., and R. Paton-Saltzberg, 1987). Students were placed into a larger class size, which led to a deficiency in the number of textbooks available in the library thus hindering their ability to access the content being taught (Lindsay, R. O., and R. Paton-Saltzberg, 1987). This lack of access to required course materials affected the overall class performance: fewer available materials led to lower performance. (Lindsay, R. O., and R. Paton-Saltzberg, 1987). It further highlights that

introductory classes with a larger group of students should have enough resources for all the students to be able to succeed.

A different study involving English as a Second Language (ESL) high school students to determine what resources benefited them the most found that student-teacher interactions, not just physical materials, were also beneficial (Sharkey, Judy, and Carolyn Layzer, 2000). This meant that a key part of the class was personal interaction, as those who participated did better with the curriculum. In addition, it was found that the attitude and overall morale of the class was important to the students' learning process (Sharkey, Judy, and Carolyn Layzer, 2000). These factors help explain that resources are dependent upon not only the learning environment but also the various interactions among students, their classmates, and instructors. Other key resources are after-school programs or tutors, whose importance is explained in the *The Russell Sage Foundation Journal of the Social Sciences*. This study involved elementary students living in urban areas, which are wealthier, compared to rural areas. Although both populations of students may have had similar struggles in class, students who were more financially secure had better opportunities (Miller, Portia, Elizabeth Votruba-Drzal, and Rebekah Levine Coley, 2019). Students pay extra for help with course material outside of the classroom from after-school programs to tutors allowing them to perform better. However, in order to attain these resources, there are additional fees to be paid; thus, the family must be economically secure to consider obtaining help outside of the classroom. Students without financial security who are behind academically and do not have access to outside resources may perform worse.

Lastly, a study that can be built upon by our current research surveyed undergraduate students across the University of California system to determine how economic security affected students' performance. It was found that those who have received Pell Grants study more hours during the week than those who are not Pell Grant recipients (Douglass, John, and Gregg



Thomson, 2012). Pell Grant recipients are those who demonstrate exceptional financial need, and underserved students fall in this category. In addition, data showed that the difference in GPA between “poor” vs “rich” students was found to be 0.03, showing there is not a significant difference in academic performance correlated with economic status (Douglass, John, and Gregg Thomson, 2012). Our project will hopefully assist UCR undergraduates identify what resources are available and useful to them, and by extension help the university know what resources are effective and which programs to support and promote.

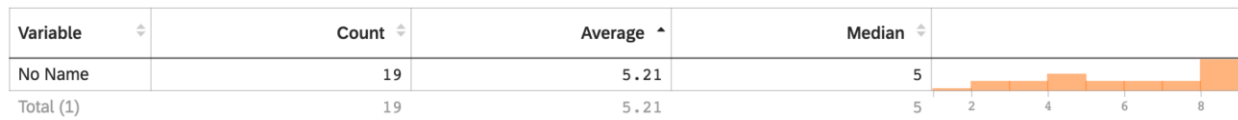
### **Methods**

For our study, we will survey UCR undergraduates who have taken or are currently enrolled in a biochemistry course with Dr. Stephanie Dingwall. S will take the surveys on electronic devices such as a laptop, computer, or touchscreen phone, as the survey is online via the Qualtrics platform. There will be one 15-minute survey for current and past students. Certain questions in the survey will determine whether the student falls within the underserved category. The survey will contain questions such as, “When accessing recorded lectures, does your video experience lag or long period of loading?” The survey will also ask what resources the students are using to study, such as “Are you using the biochemistry templates that are provided?” Furthermore, the survey will ask what grade they received in the class. Surveys questions will include multiple choice, Likert scale, and short answer. A Likert scale is a psychometric response scale in which responders can specify their level of agreement to a statement (McLeod, Saul, 2019). Although students are asked to provide some sort of identification in the beginning to ensure that there are no duplicate submissions, all identifying data will be permanently removed prior to data analysis to maintain anonymity. The Qualtrics platform will be used both to generate these surveys and organize the data for analysis, hopefully to elucidate the correlation between academic performance and access to resources.

## Results

The results of this study were collected and analyzed through Qualtrics. A total of 29 responses were collected, all from students enrolled in Dr. Dingwall’s Biochemistry 100 or Biochemistry 110B course. The first few questions asked students about their access to available resources. For example, the first question asked “During your online learning period, did you ever receive a message on Zoom stating your internet connection was unstable? If so, how consistent was the issue on a scale of 1-10?” The analysis of 19 responses in Figure 1 show that the average is 5.21, with 5.0 as the median. 5 respondents rated 8-9, 3 respondents rated 4-5 and 2 respondents rated in each of the categories 5-6,6-7,7-8 2-3 and 3-4. Thus, showing that no extreme within the Likert scale is favored as the results are split between students receiving a message on Zoom and those who did not.

**Figure 1:**

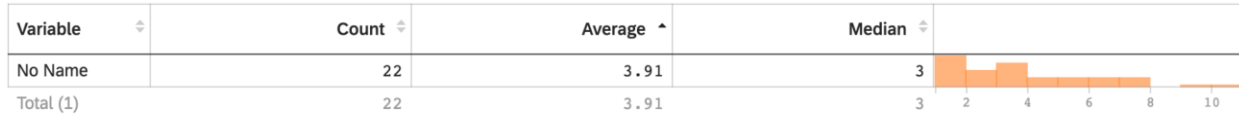


*Legend: 19 responses were acquired using a Likert scale of 1-10, in which 1 represented few to no issues, and 10 being very frequent issues. The average response was 5.21, with 5.0 as the median. 5 respondents rated 8-9, 3 respondents rated 4-5 and 2 respondents rated in each of the categories 5-6,6-7,7-8 2-3 and 3-4.*

The second question that more directly addressed the socioeconomic status of a student asked “Did you ever need to use an alternative device to access academic resources due to your device being unreliable to complete academic tasks such as online labs or downloading large PDFs? If so, how often did this occur?”. The results collected from 22 responses as seen in Figure 2 show that there was not a significance as an extreme was preferred. The extreme preferred of having few to no issues selected by respondents on the Likert scale brought the

average to be 3.91, with 2.0 as the median. 5 respondents rated 1-2, 4 respondents rated 3– 4, 3 respondents rated 2-3, 2 respondents rated in each of the categories 4-5,5-6,6-7,7-8 and 1 respondents rated in each of the categories 8-9 and 10-11. These results showed that students had few to no issues with their academic device being reliable to complete academic tasks.

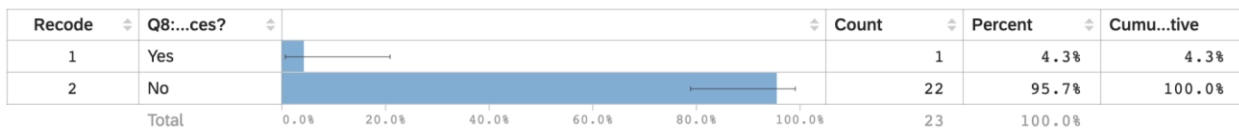
**Figure 2:**



*Legend: 22 responses were acquired using a Likert scale of 1-10 in which 1 represented few to no issues, and 10 being very frequent issues. The average response was 3.91 with 2.0 as the median. 5 respondents rated 1-2, 4 respondents rated 3– 4, 3 respondents rated 2-3, 2 respondents rated in each of the categories 4-5,5-6,6-7,7-8 and 1 respondents rated in each of the categories 8-9 and 10-11.*

The next question asked “Have you reached out to the UCR Economic Crisis Response Team (ECRT) to receive urgent access to Wi-Fi or other resources?”. The responses collected in Figure 3 found only 1 student out of 23 who use this service. 1 respondent which is 4.3% responded Yes and 22 respondents which is 95.7% responded No. These results are not significant enough to pursue further analysis.

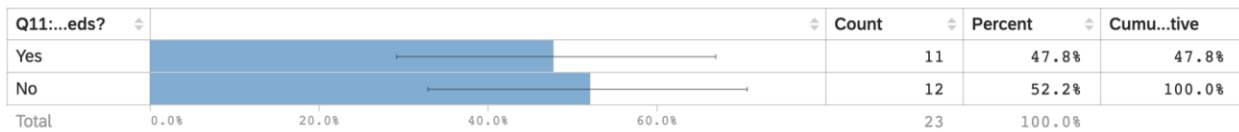
**Figure 3:**



*Legend: 23 responses were acquired using a multiple choice question in which Yes represented a student reaching out to the UCR Economic Crisis Response Team, and No being student not reaching out to the UCR Economic Crisis Response Team. 1 respondent which is 4.3% responded Yes and 22 respondents which is 95.7% responded No.*

To help determine the intersectionality between accessibility to academic resources and socioeconomic status, the survey included the question, “Have you financially struggled to buy a new device such as a laptop or iPad or printer to meet academic needs?” The bar graph in Figure 4 showed that 52.2% of the 23 respondents were unable to afford a new device to fulfill their academic needs. However, 47.8% of the 23 respondents were able to purchase a device they need for their academic needs. 11 respondents which is 47.8% responded Yes and 12 respondents which is 52.2% responded No. This shows that there is a split between the students who financially struggle to buy a new device to meet academic needs.

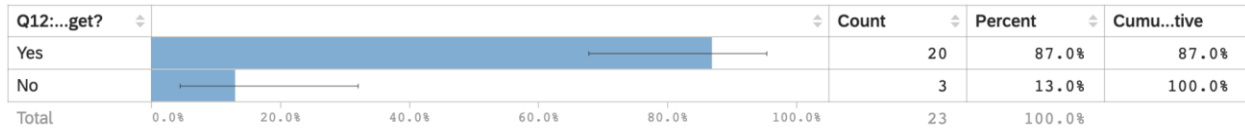
**Figure 4:**



*Legend: 23 responses were acquired using a multiple choice question in which Yes represented a student struggling to buy a new device such as a laptop or iPad or printer to meet academic need ,and No being a student not struggling to buy a new device such as a laptop or iPad or printer to meet academic needs. 11 respondents which is 47.8% responded Yes and 12 respondents which is 52.2% responded No.*

Furthermore, to understand whether the economic group of which a student is categorized in affected their access to resources it was asked “Have you chosen to download a pdf of the textbook rather than purchasing the book due to the book's price being out of your budget?”. The bar graph in Figure 5 showed that 87% of the 23 respondents chose to download a pdf of the textbook while 13% purchased the book. 1 respondent which is 87.0% responded Yes and 3 respondents which is 13.0% responded No. Thus, showing that the majority of the students are choosing to download a PDF of the textbook.

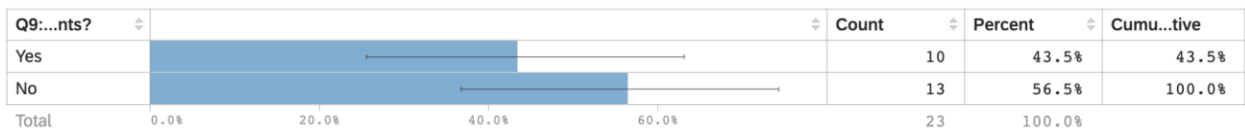
**Figure 5:**



*Legend: 23 responses were acquired using a multiple choice question in which Yes represented a student downloading a pdf of the textbook rather than purchasing the book ,and No being a student not downloading a pdf of the textbook rather than purchasing the book. 1 respondent which is 87.0% responded Yes and 3 respondents which is 13.0% responded No.*

After asking questions to determine socioeconomic status, questions were asked with regards to their studying methods. The first question asked “Have you used the UCR Academic Resource Center (ARC) resources to study for class assessments?” The bar graph analysis found that 56.55 % of the 23 respondents did not use the Academic Resource Center. While 43.5% of students did use the Academic Resources center. 10 respondents which is 43.5% responded Yes and 13 respondents which is 56.5% responded No. This shows that there is a split between the students who use the ARC as a resource for studying and those who do not. Further analysis may be useful for those who responded yes, for example, whether they used supplemental instruction (SI) or tutoring.

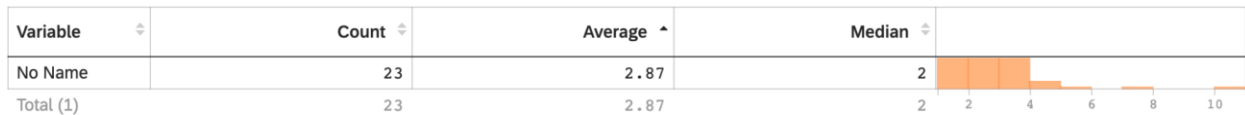
**Figure 6:**



*Legend: 23 responses were acquired using a multiple choice question in which Yes represented a student using the UCR Academic Resource Center ,and No being a student not using the UCR Academic Resource Center. 10 respondents which is 43.5% responded Yes and 13 respondents which is 56.5% responded No.*

Then, to understand whether students found the academic resources they have access to were sufficient, they were asked, if “On a scale of 1-10 (1 being rare and 10 being very often) how often do you find your access to resources insufficient to complete academic tasks?” The analysis in Figure 7 found that the average of responses from the Likert scale was 2.87 with 2.0 as the median. 6 respondents rated in each of the categories 1-2,2-3,3-4, 2 respondents rated 4-5 and 1 respondent rated in each of the categories 5-6,7-8,10-11. Based on the responses received, most of the students were able at least access or find their resources sufficient to complete academic tasks.

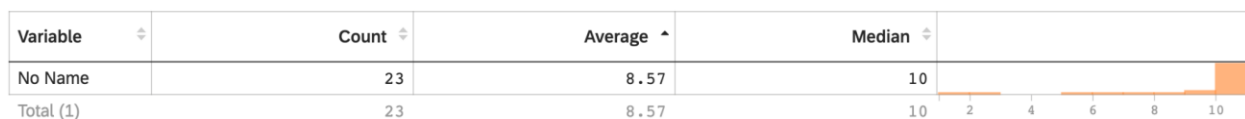
**Figure 8:**



*Legend: 23 responses were acquired using a Likert scale of 1-10, in which 1 represented not very to not insufficient, and 10 being very insufficient. The average response was 2.87, with 2.0 as the median. 6 respondents rated in each of the categories 1-2,2-3,3-4, 2 respondents rated 4-5 and 1 respondents rated in each of the categories 5-6,7-8,10-11.*

Moreover, it was analyzed if the specific resources such as biochemistry templates were beneficial to students' learning. The results were analyzed in Figure 9 which showed an average of 8.57, with 10 as the median from the Likert scale responses. 15 respondents rated 10-11, 2 respondents rated 9-10 and 1 respondents rated in each of the categories 1-2,2-3,5-6,6-7,7-8. This shows a high average thus many students found the biochemistry templates to be a resource beneficial to their learning.

**Figure 9:**

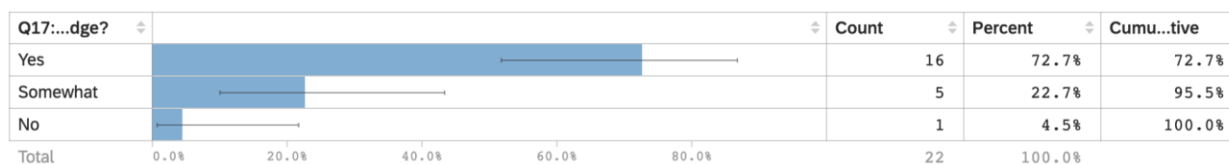


*Legend: 23 responses were acquired using a Likert scale of 1-10, in which 1 represented very little to not beneficial, and 10 being very beneficial. The average response was 8.57, with 10 as the median. 15 respondents rated 10-11, 2 respondents rated 9-10 and 1 respondents rated in each of the categories 1-2, 2-3, 5-6, 6-7, 7-8.*

The survey also asked what specific academic resources provided by Dr. Dingwall were the most helpful. Respondents cited the biochemistry templates, amino acid sheet, color coded lecture slides, study guide, lecture recordings, and office hours most often. Next, the survey asked if there are resources that Dr. Dingwall could implement in the course. Students cited mandatory check-ins, more practice problems, and access to previous quizzes and tests. Additionally, students were asked “Did you use outside resources not provided within the biochemistry class to study? If yes, what are they?”. Responses varied from YouTube videos and Anki flashcards.

Students were also asked if they felt their academic performance was reflective of their knowledge. The respondents in figure 10 showed that 72.7% said yes, 22.7% said somewhat and 4.5% said no. Majority of the respondents found their academic performance to be reflective of their knowledge.

**Figure 10:**

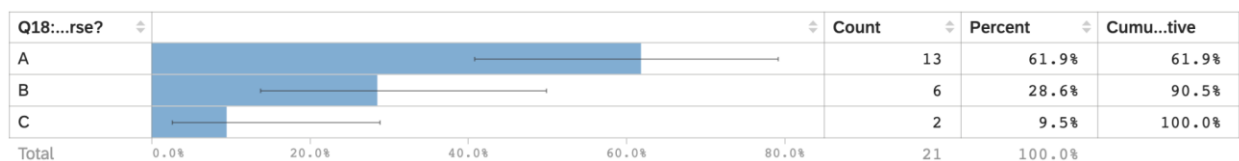


*Legend: 22 responses were acquired using a multiple choice question in which Yes represented a student who felt their grade reflected their knowledge, Somewhat represented a student who felt their grade to some degree reflected their knowledge and No felt their grade did not reflect*

their knowledge. 16 respondents which is 72.7% responded Yes, 5 respondents which is 22.7% responded Somewhat and 22 respondents which is 4.5% responded No.

Finally, they were asked what their final academic standing was in the biochemistry course. The bar graph analysis of results found that 61.9% had an A, 28.6% had a B and 9.5% had a C. Majority of students had good standing in the course with an A or B.

**Figure 11:**



*Legend: 21 responses were acquired using a multiple choice question, in which A represented a student receiving an A, B represented a student receiving a B and C represented a student receiving a C. 13 respondents which is 61.9% responded A, 6 respondents which is 28.6% responded B and 2 respondents which is 9.5% responded C.*

## Discussion

The survey had questions to determine the socioeconomic status of a student. However, some of these questions, such as a student reaching out to the UCR Economic Crisis Response Team or students downloading the pdf of a textbook, showed results that favored one extreme. Although these respondents are truthful, they did not provide results that one would have expected from certain socioeconomic groups. Rather, these questions showed results that were split. For example, the question asked whether students were able to afford new devices for academic needs, and whether students received a message on their zoom stating their internet connection was unstable. The determination of socioeconomic status was determined based on the access to academic resources students have.



From this, questions were asked about the methods that students used to study. Students answered free response questions on which resources they found most beneficial. Students' responses cited the benefits of the biochemistry templates, office hours, homework assignments and recorded lectures. Majority of students cited that reviewing the biochemistry templates and rewriting the biochemistry templates was the most beneficial. Outside resources students used to aid with class content include YouTube videos and flashcards. Some additional resources students wanted to add to the course included mandatory check-ins, more practice problems and access to previous quizzes and tests. These additional resources are something that can be incorporated into the course in the future to see if that will help students' learning and academic performance.

Additionally, students enrolled in either the online in-person courses utilized similar study materials and methods such as biochemical templates, lecture attendance, and/or watching the recorded lectures after to fill in any information gaps. There were no significant changes in resources used by the students to study biochemistry. However, students taking the in-person course found the in-person interactions and accessibility more beneficial to their learning compared to students in the online course.

Furthermore, out of the thirteen students who received an A in the course, nine of them struggled to purchase a new device for academic use. These students' academic performance was not dictated by their socioeconomic group categorization. These students took the class during the pandemic, which increased the need for devices as classes and academic resources are virtual; however, their performance did not seem to be affected. Thus, there was no marked difference in course performance among students of various socioeconomic groups.

A possible reason for this lack of marked difference may be due to the types of resources being offered within the course. One of the main resources cited on free-response questions and

the Likert scale was the biochemistry templates. These templates are used to write out key biochemistry metabolic pathways and can be drawn out with pen and paper. These metabolic pathways go over topics that are heavily tested on within the course. Thus, the universal accessibility of these templates - not requiring any electronic device, but simple pen and paper - did not adversely hinder their accessibility to unattainable resources, and hence no marked decrease in academic performance within the biochemistry course, at least not with respect to resource availability.

Furthermore survey responses cited the benefits of having office hours after class. The office hours were held in person post pandemic and have been helpful in answering students' questions and clarifying topics. The access to meet with the Instructor directly after lecture allows for reinforcement of curriculum helping students learn. Office hours offer assistance with topics without the form of payment as tutoring making it more accessible. This is an additional possible reason for this lack of marked difference between students academic performance and various socioeconomic groups.

### **Difficulties**

One of the difficulties of this research study was the collection of responses. As this survey was optional and provided no reward for completion, there were fewer students willing to complete it. Additionally, as it asks students questions about their socioeconomic status, some questions might make some feel uncomfortable sharing what resources they have access to, as this may make them feel targeted. This discomfort might deter students from participating in the survey. There could also be a deterrence to fill out the survey due to students feeling uncomfortable answering questions about their academic performance. In order to make the survey less daunting for students I would include an announcement at the beginning of the survey so that students are more prepared when they answer the survey.

I believe the students who might hesitate while taking the survey could contribute to why the data is biased towards students who received an A within the class. There is a heavy bias as the ratio of A students to B and C students is 13 to 8. In the future to prevent this issue, I would make sure that a reward of some sort is offered to create a greater amount of responses. I would recommend offering extra credit for the biochemistry course for completing the survey or offer a chance to win a monetary reward if the survey is completed.

Additionally, I believe that I could expand my survey to other biochemistry courses that would increase responses received. Notably, these courses should have the same academic resources being offered in order to have an appropriate comparison, preferably be taught by the same instructor, and at the same level so that students would have similar experiences across the board leading to more comparable, consistent results with the least amount of bias.

Lastly, many students did not complete the survey fully, but their responses were still collected by Qualtrics thus leading to uncompleted surveys and a smaller data pool. This made it harder to analyze the results and made the data set for certain survey questions smaller.

### **Conclusion**

The results showed that the implementation of biochemistry templates within the course was the most helpful academic resource in the learning of the course material. As this was one of the most beneficial resources to students learning, it should be a mainstay course curriculum. As these academic resources have worked successfully within this biochemistry class, they can be implemented in other biochemistry courses. Moreover, it did not require any electronic device or external purchase, both of which would otherwise be possibly concerning to students at a financial disadvantage. Providing resources that do not require the use of devices to study can be implemented into other courses, which can help make learning more accessible and equitable. Some additional academic resources that could be added to help students' learning and academic

performance are an inclusion of more practice problems and access to previous quizzes and tests. Furthermore, it was found that there is no correlation between the course performance among students of various socioeconomic groups, even though accessibility varied, for example, such as being unable to purchase academic devices or accessing Zoom. However, students within this socioeconomic status did not perform worse in the class. Thus there was no correlation as results showed that access to academic resources was not related to students academic performance.

### **Future Experiments and Improvements**

In this study it was found that the performance of students was not affected by their access to academic resources. However, we were not able to determine which resources helped underserved students perform well academically. To better understand their performance another research study can be conducted which would first determine the socioeconomic group a student is part of. This can be done once again by asking what resources they have access to. From there it could be asked which resources they implement the most in studying if they were not able to access a resource. I would ask more specific questions within this survey such as, “How did they access the biochemistry templates? Did you use outside free resources such as YouTube or Quizlet?” Additionally, a study can be conducted with the implementation of the changes students mentioned prior such as including mandatory check-ins, more practice problems and access to previous quizzes and tests. This study would add additional academic resources to the curriculum, whose helpfulness will be determined by the academic performance of students. The academic performance with the additional rescues will be compared between students of various socioeconomic backgrounds. Both of these studies would help develop this research study further by finding which alternative methods underserved students have to use when they are not able to access academic resources.

Another study can be done to track the performance of students before and after using the biochemistry templates. The study can determine whether the biochemistry templates are the main reason for students' performance, regardless of their access to academic resources such as iPads or laptops. Underserved students' academic performance is tracked before and after the use of biochemistry templates within the class would indicate whether the biochemistry templates are the most effective and accessible method of learning.

In addition, in the future I would like this survey to be conducted in more classes so that there could be further analysis to see if this conclusion only applies to biochemistry courses. I believe this benefits students in other classes as they can find out what resources are most accessible and helpful to students. Then those resources can be implemented within the curriculum.

### **Special Requirements/Approval**

This research study required the Institutional Review Board application and approval. The specific type of Institutional Review Board submitted was the socio-behavioral classification. The Institutional Review Board application needed to be submitted for this study as human beings were participating in data collection. The Institutional Review Board forms were filled out and checked, Dr. Dingwall signed it and the Institutional Review Board approval was given before distributing and collecting data. The Institutional Review Board helps keep a code of ethics to protect participants and make sure the surveys are appropriate. This research study received Institutional Review Board approval on June 16, 2022.

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