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Investigating the Relationship between Self-Efficacy and Success in Chemistry Courses

Issa I. Salame
Assoc. Prof., The Department of Chemistry and Biochemistry, The City College of New York of the City University of New York, USA, *isalame@ccny.cuny.edu*

Hussain Khan
The Department of Chemistry and Biochemistry, The City College of New York of the City University of New York, USA, *hussain.k9299@gmail.com*

Eman Megally
Department of Psychology, The City College of New York of the City University of New York, USA, *emegall000@citymail.cuny.edu*

Self-efficacy is an individual's belief in their ability to successfully perform a specific task. The purpose of this research project is to examine students' self-efficacy and its relationship to success and performance in chemistry courses at the college level. The research study took place at the City College of New York, a minority-serving, Commuter College in an urban setting. The research participants were students enrolled in chemistry courses. The research method used in this study consisted of a questionnaire that was made up of Likert-scale and open-ended questions. The Likert-type questions were on a five-point scale that was converted into numerical values, and the averages of the students' responses were taken. For the open-ended questions, the data was coded and compiled based on categories and similarities, converted into percentages, and used to create bar charts. Our findings show that there is a positive correlation between self-efficacy and GPA, as well as the number of college credits completed. Additionally, the findings suggest that students' confidence in their skills, which is influenced by characteristics including mastery experiences, structured academic support, and self-regulated learning practices, is strongly associated with their academic achievement. The study underlines the necessity of creating educational environments that promote self-efficacy through focused interventions.

Keywords: self-efficacy, performance, academic achievement, chemistry, performance

INTRODUCTION

In recent years, the concept of self-regulation in academic success and learning has gained increasing interest. Self-regulation refers to how students regulate their learning system behaviorally, metacognitively, and motivationally (Zimmerman, 1990a). Self-

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efficacy, on the other hand, refers to an individual's personal belief or confidence in their ability to effectively perform specific tasks (Yusuf, 2011). Self-regulation is not a mental ability or an academic performance skill; self-directive process by which learners transform their mental abilities into academic skills, which has become a major part of education and is considered an essential skill (Zimmerman, 2002). Self-regulated learners are more motivated in learning and can create different strategies to achieve a goal that is difficult but possible to attain. Self-regulated learners exhibit a high sense of efficacy in their capabilities, which influences the knowledge and skill goals they set for themselves and their commitment to fulfill these challenges (Zimmerman, 1989, 1990b).

Self-efficacy theory emphasizes that human action and success depend on the depth of interactions between one's personal thoughts and a given task (Bandura, 1986, 1997). It is especially crucial for college students, as it affects their learning and performance during an integral part of their lives. Chemistry is one of these branches of study that needs to be taught uniquely because students often struggle through chemistry and unfortunately do not do as well during classes because of the abstract nature and complexity of the information (Nakhleh, 1992). Since chemistry is both conceptual and abstract, students often find it difficult to apply what they learn to real life because there are principles that work at the molecular level (Dalgety & Coll, 2006).

Self-efficacy is a multifaceted construct that is integral to the social-cognitive approach. It also helps to conceptualize individuals as being purposeful, proactive, self-evaluative, and self-regulatory (Bandura, 1989). Experiences with success or failure are associated with strong or weak feelings of self-efficacy and are predictive of performance for advanced college students (Gore, 2006). Successful academic performance is associated with increased confidence and it will likely encourage students to take greater responsibility for successful task completion (Zimmerman & Kitsantas, 2005). Self-efficacy is crucial in that it can help change how people study and how well they perform. The importance of self-efficacy becomes more pertinent when considering procrastinators who perform poorly not because they lack knowledge of useful strategies but because they lack the confidence to apply these strategies in starting and completing tasks (Klassen et al., 2008). In school settings, students who are asked to provide self-efficacy judgments about themselves and their performance in subjects that are not their expertise, often have expectations that are based on the ability to learn and generalized past performances rather than the actual knowledge of the task (Zimmerman et al., 1992).

People can have different senses of self-efficacy which can either hinder them or help them overall. Different experiences with success or failure are associated with strong or weak feelings of self-efficacy and are predictors of performance for advanced college students (Gore, 2006). Individuals with a low sense of self-efficacy possess negative thoughts and think of task demands as threatening instead of as challenging and will set low objectives for themselves (Suraya & Ali, 2009). Inefficacious individuals usually avoid challenging tasks and if they attempt a challenging task, they are more likely to give up more easily than individuals with high efficacy. When inefficacious individuals fail, they attribute the unsuccessful result to a lack of ability and tend to lose faith in

their capabilities. If these inefficacious individuals succeed, they are more likely to discredit themselves and give credit to external sources (Bandura, 1986 & 1997).

Students with a high sense of self-efficacy tend to be more persistent, hardworking, and willing to take on difficult tasks while effectively managing their anxiety. They are also more likely to use critical thinking to solve problems compared to students with low self-efficacy (Phan, 2009). Individuals with a high degree of self-efficacy are more likely to engage in challenging tasks, persist with them for longer periods, and put in greater effort. Additionally, research has shown that high-ability students have stronger self-efficacy, are more accurately calibrated, and have more precise self-perceptions (Zimmerman et al., 1992). When highly efficacious individuals experience failure, they tend to attribute it to a lack of effort or external factors rather than personal inadequacy. They are less likely to discredit themselves. Conversely, when they succeed, they attribute their achievement to their abilities. Ultimately, individuals with higher self-efficacy are also more likely to engage in self-regulating processes such as goal setting, self-evaluation, and self-monitoring (Zimmerman, 2000).

Self-efficacy theory postulates that individuals acquire information from various factors to assess their efficacy. Four key factors influence self-efficacy: enactive mastery experience, vicarious experience, verbal persuasion, and physiological and emotional states (Aydin & Uzuntiryaki, 2009). Enactive mastery experience is the most influential of these factors. It refers to an individual's past experiences with success and failure. Teachers' self-efficacy is mostly influenced by mastery experiences (Zee & Koomen, 2016). Prior experiences are internalized, with past successes boosting self-efficacy and repeated failures diminishing it (Bandura, 1986 & 1997; Lane et al., 2004). Vicarious experience occurs when individuals compare themselves to others, such as peers with similar intellectual levels and abilities. Watching their peers succeed helps to increase self-efficacy and watching them fail lowers it.

An individual's physiological state can impact their self-efficacy when bodily symptoms, such as an increased heart rate or sweating, etc. This can cause the individual to believe that they lack the necessary skills, thereby lowering their self-efficacy (Schunk, 1991). However, these factors are cognitively appraised by the individual and do not directly influence efficacy. Efficacy appraisals are inferential and depend on attributional factors as well as other influences (Schunk, 1989).

Goal setting plays a crucial role in affecting motivation. When students are given a goal by a teacher or role model, they are more likely to experience a sense of self-efficacy upon achieving it (Bandura, 1988). Instructors' roles in being enthusiastic about concepts they teach, having the ability to relate to their students, and informing students of their roles and part in being success can enhance students' success and self-efficacy which leads to improved performance (Pedota, 2015). An increase in self-efficacy helps sustain motivation and increase skill development. When making their commitment to attempt the goal, they will engage in tasks and activities that they believe will help them attain it. They become more motivated to complete tasks that support their progress, such as rehearsing information, actively observing and listening to instruction, and demonstrating persistence, etc. Self-efficacy is further reinforced

when students monitor their progress and recognize how their efforts have paid off (Elliot & Dweck, 1988). Self-efficacy also increases when students receive feedback on their goal progress. In 1985, Schunk found that self-set goals helped to promote self-efficacy and that those who self-set goals and those who had goals given to them demonstrated greater motivation than children who had no goals. It was concluded that students who set their own goals achieved the highest levels of self-efficacy and skill development compared to those with assigned goals or no goals at all.

Many research studies are exploring the relationship between self-efficacy, mental effort, various cognitive dimensions, learning strategies, etc. One research demonstrated that self-efficacy can predict writing performance. This was examined by having students write an essay at the beginning and end of the year, with their efficacy for writing objectives assessed at each time (Meier et al., 1984). Learning strategies were found to help task performance, influence motivation, and strengthen self-efficacy. The belief that a specific strategy can improve comprehension provides a sense of control over success, thereby increasing self-efficacy and encouraging individuals to apply those strategies. Pintrich and De Groot (1990) conducted a study in which seventh graders were assessed for self-efficacy while using various strategies, including effort management and persistence. The results showed a positive correlation between self-efficacy and reported strategy use. Similarly, Zimmerman and Martinez-Pons (1990) studied students in Grades 5, 8, and 11, evaluating their use of various learning strategies, including motivational components and their efficacy in performing mathematical and verbal tasks. The findings indicated that self-efficacy was positively related to reported strategy use across different domains.

Self-concept is an individual's collective self-perceptions that are formed through experiences with interpretations and their environment. It is also influenced by reinforcements and evaluations by significant other persons (Shavelson & Bolus, 1982). Self-concept is comprised of self-esteem, self-perception, self-confidence, stability, and self-crystallization. Self-esteem refers to an individual's sense of value or self-worth, or the extent to which people value, appreciate, or like themselves (Lane et al., 2004). Stability refers to the ease or difficulty of changing the self-concept, and it depends on how crystallized or structured an individual's self-beliefs are. Beliefs become crystallized with repeated similar experiences (Rosenberg & Kaplan, 1982). Self-concept is an overarching view of oneself, encompassing both academic and non-academic perceptions, including emotional, social, and physical aspects (Schunk, 1991). Within this framework, self-efficacy refers to one's belief in their ability to succeed in specific situations. For example, an individual may feel highly efficacious in math and science, and moderately confident in English and the arts, but have significant doubts about their physical sense. Self-efficacy explains that the best predictor of behavior is an individual's perception of their ability in a given situation, which can change over time (Schunk, 1989). Moreover, Self-efficacy may affect the other ideas under the umbrella term self-concept. For instance, if a person has high levels of self-efficacy on tasks within an occupation in which he/she has invested much self-worth then there is likely to be a positive correlation between self-esteem and self-efficacy (Bandura 1997).

Researchers report that students' self-efficacy plays a significant role in predicting students' academic achievement, where students' perception of their self-efficacy is consistent with their academic achievement as it relates to their GPA (Moussa, 2023). Furthermore, it has been found that a positive correlation exists between self-efficacy and academic engagement which leads to improved performance and academic success (Fatimah et al., 2024). Self-efficacy has been found to improve persistence among college students and could play a role in improving students' cognitive variables related to persistence decision making (Wright et al., 2012). Additionally, self-efficacy and motivation have been found to have a significant role on grades (Zou, 2025).

Researchers have investigated the relationship between efficacy and college student's confidence in enrolling in specific majors and career choices in science and mathematics. Many students often enroll in introductory chemistry classes to fulfill credit requirements mandated by the university and thus, researching how to improve teaching to students who are non-chemistry majors is important (Nakhleh, 1992). These are the students who are least likely to exhibit high self-efficacy in chemistry (Uzuntiryaki & Aydin, 2009). Also, it has been shown that efficacy beliefs in mathematics usually tend to predict students' choice of math courses and majors more so than previous achievements in mathematics (Pajares & Miller, 1995). Nevertheless, a student in chemistry is more likely to have high efficacy expectations for a particular task if he or she has already successfully completed that task. When asked to explain their self-efficacy in college chemistry, students noted their prior success in chemistry as a common theme (Dalgety & Coll, 2006). Studies have demonstrated that science self-efficacy is associated with science achievement and science-related choices across grade levels (Britner, 2008). At the college level, science self-efficacy predicts achievement (Andrew, 1998) and persistence in science-related majors and career choices (Dalgety & Coll, 2006; Gwilliam & Betz, 2001).

Emphasizing self-efficacy is essential, as it helps individuals approach new challenges with confidence while enhancing their performance, motivation, and behavior (Bandura, 1986). Studies have shown that active learning has a positive influence on self-efficacy and thus enhancing students' learning outcomes (Kustyarini, 2020). The Teaching method carried out by the instructor, which include active learning methods, improves student ability to perform a given task and to self-evaluate, which contribute to enhancing students' self-efficacy (Jeong et al., 2019). Furthermore, evidence suggests that there is a positive association between self-efficacy and student-centered mode of instruction (Hwang, 2021). We should note that technology can be used to improve learning and self-efficacy, self-regulation, and achievement (Zetriuslita et al., 2021). Digital learning also has been found to improve achievement, enhance engagement in the material, and improve self-efficacy (Widowati et al., 2023). In one study, authors report that they found a positive and direct correlation between students' learning of mathematics and self-efficacy (Muhtadi et al, 2022).

METHOD

Researching how self-efficacy influences students' future success is crucial, as it can change teaching techniques for a plethora of classes. This research project will focus on

how self-efficacy can ultimately help students in chemistry courses. Self-efficacy plays a vital role in college-level chemistry, where complex theoretical concepts and problem-solving skills are essential. Chemistry requires abstract thinking and frequent practice, making it particularly challenging for many students. Since each student has unique intellectual abilities and learning preferences, it is important for professors to implement diverse teaching strategies. Some students may not need the extra explanations in comparison to others. Therefore, Instructors should integrate self-efficacy principles into their teaching, as students with lower self-efficacy tend to study less, struggle with motivation, and blame the professor if they don't understand the lecture. They will avoid doing tasks that will help them in the class. Thus, it is important to include classes that revolve around working with classmates to promote and increase self-efficacy in the students.

Other strategies for integrating self-efficacy in the classroom include setting short-term, realistic yet challenging goals, avoiding student comparisons, incorporating student interests into lectures, and fostering a supportive, approachable relationship with students. These methods can encourage students to engage more actively and perform better in class. These are some ways professors can try to include self-efficacy in lectures. This study aims to assess the effectiveness of self-efficacy integration in ordinary chemistry courses. The results from the study are hypothesized to indicate that the use of self-efficacy to help teach students will increase the grades of the students in comparison to the prior chemistry courses.

The research study took place at the City College of New York (CCNY), which is a commuter college in an urban environment. The CCNY is a minority-serving institute. The number of participants in this research project is 179. The students' majors included chemistry, biology, chemical engineering, civil engineering, and pre-health professionals. The majority of the students were minority students mostly Latino and African American. The student population also included White, Asian, and Middle Eastern students. We should note that the overwhelming majority of our student population come from lower socioeconomic backgrounds and qualify for financial aid.

The inclusion criterion for the participants is that all students registered for science courses at the City College of New York and are 18 years of age or older were eligible to participate in the project. The reason is that these participants provide valuable information that can inform instructors about impact of self-efficacy on learning and performance in science courses. The exclusion criterion is that minors cannot participate in this study.

Two experts have examined the survey and consent that the questions appropriately adequately express the investigation about transitioning to online learning. The reliability coefficient was determined to be 0.84 using the test-retest procedure. The data from the Likert-scale questions were analyzed using single-factor ANOVA, revealing that $p < .001$ and p-value < 0.05. This confirms the rejection of the null hypothesis and verifies a strong relationship between the variables.

The Likert-type questions were on a five-point scale that were converted into numerical values, as follows: strongly disagree (1), disagree (2), neutral (3), agree (4), and

strongly agree (5). The averages of the students' responses were taken and reported in the table. For the rest of the questions, open-ended, we collected the data, compiled the answers based on categories and similarities, converted them into percentages, and used them to create bar charts based on the percentages of the answers provided by the research participants. We should note that all of the research data was based on the survey that was administered and collected from research participants. The percentages were calculated based on the number of participants who provided answers that fit into similar categories based on the total number of responses.

FINDINGS AND DISCUSSION

Table 1
Likert-type questions and average answers from respondents (1 least – 5 most)

Likert-type Question	Average Answer from Respondents
When compared to other students, do you feel that you are the on same level in terms of science learning?	3.23
Do understand most ideas that you read in the textbook?	3.43
Once you finish an exam, can you tell how well you performed?	3.64
When answering questions, do you consider multiple ways to do it?	3.51
Do you try to reword different pieces of lecture material in your own words?	3.72
Do you participate during class discussions/lectures?	3.24
Do you arrange times and places to study without distractions?	3.98

Table 1 shows the average answer to the Likert-scale questions. The first five questions look at how confident students are in academic knowledge in relation to themselves and to others. They illustrate the different beliefs of the students in their knowledge and how they fare during exams. The other two questions look at how these students act in terms of studying. For the majority of the questions, the answers from the respondents suggest an agreement. This shows that most students are somewhat confident in their knowledge and put a decent amount of effort into studying. Self-efficacy is the idea that someone believes in the fact that they can accomplish a task and this confidence makes it more likely they will accomplish it. Therefore, the confidence that these students have is essential to their learning because it will make them more likely to have succeeded in doing so.

Students expressed the most confidence in "arranging distraction-free study environments" average: of 3.98 and "rephrasing lecture material into their own words" average: of 3.72. Confidence in participating in class discussions is also considered to be a high average: of 3.24 which highlights the importance of self-efficacy. Self-efficacy promotes not just students' confidence in comprehending academic information, but also their use of successful study techniques such as creating distraction-free study settings and rewording content. Researchers found a positive correlation between goal setting and self-efficacy (Burns et al., 2018).

These findings are consistent with Zimmerman's (2000) research on self-regulated learning, which suggests that strong self-efficacy is associated with efficient study habits such as planned study schedules and active engagement with content Schunk (1991). Students' strong confidence in generating distraction-free settings demonstrates

their capacity to manage their external circumstances to improve attention, which is an important predictor of academic achievement (Klassen et al., 2008). This relationship is demonstrated in Table 1, where students' high average score for creating distraction-free study surroundings reflects their strong self-regulatory abilities. The findings imply that promoting self-efficacy could boost students' confidence and study habits, thereby increasing their chances of success.

Furthermore, students who have high self-efficacy are more likely to actively engage with academic material and participate in class. The relationship between self-efficacy and active engagement emphasizes its relevance in promoting deeper learning and connection in academic environments. For instance, rewording lecture content promotes deeper cognitive processing and recall Pintrich and De Groot (1990). This relationship is seen in Table 1, where students expressed high-class engagement (average: 3.24) and reworded different pieces of lecture material in their own words (average:3.72) which all are indicators of self-efficacy. Furthermore, researchers report that, within a school system, interpersonal relationships, belonging, and academic achievement have a positive association with self-efficacy (Zysberg & Schwabsky, 2020).

Table 2
Likert-type questions and average answers from respondents (1 Never – 5 Always)

Likert-type Question	Average Answer from Respondents
How well can you use an appropriate formula to solve a science related problem?	3.77
In the science laboratory section, how well can you carry out experimental procedures?	4.04
How well can you interpret chemical equations?	3.41
How well can you apply a set of chemistry rules to different elements of the periodic table?	3.72
How well can you explain the fundamental concepts of science?	3.69
How well can you create a laboratory report based off the findings of experiment?	3.93
How well can you apply a theory learned in lecture to a laboratory experiment?	3.71
How well can you explain something learned in the science course to another person?	3.66
How well can you tutor another student in a science course?	3.25
How well can you determine appropriate units for a result determined using a formula?	3.82
How well can you ensure data taken in an experiment is accurate?	3.77

Table 2 above includes 6 questions from the first part of the survey. The first question and second questions look at how well lab reports can be made and lab procedures can be followed. The average answer was 3.93 and 4.04 respectively which can be taken as confident. The second, third, fourth, and sixth questions illustrate how well the students believe in their knowledge of science in different settings. The average answer for these ranges from 3.41 to 3.77 which can be taken as somewhat confident. These questions ask how confident the students are in performing the different tasks related to introductory chemistry. The confidence of the students is important in that it can potentially lead them to succeed in the class. The average answers for the questions being above three is a good sign as it can lead to an increase in self-efficacy. Research evidence shows that there is a positive association between self-efficacy and academic

achievement and achievement-related outcomes, as in grades and self-perceptions, in school settings (Honicke & Broadbent, 2016).

Table 2 also includes the average answer on the Likert scale for 5 questions, with 5 being the most confident and 1 being the least. These questions looked at how confident the students were in their knowledge. All the answers were above 3. This indicates that an average amount of students are somewhat confident in their knowledge. It signifies the confidence levels of the students. Unfortunately, the data to correlate the confidence levels to the test scores is not available. But overall, the self-efficacy/confidence levels of the students are considered high.

The most confidence was found in "carrying out experimental procedures" (4.04) and "creating laboratory reports" (3.93). Tasks requiring conceptual comprehension, such as "interpreting chemical equations" (3.41), had slightly lower scores. These findings suggest that students feel more competent in procedural tasks than in conceptual ones. This is supported by Aydın and Uzuntiryaki's (2009) research which found a significant correlation between self-efficacy and students' confidence in doing chemistry-related activities. Their research found that students with high self-efficacy in chemistry performed better in laboratory settings and interpreting complex chemical concepts, which correspond directly to the high confidence scores in Table 2 for tasks such as formula application and conducting experiments (average: 3.77 and 4.04, respectively).

Additionally, Dalgety and Coll (2006) examined how first-year chemistry students' self-efficacy levels affected their performance. They discovered that confidence in implementing theoretical concepts in laboratory environments considerably improved student performance. Table 2 shows that students had moderate-to-high confidence in applying lecture-based theories to laboratory experiments (average: 3.71). Such findings emphasize the importance of self-efficacy in connecting academic knowledge with actual practice. This is consistent with research on self-efficacy which has been found to positively impact academic success, as measured by grade point average, and persistence in academic major in first-generation college sophomore students at California State University (Vuong et al., 2010).

Moreover, Hofstein et al. (2001) stated that laboratory settings help students develop self-efficacy by providing hands-on experiences. Their research found that involving students in well-designed lab activities boosts their confidence and ability to compose accurate lab reports, as seen in Table 2 (average score: 3.93). These findings imply that laboratory environments not only improve or deepen content understanding but also boost self-regulation and problem-solving abilities, which are critical for academic success in chemistry.

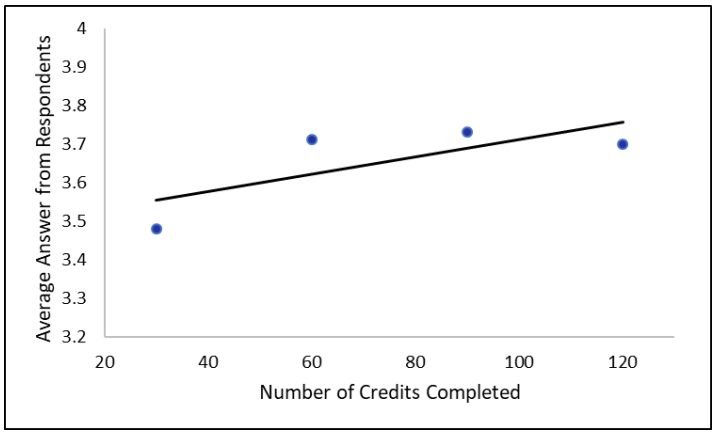

Figure 1
Linear Regression graph of the average responses to the last 11 questions asked in the survey vs. the average number of credits completed by the student

Figure 1 is a line graph that compares the number of credits completed with the average answer of the last 11 questions asked. As you can see the graph has a positive slope which indicates that there is a correlation between the number of credits and the average answer to the questions on the Likert-type part of the survey. This indicates that with experience and time, students who took more classes and completed a number of credits had an increased confidence. The average answer on the Likert scale increased as the number of credits increased which indicates that the number of credits can potentially be positively correlated with confidence in students' learning ability.

Numerous studies support this finding, emphasizing the strong relationship between academic achievement and self-efficacy. In one search study, authors demonstrate that academic self-efficacy changes with experience when students master academic activities over time, their confidence and drive increases. The study underlines the importance of positive academic experiences in developing confidence in one's capacity to handle and succeed in challenges in the future (Artino et al, 2020). Similarly, a study done by Utah State University demonstrated that completing more credits or courses greatly increases self-efficacy, as students perceive themselves as more capable and prepared for students who successfully navigate the challenges of additional coursework have a stronger conviction in their academic ability, which leads to better performance and more persistence in their studies (Proctor et al., 2011).

The relationship between self-efficacy and time to degree completion among doctoral students further emphasizes the relevance of self-efficacy in promoting academic persistence and facilitating timely degree completion. The study found that when students gain experience and credits, their confidence increases allowing them to face educational problems more successfully and make continuous progress. Academic achievement, in turn, boosts self-efficacy and promotes the development of critical skills like time management, self-regulation, and problem-solving, all of which lead to better academic performance (McBrayer et al., 2018).

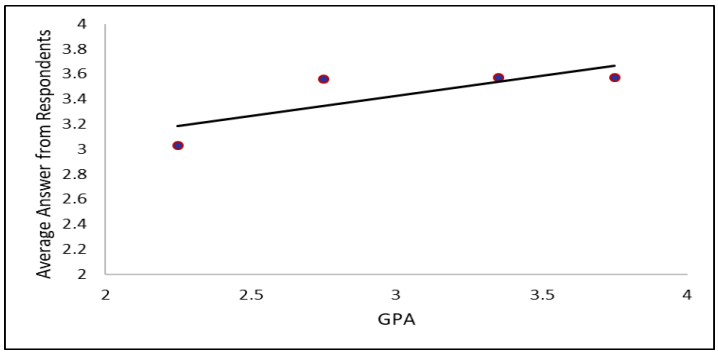

Figure 2
A linear regression curve that correlates the average response to the first 7 Likert-Scale questions vs. the average GPA

This is a linear regression graph that compares GPA with the average answer of the first 7 questions. An increased GPA is seen to correlate with an increase in average answers. The seven questions revolve around asking how much effort students put into studying and class time. Additionally, one of the questions asks how well the student thinks they fare in terms of academic ability in comparison to their classmates. The positive linear correlation between GPA and the average answer on the Likert scale for those seven questions indicates that the students who put more effort into different ways of studying ranging from being more active in class, reading the textbook, studying without distractions, and more. As students put more effort into studying and finding different ways to use the material given to them, they are more likely to gain self-efficacy in the topic they are studying. Students with a higher confidence score to those questions would engage in learning by themselves more often and are more confident in learning from lectures and the textbook. This correlation is consistent with the self-efficacy theory, as a greater confidence level in one's ability to do something should correlate with increased effectiveness of the task.

Several studies support the connection between self-efficacy, study habits, and academic outcomes. Zimmerman and Bandura (1994) found that self-efficacy motivates students to engage in self-regulated learning strategies, such as studying in distraction-free environments and actively engaging in class discussions. This is consistent with the findings in Figure 2, where students who expressed stronger confidence in these areas also had better GPAs. Similarly, Schunk (1991) reveals that self-efficacy directly improves academic accomplishment by encouraging persistence, effort, and the application of effective learning techniques. Students who engage in activities such as reading textbooks, rephrasing content, and exploring diverse problem-solving approaches and behaviors highlighted in the survey are more likely to excel academically.

Also, the correlation between confidence and GPA is further supported by the work of Pintrich and De Groot (1990), who identified self-efficacy as a significant predictor of academic performance. Their study demonstrated that students with higher levels of

confidence are more capable of learning independently and effectively applying knowledge from lectures and textbooks. This aligns with the findings presented in Figure 2, which indicates that students with greater self-efficacy have more frequent engagement in self-directed learning, ultimately contributing to their higher GPAs. Self-efficacy is fundamental to college student learning and success which includes students' personalities, motivational factors, behaviors, among other factors that determines students' performance and success (van Rooij et al., 2017).

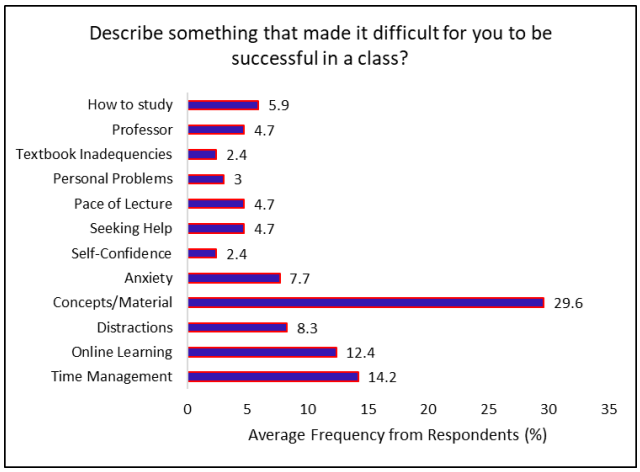

Figure 3
Displays the average frequency response given to the open-ended question

This graph shows the average frequency of answers the students wrote down when asked to describe something that made it difficult for them to be successful in a class. The answer with the highest frequency was concepts/material. This indicates that the material given to students is too dense and needs to be broken up into smaller parts/tasks. This relates to self-efficacy as we have seen that self-efficacy can help students achieve their goals because they are confident to do so. By breaking down the material into smaller sections, students are more likely to understand the information because there is less material at a given time. With this, they are more likely to gain confidence with the smaller sections because of the increased simplicity. Moreover, around 14 percent of the students agree that time management seems to be an obstacle to learning and 12 percent of students seem to attribute their struggles to the online learning mode adopted during the pandemic. About 8 percent claim that home distractions influenced their ability to succeed in a course and approximately another 8 percent refer to anxiety as a deterrent to learning and success.

As Figure 3 depicts, the most frequently reported issue is the complexity of course material, demonstrating that dense and abstract content presents a significant barrier to understanding. This finding aligns with prior research emphasizing that breaking down complex content into smaller, more manageable sections improves comprehension. (Artino et al., 2020). Simplifying course material enables students to gain confidence by

completing smaller tasks, leading to a greater sense of accomplishment and competence, thereby strengthening self-efficacy. Time management was also identified as a challenge, with precisely 14.2 % of students considering it a significant barrier. This finding aligns with (Luo et al., 2023) research, which highlights time management as a critical component of self-regulated learning. Students who struggle to manage their schedules effectively often report lower engagement and lower academic performance, underscoring the need for institutional support, such as workshops or tools to help students develop time management skills (Luo et al., 2023).

Furthermore, the shift to online learning, which was mentioned by 12.4% of students, is another major challenge aggravated by the COVID-19 pandemic. Additionally, 8.3% of students cited home distractions and anxiety as significant challenges to academic success. Research on indicates that these factors can significantly diminish self-efficacy and hinder academic achievement. Anxiety, in particular, often leads to recurring patterns of avoidance and withdrawal. Therefore, providing mental health support and creating an environment conducive to focused learning is essential (Hayat et al., 2020).

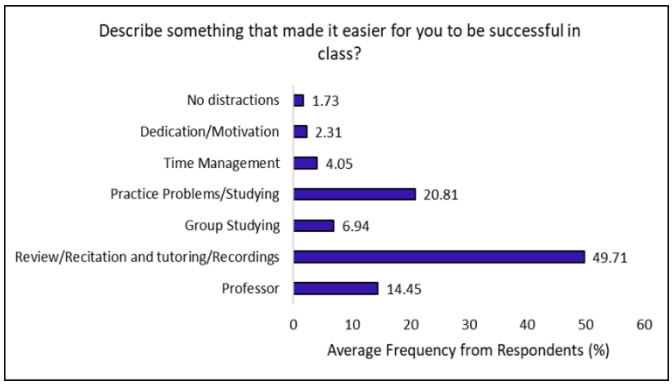

Figure 4
Displays the average frequency response topic to the free-response question found in the graph

Graph 4 illustrates the average frequency the students put down for something that made it easier to be successful in class. The answer with the highest frequency is review/recitation and tutoring/recording. It had a 49.71% which indicates just about half of the class appreciated and excelled due to these review sessions, recitation, and tutoring. The review sessions and problem-solving sessions were important to the students because they gave them chances to repeatedly answer and ask questions based on the material. The increased repetition of answering practice questions helped students fully learn the material and concepts all the while increasing their confidence in answering those questions. The increased study sessions ultimately can increase the student's self-efficacy. Notably, 20.8 percent of students attribute success and learning to studying and practicing problems. Additionally, 14.5% recognize the instructor's role as a significant factor in their learning and successful course completion. A smaller

percentage of students emphasize group studying and peer discussions as contributors to their success.

Figure 4 depicts the characteristics that students reported as helping them succeed in class. Review sessions, recitations, and tutoring were the most commonly reported variables, with almost half of respondents (49.71%) mentioning them. These findings highlight the need for organized educational assistance in reinforcing comprehension while boosting confidence. According to Dalgety and Coll (2006), collaborative educational experiences such as recitations and problem-solving sessions are important in increasing self-efficacy because they allow students to apply theoretical concepts in a practical, low-stress setting. These sessions help students achieve mastery of the content, increasing their confidence in their ability to perform well academically.

Self-regulated studying and practice were also significant, with 20.8% of respondents attributing their success to these activities. This aligns with the findings of Zimmerman and Martinez-Pons, who highlight that self-regulated learning strategies, such as goal setting and problem-solving exercises, are highly effective in improving academic performance. Students who actively manage their learning processes through individual practice develop greater confidence in their abilities and a deeper understanding of course material.

Another important factor is instructor support, which 14.5% of students attributed to their academic success. This finding aligns with Tschannen-Moran and Hoy (2001) who emphasize educators' critical role in increasing student confidence through constructive feedback and the construction of a supportive learning environment. Educators who successfully engage students, explain complex topics, and provide typical encouragement contribute to the development of self-efficacy. Lastly, peer cooperation and group discussions, though less frequently cited, were also considered valuable. Research from Learning Environments indicates that collaborative learning spaces foster a sense of community and shared responsibility, which helps students build confidence in their academic abilities while benefiting from diverse perspectives and problem-solving approaches.

CONCLUSION

Overall, our data suggest that there is a positive correlation between the number of college credits completed by the students and their confidence level. We should note that the student population is diverse ethnically, financially, and in their academic abilities. The greater number of credits correlating to a higher confidence score is meaningful because as students take more classes, they start to gain more confidence in their abilities. Additionally, our data suggests that there is a positive relationship between students' grade point average (GPA) and confidence. Practicing problem-solving questions was important as students had more experience with different questions asked. This overall would increase a student's confidence in their ability because they are exposed to questions repeatedly and work on improving the students' enactive mastery.

The findings suggest that students' confidence in their skills, which is influenced by characteristics including mastery experiences, structured academic support, and self-regulated learning practices, is strongly associated with their academic achievement. Challenges such as dense course material, time management, and external distractions were regarded as major obstacles, whereas review sessions, tutoring, and instructor support emerged as essential success factors. The study underlines the necessity of creating educational environments that promote self-efficacy through focused interventions. Breaking down complex material into smaller sections, providing formal academic support such as recitations and tutoring, and supporting self-regulated learning practices can help students gain confidence and improve their learning outcomes Furthermore, addressing external problems such as online learning barriers and mental health issues is necessary to provide a supporting framework for all students. School educators, counselors, advisors, and other stake holders need to work on developing, improving, and enhancing students' positive perceptions about their own capabilities which can impact their success and performance (Kim, 2014).

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