Mitigating Student Barriers to Office Hour Visits to Support Early Success for First Semester Health Sciences Majors

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The early college experience is different for everyone, but most would concede that the transition to college requires students to develop new social and academic habits. This transition can be daunting, especially in light of early coursework that sets the groundwork for competitive admission to professional programs. Further, the literature suggests that this adjustment is less intuitive for some students. This study focuses on the role of student-instructor interactions during office hours in the early success of first-year pre-physician assistant students through their first semester of introductory biology. The aim of this work is to improve persistence through undergraduate courses and acceptance rates into physician assistant programs. Ultimately, this work would increase the diversity of healthcare practitioners in local healthcare systems.

Using the improvement science model, I introduced a series of interventions designed to learn how these changes affected student office-hour attendance for my introductory biology course. One such intervention, a video providing explicit directions on how to get to instructor offices and what the office hour experience would look like, was effective in removing barriers to office hour attendance for some students. Specific reminders to students inviting them to attend office hours were also influential. Finally, the office hour experience seemed to support students' self-efficacy, feelings of community, and development of academic practices, which, in turn, contributed to their classroom success. Further study is required to understand if these

interventions will affect student transfer of office hour practices and resulting skills to other classes.

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Dedication

This work is dedicated to my students who enthusiastically supported this work every step of the way and in doing so, have improved the early college experience for students who come after them. In this dissertation I hope to honor your voices. I am forever grateful for your kindness and tenacity. We went on these journeys together and I am so proud of us!

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I am also indebted to my instructors at the University of Pittsburgh, who helped us, the 2020 cohort, to find our way, laying the groundwork for our scholarship and encouraging us as we grew. They did this as they carried their own burden of learning to educate during a pandemic which was no small feat. I am so grateful to my classmates and especially the "STEM ARCO" members, each of whom provided answers and feedback throughout this adventure, helping us all stay on track.

I am grateful to my niece Sarah Weber who welcomed me into her home on weekends when I commuted to Pittsburgh for classes, and to my daughter, who proofread my manuscript even while pursuing a degree of her own.

I could not have undertaken this journey without the support of my kids, both of whom completed their educational journeys and encountered their own adversities on the way and still made time to cheer me on; my husband, who is consistently patient with me and keeps the household functioning; and my family and colleagues who supported me in so many ways along this journey. This journey began when I was born to my very special parents who always valued education and hard work, which left an indelible impression on me.

1.0 Naming & Framing the Problem of Practice

1.1 Broader Problem Area

In 2019, the National Commission on the Certification of Physician Assistants reported that 86.7% of practicing physician assistants were white. While Wilber et al. (2020) note that the diversity of healthcare workers is increasing overall, much of the increase is in lower-paying entry-level work. The lack of diversity of healthcare providers contributes, at least partially, to inequities in healthcare (Parkhurst et al., 2017; Thornton et al., 2011; Torestky et al., 2018). In one study using a social concordance tool, which measures shared social characteristics, Thorton et al. (2011) found that more social concordance between a patient and physician can lead to more positive patient care perceptions. These findings held for differences in income, cognitive diversities, race, gender, education, and age. If healthcare is to become accessible and effective for people of all demographics, the demographics of healthcare providers, including physician assistants, must become more diverse.

It follows that access to and success in educational pathways leading to healthcare careers for people from all demographics, specifically programs educating physician assistants, could make a difference for patients who belong to underserved minorities (Thornton et al., 2011; Wilber et al., 2020). Nevertheless, students of many backgrounds can encounter barriers along the educational pathway to becoming physician assistants. In a recent review, Ackerman-Berger et al. (2022) found several reasons applicants fail to gain admission to physician assistant programs, including low application scores, low bachelor's grade point average (GPA), missing prerequisites, late applications, and low prerequisite science GPA's.

Two of these reasons, a low bachelor's GPA and a low prerequisite science GPA, were of particular interest to me as a science instructor who meets pre-physician assistant students during their first college semester. Locally, the Penn College Physician Assistant Program places a weight of 60% on a student's science GPA when considering their application. According to Dika & D'Amico (2015), student success in early college science courses has an important effect on persistence in science courses. Such weighting can also affect the diversity of the students admitted to such programs. Wilber et al. (2020) note that getting students who belong to underrepresented minority groups into higher-paying jobs in healthcare seems to depend on programs that include "a combination of social support, academic support, and financial support" (p. 1). Educators are appropriately positioned to provide at least social support and especially academic support.

1.2 Organizational System

The improvement science approach to systemic change focuses on testing small change ideas that are specific to a particular organizational system (Bryk et al., 2017; Mintrop, 2018; Perry, 2020). A strength of this approach is that it focuses on problems in a practitioner's unique organizational system. This section describes Pennsylvania College of Technology (Penn College) as the focus of this study. Penn College is a special mission school of Penn State University. Penn College offers certificates, associate, bachelor's, and master's degrees in applied majors and works with local industry to provide apprenticeships and certifications.

Penn College is an open-admissions institution, meaning students do not need a particular GPA or minimum test scores to attend. Rather, any students with a diploma, GED, or military background gain acceptance into general coursework. Students later earn seats in specific

programs of interest. For example, the physician assistant program at Penn College has thirty seats; application for these seats is available to both Penn College students and students who have done undergraduate work elsewhere. For undergraduate Penn College students, our open enrollment policy means that students arrive at our college differently prepared for a college environment. Additionally, this means that Penn College students are competing with students from more selective colleges which only increases the competition.

Based on Penn College's mission statement, the institutional focus is "Inspiring and preparing Tomorrow Makers, the next generation of industry leaders, with real-world experience and innovative spirit." Our goals include fostering well-rounded, career-ready graduates in majors that emphasize "hands-on technical education" (Pennsylvania College of Technology, 2021). We seek "to cultivate a diverse community of innovators and creators determined to shape a better tomorrow." The published values statement focuses on five values important to our institution: "Strength through Respect," a "Student-centered Environment," "Real-World Education," and "Business and Industry Partnerships." Lastly, one of our strategic goals that is especially relevant to my problem of practice is the aim to "reinvigorate a college-wide focus on retention programming to mitigate obstacles to student success and improve graduation rates" (Pennsylvania College of Technology, n.d.).

1.2.1 The Student Body at Penn College

However, Penn College is facing more than just the challenge of implementing these goals. Like many other colleges, Penn College is experiencing declining enrollment. The National Center for Education Statistics reports that national undergraduate enrollment decreased by 9% between 2009 and 2020. This national decline was compounded by a precipitous drop in enrollment in the

fall of 2020 (NCES, 2022). In fact, at Penn College, Fall 2021 enrollment reflects a consistent decline over the last ten years at Penn College, with current enrollment at 4,240 students. The following paragraphs describe our student body in more detail.

The demographics and characteristics of the students that come to Penn College remain consistent. Notably, just over 45% of our female students and about 54% of our male students are first-generation college students. Of the students in the School of Health Sciences at Penn College, 86% of female students and almost 13% of male students identify as first-generation college students. For comparison, in the 2015-16 academic year, 23.9% of undergraduate students identified as first-generation college students nationally (NCES, 2023). Further, more traditional colleges nearby show a lower percentage of first-generation college students. Bloomsburg University, a public university in central Pennsylvania, reports on a webpage that "nearly 30%" of their students are "the first in their families to attend college. (Bloomsburg University, 2022)" A nearby private college, Bucknell University, reports that 13.3% of its students are first-generation college students (Bucknell University, 2023.)

Minority students make up about 13% of our students (Pennsylvania College of Technology, 2022), compared to statistics by the National Center for Education Statistics, which reports that 13.1% of fall enrollment for 2020 identified as Black and approximately 20% as Hispanic. Penn College is less diverse than nearby Bucknell University, which reports that 21.8% of its student body are students of color. Meanwhile, Bloomsburg University reports that 17.5% of its students belong to minority groups (Bloomsburg University, 2022).

About 10% of our students come to Penn College from other states, and 0.5% are international students. Most Penn College students receive financial aid (86%), and approximately 35% receive a Federal Pell Grant (Pennsylvania College of Technology, 2021). According to the

National Center for Education statistics, about 32.1% of undergraduate students nationwide received a Pell Grant for the 2020-2021 school year (2023).

In addition, many of our students are returning for second careers or furthering their current careers. Penn College has a sizable number of veterans enrolled, with several in the pre-physician assistant track. Many Penn College students also come from small rural schools (Pennsylvania College of Technology, 2022). In sum, the demographic makeup of Penn College is highly varied with regards to economic backgrounds, pre-college experiences, and first-generation status, but less diverse when considering students that belong to minority groups. The result is a student body with incredibly diverse academic and support needs.

1.2.2 The Department of Natural Sciences at Penn College

The courses offered within my department, specifically chemistry, biology, and physics, serve the largest program areas. For example, students required to take my microbiology class mostly represent nursing, the largest program area, and dental hygiene, the tenth-ranked program area by size (Pennsylvania College of Technology, 2021). Additional health science majors, such as surgical technology and physician assistant programs, also require these classes.

I, and 12 other instructors, serve students in health science majors. Of those instructors, four are female, 12 of these instructors are white, one identifies as Hispanic, and a recent retiree identified as Arabic. The last three faculty hires in my department were white males, despite efforts of hiring committees to encourage and select diverse applicants. Campus-wide, the number of new hires that are diverse has improved.

One possible reason our applicant pool is not more diverse could be that Central Pennsylvania, generally, and Williamsport specifically, may not seem like a desirable destination

for diverse applicants compared to larger Pennsylvania metropolitan areas. While it is a rural area with access to major cities (most major cities in Pennsylvania are a three-hour drive from our institution), beautiful hiking trails and opportunities for outdoor recreation and interaction with nature abound, Williamsport lacks the amenities found in cities such as airports and large museums. And although many of our faculty are engaged in research, teaching is our primary focus, with faculty carrying a five course per semester contractual load.

1.2.3 Supporting Services at Penn College

Our focus on teaching and student success, regardless of student background and college preparation, reflects Penn College's core values. For this reason, students of all majors may interact with various support mechanisms, including a tutoring center, a writing center, our new Learn, Evolve, Adapt, Prepare Center (LEAP Center), student advisors, and counselors. In addition, faculty are expected to maintain updated grades and identify high-achieving students and struggling students at the mid-point of each semester in Starfish, a student retention and college success software. Students may be "flagged" for any reason in the Starfish system. Flagging a student initiates a follow-up via phone or email, encouraging the student to meet with their LEAP advisor. The LEAP Center advisors are trained to introduce students to helpful resources, help them through difficult transitions, encourage them to seek assistance from their professors, and directly discuss strategies for success. Unfortunately, if students do not respond to messages from the LEAP Center, the Starfish flag is marked as resolved with a comment stating the type of outreach attempted.

The tutoring center employs a professional tutor with a science background as well as peer tutors who excelled in the classes for which they are tutoring. It offers both scheduled appointments

and drop-in tutoring. Students can also schedule and attend tutoring using virtual meeting platforms. This can be helpful because many of our students commute to campus for their classes, some an hour or more. Although I post tutoring center hours and encourage students individually to visit the tutoring center, few actually do. This is disappointing as most students that visit the tutoring center report that they have a good experience. According to the professional science tutor, some students prefer to meet with a peer, while others shy away from their student counterparts for fear of being judged and therefore prefer to meet with a professional tutor (Brauning, personal communication, 2022).

While we have always been an open-enrollment institution and recognize the need to provide support for a student body from diverse backgrounds, current trends in declining enrollment and the COVID epidemic together drove Penn College to overhaul these aforementioned support systems in order to foster student success more effectively. The LEAP Center is an example. Because the LEAP Center is in its second year and the new FYE curriculum is also in its second year, its full impact is not yet clear. I hoped to learn more about the impacts of these programs during my semi-structured interview with the director of the LEAP Center, but given the recent launch of this department, little data is available. However, there is some evidence demonstrating a positive impact. A recent student satisfaction survey of first-year students, the primary target of the LEAP Center, which had a 22% return rate, showed that students overall were satisfied with their interactions and felt supported and welcome as a result of the outreach. The LEAP Center also found that the majority of first-year students with D and F midterm grades had not engaged with the LEAP Center (Cracker-Bing, personal communication, 2021).

1.2.4 Equity Initiatives at Penn College

Penn College is also making important changes to better support equity and justice for our student body. The Office of Diversity & Community Engagement, which is part of the Student Engagement Office, focuses on fostering a community of belonging, addressing one of Penn College's four core values, "Strength through Respect." In addition, they coordinate student-led activities for multicultural programs and initiatives such as Pride Week, heritage months, National Coming Out Day, and others. This department also provides resources and training on equity issues such as intersectionalities and microaggressions for our student body and for faculty. Additionally, Penn College created and filled a position titled "Special Assistant to the President for Inclusion and Transformation," with the goal of improving the campus climate for students and faculty by improving inclusive practices.

Other recent victories for our college include a land acknowledgment which was crafted by a committee that included professors, administrators, and Native American Alumni. Penn College student government also initiated successful initiatives to establish a Black Student Union, gender-inclusive housing, and family-inclusive housing. These recent changes will hopefully foster an increase in student and faculty diversity on campus, and I am proud to see Penn College make these changes.

1.2.5 The Department of Natural Sciences at Penn College

I teach in the Department of Natural Sciences, which is part of the School of Business, Arts & Sciences. We do not have any majors within our department. Rather, we provide prerequisite courses for a number of majors. As discussed earlier, I specifically teach classes that support

students whose majors are in the School of Health Sciences. Decisions made by other Penn College schools and their majors often affect the enrollment, sequence, or content of classes offered by my department without the input of our department. For example, new classes may be requested, or existing classes may be modified or dropped from the curriculum without our input. In addition, classes in the Natural Sciences Department, particularly chemistry and biology courses, affect the science GPAs of our students and therefore influence the selection process for seats that exist in each major. Because I teach two of these first year courses, my interactions with students can play a pivotal role in their career path.

Students who enroll in pre-physician assistant courses have program advisors that teach in the physician assistant program but do not teach classes in the pre-physician assistant courses. Faculty advisors from the PA program help students choose classes and provide some coaching for students, but before program acceptance, their interaction with their students is limited. As non-program professors who interact frequently and significantly with these students in their pre-program classes, we come to know these students well. While I have witnessed teaching excellence in the health science faculty in their upper-level classes, they don't have much opportunity to interact with students much until these students are accepted into the program.

As a small school with a high ratio of instructors to students, Penn College instructors are very accessible to students. The average class size on campus is 16 students, but my typical class size is between 25 and 30 students. I generally have between 60 and 70 students each semester in two to three different classes. Instructors may also have students for more than one class. For example, a student may have the same instructor for anatomy and physiology and microbiology. Thus faculty in my department come to know students well. Students also have access to instructors outside of class. We are contractually required to offer five office hours per week over

the span of at least three days. Up to two of these office hours may be virtual. Many professors also offer additional times by appointment in case student schedules do not match with office hour schedules.

In the Natural Sciences department, the physical space outside our offices is conducive to student/faculty interaction. My department is fortunate to have a suite of offices that surround a common student area, complete with tables and whiteboards. Many students gather here to work and study, knowing that they have access to their professors, but it often takes first-year students a while to find this valuable space.

1.2.6 Positionality Statement

I am also part of Penn College's organizational system, and as a part of an improvement science project, my perspective is important to this investigation. Likewise, my positionality and experiences affect the way I view this research and the experiences of my students. First, I am dedicated to effective biology instruction for all students. As a first-generation college student myself, I struggled to understand the system in my own early college experiences. I feel everyone should have access to resources that allow them to pursue their passions and secure a rewarding profession that both supports their intended lifestyle and allow for a secure future for themselves and their family. I realize that this is essentially social mobility ideology which is something that I carry with me as a result of my working-class upbringing where, regardless of how hard my parents worked, a financial crisis was always around the corner.

I am also an educated, cis-gendered, middle-aged white woman who is responsible for assessing student work and designing the grading policy for the courses I teach. I attempt to be consistent in my grading policies with others in my department, but variability exists, and

ultimately, my grading framework is up to me. I recognize that student responses to the surveys upon which this study relies may be affected by my position as their instructor.

1.2.7 Summary of Penn College as an Organizational System

In total, the information that I have learned about the system in which my problem of practice exists leads me to wonder how new diversity initiatives and a revamping of college support services will improve the success of my students. More central to my problem, how can instructor strategies be adjusted to encourage students to attend office hours? The critical nature of this problem of practice is especially, but not exclusively evident in the time of the historic coronavirus epidemic (Andraska et al., 2021). Solving this problem of practice will, at least in part, allow for the additional success of students of diverse backgrounds in healthcare-related fields who will bring unique perspectives and skills to patient care. A diverse healthcare workforce is essential to reducing the health inequities that have social, economic, and moral consequences (Wilber, 2020).

1.2.8 Stakeholders

Identifying the stakeholders who are affected by or influence the problem of practice is important in determining who is the focus of the study and identifying where change ideas can make important movement toward mitigating the problem of differential success for first year students. Bryson et al. (2011) note that "failure to attend to the interests, needs, concerns, powers, priorities, and perspectives of stakeholders…too often and too predictably leads to poor performance…" (p. 3) and propose both identifying stakeholders and understanding each

stakeholder group with regards to their interest and their power in the context of the study. As I identified stakeholders, I moved from the broad scope of the problem area defined above and moved toward my particular problem area. Each of these identified stakeholder groups was analyzed.

The stakeholder analysis of the groups involved in my problem of practice was accomplished using a grid that classifies stakeholders along a continuum using two axes: Power and Interest. Once plotted, stakeholders can be categorized as "subjects" who have significant interest but little power; "players" who have significant interest and substantial power; "crowd" with less direct interest and little power; and "context setters" who have power but are less focused interest on the problem (Bryson et al., 2011).

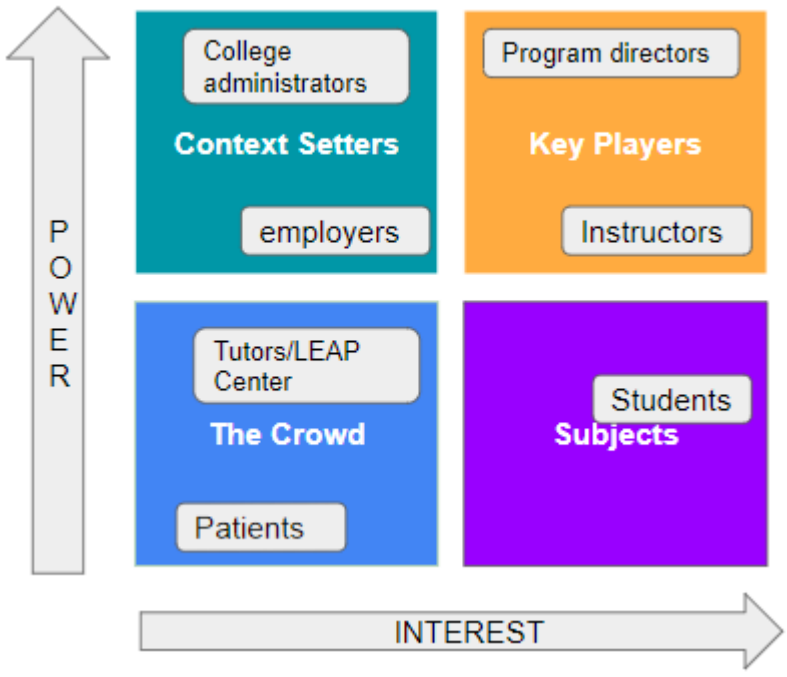


Figure 1. Power/Interest Grid Illustrating Stakeholders and Their Relative Power and Interest in The Success of Students in Gaining Acceptance to The Physician Assistant Program of Study

1.2.8.1 Students

Discussing and researching early experience college students as stakeholders is complex because of the overlapping identities of our population. For instance, many first-generation college students are also rural or urban students, students from underrepresented minorities, and students from families with low economic status. Many of my students have children, take care of elders, and hold jobs outside of their college responsibilities. Some students support themselves financially as paramedics, emergency management technicians, medical assistants, or certified nurse assistants. Several attend as Reserve Officers Training Corps (ROTC) students or are in the reserves and may miss class due to being called into active duty or required to attend drill. However, one thing that all of these students have in common is that they are more likely than their privileged peers to come to college with important skills (for example, technical, communication, management, or interpersonal skills) that are less valued or not recognized at all in the traditional academic college setting. Valuing these students' skills and keeping them on their career path is both in their best interest and ultimately makes healthcare better for everyone.

Ives and Castillo-Montoya (2020) investigated how scholars conceptualize one of these categories, first-generation college students. They found that much of the literature focused on academic performance rather than the assets provided by the culture of first-generation college students. Students of all backgrounds bring with them knowledge and skills that can be leveraged to support their success if they are supported in their transition to college life. However, these students may be less likely to develop critical academic, study, and time management skills fast enough to achieve grades that grant access to the physician assistant program or another healthcare major of choice.

While our college provides dual enrollment in conjunction with local high schools to help prepare students for college, not all students arrive with these credits, and even those who do may still not be ready for college life. I am classifying first-semester, pre-physician assistant students as subjects according to the power/interest grid (Fig. 1) because these students have "significant interest, but little power." Students are the central focus of my problem of practice, but there are many others involved in and impacted by the problem.

1.2.8.2 People Who Support Students Outside the Classroom

Many people at Penn College who have an interest in student success support students outside the traditional classroom setting. For example, professors who teach the FYE class could be described as subjects as well, albeit with less interest than the students. The FYE program is designed as a supportive program, which is primarily in place to help students develop skills that help them succeed in the college setting. FYE instructors are generally instructors who do not have a full course load or instructors who have an intrinsic interest in helping incoming students succeed. At least one professor mentioned that she would like to teach the FYE course to help students along their intended pathway, specifically as pre-physician assistant students (M. Sedor, personal communication, 2023).

I would also place the professional and student tutors in our tutoring center in this same area of the power interest grid for the same reasons; their primary role is to help students develop skills that help students succeed. But, because they are not in a position to actually enact skills in the student or administer grades, they cannot force students to use their services; these tutors remain subjects.

In addition, each student is assigned an academic advisor and a LEAP advisor to support students as they transition into a college environment. These advisors are poised to play an

important role in student achievement due to their involvement with the student during the student's first few months on campus. Based on empathy interviews, I found that LEAP Center advisors are truly invested in the success of the students that they advise and meet the "significant interest" benchmark but not the "substantial power" of the player category in the power interest grid. Therefore, these advisors are subjects.

While the LEAP center advisors are working hard to design programs that educate first-year students on how to study, handle stress, and establish healthy time management habits and other life skills, the advisors also have a heavy caseload; each counselor interacts with over 100 students. The LEAP advisors express hope that instructors will exercise their power to be flexible with struggling students but also acknowledge that students must be aware that they need help and be able to articulate their needs in order to find resources. When asked about students who have succeeded against the barriers to their progress, one counselor gave a formula: "intrinsic motivation and desire to succeed, willingness to take advantage of supports and resources, and the ability to form a network amongst classmates." (Personal communication, empathy interview, 2021).

Academic advisors assist students in building schedules that prepare students for admission to their professional program. These advisors are not involved in the day-to-day success of these students unless and until students are accepted into their professional programs. Hopefully, these advisors are intrinsically interested in pre-program student success. However, these advisors are also interested in their program enrollment and the success of their students once they are accepted into the program. Therefore academic advisors are key players but not directly pivotal in student success in the classroom.

1.2.8.3 Content Instructors

The instructors experienced by students in their first year are important in early student success and have more power than those discussed prior. Based on these characteristics, content instructors can be categorized as players in the power interest grid (Bryson et al., 2011). According to a focus group that included students who finished their first year of physician assistant school and attended Penn College for their undergraduate experience, students feel that science instructors of first-year pre-physician assistant students are invested in the success of their students. For example, instructors are often flexible with office hours and meet with students outside of regular office hour schedules. Some encourage or even require students who receive a C or lower on an exam to complete exam reviews independently or during office hours. Biology and chemistry instructors sometimes work together to schedule tests and grade releases at times that benefit students, e.g., not releasing grades while students are in a different laboratory or staggering tests and major assignments on different days.

On the other hand, some students feel that instructor content expectations, teaching style, or approachability are barriers to their success or at least make admission to their intended programs unnecessarily difficult. These student feelings highlight the recognition of instructor power and how it can interfere with student success. Instructors also have the power to make important decisions, including who can make up assignments and for what reasons, how many classes can be missed before a reduction in grades, and how much weight particular assignments have in the total student grade. In some cases, the actual learning outcomes are not within the power of the instructor and are established by college committees according to the requirements of accrediting bodies for each particular program major. However, instructors make decisions each day on how to cover that content and to what depth and what storylines or active learning strategies

will be used (if any) to present the content. My colleagues sometimes justify decisions about how they teach and assess differently from their colleagues by invoking the idea of "Freedom to Teach" or "Academic Freedom." For example, some professors give final exams while others waive the final at a particular cut-off.

Finally, program instructors who wish to continue as educators at Penn College have an interest in maintaining student enrollment. Sometimes program faculty ask pre-program faculty to change the rigor of courses, or program advisors may refer their students to transfer online courses instead of taking the required pre-program courses offered by Penn College with the goal of increasing or maintaining program enrollment.

1.2.8.4 Program Directors

Program directors, including the director of the physician assistant program, are also players in the power/interest grid because they are involved in the selection process and assessing students for admission to the physician assistant program. Program directors also have a significant interest in the success of students who are admitted to their program. If selected students do not succeed and drop out of the program, the resulting open seat cannot be filled for that cohort (Josh Bower, personal communication, 2022). Therefore program directors have an interest in selecting the most accomplished students who can make it through the entire program. This interest is influenced by a number of factors, including accreditation requirements and maintaining a sustainable enrollment. While some students apply to other physician assistant programs, many students come to our college with the intent to attend the physician assistant program on our campus.-

My interview with our current physician assistant program director revealed that, in the past, students could be accepted into the PA school after taking the courses needed for selection

as many as three times, which indicates flexibility and tenacity on the part of the student but these students often do not succeed in the rigorous environment of the physician assistant school. The program director also indicated that students often come to the physician assistant program weak in critical thinking and application skills and may expect the program instructors to accept work that falls below the expectations for physician assistant education (personal communication, empathy interview, 2022). He indicated that these growing issues are not unique to students coming from Penn College alone, as this has been an issue with students coming from other colleges as well. I question why students are reaching a graduate program such as our PA program lacking the very critical thinking skills that they should acquire as undergraduates. It may be that students are taking courses until they can demonstrate rote content knowledge rather than learning content in a way that allows for application and synthesis.

1.2.8.5 Healthcare Systems and Patients

Other important users include healthcare systems (context setters) that will be employing our students, patients that will be treated by our students (crowd), and also society in general (crowd) since the health of our populations impacts economic productivity and the right to live a fulfilling and enjoyable life (Fig. 1). It would be interesting to learn more about how employers experience our students as professionals in the healthcare field. Although we do survey those who employ our students, the most recent survey is dated 2016, and the survey content is general. For example, these survey results show that 85% of our students meet or exceed expectations for occupational job knowledge (Penn College, unpublished).

Especially critical, but outside the scope of this study, is a better understanding of how patients are served by our students. While the employer survey shows that 88% of employers say the ability of our students to “get along with” or “appreciate” people from diverse backgrounds

and that 12% exceed expectations, specific criteria are not given for how this is assessed in the workplace (Unpublished, Penn College, 2020). Because our students tend to be from a variety of backgrounds, our students' success in our programs would ensure that patients would be more likely to experience healthcare from people who have similar life experiences and backgrounds, which could then, in turn, reduce some inequities that are experienced by patients from minoritized and underserved backgrounds (Wilber et al., 2020; Thornton et al., 2011).

1.2.9 Problem Statement

Students entering the pre-physician assistant major must achieve high grades (A's and B's) beginning in their first semester to be competitive for selection into physician assistant programs. Some students have difficulty acquiring the practices necessary for immediate academic achievement during their first college experiences. Even if a competitive GPA is not required early in the college career, students with lower GPAs in their early semesters are more likely to switch majors rather than persist in the physician assistant track. A study by Shaw and Barbuti (2010) found that the most significant difference between students who switched majors and those who did not switch was first-year GPA. When students with diverse backgrounds do not progress to the physician assistant program, the result is a less diverse population of healthcare providers, contributing to inequities in patient care.

My problem of practice focuses on the differential success of early pre-physician assistant students in the competitive and science-heavy preparatory curricula required to attain seats in our physician assistant program. Because of our small class size and significant student access to professors, it is important that we understand how instructor policies and the role of faculty and student interactions both in and out of the classroom support student success in their early college

careers. Student retention is also in the best interest of our institution in an era of declining enrollment. As an instructor in first-year biology for these students, the policies that I use in my courses can have an important influence on the development of student identity, student community building, acclimation to college life, and ultimately on, student success.

1.3 Review of Supporting Knowledge

1.3.1 Purpose of Review

Fishbone analysis (Perry et al., 2020) was used to uncover a number of reasons for differential student success in early college experiences (see Appendix A). I probed the literature to learn more about the characteristics of first-semester students who are not from continuing education backgrounds or who are not from white upper-middle class families. Then I turned my inquiry toward learning more about the barriers these students may face as they experience during their first year of college and how those barriers affect the progress of students through and beyond their first year. Finally, I explored practices and research that helped me understand how instructors can mitigate and remove barriers to early student achievement for pre-physician assistant students.

1.3.2 Question 1: What Causes Students to Struggle or Persist in Early College Courses

A variety of influences affect student success and persistence in their first year of college, including instructor and institutional decisions about course structures, classroom and course policies, and instructional practices. Identifying the forces that foster student success and provide

barriers in early college experiences is critical to building effective instruction and classroom policy. The first-year GPA is one important influence on student persistence in STEM courses (Dika & D'Amico, 2015, Shaw & Barbuti, 2010). The importance of early college experiences for the pre-health care students in my classes is compounded by the competitive nature of our pre-professional programs. Simply experiencing their first classes in a competitive light may influence a student's perception of success in the college environment (Hurtado et al., 2007; Hurtado et al., 2011).

While I recognize the complex and interconnected nature of influences that put students at a disadvantage as they enter college, in this section, I have categorized causes of struggle for early college students according to their pre-college experiences and early college experiences.

1.3.2.1 Describing Early College Students

Early college students represent a complex population with intersecting identities and unique experiences, including identities as first-generation college students, students from under-represented minorities, students from rural and urban school districts, and students from families of low economic status in addition to traditional, middle, and upper class continuing education students. While my focus was on all early college students in the pre-physician tract, the body of literature describing the challenges of first-generation college students helps elucidate the challenges of my students, many of whom reflect the intersecting identities that manifest under the first-generation college student classification. Specifically, first-generation college students are more likely to be minority students, be older than twenty-four, and have substantial work and family commitments (McCallen & Johnson, 2020; Hurtado, 2007; Stebleton & Soria, 2012, Tracy, 2022).

A large body of literature describes first-generation college students, who make up a portion of my student population. McCallen and Johnson (2020) note that "disparities in the outcomes between first-generation students and their continuing generation peers may be attributable in part to the fact that their status overlaps with other social and demographic factors shown to independently limit success" (p. 320). These students can encounter barriers that position them to be less likely to persist through the first year of college than their continuing education counterparts. This, in turn, prevents them from sharing their perspectives and skills with the college community. The diverse backgrounds of these students are rich in experiences, all of which provide essential funds of knowledge to college classrooms and, later, professional communities.

Low-income and first-generation college students often balance work schedules and family responsibilities; however, a study by Freeman S. et al. (2020) implies that these students rise to the challenge. Freeman, S. et al. (2020) surveyed introductory biology students at two-year community colleges and regional comprehensive and R1 universities (universities that emphasize research) to determine the amount of time spent on non-academic commitments and studying for biology courses. Their results showed that "community college students commit as much time to studying biology as other students." While Penn College is not considered a community college, our demographics reflect a population similar to those in community colleges. Hurtado et al. (2007) mentions that family support can be a critical asset for students who belong to underrepresented minorities unless these responsibilities interfere with student responsibilities in the student's first year of college. Meanwhile, there can be a tension between these students and their families as student identities evolve according to their college experiences. These tensions can introduce additional emotional stressors for these students (Housel, T. H., 2012; T. W. personal communication, 2023).

While students from all backgrounds can navigate college systems and contribute to the richness of the college community, these college systems have facets that hinder persistence along a chosen career path. Using results from 58,000 responses to the Student Experience in the Research University Survey, Stebleton and Soria (2012) found several factors that disadvantage first-generation college students' persistence in their major, such as job and family responsibilities. Duffy et al. (2019) also suggest that low-income and minority students experience distress from financial concerns, and prejudices can impact their career choices and volition (2019). Further, a student's family and job responsibilities can negatively affect student self-efficacy (Hurtado, et al., 2007), which, in turn, can reduce student success (Stebleton & Soria, 2012).

Financial concerns are among the barriers that some Penn College students encounter. According to the 2021 edition of Penn College Fast Facts, 86.6 % of Penn College students received financial aid, and 35.12% received a Federal Pell Grant. Internal statistics report that 37.9% of the total student body qualify as low-income students (Penn College, 2022). Financial need is compounded for students in competitive programs. Students may need to retake courses to acquire competitive grades or attain a master's degree, which requires them to pay for two additional years of tuition. In conversation with students, I learned that if these students cannot afford to retake a course or if the course is not offered in a particular semester, their education can be prolonged, making cost a barrier to these students. As a result, they may consider switching to less competitive majors rather than their career preference due to financial constraints (Dika & D'Amico, 2015; students, personal communication, 2023). In fact, this semester, two high-achieving students in a second-semester biology class reported switching majors due to the cost of the master's degree associated with the physician assistant program. Many of our students grow up in rural areas, generating strong community and family connections, which can benefit students.

However, rural students have some concerns that are similar to urban student populations, like limited high school course offerings, limited resources, help with applying for acceptance and financial aid, and being away from their family and community (Byun et al., 2012; Morton et al., 2018). Morton et al. (2018) found that rural students are more likely to be first-generation college students and come from low-income families. They also found that rural students "were more likely to enter college with a less rigorous academic curricular background than their metro counterparts" (p. 8) due to the access to advanced courses that Byun et al. (2012) found to be more available in some urban school districts. Despite these differences, Byun et al. (2012) found that rural students were at least as likely as their peers to complete college. This study did not address whether students completed their intended major for the bachelor's degree.

1.3.2.2 Pre-College Experiences

Students arrive in their first college classes from a variety of high school academic experiences, which may shape their initial successes in the college classroom. Trujillo and Tanner (2014) recognize that students bring feelings about biology and their ability to succeed into the college classroom with them, and these feelings develop as a result of their pre-college experiences.

Anecdotally, these experiences dwell in the mind of my students and arise in our conversations. For example, a student may say, "I haven't had a biology course since ninth grade," "I didn't enjoy my high school biology course," or "I did/didn't get along with my high school biology teacher." Varying evidence for the effect of high school academic experiences is presented by Shaw & Barbuti (2010), Stebleton & Soria (2012), Dika & D'Amico (2015), Ainscough et al. (2016), and Tracy (2022). Conversely, students from small or rural schools often develop strong ties that mitigate reduced access to resources (Morton, et al., 2018), and, according to a focus

group conducted in preparation for this inquiry, some report that high school teachers are important mentors that support success in these environments.

A study by Tracy (2022) provides evidence that incoming preparation is at least partly responsible for the struggle experienced in introductory biology courses. Based on coded responses to a survey, approximately a third of responses from students who reported less struggle cited prior biology courses as a reason why they did not struggle. In this study, students who did struggle were less likely to mention prior biology experiences. These results imply that students who struggled less may be bolstered by their prior biology education experiences.

Research such as Byun et al. (2012) and Hurtado et al. (2011) highlight the importance of rigorous high school preparation for the success of rural students in college. A large survey of students revealed that weak English and math skills (among other important factors) are a barrier to early academic success (Stebleton & Soria, 2012), while Dika & D'Amico (2015) found that prior math experiences were a more important indicator of student perseverance in college. Shaw & Barbuti (2010) found that high school math and science GPA, as well as whether or not students took (or had access to) advanced placement science courses in high school, could be correlated with those who stayed in STEM majors versus those who switched out of STEM majors. Both Shaw & Barbuti (2010) and Ainscough et al. (2016) found that high school biology and chemistry experiences support self-efficacy, at least at the beginning of the college experience (Ainscough et al., 2016).

1.3.3 Question 2: What Factors are Pivotal in Managing Student Struggle in Early College Course Experiences?

The literature addressing early student success for first-generation college students, low-income students, and students that belong to minority groups and other identities often casts them using a deficit lens (Ives & Castillo-Montoya, 2020). On the contrary, these students have unique perspectives on navigating the world due to their cultural upbringing. Their unique perspectives can be leveraged to support learning and contribute to the richness of interactions with their classmates. This body of literature is referred to as "funds of knowledge" and can enrich the creativity and learning of those around them (Gonzalez, et al., 2005)

The framework for "how to do things" in the college environment, sometimes called "capital," may be more intuitive to continuing education students, putting them at an advantage for persistence and success in the college environment (Stephens, 2012; McCallen and Johnson, 2020). When some students succeed in their desired career path through college because of their continuing family experiences in education while other students are disadvantaged in the college system, this results in broader societal problems and deprives the college classroom and the workplace of unique and creative viewpoints. (Leung et al., 2008). The second part of my literature review addresses practices that manage student struggle in early college experiences.

As highlighted in the power interest grid (Fig. 1), classroom and laboratory instructors have a great deal of influence over student experiences in their classrooms. Elements of course design, curricular framework, classroom climate, assessment of student knowledge, and the when, where, and how of student/instructor interaction are largely controlled by the classroom instructor. In the paragraphs that follow, I discuss the role of instructor mindset, instructional practices, and classroom climate in a student's early college experiences.

A survey of second and third-year pre-physician assistant program students cited instructors as a barrier to success, at least for some students. In general, students in this survey mentioned that professor expectations and course pacing were overwhelming at times. Others felt that professor attitudes toward students, consistency in course design, and the language used by professors in their instruction made student progress more difficult (Avery, 2022).

The way professors think about student potential can have an effect on student success (Hurtado et al, 2011). Fixed and growth mindsets (Dweck, C., 2018) tie closely with deficit and asset assumptions about students. Trujillo and Tanner (2014) say that instructors working from a student assets viewpoint would be more inclined to learn about students' feelings about their capabilities as science students. The teacher's perspective in this regard is perceptible to students. Canning et al. (2019) found that students perceived instructors with growth mindsets as more empathetic and focused on student development, especially in students who belong to underrepresented minority groups. Further proof lies in an investigation showing that a growth mindset intervention improved student GPA in Latinx students, an effect that persisted into the next semester (Broda, et al., 2018). Unfortunately, while faculty may have been exposed to growth mindset ideology and claim to embrace it, evidence proves otherwise. For example, an unpublished study investigating the alignment between faculty beliefs about growth mindset and policy for grade recovery listed in their syllabus indicates that while faculty may claim to have a growth mindset, their classroom policies may not support that claim (Czikari, unpublished, dissertation in progress).

Faculty have varying agency over course design, content, and pedagogical practices. In several stories, students report that teaching practices can influence how they experience their courses. A common source of student struggle reported by students was often “classroom factors”

that were under an instructor's control (Tracy, 2022). For example, using active learning strategies in the college classroom can support student self-efficacy and social belonging (Freeman, T. et al., 2007; Hurtado et al., 2011; Ballen et al., 2017), which is, in turn, associated with improved academic performance, especially for students who belong to minority groups (Tanner and Trujillo, 2014). Active learning strategies such as small group discussion may foster community building (Venkatesh, et al., 2021) for more prosocial learners (Stephens et al., 2012; Ives & Castillo-Montoya, 2020), although the way that active learning is enacted by professors and perceived by students is critical for its successful inclusion in the college classroom. (Cooper, Schinske, and Tanner, 2021).

Tracy (2022) found that students reported less struggle in an introductory biology course when the content was more interesting to the students. Further, Trujillo and Tanner (2014) report that when students surmise that an academic activity is valuable, they feel a greater sense of belonging, which, again, is associated with improved student outcomes.

Management of learning activities by instructors is also important. According to Freeman, T. (2007), effective design and implementation of instruction are important in fostering student sense of belonging which fosters the development of student identity (Trujillo and Tanner, 2014). Instructors should encourage student questioning and make student questions seem like a normal part of learning (Gasiewski, 2012).

1.3.3.1 Instructor Relationships with Students

Students' sense of belonging in a classroom is positively connected with academic motivation, and instructor characteristics such as warmth foster a sense of belonging in college students (Freeman, T., 2007; Hurtado et al., 2011). Additional instructor characteristics positively associated with student sense of belonging uncovered by T. Freemen's (2007) investigation

include encouragement of student participation and interaction. More generally, when students feel cared about, several benefits arise, including an easier transition to college and better feelings about "social and academic matters" (Hoffman et al., 2002).

Chickering and Gameson (1987) sum up earlier research about effective instructor practice in "Seven Principles for Good Practice in Undergraduate Education" In this document, they state:

> Frequent student-faculty contact in and out of classes is the most important factor in student motivation and involvement. Faculty concern helps students get through rough times and keep on working (p. 3).

1.3.3.2 Student Role in Faculty/Student Interaction

The other part of student-teacher relationships would, of course, be the student. Rural students often benefit from closer relationships with teachers in high school (Morton et al., 2018). Many students would like to have close relationships with college instructors as well but may not connect with instructors due to fears of being found incompetent or unprepared (Ives & Castillo-Montoya, 2020, Gerrero & Rod, 2014). First-generation college students, in particular, may also interpret "initiative" or "responsibility" for learning to mean that they should figure it out on their own rather than pursue help from instructors (Ives & Castillo-Montoya, 2020).

I learned more about student-instructor relationships locally in a focus group with prior students who were accepted to the Penn College Physician Assistant program. These students cited relationships with professors as one element that contributed to their success and their struggles. This is further supported by surveys of second and third-year students in the pre-physician program. For example, one student mentioned that "When a professor cares about you and your education in their class, it makes it more comfortable to learn, have discussions, ask for help, and

ask questions." Meanwhile, another student mentioned that the dismissive attitude of an instructor toward her help-seeking "closed the door" to her learning in that particular class.

1.3.3.3 Interaction Between Student Affect and Learning

Trujillo and Tanner (2014) explain elements of student affect that describe how a student feels about themselves, their learning, and learning in a particular subject. Trujillo and Tanner (2014) describe affective learning as applying to activities that are "directed at coping with the feelings that arise during learning" (p. 2). They even link the psychology and the biology of learning by noting that some parts of the brain involved in learning are located near regions of the brain involved in affect. Finally, Trujillo and Tanner (2014) divide the study of affective learning into three elements: self-efficacy, sense of belonging, and science identity.

The term self-efficacy describes "how a person acquires beliefs about" their "ability to do something" and "how these beliefs affect behaviors" (Trujillo and Tanner, 2014). In the early college experience, these include developing beliefs about how a student learns, how a student navigates college infrastructure and environment, and how they advocate for themselves in the academic world. When students succeed at a task, they build self-efficacy for that task. Further, students may build self-efficacy by watching peers succeed at a task (Trujillo and Tanner, 2014), highlighting the importance of community-building in the early college experience. The research cited by Trujillo and Tanner (2014) proposes that "weaker" academic backgrounds may be mitigated by high self-efficacy, although Ives & Castillo-Montoya (2020) counters that how students may feel about their academic skills may be at odds with their actual capabilities at a particular time, positioning students to feel surprised when their current skill set does not result in expected outcomes on assessments.

A second element of student affect, as defined by Trujillo and Tanner (2014), is sense of belonging, and while this was discussed above with regard to instructor and student interactions, here it is discussed with a focus on the developing student community. Developing community or "finding your people" is important for early college students. According to Hurtado et al. (2007), academic adjustment and sense of belonging are strongly linked for students in their first year of college. Further and more specific to this inquiry, Dika & D'Amico, (2015) found that "social fit" was important for persistence in STEM majors. The importance of developing community with peers may be especially salient for groups that are prosocial learners, such as first-generation college students (Ives & Castillo-Montoya, 2020).

Hurtado et al. (2007) found that peers contributed to "foundations of success in college including aspirational, intellectual, emotional and navigational capital." Findings by Trujillo and Tanner (2014) propose that peers may encourage each other as they navigate their academic life. When I surveyed second and third-year students in our pre-PA program mentioned that finding peers for study groups bolstered learning and sense of community. In studies reviewed by Trujillo and Tanner (2014), sense of belonging in classrooms lends itself to student well-being resulting in a student who is mentally and physically alert and engaged in the course. Sidelinger et al. (2010) also support this finding in their study, noting that "connectedness fostered a positive communication climate and sense of community for college students," which made them more willing to participate in class (p. 14).

When instructors foster interactions that build a sense of a learning community within a classroom, students form peer relationships that support a feeling that "they are not alone in the academic endeavor" (Hoffman et al., 2002. p. 235). Hoffman et al., (2002) further found that students who were a member of learning communities were "more resilient and more comfortable

in the university environment." (p 237). Sense of belonging in 4-year colleges is lower for first-generation and minority students, according to a large survey of 23,750 students by Gopalan and Brady (2019), which implies that differences in success could be minimized by fostering a sense of belonging for these students.

A third element of student affect is science identity. The influence of science identity and a sense of belonging dovetail and are especially important for first-generation and minority students (Chen, 2021). Gee (2000) defines identity as "the kind of person you are in a particular context." Early college experiences require students to explore a number of shifting identities: from high school senior to college student, from living at home to living away from family and in a new community, and as a student exploring a specific major. Vincent - Ruz (2018) proposes that science identity can be supported by a sense of community. Le et al. (2019) further explain that science identity can be linked with persistence because building science and community provides a system of feedback that shapes students' ideas about their science identities. Science identity is important because it can be linked with higher GPAs (Chen, 2021) and persistence (Le et al., 2019). It is important to note that others have found a reciprocal relationship between identity and GPA; specifically, Stets et al. (2017) suggest that increased GPA builds science identity rather than the other way around, as proposed by Chen (2021). Finally, Stets et al. (2017) found that science identity plays an important role in the ultimate career path of students, specifically that students with a strong science identity are more likely to end up in STEM jobs compared to their peers.

1.3.3.4 Office Hours as a Specific Opportunity to Build Student-Instructor Relationships and Improve Student Affect

Faculty/Student interaction is an important way to build student self-efficacy (Briody et al., 2019). Several opportunities for faculty-student interaction exist, such as via email, during class and the times adjacent to class, and even by chance encounters in the hallway. One important opportunity for instructor-student interaction is during office hours. While the benefits of these interactions are recognized by students (Guerrero & Rod, 2013), student office hour use is empirically low (Guerrero & Rod, 2013; Griffin et al., 2014; Cotten & Wilson, 2016; Abdul-Wahab et al., 2019;). While Griffin et al. (2014) posit that the reasons for the low frequency of student-instructor interaction lie outside of instructor control, other studies uncover reasons that can be attributed to instructors, students, and institutions.

1.3.3.5 Barriers to Office Hour Use

Expectations for faculty office hour policy vary across institutions. At Penn College, full-time instructors are required to hold five office hours across at least three days. Up to two of these may be held virtually as long as the instructor is in the virtual space during the scheduled virtual office hours. Instructors in a large institution are required to have one office hour per week. However, other biology professors reported between two (University of Washington at Tacoma) and five office hours a week with a variety of requirements for the duration, timing in proximity to classes, number of days, and modalities. Instructor behavior during office hours also differs, with some professors reporting that they moved their office hours to areas of higher student foot traffic, and others admitted that they prefer to use the time to complete their own tasks (Personal communication, 2023).

Griffen et al. (2014) propose that factors that get students to use office hours are largely out of the control of instructors citing factors such as convenience and/or accessibility of scheduled office hours time or location to the students, instructor characteristics, and whether the course is a major requirement. Further, Griffen et al. (2014) puts instructor characteristics like their identities and affect outside the control instructors. In an article by DeShun Harris (2018), she mentions that students may be more reluctant to visit an instructor if perceived identities such as gender or race are different from their own. Smith et al. (2017), not surprisingly, found that students are reluctant to visit instructors that seem unapproachable. Consequently, instructors can become discouraged by low attendance and respond by investing less time in reaching out to students to encourage their attendance (Guerrero & Rod, 2013).

There remains a great deal that is in the power of the instructor. For example, some students report a reluctance to attend office hours because instructors are not present for the scheduled office hours or seem overwhelmed and too busy to actively attend to student concerns (Abdul-Wahab et al., 2019; Briody et al., 2019). Students mention that they do not want to burden their professors (Smith, 2017; Guererro and Rod, 2013; Briody et al., 2019). Therefore it falls on the professor to dispel the notion that their students are an imposition during office hours. While Griffen et al. (2014) posits that instructor affect is out of instructor control, I argue that instructors can cultivate active listening skills and take actions that make students feel welcome. Small adjustments such as providing a clear desk and turning away from a computer can help instructors be more present for students. Effective instructor feedback seems to support student office hour use (Griffen et al., 2014) and discourage student attendance in the absence of effective feedback on student practices or assignments when students do attend (Abdul-Wahab et al., 2019). Perhaps

students see effective instructor feedback as encouraging or an invitation to pursue more assistance from a professor.

Although Cotten and Wilson (2006) found that not all students seem aware of the benefits of interactions between students and faculty outside the classroom, other studies present evidence to the contrary. Guerrero & Rod (2013) found that all students surveyed affirmed the importance of office hours for academic success in their studies, even if most do not use them. Smith et al. (2017) report that students use office hours as a last resort when their GPAs drop. By this time, it may be too late. Students may find that office hours are ineffective or inaccessible if they wait until directly before a major assessment (Abdul-Wahab et al., 2019).

Several studies uncover intrinsic student characteristics and reasons why students shy away from attending office hours. Students seem to be unsure of how to use office hours in surveys conducted by Smith et al. (2017). While some students seem to be at a loss to understand why they would use office hours, others assume that they must have specific questions or want extra credit to attend (Smith et al., 2017).

Student characteristics like shyness, habits (procrastination), and anxiety about speaking one on one with instructors provide a hurdle to office hour visits (Cotten & Wilson, 2016; Abdul-Wahab, 2019). Students may fear showing that they are "weak," unprepared, or "bad" at a subject (Smith et al., 2017). Guerrero & Rod (2013) find that students may be embarrassed or lack confidence which prevents them from meeting with professors during office hours. Conversely, Harris, D. (2018) proposes that attending office hours may provide a threat to a student's false identity of perfection. Also, students who do poorly are less likely to use office hours (Harris, D., 2018) or consider the trip to be a "waste of time" (Abdul-Wahab et al., 2019). A study by Briody et al., (2019) identifies "social distance between faculty and students based on unequal status

within a rigid, hierarchically organized culture as a key barrier to FSI (faculty-student interaction)" (p. 1).

Office hour attendance is a critical leverage point because it can support both student success and effective instruction. Cotten & Wilson (2016) report that students may be unaware that instructors can do more than help with homework. Office hours can help students adjust to the college environment. During focus groups, one student reported that office hours helped her to transition from high school, where she had been close with her teachers, to the college environment (Avery, 2022). Dika & D'Amico (2015) propose that relationships with instructors can build social capital that helps students navigate the college environment.

Jackson & Knupsky (2015) also propose that face-to-face office hours can provide an opportunity for mentoring, which can be especially important for students from underrepresented groups (Mina et al., 2004; Glass, 2022). Students reported that contact with professors outside of classrooms increases their comfort level in class and satisfaction with college experiences (Cotten and Wilson, 2006).

During office hours, students can be coached in critical thinking and asking deeper questions than they may have had time for during lectures (Harris, 2018). Students may be inspired by these interactions and further engage students in their education (Guerrero & Rod, 2013). Guerrero & Rod (2013) find a positive correlation between office hour use and GPA and even quantify the increase in GPA per office hour visit.

Meanwhile, instructors also benefit from the interactions that can occur during office hours. Frisby et al. (2016) found that instructors find more satisfaction and "enhanced teaching efficacy" when they build relationships with students. For example, instructors may uncover student misconceptions or problem areas. Abdul-Wahab et al. (2019) further suggest that instructors can

learn more about how students are experiencing their instruction and content, thus uncovering opportunities to adjust instruction as a result of office hour conversations.

1.3.3.5.1 Possible Solutions

Several sources articulate the importance of explicit instructions on how, why, and when to use office hours for first-year students. (Guerrero and Rod, 2013; Smith et al., 2017; Harris, D., 2018). Instructors should post the times, dates, and locations for office hours on the course syllabus, learning management system, and near the office (Smith et al., 2017). Instructors should also consider when students may be most available; for example, many of my students commute and are unlikely to come to campus on days when they don't have classes. Additionally, instructors should provide constant reminders and invitations both in class and using online messaging technologies such as email and learning management systems. Guerrero and Rod (2013) further advise scheduling office hours during different times and days to increase the chances that students will be able to attend.

When students attend office hours, instructors should be intentional about how students perceive the experience by sending clear signals to students that instructors are present and students are not a burden to them. Harris (2018) advises that office hour visits should be student-centered, focus on active learning, and give explicit strategies for studying, test-taking, and navigating courses.

1.3.4 Synthesis

In sum, increasing student efficacy and persistence in their early college experiences can be supported using a variety of strategies, one of which is interaction with faculty using office

hours. This is further supported by a focus group (2022) and surveys (2022) of prior Penn College students later in the physician assistant career path designed to learn more about the influence of office hours on successful students.

A review of the literature makes apparent that moving barriers to office hours supports both student success and effective instruction in a number of ways. Interactions between students and faculty in general, and especially during the dedicated time allotted during office hours, can support elements that, in turn, foster student success and persistence in the classroom and further, on their pathway toward their intended career. My theory of improvement proposes change ideas that remove barriers to office hour attendance by providing explicit guidance for finding the office, learning how faculty-student interactions during office hours build student identity and efficacy to support student success, and abating the anxieties or concerns that could keep students from visiting instructors during their office hours. Learning more about how students experience office hours could be used to generate a student perspective to share with my colleagues with the hope that we all learn how to support early college students more effectively.

2.0 Theory of Improvement & Implementation Plan

Office hours as a strategy for college success may seem to be an obvious way to foster faculty-student interactions and student growth, yet many first-year college students in my classes do not use office hours as part of their routine in their first year of college. Meanwhile, a common cliche is to see instructors throw their hands up and say things like, “I am here for my students, but they just don’t visit during office hours.” This implies that being available on the part of an instructor is the simple solution to differences in student achievement. A body of research exists to identify practical reasons explaining why students do not take advantage of office hours. For example, some students report feeling unsure of what office hours may be like and what they should do when they get there. Others admit to feeling awkward about attending office hours with a professor (Smith et al., 2017) or that the professors are too busy to work with students (Briody et al., 2019). Finally, several students stated that a visit to office hours is warranted only as a last resort or “in case of emergency” situation (Smith et al., 2017; Briody et al., 2019).

2.1 An Introduction to Improvement Science in Education

To investigate instructor actions that could improve office hour attendance and therefore support the growth that leads to student persistence and achievement early in their college career, I designed my inquiry using improvement science. Improvement science has been used to investigate the effect of practical changes in educational settings in various contexts (Byrk et al., 2017). This process begins with a study of the system to identify actionable problems where

potential change could improve the system outcomes. Root causes of these problems are identified using fishbone analysis (Bryk et al., 2017; Perry et al., 2020; Hinnant-Crawford, 2020). By learning about specific elements uncovered by the fishbone analysis, an Aim Statement can be constructed. This Aim statement is supported by a driver diagram that articulates drivers that identify "key leverage points" that can address the problem and improve the overall system in which the problem exists (Perry et al., 2020, p92). The drivers serve as areas of improvement and change ideas that could achieve or, at least, move the system toward the identified goal. These exercises ultimately inform the theory of improvement (Perry et al., 2020) or the theory of action (Mintrop, 2018). The theory of improvement makes explicit particular interventions that could improve the system by addressing the problem. The investigation is then designed using iterative Plan, Do, Study, Act or PDSA Cycles, which build upon each other based on outcomes provided by various measures.

In this study, the theory of improvement focused on removing identified barriers to office hour attendance to support qualities that are identified in the literature as improving student self-efficacy and, therefore, student success in their early college career. A more specific Aim Statement follows: Early Pre-physician assistant students will attain a B or better in their first semester of biology.

Primary drivers directly support the attainment of the aim statement. Each primary driver can be further dissected into specific elements or secondary drivers that identify elements of primary drivers that are actionable. These secondary drivers assist in narrowing the scope of the study such that change ideas can be generated with the goal of moving the system toward the achievement of the aim statement. A driver diagram provides a visual representation of the elements described in this section (Appendix B).

During my investigation of the problem, I identified two primary drivers of early success: student practices in class and student practices out of class. The primary drivers can be further disarticulated into three secondary drivers: student practices, student affect, and community building. Specific student practices that develop and lead to persistence and success for early college students include study skills, test taking, and note taking for understanding and processing content. Developing student affect can be further divided into student identity (both identity as a college student and identity as a pre-physician assistant student) and confidence as a student. A final secondary driver involves the building of a community within and outside the classroom and amongst students, and between students and professors.

The secondary and primary drivers helped to identify change ideas, and actions that can be taken on the part of faculty to remove barriers to office hour attendance. These change ideas were used to generate PDSA Cycles with the goal of achieving the aim statement.

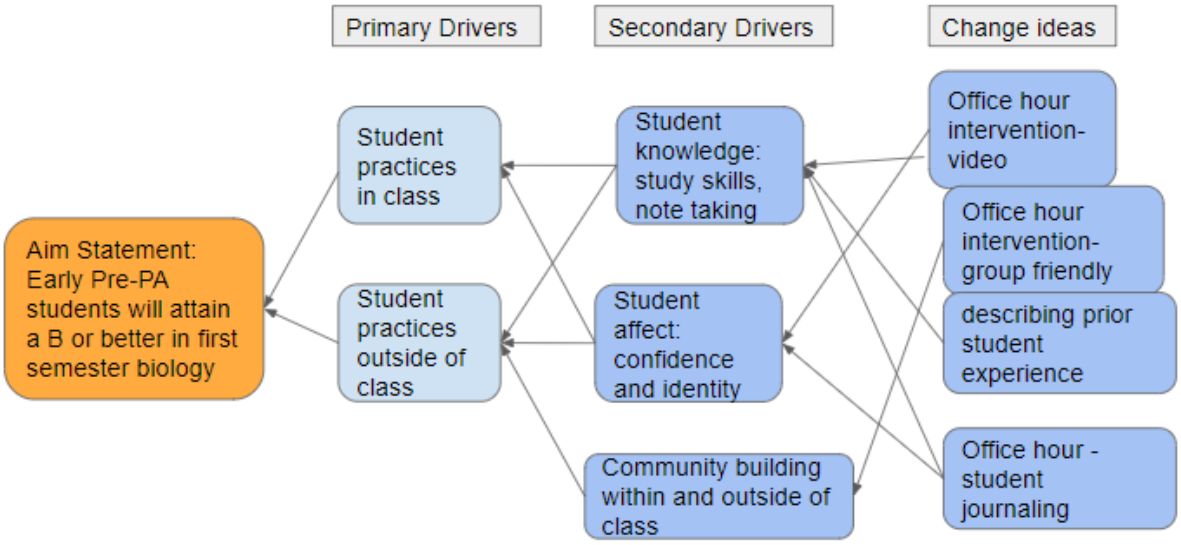


Figure 2. Driver Diagram

2.2 PDSA Cycles

The following Plan, Do, Study, Act cycles (PDSA) provides an overview of my inquiry which could foster students' success in their first semester of college and ultimately along the path to becoming a physician assistant by removing practical barriers to office hour attendance.

I tested several interventions that encouraged students to attend office hours for my class. Nested goals resulting from these interventions included fostering study skills, community building, and developing college student identity. Longer-term goals included positioning students for success in the pre-physician assistant degree and acceptance into physician assistant programs.

2.2.1 Plan (Using the Literature to Devise Change Ideas)

Based on my literature search, I planned change ideas designed to mitigate student-perceived barriers to office hour attendance keeping in mind the goal of fostering skills and practices that support early college students. I focused on providing explicit and accessible information for students on how to attend office hours with the intention of building community between students and their peers and students and instructors, ultimately fostering belonging in the college community.

2.2.2 Do (Enacting the Change Ideas)

During the first week of class, I introduced and described office hours as I usually do while introducing the course. At the end of the fourth week of the course, I played a short video in class. I made this video using a tablet and basic software and added closed captioning in a style similar

to social media platform reels. This video visually "walked" students from the classroom to my office and modeled an office hour interaction. The video featured me discussing what exactly could happen during an office hour visit. (The video script is included in Appendix C)

A second intervention occurred after the first exams and quizzes at the end of the fourth week of classes. I reached out specifically to any student who scored below 80% with a personal invitation to visit during office hours. This invitation occurred via email or as feedback within the grade book of the learning management system. I added that students might use a virtual option for attending office hours and instructed them on how to access office hours this way.

Finally, students were encouraged to use office hours in groups. Based on prior experience, students often form study groups that meet in our library, dorm, or office area, but when visiting office hours they become confused about whether more than one student is allowed to drop by at a time. This third intervention aimed to reduce that confusion, which can also act as a barrier to office hour attendance.

2.2.3 Study (Learning About the Effect of Change Ideas)

As each change idea was introduced, I used a brief anonymous student feedback survey, and I completed the office hour journal for each visit to keep track of change after each change idea was implemented. These measures are fully described in the methods section of this paper. I also gathered student thoughts on the changes using an anonymous survey (Appendix D).

2.2.4 Act (Using my Learning to Improve the System)

Based on the findings of this inquiry, I will fine-tune the change ideas in the following semesters to make student-faculty interactions during office hours more accessible to students and continue to collect information about the usefulness of those changes. I also wish to share findings from this investigation with my colleagues in my place of practice to bolster student success in their intended career path.

2.3 Methods and Measures

Ives & Castillo-Montoya, (2020), Delpit, L. (1988), and others discuss the importance of both addressing specific practices that allow students to access the student support systems that exist in academia but also honoring student culture rather than forcing them to fit into systems that disadvantage their success. Students bring prior content knowledge and ideas about how to attend and participate in classes based on earlier educational experiences. They also come with practices designed to document the happenings in the classroom, in other words, note-taking skills. Finally, students attend their first semester classes with elements of student affect developing (Trujillo and Tanner, 2014). The development of each of these elements can be supported by instructors and, more specifically, interaction with instructors. One specific type of interaction between instructors and students, the influence of office hour attendance, was the focus of this study.

This study was guided by three inquiry questions:

- How does explicitly addressing the purpose of and the process around office hour use shape student office hour practice?
- How do office hour visits shape students' sense of community and identity as college students (student affect)?
- How do the findings of this study at a small technical school compare to the broader literature?

2.3.1 Sample Population

Because early student success in rigorous STEM courses can be predictive of perseverance in the STEM major (Dika & D'Amico, 2015; Hurtado et al., 2011), my target population included students in introductory biology in the first semester of their college experience along this career path. It is important to note that two students had already earned associate degrees and were returning to advance their careers. According to their choices, students self-selected into two categories with regard to this study: office-hour visitors and office-hour non-visitors. Ultimately the sample size was twenty-three students (two students dropped the class after the beginning of this inquiry), although not all completed the survey and therefore are not reflected in some parts of this inquiry. A few of these students had career goals that fell outside of the physician assistant pathway but still were working to gain entry to other programs, and thus I included them in this inquiry.

I began the semester with the usual description of timing, location and how to access office hours as listed in the syllabus, to establish a baseline for office hour attendance. A few weeks later,

I addressed this theory of improvement by implementing my first change idea: A video introduction explaining how to access and use office hours. This video was designed to address barriers to office hour attendance uncovered in the literature and in a survey and a focus group of students further along in their educational pathway in the pre-physician assistant major at Penn College. This short video was made using Apple Clips and designed to look somewhat like videos that students often view on social media platforms, including captions. The video began in the classroom and walked students to the office area using a student (outward facing) view.

Along this walk, I pointed out "landmarks" that would help students find my office and the offices of other science instructors. Once in the common space outside faculty offices, I highlighted helpful resources available in this space. This portion of the video culminated in showing my office door opening. I then placed the camera so that it would record me from a student's perspective with a view across the desk pointing at me. I discussed what a student could experience when attending my office hours, how they could show up for office hours (prepared with questions or not), and content that they could expect to cover (notetaking, study or test-taking strategies, content questions, or general mentoring). The script for this video is provided in Appendix C.

Two weeks later, an additional change idea was implemented. Using the learning management system or email, students received a direct and personalized invitation to attend office hours anytime any assessment grade was below an 80%. A final change idea was introduced in the last few weeks of the semester. Students were given an invitation to attend office hours with a classmate or via an online meeting platform. This change idea was announced in the classroom.

This final change idea was based on statements submitted by survey and focus group comments in which participants highlighted the importance of office hour accessibility and peer

support along their learning journey. McCallen and Johnson (2020) write about the role of peers in the development of "aspirational and emotional capital" as protective agents and their roles in building a "foundation for success" in college (p. 325).

2.3.2 Measures

Appropriate measures are critical to advancing change using a theory of improvement identified in a driver diagram (Bryk et al., 2017; Perry et al., 2020, Hinnant-Crawford, 2020). Perry et al. (2020) describe a series of measures commonly used in improvement science to evaluate the effectiveness of change ideas and inform the progress of PDSA cycles which are based on the driver diagram. These measures include process measures, driver measures, outcome measures, and balancing measures.

2.3.2.1 Process Measures

Process measures "seek to quickly and easily answer how the change idea is working" (Perry et al., 2020). I collected semi-anonymous information about changes caused by interventions in several ways. For a process measure, I placed a QR (quick response) code sticker on my desk and asked students to take a quick survey after each office visit. Students who visited multiple times completed this survey each time they visited. To ensure participation, I kept it short and easy to complete, with four simple questions and a Likert-like scale. This is not a true Likert Scale but rather a rating system like those students experience for product evaluations. The questions were designed to collect immediate information on student feelings about elements that can support student success that were listed as primary drivers, such as confidence, content knowledge, and community or feelings of belonging.

Questions included in this survey follow:

To what degree do you agree with these statements:

- My visit to office hours helped me feel more confident about content knowledge.
- My visit to office hours helped me to feel more confident about being a college student.
- My visit to office hours helped me to learn new strategies for improving my success in this class.
- My visit to office hours helped me to feel a greater sense of belonging at Penn College.

The above process measure may have also acted as an intervention in the form of affirmation of the student's office hour experience. The results of these short surveys were analyzed with simple descriptive statistics such as mean, percentage, and mode to uncover patterns in student thinking about office hours. The results of this short survey were also used to corroborate the findings of the office hour journal discussed below, such as the number of visits overall and visits per month as well as tracking the number of visits before and after the implementation of change ideas.

I employed an additional process measure in the form of an office hour journal in which I recorded students who attended office hours. Using this journal, I also recorded the general reasons for their visits, such as skills like study or test-taking strategies, content-focused questions, help with navigating college, or other life skills. Finally, I kept track of which students visited to find out whether a correlation between grades and office hour visits emerged.

2.3.2.2 Driver Measures

Driver measures "let us know if the change is working to improve the system" (Perry et al., 2020. p106). I probed student thinking about office hours using a Qualtrix survey at the semester midpoint and semester end. Questions included in the survey are included in Appendix D. The intent of the survey was to gather qualitative information about student thinking and reasoning for and about office hour attendance with regard to primary and secondary drivers included in the Driver Diagram (Fig. 2). The survey included several multiple-choice questions and open-ended questions and was pre-tested by a few non-students in their early twenties, several colleagues and my peers in the EdD program. Simple statistics were helpful in analyzing multiple-choice questions. However, Ives and Castillo-Montoya (2020) recommend that surveys include open-ended questions which provide opportunities for students to use their voices in their responses. Student participation in the survey was voluntary, and the survey was accessed by a QR code displayed on a screen in the front of the classroom.

This survey was administered twice. Using a comparison of the first responses at mid-semester with the final responses at the end of the semester, I could find if changes in student thinking about office hour attendance emerged. Although names were included with responses, they were replaced by numbers by another faculty member. The original responses will be kept for a period of one year; after that, only the de-identified information will be retained, and identifying information will be deleted from the original copy.

In the analysis of the open-ended questions on this survey, I used open coding to find emerging themes about student thinking about the role of office hours in their progress through their first year of college while also considering the elements of the primary and secondary drivers. I also used basic quantitative measures to compare the numbers of students who found the change

ideas helpful and how those responses compared to the number of students who actually attended office hours.

2.3.2.3 Outcome Measures

Outcome measures are helpful in determining if change ideas are actually changing the system and can be divided into leading and lagging measures (Perry et al., 2020). While lagging measures, such as how many students from my sample ultimately gain acceptance to a physician assistant program, are the ultimate measure of change in this system, they are outside the scope of this study. Leading outcome measures provide a more immediate indication of the effectiveness of change ideas and include the number of students who persisted from the first-semester biology to the second semester of biology. Leading outcome measures also follow the final semester grades of office hour visitors versus non-visitors since those applying for physician assistant programs must have competitive grades. For example, at Penn College, science GPA accounts for 60% of the weight of the physician assistant program application.

2.3.2.4 Balancing Measures

Some students learn more about their interests during their first semesters at college and change majors not because they are unsuccessful in their first classes but because they find that they do not wish to be a physician assistant. Using student numbers as an indicator of the success of my change ideas could cause a misinterpretation of the change idea. Therefore, I will note those students who do not continue because they willingly choose a different career path. Students often self-report these switches.

Another appropriate balancing measure is how an instructor may experience the increase in office hour visits by students and how students may be using these office hours. For example,

will the number of office hour visits exceed an instructor's capacity for appropriate coaching of individual students? Another balancing measure is whether students become overdependent on office-hour interaction for validation rather than growth. Information about these balancing measures emerge from the office hour journal.

2.3.3 Analysis of Data

While keeping in mind elements of student self-efficacy, identity as a student, and community building, I also kept an open mind in identifying themes as I analyzed the data from the office hour journal, the student surveys, and the brief office hour student survey. Further, I used simple quantitative measures such as percentages, averages, ranges, and modes to learn about the effects of change ideas implemented throughout the semester.

2.3.3.1 The Student Survey

The initial response to the student survey (twenty students out of twenty-five) was larger than the final response (eighteen out of twenty-three). Seventeen students provided answers at both mid-semester and end-of-semester dates, thus providing a basis for comparing change over the semester.

While keeping in mind the secondary drivers identified for this study, such as growth in identity as a student, community-building, and student practices, an inductive, open coding approach was used to identify themes amongst the survey responses for students who attended office hours and students who did not. I also looked for answers to new questions that arose as I read these results. Some student responses were double-coded when comments were applied to more than one theme.

2.3.3.2 The Office Hour Journal

Using the office hour journal I compiled the frequency of visits per student, frequency of visits over time, and in reference to the introduction of change ideas. I also looked for patterns and themes in office hour use by students in the notes I made in the office hour journal. I used basic statistical tools such as percentage and mode to compare visitors. As I uncovered themes using these tools, I attempted to corroborate results across measures.

2.3.3.3 The Student Exit Survey

I used basic statistics such as percentage and mode to analyze the student office hour survey to learn how students were experiencing office hours over time and according to the introduction of change ideas. I also used the number of responses by week and month to corroborate my own office hour journal findings about student visits.

This inquiry was reviewed by both the University of Pittsburgh and Pennsylvania College of Technology IRB and was designated as improvement science, thereby finding the full IRB process unwarranted for this investigation.

3.0 PDSA Results

How do office hour visits shape students' early college success, and how did the change ideas used in this study foster those changes? The answers to these questions are important for interpreting the effect of implementing change ideas on the primary and secondary drivers. According to the office hour journal, overall themes for office hour visits fell into three broad categories: content-related, study and test skills, and questions or discussions that address student well-being but were not directly related to biology class. (Fig. 3). Note that many students visited for more than one reason; each reason was recorded.

3.1 Content Related Visits

Using the instructor office hour journal, I could see that the majority of office hour visits focused on content questions about either class content or lab exercises. Students often opened with questions that they prepared before they arrived, showing that they worked through the content or exercises in preparation for their visit. Some students opened with questions like "How do I answer this question?" and simply needed to be coached to look for or synthesize information in their notes and activities. These sorts of questions addressed "entry-level" issues, and students were guided through the process of finding information or interpreting questions. Other students came with questions about my expectations, "Is this the answer you are looking for?" or "Did I provide enough information in this answer"? These questions reflect a desire to refine answer construction, figure out how to provide evidence of their knowledge to fit my expectations, or

simply get validation that they are on the right track. Students also came with questions about how to fully explain or express their scientific thinking (sense-making) about a problem or asked clarifying questions. Students often began with specific questions and moved toward making connections with prior knowledge and experiences.

Some questions were direct and practical such as “What do I need to know for xxx assessment?” Others had clearly worked through the content, identifying trouble areas, and brought specific questions or clarifying questions. Some students wished to study or work on study guides in my office and simply wanted to know I was there to explain when they had an issue. Some of these students would ask for verification with their completion of each study guide answer, while others worked away quietly, only occasionally asking questions as they arose. A few students attended with peers and did not ask questions; they simply wanted to listen to others study or ask questions.

3.2 Skills Such as Note-taking, Test-taking, Lab Analysis, or Studying

Some students also had technical questions which focused on lab techniques, and occasionally, students reported discord within lab groups and asked for advice about how to handle it. Students also came to office hours as they grappled with preparing for exams. Note-taking and exam-taking skills were other topics of discussion during office hours. Sometimes students would come in and explain how they were working through learning to take notes in the college setting (annotating slide shows, writing everything, typing notes on computers) and then how they studied later (many explained that they rewrote their notes in a way that makes sense to them). While some simply wished to talk through their process and receive affirmation that they were on the right

track, others asked how to build on those skills, or they asked for tips and tricks to hone their in-class learning. Students also visited to review exams and identify problem areas, clarify content and ask how they would prepare for future assessments. Some students sought to identify where they went wrong and learn about test-taking skills that could help them avoid test-taking errors.

3.3 Outside of Class Learning

Some early college students encounter new problems that don't involve college learning directly but require mentorship or guidance, nonetheless. One student came to talk about a fender bender in the parking lot and how to navigate it. Car care and maintenance actually came up a few times. A few students wanted to share their family background or circumstances, unprompted, sort of sharing their origin stories. Several stopped by to track down lost items like keys, IDs, and water bottles. These conversations sometimes followed discussions that were more focused on academic issues, but on occasion, students stopped by just for these non-academic discussions (Fig. 3).

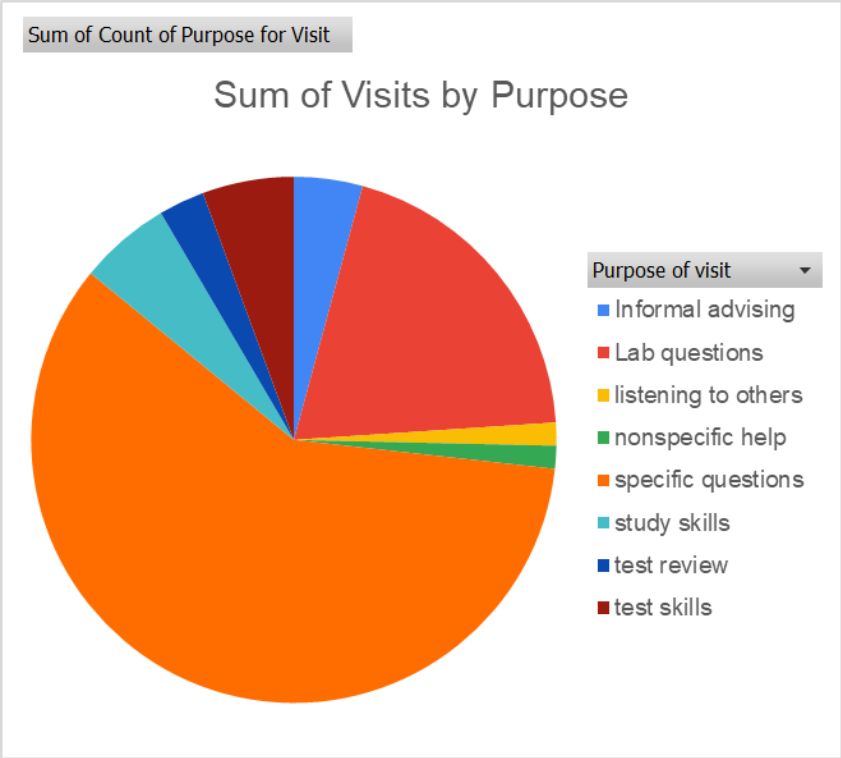


Figure 3 Visits According to General Reason for Visit with Some Visits Having Multiple Reasons

3.4 Quantitative Results from the Office Hour Journal

Using the office hour journal, I can see that 16 total students from the sample used office hours and nine did not. Although many variables are at play, when looking at the end-of-semester grades within these two groups, more students in the office hour visitor group earned an A as a final grade (44% of visitors and 22% of non-visitors). If A's and B's are combined, 62.5% of visitors and 55.5% of non-visitors attained the grades necessary to be competitive for admission to the physician assistant program.

Table 1 Semester Grade Earned by Office Hour Visitors Compared to Non-Visitors

Grade Earned	Office Hour Visitors (62.5% >=B and 75% >=C)	Non-Visitors (56% >= B and 56% >=C
A	7/16 (44%)	2/9 (22%)
B	3/16 (19%)	3/9 (33%)
C	2/16 (12.5%)	0/9
D	2/16 (12.5%)	1/9 (11%)
F	0	1/9 (11%)
Drop	2/16 (12.5%)	2/9 (22%)
Avg. Grade for visitors (at least 2 visits) vs Average grade for Non-Visitors	Average =87% Range= 63-97%	Average=80% Range= 52-92%

Because student names were documented in the office hour journal, I could follow persistence during the course of study from one semester to the next as a lagging measure in this study. More visitors registered for a second semester of biology (seven compared to five), and, to date, more visitors have stayed in their professional track at mid-semester (seven) compared to non-visitors (one). In other words, by the midpoint of the second semester, only one of the non-visiting students is still following the pre-physician assistant course sequence. Importantly, three high-achieving students self-reported that they switched majors to nursing due to the cost of their education, saying that they would be better able to afford a four-year Bachelor of Science in Nursing (BSN) than a master's degree in physician assistant and still make a comfortable income.

3.5 Results from the Student Exit Survey

3.5.1 Visit Frequency Over Time

Most, but not all, students obliged by scanning the QR code as they left my office, providing information on the number of office hour visits (n=52) that could corroborate the number of visits collected in my office journal (n=56). New students visiting office hours occurred steadily through September and October but there were no new visitors in November. December had only one week, which was final exam week. Although the final for this course was the first day of this first week in December students still stopped by after the final. However, no new visitors came during that week.

The month with the highest frequency of office hours visits is the month during which the students watched the office hour video and the month when reminders to those with scores under 80% began (Table 2). While interaction via email is outside the scope of this study, it is important to recognize that some students pursued their questions or concerns via email only, and others used both office hours and email.

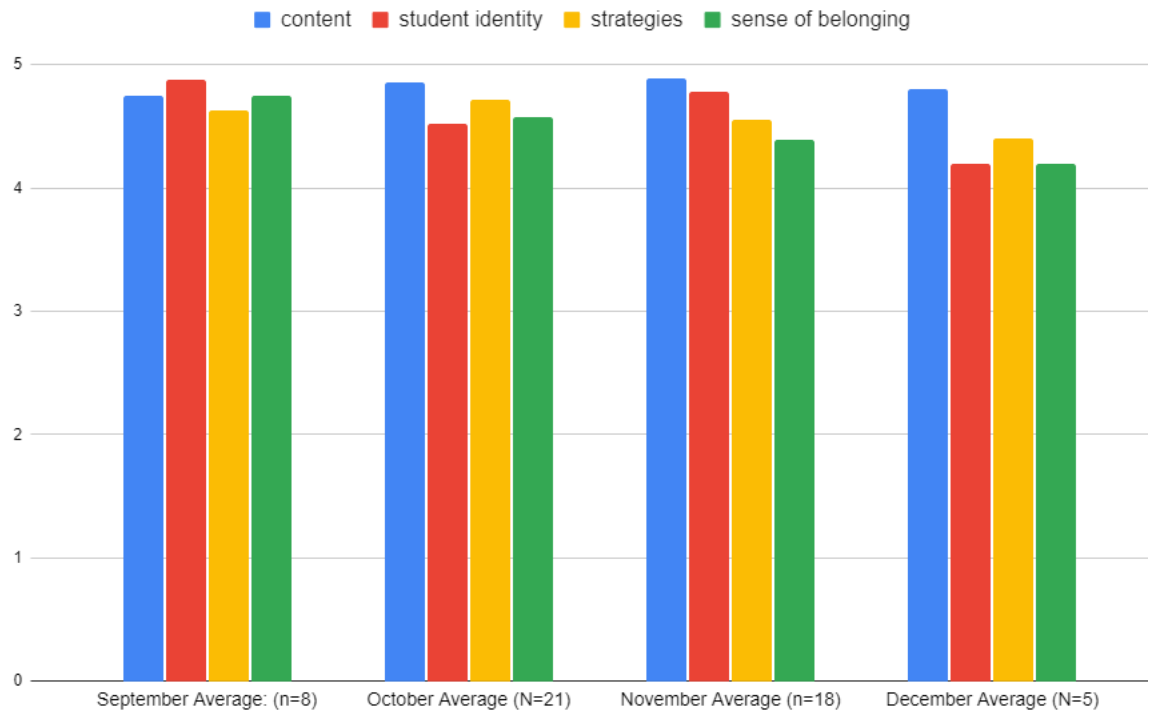
Table 2 Total Number of Office Hour Visits

Month	Number of Visits
September (four weeks)	8
October (21 weeks)	21
November (three weeks)	19

3.6 Results Addressing Primary and Secondary Drivers

Using a simple Likert-style survey, office hour visitors rated their feelings of confidence in content, confidence as a student, learning of new strategies that support success and feeling more a part of the Penn College Community. Their responses provided information that addressed the process measures of the Driver Diagram (Appendix B). Responses to this survey were anonymous and repeated with each visit. Responses did not change significantly over time according to averages of responses divided by month. Of note, there was only one academic week in December, and it was final exam week. The final for this class was given on Monday and therefore, there were a low number of visits (N=5).

Figure 4. Likert-Style, Self-Reported Student Feelings about Gaining Content Knowledge, Confidence and Community



Student Response to the question “My visit to office hours helped me feel more confident about content knowledge” appears to be strongest, but all areas appeared to show important growth. Students chose four or five stars in response to content knowledge and did not choose one or two stars for any category. In general, office hour use for office hour visitors seemed to be important for students in building confidence as a student, building community at Penn College, learning new strategies for academic success, and learning content. For each of the four questions in the QR Code Survey, the mode, both before and after interventions, was five stars.

These responses are corroborated by the responses to the mid- and end of semester survey in which office hour visitors selected yes (12/13) or “sorta” (1/13) when asked if they felt more confident as a student and (11/13) selected yes and 2/13 selected “sorta” when asked about feeling more a part of the Penn College community. These responses address driver measures.

3.7 Changes in New Office Hour Visitors According to Interventions

Twenty-five students in the class experienced the change ideas articulated in my driver diagram. Before the first intervention, there were eight office-hour visitors representing 34.8% of the sample. One can infer that these students either felt welcome or motivated to visit early based on a simple introduction to office hours by way of the syllabus or prior knowledge or advisement that office hours could be helpful. One student noted, “The video i feel didn’t impact my decision. I had it planned out before the video was watched”.

After the video, eight additional new visitors attended office hours, and the overall frequency of visits increased. This could be due to the mitigation of barriers addressed in the video,

or because students were naturally becoming more comfortable in their college environment, they also may not have had questions earlier in the semester.

After I began to introduce reminders, three new visitors attended office hours, two of them in direct response to the reminders according to the survey. One additional student sent an email to tell me he would be attending office hours but then did not attend. Prior to the final intervention, the invitation to attend in groups or online, students had begun to build community with their classmates and often attended in groups, rendering the final change idea somewhat moot. Only one student chose to use a virtual platform for office hours, mostly due to a need for accommodations that could be more easily provided in a virtual setting.

3.8 What the Student Survey Reveals About the Effectiveness of Change Ideas

3.8.1 Change Idea 1: Student Feedback About the Video

Twenty of twenty-three students in the sample completed the driver survey mid-semester. Of those who completed the survey, thirteen selected "the video made me more likely to visit office hours," and six of twenty selected "the video did not influence whether I attended office hours," two of whom did not remember watching the video. Meanwhile, eight of those who affirmed that the video made them more likely to visit office hours actually visited, and five did not visit. Four students who felt the video did not influence their decision to video attended office hours nonetheless. The video script is listed in Appendix C.

Office hour visitors mentioned that the video made them feel more welcomed and comfortable in the office area in general. These feelings are demonstrated in the quotes below:

- It made me feel more comfortable that my education is important and that I can get help when I need it.
- It just made me feel more at peace with not feeling dumb for coming to office hours.
- It made it seem accessible, not as worried about ‘wasting’ professor’s time, reinforced professor WANTS to educate with office hours.

In the comments that follow, several mentioned that the video helped them to understand that the purpose of office hours is to address student concerns and questions. They also commented about learning that office hours were for the students and not the instructors.

- Knowing exactly where it was was nice, but also just seemed like a much more inviting environment afterwards. I.e. you weren't just offering office hours 'because you have to.'
- ...the video description made office hours seems more like a resource for us, opposed to time for the professors, which is what I initially believed it to be.

Others mentioned that the video helped them to learn how the common space outside the instructor offices could be valuable and that the video was helpful in learning the location of the offices:

- I wasnt sure how to attend office hours so watching the video about office hours allowed me to understand how to attend which boosted my grade because i was able to understand the material with the help of Karen [sic]

- The video made office hours seem like a good tool to use opposed to somewhere to go with questions. There's desks set up for students and whiteboards. The layout was very open, and the video description made office hours seems more like a resource for us, opposed to time for the professors, which is what I initially believed it to be[sic]

Students who did not use office hours (Non-visitors) also provided feedback about the video. Five of eight non-visitors stated that the video made them more likely to visit during office hours, and two reported that the video had no influence (one survey respondent left the question unanswered). Non-visitors cited reasons for not attending office hours. Several wished to work through their difficulties on their own or did not have specific questions, while others reported not having time to visit. This could be due to class schedules but also because many full-time students work full-time, and at least one has children. While I offer the option to schedule appointments

outside the scheduled office hours, students don't always use this option. One student mentioned that they did not feel comfortable visiting during office hours.

3.8.2 Change Idea 2: Student Feedback About Reminders

Two weeks after students watched the video, any student who acquired a score of 80% or less on any assessment received a reminder in the feedback section of that assessment within the learning management system or via email, which invited them to visit during office hours. Of students who reported visiting office hours, twenty selected "reminders made me consider visiting office hours," two visitors selected "reminders did not make me more or less likely to consider office hours," and two respondents changed their response from "reminders did not make me more or less likely to consider office hours" to "reminders made me consider visiting office hours".

Meanwhile, five non-visitors reported that "reminders did not make me more or less likely to consider office hours," one selected that "reminders did not make me more or less likely to consider office hours," and two flipped their answer from "more likely" to "did not make me more or less likely."

Table 3 Student Reported Response to Reminders About Office Hours

Responses	**Office Hour Visitors (Visitors)**	**Non-Office Hour Visitors (non-Visitors)**	**Totals**
Reminders made me consider visiting office hours	10/13 (76.9% of Visitors)	5/8 (62.5%) of Non-visitors	15/21 (71.4%)
Reminders did not make me more or less likely to consider office hours	1/13 (7.7% of office hour visitors)	1/8 (12.5% of office hour non-visitors)	2/21 (9.5%)
Switched from "more likely" to "did not affect"	0/13 (0% of office hour visitors)	2/8 (25% of office hour non-visitors)	2/21 (9.5)
Switched from "did not affect" to "more likely"	2/13 (15.4% of office hour visitors)	0/8 (0% of office hour non-visitors)	2/21 (9.5%)

Implementation of the reminders as a change idea seemed to be impactful, overall 72.4% of respondents reported that these reminders made them consider office hours, even if a few did not attend. The office hour visitor that was not affected by reminders was also not affected by the video. This student apparently decided that office hours would be helpful without any additional intervention. It is also important to note that three non-visitors reported no influence from either the video or the reminders. A third change idea, to encourage office hour use with peers, yielded no immediately measurable results, as students began to visit with their peers earlier in the semester.

3.8.3 How Did Office Hour Visitors Change Student Practices Compared to Non-Office Hour Visitors?

When asked to choose a response that describes the impact of office hours on the changing practices of students throughout the semester, three students reported that office hours had a moderate influence on changes, and six students reported that attending office hours influenced changes "a great deal." Three students reported the influence of office hours on practices to have a moderate effect but changed their answer to "a great deal" on the second administration of the survey while one student changed their answer from "a great deal" to moderately at the end of the semester. These changed responses seem important as students reflected on how they experienced office hours as their student identity evolved throughout their first semester.

Open coding was used to learn more about how practices changed in the office hour visitors versus those who did not visit office hours, uncovering differences in the evolution of practices between these two groups. More than one code could be applied to each response, as many responses mentioned several changes in practice. Themes that arose from comments in the student survey from office hour visitors included pacing (two), active studying/efficient studying (six), group study (two), previewing materials (four), asking questions (two), and learning more about what works for them (one). These responses address movement in driver measures like community building and self-efficacy as a college student. Office hour visitors choose either moderately or "a lot" when asked how much these practices were influenced by office hour visits.

By contrast, non-office hour visitors were more likely to mention that they began to study more (two), and reviewing was mentioned more (ten) without the more nuanced attention to how they were studying, which came up in the comments of office hour visitors. Two non-visitors mentioned an increase in focus or active listening while in class (two), which was not mentioned

by office-hour visitors. When asked about the bases for these changes, one mentioned the increasing the rigor of the course, and two mentioned becoming more comfortable as a college student. Two students mentioned that they did not change their practices, and three mentioned wanting a better grade in the class. These responses also indicate movement in driver measures for some students making the non-visitors a good reference group here. However, when office hour visitors were asked about additional influences for changes in practices, they also mentioned low exam grades. Office hour visitors were more likely to indicate that they were inspired or more confident as they went through the semester, which led to changes in practices.

Were students who used office hours more likely to seek additional resources, a possible measure of increasing self-efficacy or identity as a student? Interestingly, students who did not visit office hours were more likely to report using outside resources like the tutoring center or LEAP center, but a check of tutoring center logs showed that none of the students reporting tutoring center usage actually attended the tutoring center. Meanwhile, of the seven students in the visitor category reported using the tutoring center, four actually visited. Members of both groups report using the LEAP Center as a resource, but I am not able to verify whether they really used the LEAP Center as a support. As an assignment for students in FYE (First Year Experience) Class, students must visit their LEAP advisor. Therefore, the LEAP Center logs show all students visited their LEAP advisor at least once.

4.0 Section 4: Learnings & Actions

4.1 Discussion

The results of this study demonstrate the benefits and limitations of the change ideas explored in this investigation. Although the quantitative analysis does not provide evidence of a clear benefit of the change ideas in getting students to office hours, comments from the student survey reveal a different perspective. Evidence collected in this study supports that the video was helpful in reducing several barriers to office hours uncovered in the literature review.

The office hour video was helpful in providing explicit coaching on how students can access and use office hours. In the survey, students noted that the video helped them to find the location of my office and the offices of other science professors. One response noted that seeing the office space and associated resources was helpful. Informal observations outside of this study support the helpfulness of this piece of the video intervention: I often find students in the hallway looking for classrooms and instructor offices, unsure of where in the building they should be headed.

The office hour video also assisted in student understanding of the purpose of office hours as recommended by the findings of Smith et al. (2017), who found that some students did not know how or why to use office hours in the first place. Prior to watching the video, not all students in my study understood initially that office hours are “for them” or that office hours were designed to be used to support their learning and not just offered because they are required of instructors by the college. Another student mentioned that the video helped them to understand that I “didn’t mind” them “dropping in unannounced.”

Finally, some students mentioned reduced anxiety about visiting office hours, that they did not have to "feel dumb" for asking questions, and that they felt welcome in the office space. One student mentioned that "it (the video) made [Karen] seem more accommodating and welcoming."

Those who did not attend office hours helped to reveal the limitations of using a video as a change idea for removing barriers to office hour use. Several noted that they did not have specific questions, which may indicate that they only perceive office hours as a way to address questions that they already had rather than uncovering strategies they could use to support their learning and development as a student. Or it could mean that they were doing well and using office hours wasn't necessary for their success in the class or as college students. Accordingly, two non-visiting students earned an A for the course, and three noted that they did not have specific questions. It may also be inferred that they did not see office hour attendance as critical to their community building or important to generating skills that foster success in their early college experiences.

Busyness and schedule conflicts were mentioned as barriers to non-visitors. The perception of conflicting schedules remained even after the suggestion that students could schedule an office hour meeting time outside of my scheduled office hours, according to the video. Briody et al. (2019) and Abdul-Wahab et al. (2019) both discuss busyness as a barrier to faculty-student interaction. Both studies noted that students avoid office hours because they are busy and because they perceive their instructors as overwhelmed or unavailable. An attempt to use a word cloud to verify this was not helpful because busyness came up in different ways, but in a larger study, this would be a useful tool to find trends that reveal students' thinking about their perceptions of their instructors.

As mentioned above, sometimes students perceive instructors as busy, and although we are, the perception of instructor busyness can, unfortunately, deter student visits. While instructors

at Penn College are not required to do research, we do not have course designers, instructional coaches, and teaching assistants like some at more traditional or larger research universities. Therefore we assume the full role of how to teach and assess student progress. Many of us embrace this role and consider the role of office hours to be an essential part of the way we support our students. Visiting students noted that the video helped them to see that I was welcoming and wanted them to come to office hours, so the video was effective for some in addressing that barrier.

While non-visiting students did not address their perception of my busyness head-on, they did address a second barrier mentioned in Biordy's study (2019), which is that students may have been nervous or uncomfortable about attending office hours. In these cases, the contents of the video did not assuage their anxieties associated with office hour visits. One student mentioned that the video made it seem like a "much more inviting environment" and that I wasn't "just offering office hours 'because you have to.'" Another student response noted that "it made her seem more accommodating and welcoming." Regardless one student reported in the student survey that they felt anxious or uncomfortable visiting office hours. A second non-visitor self-reported generalized anxiety around being a student during a conversation after class, and I wonder if those feelings prevented office hour visits.

A few reasons for anxiety around attending office hours are explored in the literature. Briody et al. (2019) define the social distance between students and faculty and propose that distance is at least one element that contributes to professor avoidance. For example, universities have a hierarchical organization with stratification according to status as faculty or student. Students may feel further stratified as they compare themselves to peers according to how many credits they have acquired or prior life experiences. In my place of practice, students are often of different ages, with some students returning for a second career or becoming students after time in

the military. In an after-class conversation, a first-semester student, unprompted, mentioned that she felt intimidated by the other students who had prior college experiences.

Briody et al. (2019) also bring up the topic of perceived distance between the status of instructors and students. Hierarchical sorting mechanisms underpin many academic cultures. For example, instructors are sorted into categories by degrees or academic ranks, such as assistant, associate, or full professor. More importantly, there is a noticeable difference in status between instructors and students. Any of these intrinsic sorting mechanisms may manifest as feelings of distance between students and between students and instructors.

Because instructors are in a position of power, students look to them to establish the rules of engagement. Using titles like “professor” or “doctor” for instructors while students are called by their first names can further introduce feelings of distance between instructors and students (Briody et al., 2019). These traditions likely accompany students from their pre-college education and are then reinforced when they get to college. Although I encourage students to call me by my first name, many are uncomfortable doing so. In that case, I simply let them choose “Mrs. Avery” or “Professor Avery” as they wish. A few students choose to call me simply “Avery” I am not sure if I find that endearing or just odd; however, I allow it, reflecting the power I have over the rules of engagement between my students and me. Despite efforts to decrease distance by using a first-name policy, social distance, as defined by Briody et al. (2019), still influences how students engage with their professors.

In conversation, at least one of my peers wondered if students avoid office hour visits because of differences in student/instructor identities. In particular, a peer wondered if some female students do not visit because he is male. (personal communication, Gess, 2023). Hurtado et al. (2011) provide some insight into the role of social identity in faculty-student interaction.

Their study found that Black students attending Historically Black Colleges and Universities (HBCUs) are more likely to interact with faculty outside of class than they are at Primarily White Institutions (PWIs). Interestingly they did not find the same pattern for Hispanic students attending PWIs as compared to Hispanic Serving Institutions (HSIs). This echoes the finding that some people may not visit healthcare providers that they perceive to have different identities (Parkhurst et al., 2017; Thornton et al., 2011; Torestky et al., 2018).

Another possible source of anxiety for students who wish to interact with their instructors using office hours may lie in the physical location of instructor offices. Students may feel uncomfortable being in a small room with a faculty member that they don't know. Some professors have addressed this phenomenon by moving the site of their office hours to more open spaces such as libraries or student centers. At least two instructors that I spoke with at different institutions mentioned moving their office hours to more physically open and student-centered places. Not only did they report more student visitors, but the instructors also found themselves enjoying the more open environment. At least one instructor mentioned enjoying amenities such as the presence of the resident therapy dog and free coffee in addition to increased student interaction (personal communication, BioInteractive Members, 2023).

Some non-visiting students in this inquiry mentioned that they wished to find answers to questions on their own. The basis for this could emerge from a few places. While studies investigating first-generation college students find that they often come from upbringings that value interdependence, they expect that independence in college means figuring out their learning on their own. Meanwhile, their continuing education peers understand independence to mean seeking out help from professors (Stephens et al., 2012). Another source for this independence could be the overlap of the perception of being too busy and the availability of quick and easy to

access resources such as search engines and educational videos. Abdul-Wahab et al. (2019) noted that some busy students see office hours as a waste of time when they could simply ask a friend for help or look it up online. This easy accessibility can produce mixed results for biology students. For example, online videos may miss the level of complexity by being either too detailed or too general. Other videos introduce misconceptions or apply to different biological contexts. At least one student outside the test group in my inquiry mentioned to me that she is using the generative artificial intelligence (AI) program ChatGPT to answer the questions that come to her as she learns. This presented an opportunity for discussion, revealing where the AI-generated responses to her questions were appropriate. We also discussed where the generated responses were misleading or did not apply to what we were actually learning.

Some students find that waiting their turn to ask questions during office hours or just the act of going to office hours is too time-intensive (Smith et al., 2017). Briody et al. (2019) and Abdul-Wahab et al. (2019) all found evidence that students find it faster and easier to bring their questions to peers. These findings may point to students building community, one of the drivers included in the driver diagram that guided this study (Appendix B). The use of outside sources to answer questions could be especially helpful when combined with office hours instead of replacing them. Some of my students reveal that they use online videos to help them to understand the content but then follow up with unresolved questions during office hours or email, which generally fosters helpful learning.

Other institutions and professors have used videos to encourage students to remove barriers to office hour use. Notably, Arizona State University released an entertaining two-minute video that imitated a pharmaceutical advertisement, implying that students may be "suffering" from "fear of meeting one-on-one with my professor" or "FMOOWMP." This malady is, of course, curable

by visiting with their doctor of philosophy (Ph.D.). This video proposes a treatment called "FOH," or faculty office hours which produces outcomes like improved grades and reduced stress and anxiety associated with grades (Arizona State University, 2015). Another video from an individual faculty perspective provides a template for requesting a visit to office hours by providing an email template, an example of explicit instruction to uncover unseen or unknown societal rules regarding interactions with instructors. This idea of unseen rules guiding how to access education is discussed by Lisa Delpit (1988) in her important paper "The Silenced Dialogue: Power and Pedagogy in Educating Other People's Children," where she described that "Some children come to school with more accouterments of the culture of power already in place…" (p. 285) and while she is discussing the experiences of primary school age children, I think it also applies at the college level as well. More specifically, some students understand things that are hidden to others such as how and when it is ok to visit a professor and what to do during those visits.

It would be helpful to understand more about how students felt about their early college experiences before and after interventions. According to the anonymous QR code survey, it's difficult to find a difference in student feelings before and after change ideas, although these responses do seem to indicate that students felt that their visits to office hours helped them to feel more confident about biology content and being a college student as well as fostering new skills for success in class and a greater sense of belonging at Penn College. These results measure progress at the driver level in the driver diagram (Appendix B).

According to information collected in the office hour journal, students who dropped the class or did very poorly (D or F) did not use office hours, suggesting that those who visited benefited from those visits.

It’s important to note that unseen influences, most predominantly the ever-present effects of a global pandemic, can still affect students’ well-being and ability to do well in class. Students still struggle in class because they become ill or may be responsible for caring for family members. These factors influence the results of this inquiry in a way that I can’t measure in the scope of this study.

Unfortunately, it is these particular students for whom the change ideas were designed, implying that friction still exists in the system despite the implementation of change ideas used in this inquiry. As discussed earlier, the remaining barriers appear to include time constraints or conflicts between office hour schedules and students’ schedules. This effect could be mitigated by making it clear that professors are available using virtual platforms and during times outside of scheduled office hours; because this was part of a PDSA cycle, this information was brought to the students later in the semester. Although this policy is listed in my syllabus, many students do not recognize the syllabus as a source of useful information or don’t refer to it when they have questions about instructor policies.

It's interesting to note that many non-visiting students self-reported that they used the tutoring center or the LEAP center in lieu of attending office hours, but according to logs kept by the tutoring center, these students did not actually visit. Over-reporting the use of the Tutoring Center as a resource could be unintentional and due to misremembering on the part of students. In addition, a LEAP Advisor mentioned that students who are experiencing stress in their first semesters appear to exhibit “fight, flight, freeze, or fib” as a response to anxieties experienced as new college students (personal communication, Scheib, 2023). This over-reporting also existed in the office hour visitor survey but to a much lesser extent.

Students who visited during office hours made more granular assessments about how they evolved in their practices throughout the semester. This implies that students who visit office hours are employing metacognition, or thinking about their thinking and learning, which is an important tool in the movement toward more effective student practices. These specific student statements may address the development of student identity, which is included as a secondary driver in the driver diagram which guides this study (Appendix B).

4.1.1 Next Steps and Implications

The first change idea, using a video to reduce barriers to office hour attendance, provided direct information about how to access and use office hours but was specific to my policy and may not apply in the same way to other educational settings. Despite these limitations, findings from my inquiry can benefit other instructors in the Penn College setting and in other similar college settings.

I can share my findings and interventions as a professional development session with current faculty and as a contribution to the orientation class of new instructors when they are hired at Penn College. Many Penn College instructors are valued experts in their trade but do not have formal training in educational and classroom practices. Introducing new faculty to effective office hour practices could reduce the stress that comes from learning new policies as well as being helpful to their students.

Finally, I wish to share helpful findings in practical sections of a professional journal such as The American Biology Teacher's "Tips & Tricks" column. Most published columns in this publication focus on pedagogical content knowledge (Shulman, 1986) rather than supportive practices that foster faculty/student interaction. However, these supportive practices are a critical

tool for supporting the development of student identity, developing content knowledge and thereby fostering success for early college students.

4.1.2 Summary of Important Lessons

I have a great deal left to learn about how to support students through their first year of college with rigorous courses. I don't know how my students experience office hours with me in particular and whether the experiences in my office hours foster office hour use for other professors. Also, does it set them up with expectations that do not bear out with other office hour experiences?

I'd like to learn more about how my colleagues use office hours and their expectations of office-hour interactions. I wish that this had been a part of my study. Based on discussions with other professors, I find that expectations set by other professors for office hours may not align with mine. For example, some do expect that students come to office hours with specific questions, showing that they have already processed the information. This could be more appropriate for second-semester students who already have college experience. I see the requirement of having questions ready to be a possible barrier for students who are struggling to figure out the college system. Other instructors ask students to make an appointment before they arrive, requiring an additional step that could be helpful in teaching students to prepare for appointments in general, but could also provide a "speedbump" to office hour attendance for a first year college student.

Recently a struggling student came to office hours seeking advice on whether she should drop the class. When I asked why this was her first visit to office hours, she explained that she felt guilty for coming to office hours without questions and felt bad about not studying enough before

office hours. Further questioning revealed ineffective studying practices, which could have been addressed early in the semester. I think we both felt sad about this.

5.0 Section 5: Reflections

5.1 Student-Faculty Interactions and Feelings of Belonging in Early College Students

Each student encounters the early college days differently because of their familial, cultural and pre-college formative experiences. Any student from a non-dominant culture must uncover the unspoken curriculum and ways of being and knowing that are more obvious to those who have been raised to understand the established system. In an article by D'Agostino, these unknowns (formally called social capital) are aptly described as the "'dark matter of opportunity' because you can see its effects but it can really be hard to spot and measure" (2022). Students from a dominant culture may understand independence to mean that they are expected to seek out help and ask questions, or self-advocate. Students from non-dominant cultures often interpret independence to mean that they are expected to figure out how to navigate tough classes on their own (Stephans et al., 2012).

Getting students to recognize that meeting with instructors outside of class provides a critical opportunity for students and faculty to work together for student success. It also provides an important space for students to embrace the fabric of their own identity while growing their student identity. In other words, faculty must honor the values that students bring to classrooms and educational spaces while supporting the learning of content knowledge and critical thinking early in the college experience if we are to keep students on the path to healthcare careers. After all it is these unique perspectives that are missing from student bodies and from the healthcare experience of those from non-dominant cultures.

The findings of my inquiry support the idea that faculty student interactions during office hours promote multifaceted student growth in building student efficacy and identity. Faculty have an important role to play in helping students become part of a community, understanding content, and developing skills and confidence that supports their progression through challenging science courses and to a chosen career. My inquiry also provides evidence that making the hidden rules, part of what Phillip Jackson (1968) called the "hidden curriculum", evident to students makes a difference for first year college students. For example, telling students up front, how to find instructor offices, explaining office hour expectations and how to take advantage of them removes a barrier to the relationship building between students and faculty that support student success. This work also emphasizes the importance of framing office hours as what independent, hard-working students do as a part of their education.

5.2 Possibilities for Further Inquiry that Emerge from Findings

While this study was helpful in understanding the role of several interventions in improving office hour attendance and also uncovering how office hour attendance changed student practices, it also hinted at how students develop efficacy and identity as students in their first year. The time frame and population size of the study were necessarily limited but act as an effective launch point for further inquiries that can reveal additional strategies that support student growth in their early college experiences.

Hurtado et al. (2011) identified several factors that influence how students interact with faculty, and one of those is of interest to me. In particular, I am interested in building physician assistant student identity by connecting early college education students on this pathway with

current didactic year physician assistant students. Hurtado et al. (2011) also found that students who joined pre-professional clubs or clubs associated with their specific major "appeared to interact with faculty significantly more often than their peers who did not join these organizations" (p. 9). Penn College has a Physician Assistant Club, which seemed to have limited value to students in the past (G. Fenstermacher, personal communication, 2023). Current didactic year students are making attempts to make PA club meetings more relevant to incoming first year students. For example, a recent club meeting taught students how to intubate a patient to assist with their breathing. Unfortunately, this meeting was only attended by one student. PA students speculated that perhaps the meeting was not well promoted or that student schedules conflicted with meeting times. In any case, making these connections between first year students and physician assistant students is an area that provides an opportunity for a new problem of practice using improvement science.

Further, I intend to investigate the effects of involving didactic year physician assistant students in the lab activities I design for early experience college students. I recently embarked on this investigation by inviting physician assistant students to attend a fetal pig dissection lab. Usually, fetal pig dissection is used to acquaint students with the major body systems of mammals and introduce students to dissection skills they will use when they do their cadaver dissections in the PA program. This semester, didactic year physician assistant students attended the fetal pig dissection and taught biology students different methods for suturing and stapling the resulting "surgical wounds" acquired by the pigs during dissections. The experience grew organically as students progressed to doing tracheotomies, skin biopsies, and even a few vasectomies. While the fetal pig dissection lab is usually a student favorite, both the physician assistant students and the pre-physician assistant students reported that this activity was useful and motivating. I would like

to learn more about how experiences such as these build physician assistant student identity and how that developing identity, in turn, affects student motivation during early semesters.

5.3 Reflections on Inquiry Design

In addition to viewing this study as a springboard for further investigations and improvements, I've found several missed opportunities in this investigation for a more robust study design. Unfortunately, two office-hour visitors do not remember viewing the actual video which was presented in the lab. Although the lab setting is structured to present important information at the beginning, the actual learning time in the lab setting is less structured. I initially thought that the laboratory setting was a better place to use the video because the number of students in the lab is much smaller compared to the lecture setting, in which both lab sections are combined. I hoped that showing the video in the lab could produce discussion or questions given that students are arranged in small groups around octagonal tables however, students may be less focused as they enter the lab than they are in the classroom. These important experiences will frame how I introduce change ideas and how I collect and analyze the data that arises from future investigations.

Having several systems to measure the effects of change ideas in this study toward student changes was helpful in clarifying results. However with more experience, I would design these to yield more refined student feedback. For example, in the design of the QR code survey, I wish I had spent more time defining the meaning of the rating system. I intentionally designed it to be quick, simple, and accessible as possible to maximize participation. Given my small sample size, I also felt that participation would be maximized and closer to the true feelings of students if it was

fully anonymous, but this means that I don't have demographic information about those who gave ratings. I did have almost 100% participation (93%) in that survey.

The office hour journal was helpful in the interpretation of measures provided by both the anonymous student survey and the office hour feedback survey (QR code). In future iterations, I would improve the coding for the reasons for office hour visits to be more specific. I would also make more granular observations in my notes following visits.

5.4 Reflections on Improvement Science

The design of this inquiry is based on a methodological framework called improvement science in which scholarly practitioners, working professionals who are situated within a system, identify specific, actionable problems based on an analysis of the system in which they work. Improvement science is a common problem-solving model in healthcare systems but is valuable in educational systems as well. Part of the value stems from the position of the scholarly practitioner, one who is close to the problem and can learn more both by interrogating the literature and also by investigating the root of the local problem by learning more about the design of the system that produces it. This allows a tight focus around actionable elements of this system and the design of small tests of change which can mitigate or alleviate the problem.

Although I have been an educator for most of my career, my training has been in the biological sciences and not in educational research. During my growth as a scholarly practitioner applying the improvement science framework to educational inquiry, I sometimes felt some dissonance as I tried to resolve my training in science with how I interpreted research in education and sociology. I also had to adjust the way I understood how to design an investigation and

interpret results in this space. For example, scientific investigators place a great deal of value on large sample sizes and quantitative evidence. And while these types of data are still important in educational research and to improvement science, qualitative data allows for each individual student's perspective and experiences to be considered in the improvement of a system. I have found that if these results are to apply to and improve the system where I teach, student voice is the most important evidence toward measuring change.

As I read through studies and designed my own, I was concerned that my sample size was too small. Meanwhile I learned that despite the small sample size in my investigation, the information gained from surveys was ample for learning about how interventions affected students and further, the benefits and limitations of office hour use. And although the quantitative information I gathered was important, it wasn't the most telling measure in this investigation.

Lastly, scientists go to great lengths to remove bias by removing their perspective from a scientific investigation. In improvement science, the practitioner is part of the system and potential practitioner bias must be addressed in a different way, by recognizing the investigator's role in the system and their positionality. Initially this was difficult for me to navigate as part of my training as a biologist where often the investigator is expected to be blind to the investigation in some capacity to remove bias from experimental design and interpretation of results.

Like investigations in biology, improvement science investigates a particular area that contributes a broader understanding of a larger problem. Identifying a single specific element that can improve an educational system is important, and interpreting the results with a small sample may not be immediately evident. While this project is limited in its scope, it brings forward new ideas for how to support students in their early college experience. The findings from this

investigation are important as I attempt to uncover why students seek, oit'sr do not seek, support using office hours and how to get them there.

My place of practice is a unique institution, but I am confident that these findings can be generalized to other institutions where they can improve instructor practices regarding office hours. Ultimately, better support for all college students pursuing physician assistant careers holds great importance for reducing healthcare inequities by having the broader impact of improving the diversity of healthcare providers and providing better outcomes for all patients.

Appendix A Fishbone Analysis of the Problem of Practice

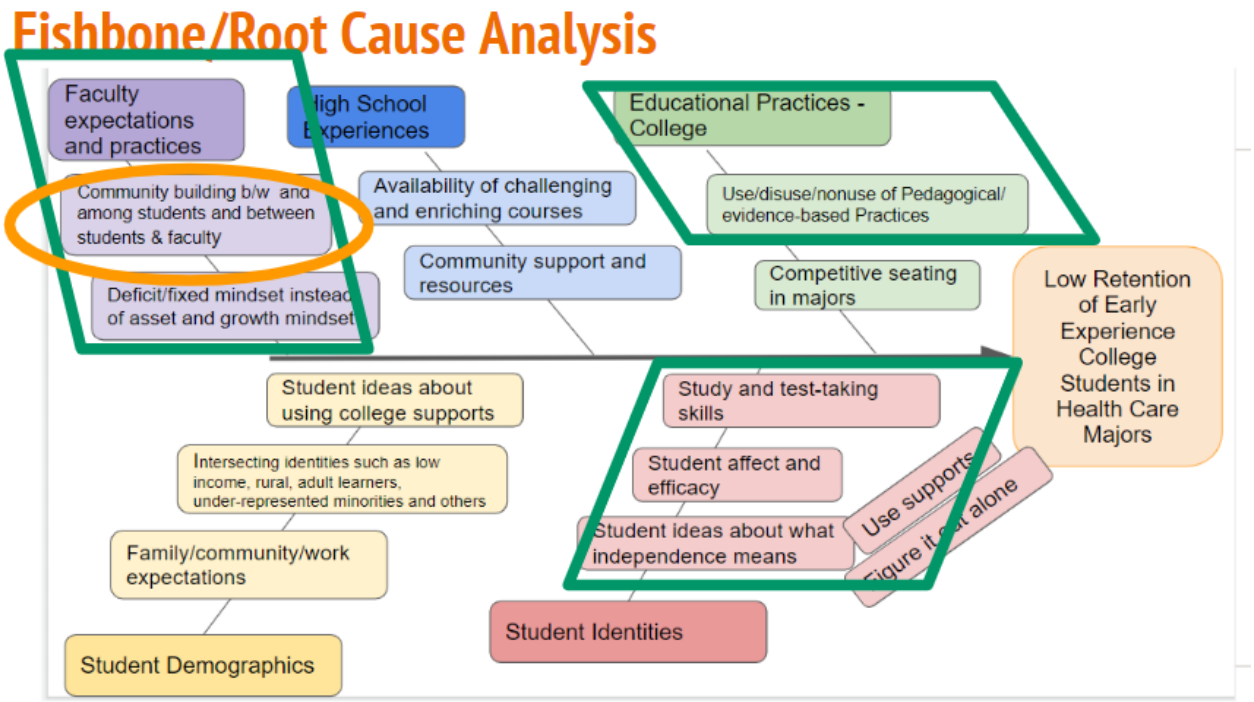


Figure 5 Fishbone Analysis of the Problem of Practice

Appendix B Driver Diagram

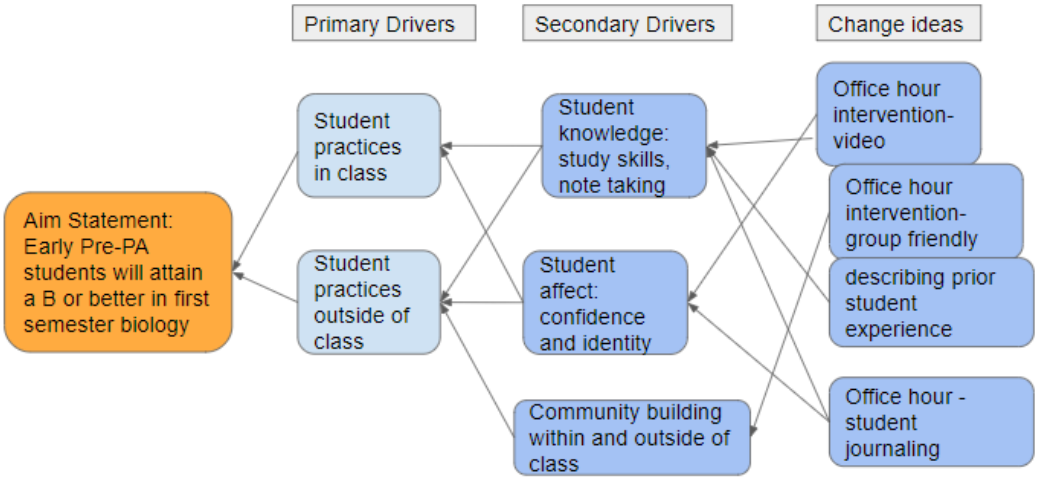


Figure 6 Driver Diagram Showing Factors that Lead to the Aim Statement

Appendix C Script for Office Hour Video

Part 1: From Classroom to Office

In student classroom, camera facing me:

"Hi, here we are in your classroom. I am going to take a minute to walk you from the classroom to my office so that its easy to find"

View switches to outward facing, showing what students would see as they walk out of the classroom:

"And so here we go, out the door as usual and down the hall. You guys usually take this walk as you are headed out or headed to lab, but this time we are headed to my office. We are going to go right through these poles and through this door."

Taking a moment to look at the directory outside the office door:

"In this section you will find all of your science faculty"

Turning to the door to the office suite and opening it:

"We have a printer, some really great student study space, some big whiteboards to sketch your ideas out on, and finally…here we are at my office"

Video shows my office door, along with my office number

Video Part 2: Inside the Office

Video restarts with a view from the student seat and with me in my desk chair.

"So now that you're here, what do we do? You can come with lots of questions, or you can show up with no questions at all. We can talk about finishing your lab questions or reviewing some of the things that you need extra help with. We can go over old exams and go over some test taking strategies. We can talk about content you need to review or need further examples to help you

understand. We can discuss time management, we can map out your schedule and find where your best study times are. We can talk about note taking strategies.

I can help you print things off or connect to the college wifi. I can connect you with resources, for instance: health services, tutoring services, the LEAP Center, counseling services, I am happy to do any of those things. Or we can just chat about what bothers you, in terms of like how to figure out how to do well in this class or your other classes

You can come to office hours by just showing up on Monday or Wednesday at between 9:30 and 10:30. I also have office hours from 2 to 3:30 on Tuesday and Thursday. And if those times or days don't suit, you can just send an email and we'll set up a time that is gonna suit both of us so you can get in here and get the support that you need to do well in biology or your other first year classes. I'm looking forward to working with you."

Video ends

Appendix D Qualtrix Survey for Students

1. Have you visited office hours for this class during this semester?

If the answer to the above question is no, the survey will continue as follows:

2.What are some reasons why you did not attend office hours for this class? (MC - select all that apply with "other" option)

    1. I didn't have specific questions
    2. I couldn't fit an office hour visit into my schedule
    3. I was nervous about office hours
    4. I wanted to figure it out myself

3.How did viewing the video affect the way you felt about the possibility of attending office hours? (or did viewing the video help with any of the times selected in the previous question?)

4.How did reminders to visit office hours affect how you felt about the option of attending office hours?

5.Discuss how your practices as a student have changed over the last few weeks. (this could include strategies in class or study strategies outside of class)

    1. To what do you attribute these changes?

6.Do you feel more comfortable or confident as a pre-pa student than you did at the beginning of this semester?

    1. Yes
    2. no

7.To what do you attribute these changes?

8.Do you feel a greater sense of belonging/community in this class than at the beginning of the semester?

1. Yes, I feel like part of a community
2. Sort of
3. No, I do not feel like a part of a community
4. other

9.Do you feel like you have become a more confident student?

1. Yes
2. No
3. Other

10.Have you used any of the other supports to help you succeed in classes? (choose all that apply):

1. The tutoring center
2. The Advising Center (LEAP Center) or other

11.What is your current letter grade in this class?

1. A
2. B
3. C
4. D
5. F
6. Not sure

If the answer to the first question is yes, the survey will continue as follows:

2. How often did you attend office hours?

a.Once

b.2-3 times

c.4-5 times

d.More than five times

3. Discuss how your practices as a student have changed over the last few weeks. (These can include in-class strategies, test-taking strategies, and study strategies)

4. To what extent did your visits to office hours support those changes?

a.A great deal

b.Moderately

c.Not at all

5. What, if any, other experiences support those changes?

4. How did viewing the video affect the likelihood that you would attend office hours?

a.The video did not influence whether or not I attended office hours

b.The video made me more likely to participate in office hours

c.The video made me less likely to participate in office hours

5. Discuss why you chose the previous answer.

6. Do you feel a greater sense of belonging/community in this class than you did at the beginning of the semester?

g. Yes, I feel like part of a community

g. Sort of

g. No, I do not feel like a part of a community

g. other

12.Do you feel like you have become a more confident student?

1. Yes
2. No
3. Other

13.Have you used any of the other supports (choose all that apply):

1. The tutoring center
2. The LEAP Center

14. What is your current letter grade in this class?

1. A
2. B
3. C
4. D
5. F
6. Don’t know

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