

Student Perspectives on Chemistry Support Course, Success, and Barriers

by

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I. Abstract

There is a student success gap for underrepresented, first-generation, and transfer students shown in their increased DFW rates for General Chemistry 1. However, they demonstrate higher levels of resilience in continuing through a chemistry degree path, suggesting the first General Chemistry course is the barrier. Different factors impact student success, but the most common factors can be divided into academic, personal, social, and demographic challenges. A co-requisite support course (BASE) designed to reduce barriers in these categories by Building student Assurance, Security, and Engagement is one solution to increase student success in General Chemistry. Appalachian State University began offering a one-hour support course in Fall 2021 to increase success in the first semester of General Chemistry. The course offers support with both chemistry material and success skills through activities designed to increase student skills and involvement. Some activities include a schedule-building activity, breakout groups to discuss different topics, reflections for each module to increase learning awareness, and guest speakers to provide students with information about resources available on campus. Data collected over five semesters shows the %DFW rates of students enrolled in the support course (34.4%) are similar to all students in the first-semester General Chemistry course (35.4%). However, the %DFW rates are lower than the historical rates for students in underrepresented groups, which indicates the support course may increase student success. Current research examines the student perspective to understand how the support course prompts student growth with data collection in both the Fall 2023 and Spring 2024 semesters. Data was collected from multiple surveys and interviews of students enrolled in the support course in the Fall 2023 and Spring 2024 semesters to gauge student confidence levels, knowledge of campus resources, the likelihood of using provided office hours and tutoring, and to get more detail on

opinions of the support course and perception of personal barriers. Data from the surveys showed a general trend of an increase in confidence in both chemistry and math material, and a mid-semester dip in likelihood and comfort with accessing resources. Data from the interviews shows time management as a prevailing issue for students and suggests that the individualized instruction that comes from the support course is beneficial for students. Future work for the research would include changes to the survey question, interview procedure, and student participant pool. Based on student responses, possible future changes to the support course include more time management activities and study skills resources to aid students in soft skills, altering the support course structure to increase in-class instructional time, and adding support course activities into regular sections.

II. Introduction

i. Gatekeeper Courses, DFW Rates, and the Hyper Persistent Zone

A student success gap exists in the STEM field, specifically affecting underrepresented or minority (URM), female, and first-generation college students. “In 2018, women earned 58% of all bachelor’s degrees, but only 36% of STEM bachelor’s degrees. In 2017, Black, Hispanic, and Indigenous individuals comprised 30% of the US population, 34% of STEM-intending incoming college students, and yet merely 18% of undergraduate STEM degree recipients”¹

These achievement gaps are especially present in gateway courses like the first semester General Chemistry. Gateway (also known as “weed-out” or gatekeeper) courses are low-level foundational courses with high enrollment numbers and higher DFW rates. These courses function as a gateway/gatekeeper because they are “required for many STEM majors, including virtually all of those offered in the life sciences... and have been shown to have an especially

large impact on students who are interested in careers in medicine, dentistry, or pharmacy.”² A quantitative marker for these courses is “DFW” rates, defined as the percentage of students who received grades of D, F or withdrew from the course. High DFW rates usually demonstrate barriers to student success and represent the courses students are struggling the most with.

URM or first-generation students statistically have higher DFW rates than their represented peers. Koch³ states that “the students who do not succeed in gateway courses disproportionately come from lower-income, first-generation, and underrepresented minority groups.” A study from the Association of Public and Land-Grant University’s (APLU’s) Powered by Publics initiative⁴, research from the Big Ten Academic Alliance⁴ demonstrated consistently higher DFW rates for these student populations in these gateway courses. Specifically in General Chemistry 1, the majority of students had a DFW of 21.1% while URM students had a DFW rate of 31.7% and non-first-generation students had a DFW of 20.8% while first-generation students had a DFW rate of 29.0%. The data also demonstrates that the DFW rates drop 6% on average from General Chemistry 1 to General Chemistry 2 confirming higher DFW rates for the General Chemistry 1.

While General Chemistry 1 is a barrier for these groups of students, studies have also shown that “female, URM, and low socioeconomic status (SES) students are more likely to persist in the STEM-major track than their well-represented peers with the same grade”². While there is a gap in DFW rates for these demographics of students, there is a higher level of persistence in a degree path after completing General Chemistry 1. This phenomenon has been deemed the “Hyper-Persistent Zone.” This data indicates that General Chemistry 1 is the barrier for success for students in these demographics. Therefore, if student success in these courses

increases, the retention rates of STEM majors will increase, and the backgrounds of people in the field will also increase as a result.

There are many factors that impact student success, however, these factors can be broken into four main categories: academic, personal, social, and demographic factors.⁵ Academic factors include classroom climate, use of academic services, use of academic campus services, learning style vs. teaching style, attitude and mindset of instructors, and study strategies. Personal factors include health issues, emotional/self-regulation, adequate support system, and personality. Social factors include cultural identification, linguistic isolation, relations with faculty and peers, and parental involvement. Demographic factors include gender, race, ethnicity, and socioeconomic status. All of these factors work together to impact student success in general, but also more so with the addition of a gatekeeper course.

ii. The Support Course in Detail

The support course is a one-credit hour co-requisite course to General Chemistry 1 (CHE 1101) that was offered at Appalachian State University in the fall 2021 semester. It is a BASE course designed to reduce student barriers by Building student Assurance, Security, and Engagement. The course traditionally has a maximum enrollment of 25 students, but the Spring 2024 semester enrollment increased to 28 students, illustrating increasing demand for the course. The support course meets for an hour once each week to provide additional assistance with chemistry material, activities for learning and success, peer-led tutoring, instructor office hours, and information on resources. The course has been co-taught by Dr. Amanda Howell and Dr. Jennifer Cecile; however, Dr. Cecile recently became interim chair for the chemistry department and the course has been taught solely by Dr. Howell in the 2023-2024 academic year. The

average class for the support course involves some sort of activity or informative lecture, followed by either a large group or small group review of material with practice problems for students. Small groups are usually divided into subjects or topics with Dr. Howell in charge of one group and myself (Audrey Gay) in charge of the other. Lectures and lab materials are usually led by Dr. Howell. Practice problems and information sessions on resources are usually led by me.

Each General Chemistry course in our department has a Learning Enhancement Across Disciplines (LEAD) tutor from the student learning center. These tutors are assigned to a section of General Chemistry and sit in on each class to not only stay up to date with tutoring material, but also to gain knowledge on instructor-specific teaching and expectations of student knowledge. Each LEAD tutor then creates worksheets and practice problems for their tutoring sessions which are held twice a week for an hour and fifteen minutes. Like regular chemistry, the support course also has a LEAD tutor, who takes on a more active role than a regular LEAD tutor in working with students during class time. I have been the LEAD tutor for the support course for the 2022-2023 and 2023-2024 academic years. Tutors for the first two semesters of the support course were Loly Amaya and Savannah Dollihigh. Since the support course has fewer credit hours than a regular chemistry course there is only one LEAD session per week with a topic-specific worksheet to give a generalized review of material to the students.

Many activities are done throughout the semester to meet the course goals of providing students with support and resources. Each student is given a binder with a summary of each module, worksheets, and extra practice problems. The semester begins with a time management activity for students to review their class/extracurricular schedules and create a weekly calendar. This activity allows students to truly understand their schedule and the amount of free or

unstructured time they have available each week. There are also short lectures on materials and information for students throughout the semester. Examples of these short lectures include: showing students how to sign up for classes and use Coursicle, demonstrating how DegreeWorks (our degree path tracker) works, and giving examples of note-taking styles and study strategies.

Throughout the semester, students reflect on their strengths and weaknesses after each learning module to better understand and evaluate their comprehension of the material. As mentioned in the class description above, the course also allows students to break out into different groups with one of the instructors or the LEAD tutor to work on material in smaller groups. These groups allow students to get more individualized help on the specific material they are struggling with. The course also has guest speakers each semester to tell students about available campus resources. Some of these guest speakers include representatives from the wellness and prevention center, the student learning center, and the career development center. Altogether these activities are used as different methods to increase the skills and success of the students in the support course. A visual representation of all the different activities can be seen in Figure 1 below.

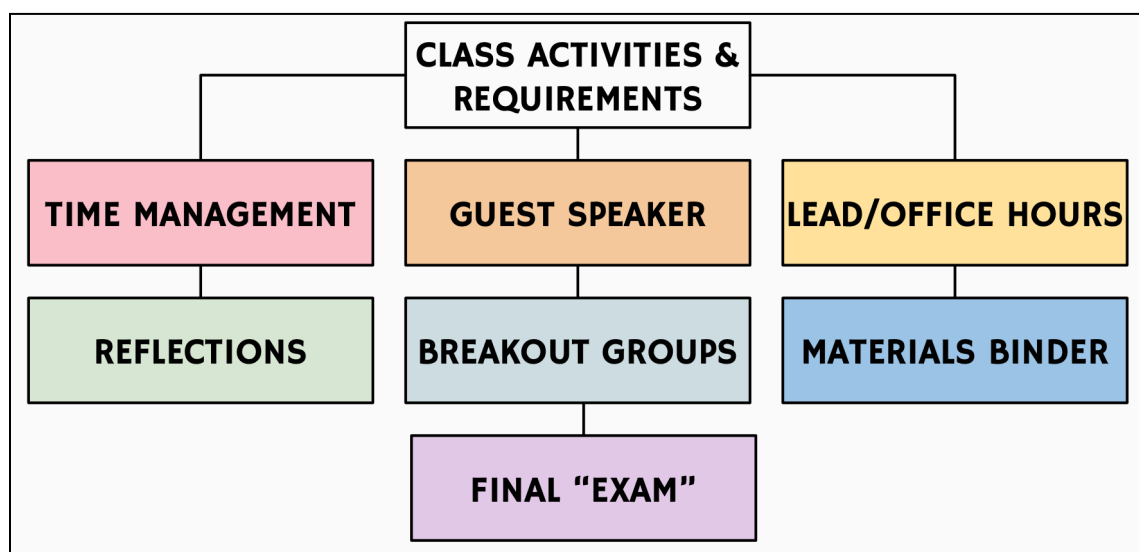


Figure 1: Visual Representation of Support Course Activities

iii. Statistics and Research Goals

As of fall 2023, Appalachian State University has approximately 20,000 students and is predominantly undergraduate. The school is composed of 19% racially and/or ethnically underrepresented, 31% first generation, and 57% female. The Department of Chemistry and Fermentation Sciences is composed of 23.8% underrepresented undergraduates and 32% first-generation undergraduates, and 54% female undergraduates. The support course has now run for six semesters with around 132 students enrolled in total. The breakdown of these students is 78% female, 16% URM, 40% first-generation, and 23% transfer student undergraduates. Based on data collected from the last five semesters of General Chemistry 1, the DFW rate for a traditional student at Appalachian State is 34.4%. The average DFW rate was 44.3% for first-generation students, 40.7% for transfer students, and 41.9% for URM students. While there is an increase in DFW rates for these student groups, the average DFW rate for the students in the support course was 35.4%, which indicates that the support course is lowering DFW rates for the students enrolled in the course. This collected data indicates that the support course is increasing student success for these student groups.

While the data supports increased student success, the purpose of this research project is to gain more data and information on the student perspective of success and personal barriers. This research aims to get information on the following questions: “What do students perceive to be their barriers to success in school?” “Do student confidence levels change over the course of the semester?” and “How do students perceive the support course and what aspects do they find helpful?” This research was conducted with surveys and interviews administered to the students in the support course. The surveys were used to determine general trends in confidence and knowledge as well as get a list of general barriers. The interviews were used to gain more

information on students' perceived barriers, opinions on the support course, and perceptions of chemistry courses and skills for success.

III. Methods

The data collection of this project was completed with surveys and interviews of students enrolled in the support course. This research has IRB approval (HS-24-17) and is exempt from review under Category 2. The participants in this study are drawn only from the fall 2023 or spring 2024 cohorts of the support course during the semester in which they are enrolled. Participation in this study did not impact any study grades or standing in the course.

i. Surveys

Surveys via Google Forms were given to the students in the support course at the beginning, middle, and end of both the fall 2023 and spring 2024 semesters. The surveys given at varying points of the semester were identical surveys containing the same information and questions. The survey consists of a consent statement and fifteen questions broken into three sections. For a full list of questions see Table #1. The first section of the survey is scale questions, where students rate how they feel about certain topics on a scale of 1-5. Examples of questions in this section include “What would you rate your current comfort level with first-semester chemistry material?” and “How would you rate your study habits?” The second section of the survey includes questions where students choose on a sliding scale whether they agree or disagree with the given statement. Examples of statements in this section include “I feel confident in my ability to succeed in a chemistry course” and “I feel comfortable asking for help from my professors.” The third section contains open-ended questions for students to give a short

answer to. Examples of questions in this section include “What material has been the most challenging in chemistry?” and “What do you consider to be your biggest barrier to success at university?” The overall goal of the surveys was to see if confidence levels changed throughout the semester and whether or not knowledge of resources, likeliness of attending tutoring, or confidence in asking professors for help changed over the semester. These surveys also provided a basic list of student perceptions of their strengths and weaknesses in chemistry and what barriers to success in university are.

Table #1 : Survey Instrument with Questions by Section

Type of Question	Question
Scale 1-5	What would you rate your current comfort level with first semester chemistry material?
	What would you rate your current comfort level with mathematics used in chemistry?
	How would you rate your current study habits?
	How likely are you to attend a tutoring session or a teacher's office hours for assistance with material?
	How likely are you to consider a future career in a STEM field?
Agree/Disagree	I am knowledgeable of the academic resources available to me to help me succeed
	I am comfortable with accessing the resources available to me.
	I feel confident in my ability to succeed in a chemistry course.
	I understand how to sign up for classes and plan my schedule.
	I feel comfortable asking for help from my professors.
	I find chemistry material enjoyable to learn
	I believe my class attendance is essential to my success.
Open-Ended	What material has been the most challenging in chemistry?
	What do you consider to be your best material in chemistry?
	What do you consider to be your biggest barrier to success at university?

ii. Interviews

In-person interviews were conducted with students during both the fall 2023 and spring 2024 semesters. Each interview was around fifteen minutes, with answers dictated by the interviewer, and students were given a \$10.00 incentive to complete the interview. The interviews began with a consent sheet (see Appendix A) for students to check and initial to confirm voluntary participation and understanding of the interview process. The interviews were 10 questions each, asking varying questions about chemistry, success skills, and perceptions of the support course. For a full list of questions see Table #2. Question examples include: “What are your current study habits?” “What do you think your biggest barrier to success is?” and “What activities of the support course have helped you?” The goals of the interviews were to determine how students perceived their own barriers in more depth and have them expand on positives and places of improvement for the support course.

Table #2: Interview Instrument

Questions
What do you think the most difficult aspects of a chemistry class are?
What are your current study habits?
What skills do you think are necessary to succeed in a chemistry class?
What do you think your biggest barrier to success is?
How is the support course different from your regular chemistry course?
What is a piece of advice you would give yourself before beginning this course?
What activities of the support course have helped you?
What activities of the support course would you improve or change?
What are changes or improvements that could be made to make learning chemistry more enjoyable?
What resource do you utilize most and why? Which one do you use the least?

IV. Results and Discussion

i. Survey Results Fall 2023

In terms of general trends in the surveys for “What would you rate your current comfort level with first semester chemistry material” the overall trend from the beginning to the end of the semester was that students’ comfort level with the material increased (shown in figures #2-3). For the statement “I feel confident in my ability to succeed in a chemistry course” the general trend for students was that they agreed more with the statement at the end of the semester instead of the beginning (shown in figures #4-5). These general trends indicate that confidence and comfort levels increase throughout the semester on average for students.

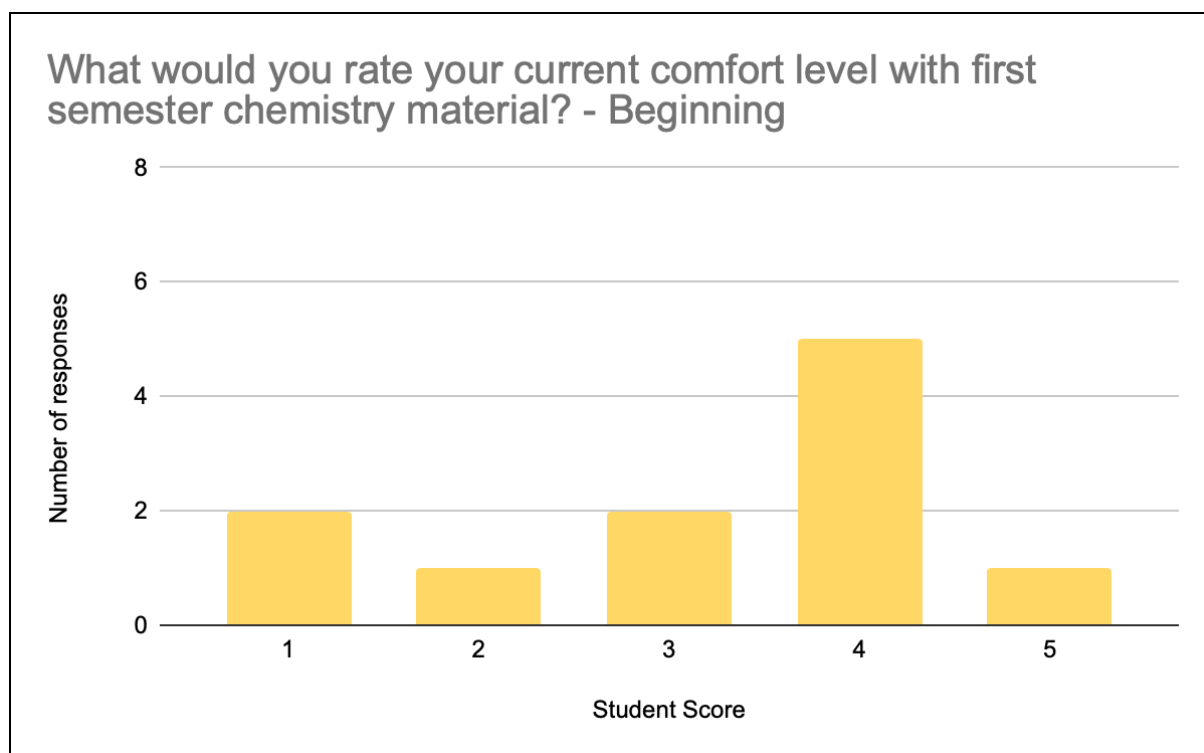


Figure #2: Question #1 Beginning of Semester Score Distribution (on a scale of 1-5 with 1 being the least comfortable and 5 being the most comfortable)

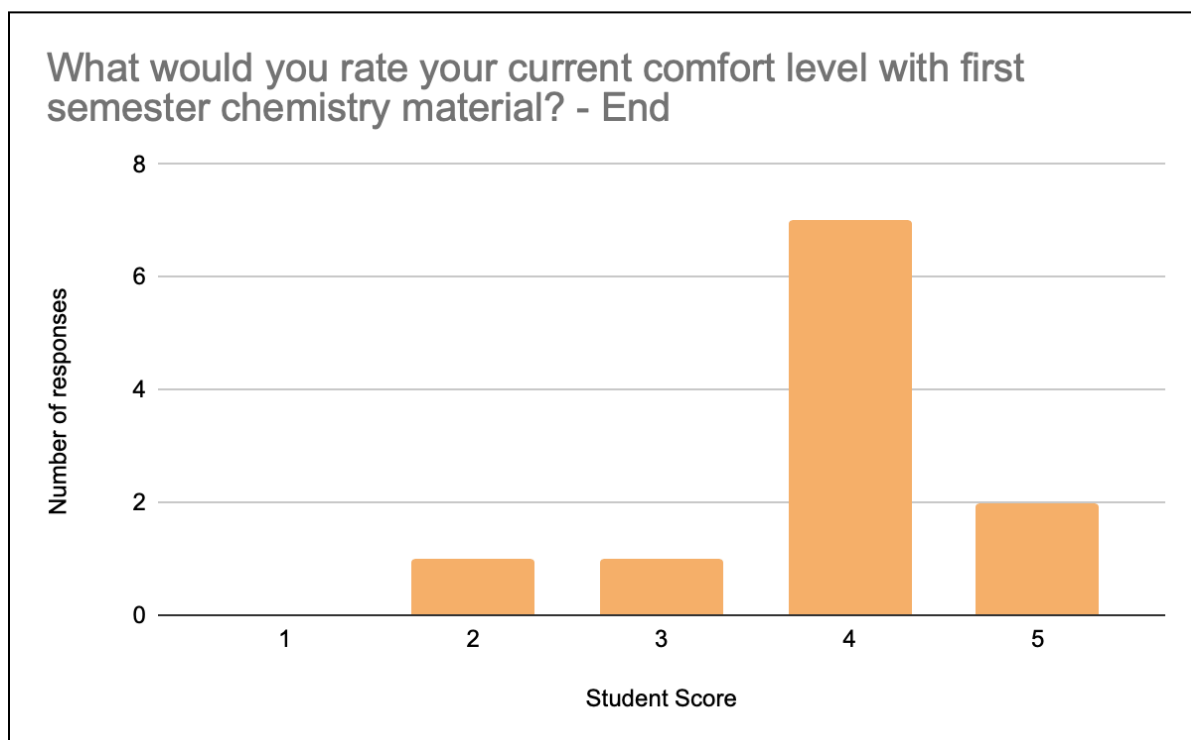


Figure #3: Question #1 End of Semester Score Distribution (on a scale of 1-5 with 1 being the least comfortable and 5 being the most comfortable)

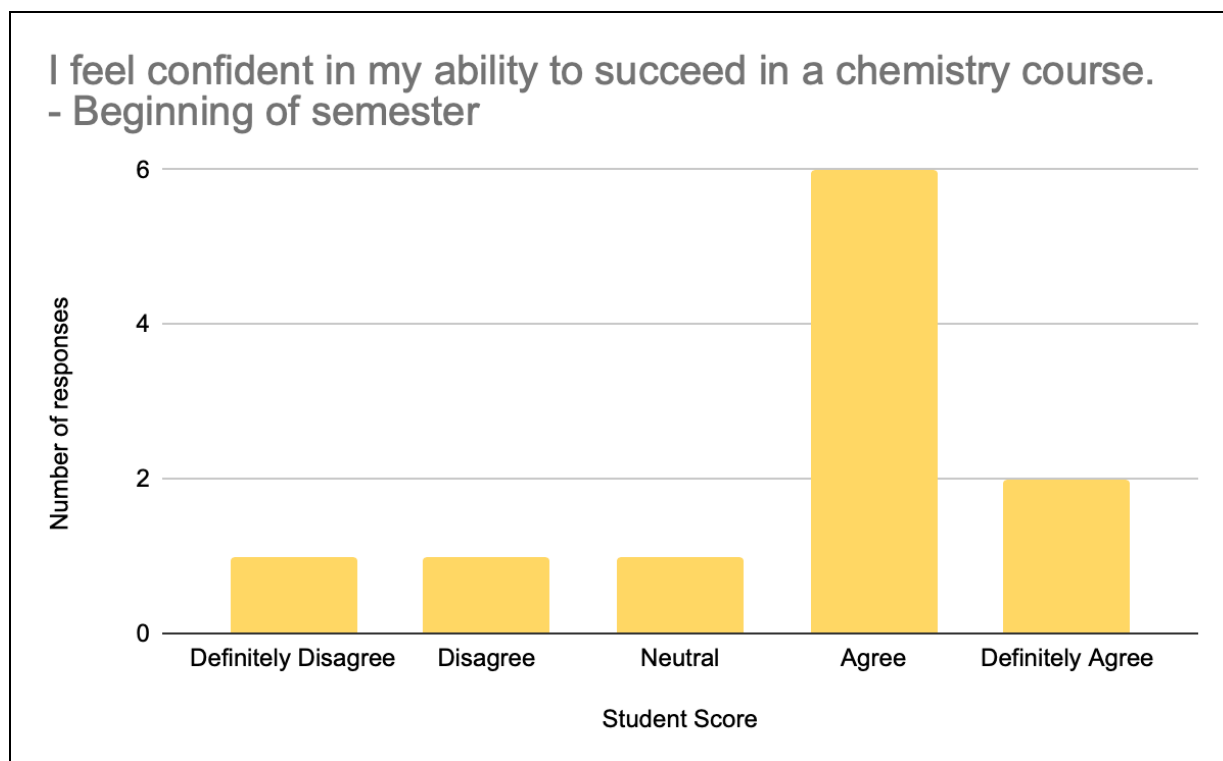


Figure #4: Question #8 Beginning of Semester Score Distribution

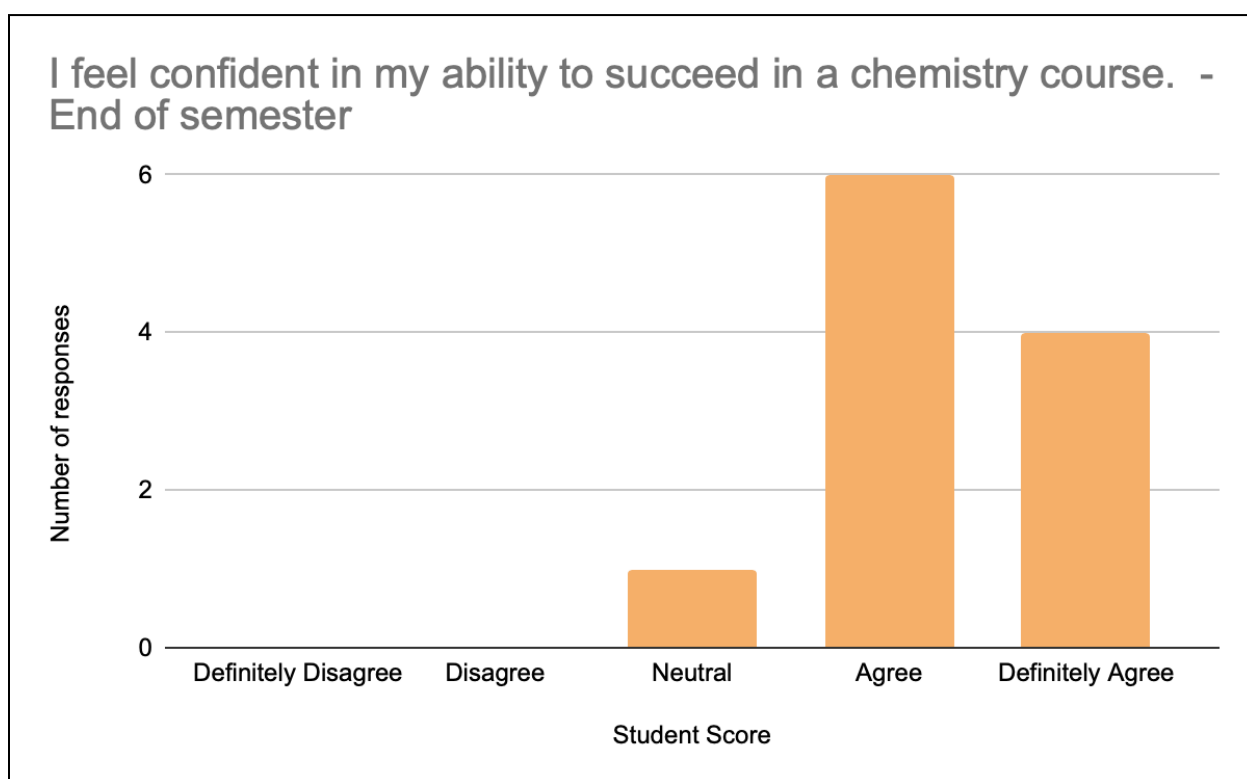


Figure #5: Question #8 End of Semester Score Distribution

Other trends in questions revealed a mid-semester dip where the middle survey indicated a decrease in agreement but overall the end of the semester saw an increase. Questions with this mid-semester dip include: “I am comfortable asking my professors for help” “ I am knowledgeable of the resources available to me” and “How likely are you to attend a tutoring session or a professor's office hours for help?” A possible explanation for this mid-semester dip is that students overestimated their knowledge at the beginning of the semester, but realized their lack of knowledge or likelihood of attending tutoring midway through the semester. A full list of trends consisting of the percent change of average student scores in the beginning to middle and beginning-to-end sections of the semester can be seen in Table #3. In this table all trends that had more than a 10% increase are highlighted in gray, and those with more than a 10% increase are highlighted in red.

Table #3: Overall Trend by Percent Increase of Average Score Fall 2023 semester (questions correspond to instrument order and increases/decreases over 10% highlighted for better differentiations)

Question	Beginning to Middle	Beginning to End
1	5.7% increase	22.9% increase
2	15.8% increase	18.4% increase
3	0.0% change	18.2% increase
4	14.0% decrease	6% increase
5	0.0% change	4.2% increase
6	6.4% decrease	6.4% increase
7	2.2% decrease	15.6% increase
8	7.5% increase	17.5 % increase
9	2.0% increase	8.0% increase
10	6.8 % decrease	9.1% increase
11	11.9% decrease	2.4% decrease
12	0.0% change	1.8% decrease

Students also listed their barriers to success in the surveys. A word cloud has been made for each semester based on student answers. The size of the word in the word cloud indicates the number of times students gave that specific answer for the semester. For the fall 2023 semester, students stated that their main barriers to success were study habits and time management. Other answers include myself, procrastination, bad professors, confidence, mental health, financial issues. These answers indicate that the prevailing issues a lot of students are facing are issues with the soft skills of schoolwork.

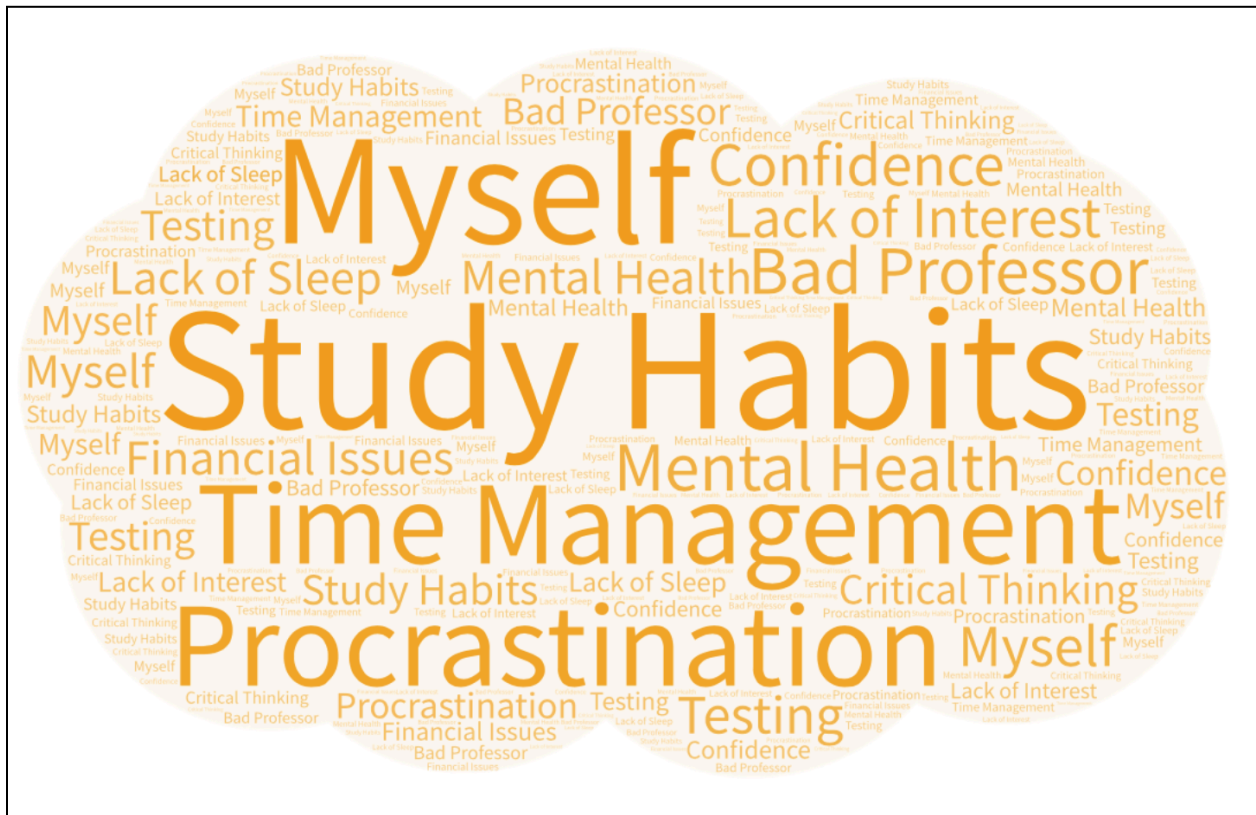


Figure #6: Word Cloud of Barriers Fall 2023

ii. Survey Results Spring 2024

In terms of the same general trends gathered from the fall semester, in the surveys for “What would you rate your current comfort level with first semester chemistry material” the overall trend from the beginning to the end of the semester was that students’ comfort level with the material increased (shown in figures #7-8). For the statement “I feel confident in my ability to succeed in a chemistry course” the general trend for students was that they disagreed more with the statement at the end of the semester instead of the beginning (shown in figures #9-10). These general trends indicate that comfort levels increase throughout the semester on average for students, but confidence didn’t see that shift in the spring 2024 cohort.

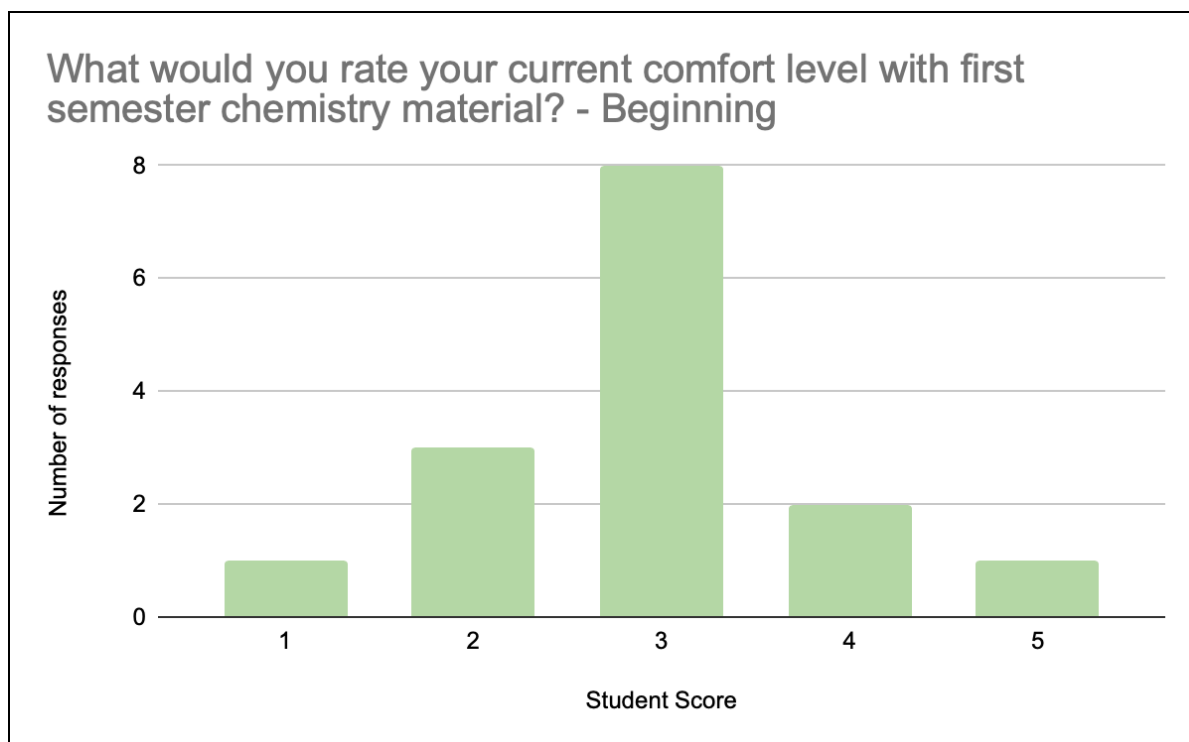


Figure #7: Question #1 Beginning of Semester Score Distribution Spring 2024 (on a scale of 1-5 with 1 being the least comfortable and 5 being the most comfortable)

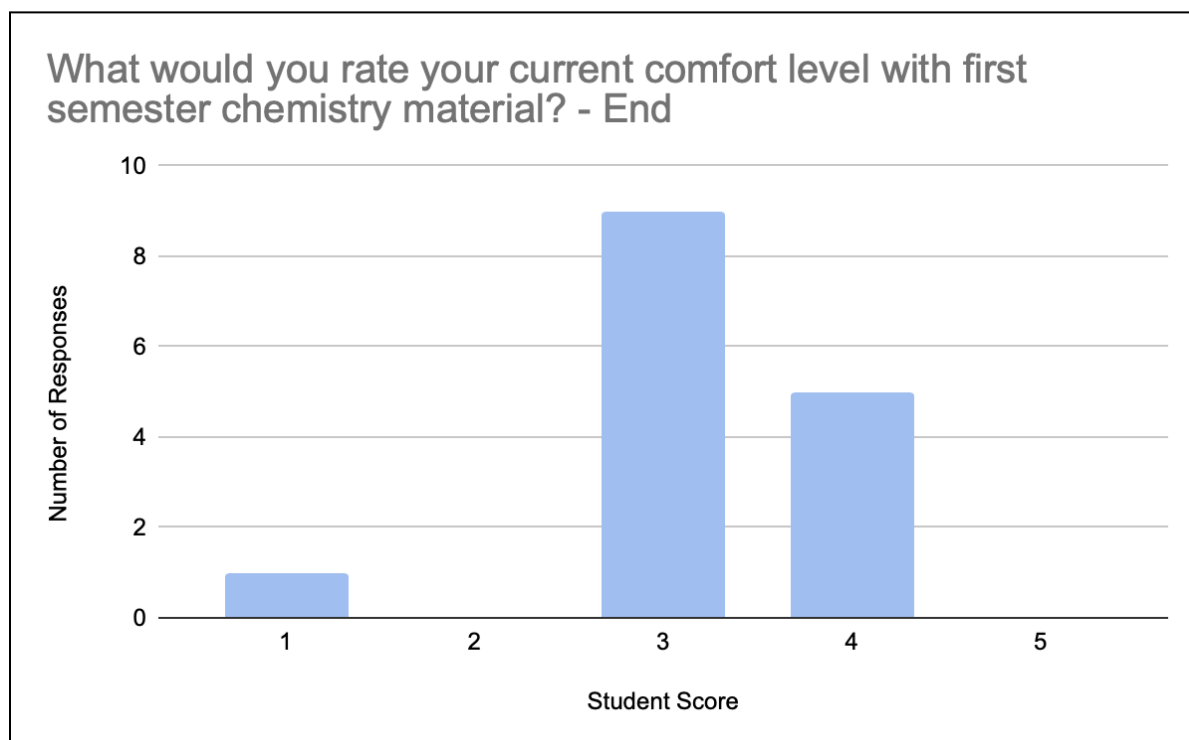


Figure #8: Question #1 End of Semester Score Distribution Spring 2024 (on a scale of 1-5 with 1 being the least comfortable and 5 being the most comfortable)

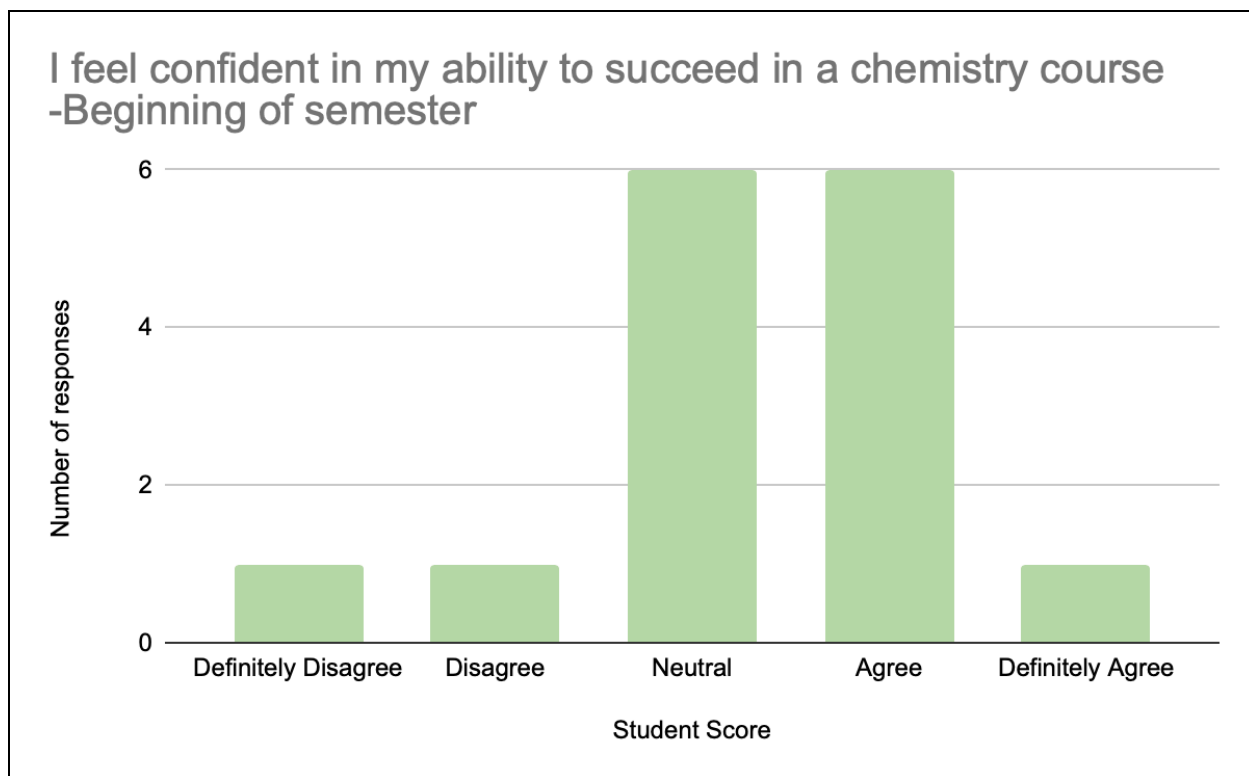


Figure #9: Question #8 Beginning of Semester Score Distribution Spring 2024

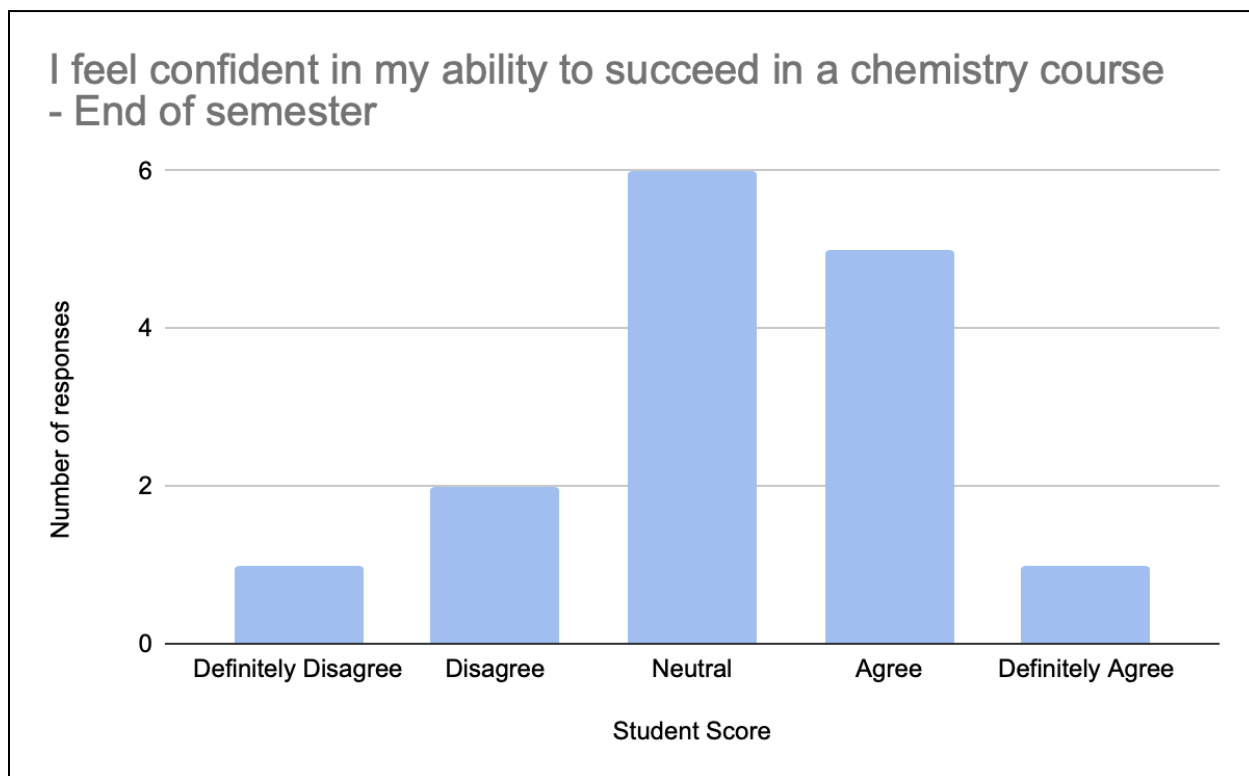


Figure #10: Question #8 End of Semester Score Distribution Spring 2024

A majority of the trends decreased as the semester progressed, which is different from the first semester. The trends in the fall semester with a mid-semester dip did not increase again by the end of the semester. The spring semester also saw a larger drop in “I find chemistry material enjoyable to learn” and “I believe my class attendance is essential to my success” than the fall cohort. A possible explanation for this trend is the group of students. The spring 2024 cohort of students demonstrated less participation and more apathy towards the support course than the fall 2023 cohort. A full list of trends consisting of the percent change of average student scores in the beginning to middle and beginning-to-end sections of the semester can be seen in Table #4. In this table all trends that had more than a 10% increase are highlighted in gray, and those with more than a 10% decrease are highlighted in red.

Table #4: Overall Trend by Percent Increase of Average Score Spring 2024 semester (questions correspond to instrument order and increases/decreases over 10% highlighted for better differentiations)

Question	Beginning to Middle	Beginning to End
1	0.0% change	9.1% increase
2	14.3% increase	11.9% increase
3	4.4% decrease	6.7% decrease
4	3.5% increase	7.0% increase
5	9.1% increase	0.0% change
6	3.2% increase	0.0% change
7	0.0% change	9.8% decrease
8	2.0% decrease	4.0% decrease
9	3.2% increase	4.8% decrease
10	3.4% decrease	8.6% decrease
11	8.1% decrease	8.2% decrease
12	11.2% decrease	9.9% decrease

Students also listed their barriers to success in the surveys. Again a word cloud has been made for each semester based on student answers. The size of the word in the word cloud indicates the number of times students gave that specific answer for the semester. For the fall 2024 semester, students were similar to the fall 2023 semester with their main barriers still being study skills and time management. The difference for the spring 2024 semester is that workload and motivation become prevalent answers for the students. These answers still indicate that the prevailing issues a lot of students are facing are issues with the soft skills of schoolwork.

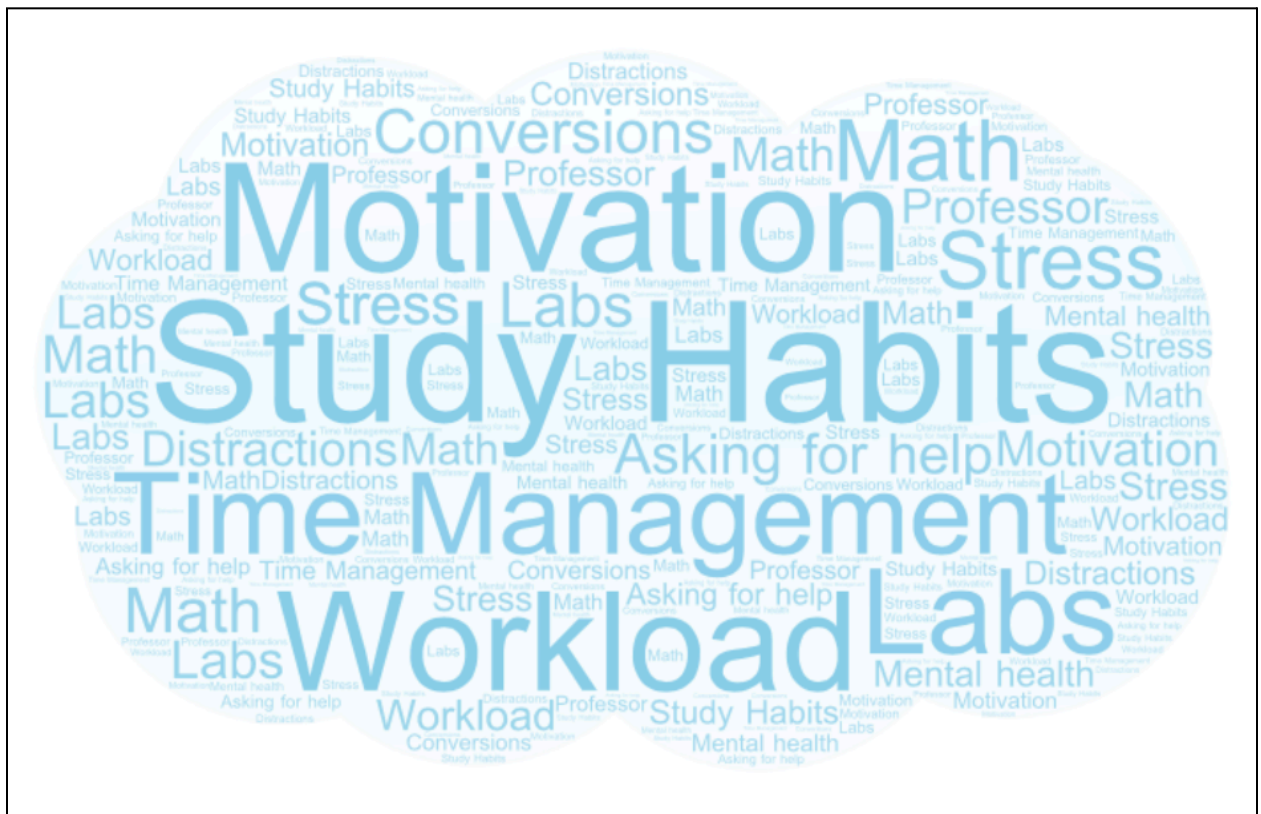


Figure #11: Word Cloud of Barriers Spring 2024

iii. Interview Results

a. Barriers, study habits, and skills for success

When asked what the most difficult aspects of a chemistry class are, the resounding and repeating answer is memorization. Students also mentioned math, as well as the pace and amount of information the course had to cover as an issue. Student #8 stated their difficulty as “just the amount of information, you know you have to fit it all into one semester so it moves very quickly.” These results indicate that students struggle with the amount of work/memorization needed for a chemistry course, but students did not state specific chemistry concepts that were difficult, just overarching aspects of the course.

When asked what their current study habits are, only one student responded with a study practice/habit, which was to review the material and see what they don't understand and then work practice problems on that topic. A few students mentioned that their form of studying is going to LEAD tutoring each week to work on material. The answers match the survey results with study habits being one of the top barriers listed by students. These student responses indicate that the course could benefit from more emphasis on how to study and offer more resources on study habits and practices for students.

A few key themes emerged from their answers when asked what skills students believe are necessary to succeed in a chemistry course. Students #1, #3, #6, and #8 all stated that time management is a necessary skill for students to succeed. Students #2, #4, and #9 all stated that effort and motivation are necessary skills for students to succeed. All but one of the students mentioned soft skills when discussing success in chemistry. The one student who did not mention a soft skill mentioned how students needed to know how to do math to succeed in a

chemistry course. These responses indicate a need to focus on resources that apply to soft skill development and more activities geared toward these issues.

When asked what their biggest barrier to success is, students differed a little from the survey results in having time management as the prevailing answer for their barrier. Two students mentioned how they themselves are their biggest barriers to success. Student #2 stated “my biggest barrier to success is myself, I don't usually think that anyone can affect you the way you can, the way you can succeed is with the help of others but through yourself, your study habits, how do you prepare for homework/quizzes, do you use the resources, can you go to your professors and ask for help. Finding someone who can relay information to you easier, finding any way you can to succeed.” Two other students stated that work ethic or keeping up with material was their biggest barrier to success.

b. Questions about the support course

For the question about how the support course is different from their regular course, the main theme from students was the individualized extra practice the course offers. Students #2 and #5 specifically mentioned practice problems, while students #4, #6, and #10 talked about how the course was individualized to students and focused on what they needed. Student #1 stated that they “feel a lot more comfortable asking questions if I need to, feels more designed to help you rather than throw a bunch of information at you and hope you don't fail” when asked how the support course differs from their regular chemistry course. Multiple students in their answers mentioned that they are more comfortable asking questions during the support course. These answers indicate that the individualized help from the support course is beneficial.

For the question about what activities of the support course have helped students, there were a few prevailing themes for students. Students #2 and #10 specifically mentioned the binder full of information as a helpful resource. Students #1 and #3 mentioned breaking into small groups to work on individual topics as helpful to their learning. Students #4 - #9 all mentioned the additional practice problems and instruction on both lecture and lab material as beneficial to them. These answers indicate the structure of breaking into groups and working on additional problems is very beneficial for the students in the support course.

When asked what activities of the support course students would change, some students focused on asking to do additional problems, and some focused on the course's structure. Students #6, #7, and #10 mentioned that they would like to do more problems while #10 specifically mentioned when the course works on lab material to allot time to do regular course material. Students #4 and #5 mentioned less time spent on resources as a preference. Student #3 mentioned that it could be helpful to do the time management activity monthly which aligns with one of the main barriers or struggles being time management for students. These responses give some feedback on the support course and offer possible ideas for changes in the design or delivery of materials for students in future sections.

Students were also asked what changes or improvements would make learning chemistry more enjoyable. Students #3 and #9 stated that the nomenclature bingo activity we did was fun and helpful. Students #1 and #6 both mentioned that more hands-on or visual materials would be beneficial for learning and make it easier to understand material. Students #4 and #10 both mentioned their professors for their lecture course in opposing ways. Student #10 stated that their teacher has nothing to improve on and is doing a great job teaching chemistry. Student #4 stated that in terms of changes or improvements to make learning chemistry more enjoyable they would

take a different professor than the one they had. These responses indicate that more activity-based learning could be beneficial to students as opposed to solely lecture-based learning. A possible structural change would be to plan short activities based on learning and add them to the schedule of the support course.

iv. Overall Takeaways

Based on the survey results, students' confidence levels generally increased throughout the semester, but other survey questions varied between semesters. The fall semester cohort survey results had general trends of dipping mid-semester and then increasing overall at the end of the semester. The spring semester cohort survey results had general decreasing trends over the semester but usually by 10% or less. The word cloud created for both semesters was consistent between semesters. Both cohorts of students identified their barriers to be soft skills required for success rather than chemistry-specific material. This indicates that chemistry isn't necessarily the main barrier for students. Instead, the skills required to succeed in college as a whole seem to be a barrier.

The interview results provided similar data. Many students mentioned time management as a barrier and could not provide comprehensive study skills. Students also generally believed that soft skills are required for a student to succeed, not math skills or critical thinking skills. Work ethic and motivation were mentioned by a variety of students and were prevalent in the spring semester word cloud. Students overall found the support course helpful for access to resources and extra chemistry practice. Students appreciated the individualized instruction. Suggestions for changes made by students are impractical due to the nature of the support course but a few can be implemented into the upcoming semesters.

V. Conclusion

General trends for students indicate an overall semester increase in confidence levels, knowledge, and comfort in accessing resources. Students indicated that their main barriers are the soft skills that are required to succeed in academia. The student responses indicate that the individualized instruction and practice with material in the support course is beneficial to students. Many students referenced the binder and LEAD tutoring as a resource they both appreciate and utilize. Based on student responses, future focuses for the support course include more activities based on time management and building good study habits. An implementation of the spring 2024 semester was grouping students by section and having them work together on practice problems. The plan is to continue to improve support among students in the support course.

i. Future work

If continued, future work on this project would have three main adjustments: changes to the survey questions, the interview process, and the participant pool. The survey adjustments would be to increase the scale of the survey questions to 1-10 instead of 1-5, and edit the questions for specificity. The survey would have fewer scale questions and more short answer questions, such as “How many hours a week do you spend on chemistry material?” or “Do you regularly attend LEAD sessions or professor’s office hours? Why or why not?” The surveys would also be less frequent to increase student participation.

The interview would have more significant changes. The interviews would be recorded either on a voice recorder or over Zoom if the interview is online. The interviews due to being

recorded would allow for more follow-up questions or further explanation from participants allowing for more detailed results. The interview would contain more confidence-based questions instead and be longer than the 15 minutes allotted for the current interviews.

Another change would be student participants. A separate survey and interview would be created to ask the participants about their confidence and barriers to success but also what resources would be helpful and whether the support course resources would benefit them. Interviewing and surveying more than just the 25-student cohort for the support course would aid in more accuracy in determining student barriers and help gain more data overall.

ii. Possibilities For Course

Possible changes for the support course are to alter the structure to increase in-class instructional time for students, similar to how the organic chemistry support course is set up. In the future, some of the support course style items or activities can be implemented into regular sections of General Chemistry 1 to try to promote student success for students who are not able to enroll in the support course. Lastly, because of the limited enrollment available to students for the support course, a possible solution could be looking towards various success skills courses offered at Appalachian State. An example of these courses would be a college study skills course offered by the student learning center. These possibilities for the future could help make a widespread impact on student success outside of just the support course.

VI. Biographical Chart

Audrey Jean Gay was born to Brian and Catherine Gay on April 7th, 2002 in Winston-Salem North Carolina. She grew up in Winston-Salem North Carolina and graduated from West Forsyth High School in June of 2020. Audrey earned her Bachelor of Science in Chemistry with a concentration in Certified Chemist at Appalachian State in May of 2024. While at Appalachian State University she was a Resident Assistant, a LEAD Tutor for the Chemistry Department, and an Appalachian Student Ambassador. She also worked under Dr. Cecile on her thesis research in Chemical Education and underrepresented student success. In the fall of 2024, Audrey starts her PhD program in Chemistry with a focus on Chemical Education Research at the University of North Carolina Greensboro under Dr. Maia Popova.

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VIII. Appendix

A. Consent for Interviews

Interview Consent

This interview is a tool that will be used to assess the CHE 2530 chemistry support course for thesis research. No identifiable information will be collected during this interview process. Please confirm your consent to participate in this interview by checking the box at the top of the notes packet for the interview. Participation in this research is not a course requirement and your participation or lack thereof will not affect your grades.

Please check the box below to certify that you consent to participating in this interview if you do not consent you may exit the interview.

Please initial below to certify that you received the incentive provided for completing the interview.

Initials _____

Date

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