

# What Impacts the Student Outcome in General Chemistry?

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## ABSTRACT

General Chemistry is an essential subject area pertinent and prudent to numerous disciplines, careers and significant areas of life. However, many students are fearful and not knowledgeable about what truly impacts student outcomes in General Chemistry. At any level, chemistry courses can provide access to many different research opportunities and career options. Though students may enter their chemistry courses with the aforementioned in mind, many become disillusioned and hopeless after having participated in a few class sessions. Despite their best intentions, students often feel lost and ultimately discouraged. There is a myriad of reasons as to why students begin to feel this way though some of the more prominent factors include self-confidence; previous educational opportunities and experiences; instructional methods; learning styles; and environmental influences. Nevertheless, it is critical to student achievement that those factors that impact student outcomes be examined and addressed.

**Keywords:** General chemistry; Student outcomes; Pedagogy and stem

## INTRODUCTION

General Chemistry courses are often the foundation for the study of other science disciplines and upper-level chemistry concepts [1]. General Chemistry is important in many different career fields and opportunities such as education, medicine, toxicology, pharmaceutical, nanoscience, computational, physics, alternative fuels, law, etc. Although General Chemistry is a foundation for many career fields, the information presented throughout this course is very challenging and difficult for students to comprehend. Many students struggle to navigate and understand concepts from the onset. With that being the case, with a weak foundation or overall negative impact of student outcomes at the onset of General Chemistry, this can begin to cause a down ripple effect further on throughout one's studies and overall career aspirations. General Chemistry is often regarded as being too quantitative; a quality that may deter students who do not have strong math skills [2]. Finally, it does not address variances in students' high school chemistry preparation [2]. General Chemistry is usually offered in the first-year of a student's higher educational experience and it does not take into consideration one's high school preparation or lack thereof. Students often enter chemistry courses optimistically, but underprepared for the course rigor and requirements. Many students cite poor teaching and disappointing grades as reasons for dropping out of STEM courses, specifically General Chemistry [3].

That critique has not gone unnoticed. In higher education, both

administrators and college faculty have made strides to better meet students where they need it most and to make courses, such as General Chemistry, more attractive to the student. The development of the Internet, communication technologies, and teaching methods create new opportunities for the modernization of academic classes [4]. But that modernization alone, although touted to enhance performance, may not always be the best or most practical option for teaching advanced concepts, specifically General Chemistry. Because the human mind has limitations on the rate and amount of new information it can accurately assimilate and comprehend, any strategy that attempts to transfer knowledge more or less directly from teacher to student—"teaching by telling" is ineffective for many if not most students [5]. This means that students may need more hands-on modelling of concepts.

## LITERATURE REVIEW

Many studies on the application of new educational models indicate that they are both more effective and preferred by students over classical approaches [4]. Though students may report that they prefer more advanced models, their response and performance show otherwise. The more appropriate approach is likely a combination of both traditional and more modern teaching methods. The combination provides more opportunities to meet students where they are using styles that better mirror their overall educational needs and specific classroom needs. Additionally, combining various education methods and didactic tools is a common approach, ensuring a high degree of flexibility in the

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courses and the ability to satisfy the expectations and needs of students with various inclinations, learning styles and intelligence types [4]. Most importantly, it is imperative to incorporate more realistic experiences in which General Chemistry will be utilized in order to gain a student's interest in the subject. This realistic experience will provide the students with an explanation as to the importance of the course and pedagogical approaches that can be implemented to refresh basics and fundamentals knowledge and skills that will be essential in the overall success in the course.

Another consideration, aside from teaching models, is technology. Students today are digital natives, and higher education must embrace the differentiation of instruction for individual students that digital learning enables [6]. With modern day technology, such as smart phones, iPads, computers and even smart watches, students are utilizing various technological advances to assist in their course work. Digital courseware is now becoming increasingly available as online homework systems become more sophisticated and more advanced with "adaptive learning" (adaptive-responsive) technology that can provide instructions tailored to each student's needs [6]. Adaptive learning technology can help teachers and students learn more about strengths and weaknesses and help to create scenarios in which both are continually and repeatedly addressed in context to assignments, homework, and exams. Every student possesses different strengths, weaknesses, capabilities and understanding towards the subject area of General Chemistry. It is imperative to engage them in practical knowledge, which will impact them more than just reading and doing assignments.

In addition to adaptive learning, "Peer-Led Team Learning (PLTL) is one of several active-learning pedagogies to transform undergraduate Science, Technology, Engineering, and Mathematics (STEM) education in the twenty-first century" [7]. Along with Problem-Based Learning (PBL) and Process-Oriented Guided Inquiry Learning (POGIL), PLTL emerged from the theory of social constructivism, which argues that learners must rigorously cultivate their knowledge through collaboration with others [7]. This method of learning can often be far less intimidating than teacher-led learning. Students may feel less pressure to perform or to have a level of knowledge and understanding that they do not possess. Student-led learning decreases those pressures. Peer learning methods are used frequently in large science and math courses and often show positive outcomes from all participants [8]. This pedagogical approach allows the students to engage in conversations and debates regarding the area of General Chemistry with their peers and colleagues. Talking to students and allowing them to share their level of knowledge and gaining an understanding and appreciation for where the student is allowing the students to gain a better appreciation of the subject and one can alter and tailor their way of teaching accordingly. This ultimately will assist in developing a greater interest in General Chemistry and overall improve the performance, grades and outcome.

For students to be successful in chemistry classrooms, a strong sense of self-efficacy is essential [9]. Chemistry self-efficacy can be defined as students' beliefs about the extent to which they are capable of performing specific chemistry tasks [9]. Self-efficacy, or the lack thereof, can be tied to a student's level of comfort in or familiarity with a particular environment. The prospect of laboratories, an unfamiliar environment, for students, can increase levels of anxiety [10]. Moreover, there is a growing body of evidence that suggests

that students' self-efficacy is inversely correlated with students' anxiety [10].

Psychologist, Albert Bandura stated that self-efficacy is, "The belief in one's capabilities to organize and execute the courses of action required to manage prospective situations" [11]. In other words, self-efficacy is a person's belief in his or her ability to succeed in a particular situation. Bandura further states that "Seeing people similar to oneself succeed by sustained effort raises observers' beliefs that they too possess the capabilities to master comparable activities to succeed" [11]. When students are surrounded by peers who perform well or consistently rise to the classroom challenges they too gain an increased desire to perform. Though this is not a solution to all of the issues that students face in chemistry courses, it does lessen the barrier, raise confidence, and increase engagement.

## DISCUSSION AND CONCLUSION

Adapting to the needs of General Chemistry students and tailoring an environment that encourages group participation is a step towards ensuring better performance. A classroom that lends itself to flexibility and adjusting to students' needs and societal advancements is ideal. Students who are engaged and participate in group activities will ask more questions and feel less anxiety because they can feed off the group dynamic. Fostering students' belief in themselves through an understanding of General Chemistry will undoubtedly cause more students to remain in STEM and programs that utilize chemistry and other sciences.

## REFERENCES

1. Reed JJ, Villafane SM, Raker JR, Holme TA, Murphy KL. What we don't test: What an analysis of unreleased ACS exam items reveals about content coverage in general chemistry assessments. *J Chem Educ.* 2017;418-428.
2. Shultz GV, Gottfried, AC, Winschel, GA. Impact of general chemistry on student achievement and progression to subsequent chemistry courses: A regression discontinuity analysis. *J Chem Educ.* 2015;92:1449-1455.
3. Wilson-Conrad A, Kowalske MG. Using self-efficacy beliefs to understand how students in a general chemistry course approach the exam process. *Chem Educ Res Pract.* 2018;19:265-275
4. Bernard P, Bro's P, Migdal-Mikuli A. Influence of blended learning on outcomes of students attending a general chemistry course: Summary of a five-year-long study. *Chem Educ Res Pract.* 2017;18:682-690.
5. Eberlein T, Kampmeier J, Minderhout V, Moog R, Platt T, Varna-Nelson P, et al. Pedagogies of Engagement in Science. *Biochem Mol Biol Edu.* 2008;36:262-273.
6. Ingram CW, Mintz E, Teodorescu D. Using adaptive learning courseware as a high-impact practice to improve students' learning outcomes in general chemistry II at an HBCU. *Peer Review.* 2019;21:1-2.
7. Frey RF, Fink A, Cahill MJ, McDaniel MA, Solomon ED. Peer-Led Team Learning in General Chemistry I: Interactions with identity, academic preparation, and a course-based intervention. *J Chem Educ.* 2018;95:2103-2113.
8. Tischhauser SM. Identifying differences in student interactions with near-peer and non-near-peer instructors in the general chemistry laboratory. ProQuest LLC, Ph.D. Dissertation, University of California, Berkeley. 2018;138.

9. Cheung D. The combined effects of classroom teaching and learning strategy use on students' chemistry self-efficacy. *Research in Science Education*. 2015;45:101-116.
10. Rummey C, Clemons TD, Spagnoli D, Fouche L, Lopez RE. Introducing the first year laboratory to undergraduate chemistry students with an interactive 360 experience. *J Chem Educ*. 2019;96:1491-1496.
11. Cherry K. Self-efficacy and why believing in yourself matters. *Very Well Mind*. 2019.