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Closing the Equity Gap and Improving the Success of All Students in Anatomy and Physiology through a Scaffolded Approach

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Abstract

The importance of a diverse healthcare workforce has been highlighted and supported by the literature as a key factor in reducing healthcare disparities and improving access to and quality of healthcare among underserved populations. However, minorities remain underrepresented throughout the health professions, and in New York, the Hispanic population is particularly underrepresented across the health professions. The largest private Hispanic Serving Institution (HSI) in NY state, Mercy College has a robust health professions program. However, Anatomy and Physiology (A&P), the gateway course for most health professions students, is the number one obstacle to persistence in those majors. In addition, this obstacle disproportionately impacts Hispanic students with a resultant equity gap in student success. Through a multi-pronged scaffolded approach, which involved developing and implementing evidence-based inclusive practices, we have closed the equity gap and improved the overall student success of all students in A&P 1 lecture and lab, even in the face of COVID.

Keywords: student success, equity gap, metacognition, supplemental instruction, technology

Resumen

La importancia de contar con una fuerza laboral de atención médica diversa ha sido destacada y respaldada por la literatura como un factor fundamental para reducir las desigualdades y brindar atención médica de alta calidad entre la población minoritaria y desatendida, no obstante, este grupo étnico sigue subestimado en las profesiones de la salud especialmente la comunidad latina de Nueva York. Mercy College que es la Institución privada más grande sirviendo a los hispanos en el estado Nueva York, Mercy College tiene un sólido programa de estudios profesionales de la salud. Sin embargo, la barrera más significativa para la persistencia en el programa es, Anatomía y Fisiología. El curso fundamental para los estudiantes de profesiones de la salud sigue siendo un obstáculo primordial para la persistencia en estas carreras. Esto impacta de manera desproporcionada a los estudiantes hispanos, teniendo como resultado la desigualdad en el éxito estudiantil. A través de un enfoque multifacético la cual incluye el desarrollo e implementación de un sistema de prácticas inclusivas basada en evidencia con objetivos específicos, se redujo la equidad y mejoró el éxito general de todos los estudiantil en el curso y laboratorios de Anatomía y Fisiología la cual obtuvo un alto rendimiento, incluso frente a los sucesos adversos del Covid.

Palabras claves: éxito estudiantil, equidad, metacognición, instrucción suplementaria, tecnología

Introduction

Throughout the US, racial health disparities are pervasive and well-documented (Medicine et al, 2017). The major causes of these disparities are social determinants of health, i.e., non-physiological factors that impact health outcomes such as socio-economic status, access to healthcare and educational opportunities. Among the numerous strategies aimed at addressing health disparities three inter-related approaches can be addressed through higher education: increasing educational opportunities, increasing workforce representation, and improving access to culturally competent care. Specifically, increased diversity in health professionals has a demonstrable impact, decreasing health disparities by promoting better access and improved quality of healthcare for underserved minority populations (Grumbach and Mendoza, 2008; Smedley et al, 2004). However, minorities remain underrepresented throughout the health professions and in New York, the Hispanic population is particularly underrepresented across the health professions (Salsberg et al, 2021).

The largest private Hispanic Serving Institution (HSI) in New York State, Mercy College, has an undergraduate population that is 44% Hispanic. The mission of the college focuses on providing transformative educational opportunities for underserved communities. Indeed, Mercy College, proudly celebrating its 25th year as an HSI, has been lauded for its dedication to intentionally serving Hispanic students and is the first and only private college to be awarded the Seal of Excelencia by Excelencia in Education (and is one of only two institutions awarded the Seal in NY state). Enrolling a growing and robust Hispanic population (the Hispanic population has grown 10% over the past 7 years), Mercy College's enrollment emulates the changing demographics of the Hispanic population surrounding its campuses in Westchester County, the Bronx and Manhattan. While celebrating its growth as an institution, Mercy College seeks to

transform not only the lives of its students but also the lives of those who make up the communities from which its students hail. By enrolling, educating, and graduating diverse students from the health professions programs, Mercy College hopes to improve access and quality of care in underserved minority communities by developing a more diverse and culturally competent healthcare workforce.

The School of Health and Natural Sciences at Mercy College enrolls nearly 3000 undergraduates and graduates, preparing students for careers in the health professions and STEM. However, too often, gateway courses in the sciences act as gatekeepers, creating obstacles to success which often disproportionately impact Hispanic and other underserved minority students (Alexander et al., 2009). As is common across the US, Anatomy and Physiology (A&P) has been identified as the number one obstacle for persistence in the health professions programs at Mercy College, with approximately 30-40% of students (n=100-150 students/year) being unsuccessful in A&P. This long-standing barrier to persistence in the health profession majors has only been further heightened by the pandemic's impact on, and trauma-response to, learning. Indeed in 2022, the Human Anatomy and Physiology Society (HAPS) reported that 72% of nursing students in A&P needed to repeat the course (HAPS, 2022). In addition, pre-COVID, there existed a racial/ethnic equity gap in success rates in A&P among Mercy College students. In fall 2019, Hispanic students were successfully completing A&P 1 lecture and lab at rates of 62% and 57%, respectively, while their White counterparts were successfully completing A&P 1 lecture and lab at rates of 80% and 73%, respectively.

In order to address the success rates of Hispanic and all students in A&P 1, we transformed both the lecture and lab courses utilizing a breadth of evidence-based best practices

to envelop students in opportunities for success and to ensure that we are propelling students towards their health care goals. Through a grant from the U.S. Department of Education's Title V Developing Hispanic Institutions Program (#P031S200074) aimed at improving academic outcomes for low-income and Hispanic students in health professions programs, we scaffolded opportunities for inclusion and resilience in A&P 1 before, during and after the semester. Our model utilizes a multi-pronged approach for implementing student success strategies, intentionally integrating the latest technologies, and renewing our focus on student learning vs. student performance and includes: (1) a pre-semester orientation to launch students on the path to success before entering the semester; (2) a near-peer led supplemental instruction program which focuses on developing content mastery and study skills while intentionally promoting sense of belonging; (3) a metacognitive reflective exercise coupled with academic coaching which gives students additional opportunities to learn foundational material and shifts the focus from performance (i.e. grades) to learning; (4) supports for bilingual students through a variety of evidence-based practices including bilingual exams and video modules; (5) a problem-based, multimodal, lab curriculum which couples state-of-the-art technology, near-peer in-class mentoring and collaborative learning; and (6) an intensive post-semester remediation to provide students with a "second chance" to cross the finish line before the next semester begins, preventing a delay in degree progression. Through this paper, we will detail our innovative teaching and learning practices, lessons learned in developing and executing our programs, and data on successfully closing the equity gap and improving the success of all students.

Scaffolded Approach to Closing the Equity Gap and Improving Student Success

Recognizing the urgency to address the equity gap and the success of all students in A&P, our goal was to completely transform both the lecture and lab to be student-ready and

focused on student learning. With generous grant support, we developed and simultaneously implemented a variety of evidence-based practices to accelerate students toward success (pre-semester), create opportunities to incubate success (in-semester) and remediate any students who needed additional time to be successful (post-semester) (Table 1). Data from students was collected via an IRB-approved survey and grades were collected from institutional data.

Table 1

Implementation of Student Success Strategies

Success Strategy	**Timing of Implementation**
Orientation	Pre-Semester
Supplemental Instruction	During the Semester
Metacognition and Coaching	During the Semester
Bilingual Supports	During the Semester
Multimodal Labs	During the Semester
Remediation	Post-Semester

Pre-Semester Accelerator Strategy and Outcome

While most of our undergraduate health professions programs map A&P in semesters 2-4, after students have gained experience in adjusting to college life, our Traditional Nursing Program maps this course to the first semester. The challenges these students face with A&P are further compounded by the challenges of their new environment along with new expectations and pacing of college-level courses. Therefore, it is important that these students are oriented to

the course prior to the start of the semester so that they can be launched on a path to success. Our pre-semester orientation was scheduled over two days and included both an online component as well as an in-person component. The program was not mandatory but was highly encouraged. On day 1, students were introduced to the course faculty, syllabi and the resources, as well as to pacing, mindset and study strategies. On day 2, students worked in teams to familiarize themselves with the campus and to begin to build a sense of community and belonging with their classmates.

Feedback from attendees was collected via survey. Students were overwhelmingly positive about their experience, with 95% of survey respondents (n=44) being either satisfied (41%) or highly satisfied (54%) with the orientation. All comments regarding the orientation were positive with many students reporting increased enthusiasm and decreased anxiety entering the course. Given the strong positive response, we anticipate making this program a requirement for all freshman entering A&P 1.

In Semester Incubator Strategies and Outcomes

Supplemental Instruction

Supplemental instruction (SI) is an evidence-based non-remedial academic support program that focuses on high-risk courses rather than high-risk students. SI sessions integrate reviewing key course content with study skills in a collaborative and inclusive environment facilitated by trained near-peer leaders who have successfully navigated the course, propelling students through historically challenging courses and preparing them for future coursework. In addition, multilingual students may particularly benefit from SI, particularly the interactive group work/study group approach (Starr, 2009).

As part of our student success strategies, we expanded and further developed our existing SI program to include SI for all A&P 1 students in both lecture and lab. Unlike other SI programs, our SI program for lecture is mandatory, weight-bearing towards the final course grade and held weekly for 1 hour either immediately before or after lecture in each week of the semester. Our SI program for lab takes on a more traditional approach with leaders assisting in lab sessions and then holding optional "open lab" SI sessions. SI programs are particularly important given not only the learning loss that occurred during COVID but also the associated loss in practicing effective study skills and opportunities for socialization that resulted in isolation. Through the SI program, all of these areas of challenge are addressed.

Pre/post student survey data was collected to assess sense of belonging, persistence in the major and resilience, all areas strongly correlated with improvements in academic achievement, retention and graduation rates. Our data, collected over multiple semesters, indicate that students felt a stronger sense of belonging ($p<0.01$), a stronger perception that they would persist in their major ($p<0.05$) and a trend towards improved perceptions of resiliency. The qualitative responses from students were also very positive with students indicating that this program was particularly helpful to them as first-generation college students, and that it helped them understand how to be successful in the course.

Metacognition and Coaching

Metacognition, the practice of thinking about thinking, is correlated with improved learning and study skills (Ambrose et al, 2010). Exam wrappers are an evidence-based tool used to develop metacognitive skills where learners can reflect upon their exam preparation and any obstacles to success, analyze their performance on the exam and develop a cohesive study plan in

preparation for future exams (Lovett, 2013). However, previous studies have indicated the greatest improvement in performance for students who scored at the peak of the Bell curve and who completed the wrapper (Gezer-Templeton et al, 2017). We developed a novel approach coupling wrappers with academic coaching and opportunities to improve exam score, to increase support of low-performing students by positioning them for success through improvements in both their mindset and metacognition and to underscore the faculty's dedication to a learning-focused (vs. performance-focused) academic environment.

In our first iteration of our protocol, students who scored below 80% on their summative assessments in A&P 1 lecture were eligible to participate in the exam wrapper and coaching protocol. Eligible students were invited to complete the exam wrapper and to schedule a 1:1 appointment with an academic coach, a non-faculty professional with expertise and previous experience teaching A&P. To further incentivize the program, students who both completed the exam wrapper and met with the coach were given the opportunity to retest on material from the previous exam and improve their score up to an 80% or up to 20 points (whichever occurred first).

Thirty-eight (38) students were eligible to participate in the program based upon their exam scores; 42% (n=16) of eligible students made appointments with the academic coach and 32% (n=12) of eligible students attended appointments with the academic coach. However, only 24% (n=9) completed the full program (exam wrapper and academic coaching) and took the advantage of the opportunity to retake. Of the students who completed the program, 78% (n=7) did better on their subsequent exam, compared to only 41% of students who were eligible but did not complete the program. Our preliminary data support an impact of our program on student success, namely a significant difference in the percent of students who improved their score on

the subsequent exam after completing the program vs. those who did not complete the program ($p<0.05$).

It should be noted that we have continued to refine and develop our protocol to ensure that it is an inclusive, sustainable, and scalable practice. This has included a shift to group (vs. 1:1) coaching sessions with faculty (vs. academic coaches), increasing the minimum grade for eligibility to an 85% (while adding eligibility requirements of completing homework assignments to enforce student ownership over learning) to engage more students in the process, and utilizing class-time for exam review and partial exam wrapper completion so that all students can engage in and benefit from the metacognitive process.

Bilingual Supports

Given our large percentage of Hispanic students and our efforts to close the equity gap, we addressed two areas of bilingual support: content and summative assessment. Faculty selected concepts which have traditionally challenged students and created short interactive video modules. Modules provided students with the option to toggle to English or Spanish subtitles. Our data indicated however, that no students selected the Spanish language subtitles. We also created bilingual summative assessments. A survey was conducted to collect data on utilization and perceptions of the dual language exam format. Of those who responded, 61% (n=46) perceived having the Spanish version of the exam made the exam more accessible or were neutral on this item. However, only 15% of students reported referring to the Spanish version and only 10% of students reported that the Spanish version was helpful to them.

As we reflected upon our outcomes, we realized that most of our students completed their high school education in English and in the US, which may indicate their preferences for English in an academic setting. We are currently exploring additional approaches to inclusive practices for bilingual students such as increasing time on exams.

Inquiry Based Multimodal Lab

In response to our low student success rates in lab, we wanted to completely redesign the lab and integrate new technologies and best pedagogical practices to support the success of our students. While the prior iteration of the lab had been heavily lecture based with minimal opportunities for peer-to-peer interaction and utilized a single learning modality, in the redesign, the curriculum was transformed into an inquiry-based lab where students work in teams to rotate through a variety of stations utilizing various technologies including models, microscopes and state-of-the-art Anatomage tables, virtual dissection tables based on cadavers (Figure 1).

Student satisfaction with the revised lab experience was collected through survey data (n=128 respondents). Satisfaction has been overwhelmingly positive with students reporting particularly high satisfaction (9 or above average on a scale of 1-10) with the integration of the new Anatomage table technology as well as with peer assistance.

Figure 1

Collaborative Learning Around the Anatomage Tables

Post-Semester Remediator Strategy and Outcome

In January 2022, we piloted a post-semester remediation program in A&P 1 lecture and lab for students who had not successfully earned the required grade in either A&P 1 lecture, lab or both. This program was offered free of charge to the students and was conducted over 5 days in January after the conclusion of the fall 2021 semester but prior to the start of the spring 2022 semester. The objectives of the program were to provide a "second chance" for students to re-learn foundational concepts, demonstrate content mastery at the level of a "C" student (the minimum grade required for the student to proceed to A&P 2), and prevent a delay in their progression towards their degree.

Twenty-seven (27) unique students across multiple health professions majors met the eligibility requirements for the program, which included earning at least a 50% average on their summative assessments, having completed at least 50% of the required course homework assignments and having attended at least 50% of the course meetings. Eligible students were required to complete a short application form, indicating their thoughtful intention to commit to

the requirements of the program. Twenty out of the 27 (74%) applied and were accepted for participation in the program, and 18 unique students participated in the program as follows: six for lecture remediation only, eight for lab remediation only and four for both lecture and lab remediation.

During this fully remote program, students met for three hours each per day for lecture and lab, Monday through Thursday, with a final assessment on Friday, for a total of 15 total hours per lecture and lab. In addition, students completed nightly low-stakes assessments. Students were provided with three hours of access to dedicated near-peer tutors nightly for both lecture and lab. Fifteen of the 18(83%) students successfully completed the remediation programs for which they applied and were eligible to proceed to A&P 2 lecture and lab in Spring 2022, preventing a delay in their degree progression. Fourteen of the 15 who successfully completed the programs (93%) enrolled in A&P 2 in Spring 2022. Seven of the 14 (50%) students who enrolled in A&P 2 from the remediation program successfully completed both A&P 2 Lecture and Lab.

Fortunately, given the combination of our other student success initiatives described above, we no longer have a critical mass of students large enough post-semester to continue to offer this program. However, for institutions who continue to struggle with student success in gateway STEM courses, this model provides a reasonable solution to keep students on track towards degree progression.

Program Outcomes and Conclusions

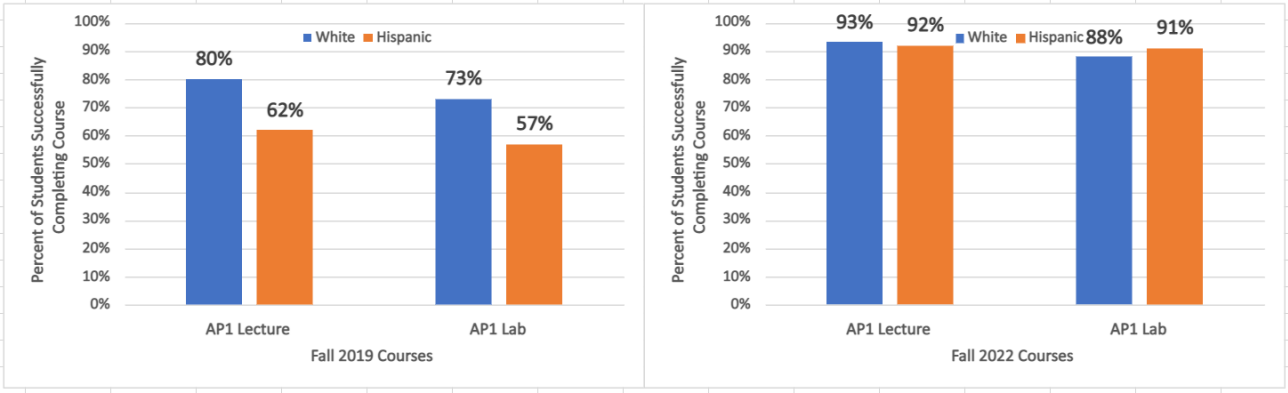
Our experiences demonstrate that through the simultaneous implementation of a variety of successful strategies scaffolded before, throughout and after the semester, the equity gap between Hispanic and White students can be closed and the success of all students in both A&P

1 lecture and laboratory can be improved (Figure 2). These results have implications for the broader context of retention of STEM students and in confronting and closing equity gaps in education. When comparing the outcomes of students pre- (fall 2019) and post-COVID (fall 2022), not only did the equity gap nearly or completely disappear, but also all students improved their success in the courses. Given the impact of COVID on learning, coupled with the disproportionate impact of COVID on Hispanic students, these outcomes are particularly striking. Since we used a multipronged approach, delivered simultaneously, we cannot isolate which strategies were more successful than others. However, the coordinated use of multiple methods likely was responsible for the marked changes observed.

While we are enthused and motivated by our success to date, we also understand that engaging in changes for equity and student success are a long-term commitment of the faculty, administration and of the institution. Indeed, the efforts here reflect the collaboration of a coordinated team of dedicated full-time and adjunct faculty members, staff and administration. We are hopeful that our powerful outcomes demonstrate the continued need for support of our programs as we refine and innovate our comprehensive scaffolding of strategies to position students for success and allow them to persist in their majors and successfully enter the health professions where their representation is so desperately needed.

Figure 2

Closing the Equity Gap and Improving the Success of All Students in A&P 1 Lecture and Lab



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