NEW YORK COLLEGE LEARNING SKILLS ASSOCIATION

Journal of Research and Teaching in Developmental Education

Spring 2022 Edition

Jesse M. Redlo, Ed.D

4/20/2022

Table of Contents

Note from the Editor: Balancing Students Needs with Academic Rigor

Fellow Educators,

In the Fall 2021 edition, I wrote to all of you about behavioral effects of COVID-19 in the classroom. The authors from the last edition offered unique insights into innovative teaching and learning strategies, as we work diligently to overcome the pandemic. As we are adjusting to the new normal of the endemic phase, I think it is timely for me to share some observations and trends on longer lasting effects of COVID-19 in educational settings; predominately, the increased focus on student mental health.

Mental health issues among college student populations have been pervasive for a long-time, but the COVID-19 pandemic has put them at the forefront of teaching practice. As educators we do more than educating the mind - we educate the whole person. Therefore, paying more attention to the mental wellbeing of our students is certainly within our moral responsibilities; however, this creates a dichotomy with the maintenance of academic rigor. In numerous conversations with fellow educators over the past couple of years, we have discussed the difficult question of: how much work is too much work? Also, how can one maintain an academically rigorous course while also being supportive and understanding?

As a teacher, I am a strong proponent of gamification in learning, as I believe in its power to foster a lifelong enthusiasm for learning among diverse student groups. Related to gamification, is the idea of purpose driven learning (PDL), which as an educational philosophy posited by Michael Matera and Adam Moreno. In essence, PDL tells us to focus on communicating the purpose of lessons to students, encouraging enthusiasm in our classrooms, getting to know our students, and fostering the concept of learning as an ongoing process. These basic tenets of PDL could assist with managing student needs, as logic would dictate the better we know our students, the more likely we are able to help them. Despite this simple notion, we have not directly addressed maintaining academic rigor while being supportive.

One of the first things we must do as educators, particularly at the collegiate-level is to challenge ourselves to explain the purpose of every assignment to our students. While this concept sounds simple, it can be quite challenging and involve levels of self-reflection. In my experience, after engaging with this challenge, you are likely to end up deleting some assignments from your syllabus, which eases the workload on your students, while still accomplishing your learning outcomes. Curriculum mapping is another helpful tool, wherein you create a table with each assignment you give and which learning outcome(s) it accomplishes. For me, I have switched to only using assignments covering multiple outcomes to maintain rigor while lightening workload.

Nothing about being an educator is easy, especially adapting to the ever-changing needs of students. Despite this, I feel it is safe to say, concern for mental wellness is rightfully here to stay. Therefore, we must continue to boldly innovate and question our practices in the pursuit of continuous learning. In the spirit of growth, I wish you happy reading of this edition of the Journal of Research and Teaching in Developmental Education!

Sincerely,

Jesse M. Redlo, Ed.D.
Editor, Journal of Research and Teaching in Developmental Education

Hybrid in a HyFlex Room: Leveraging Technology to Increase Developmental English Success

By Kate Klaiber

Introduction

Successful teaching practices from ESOL (English to Speakers of Other Languages) with a hybrid, synchronous, in-person format using HyFlex technology should be applied to Developmental English courses, especially in rural areas or wherever the student population frequently encounters transportation issues to overcome barriers to completion and success. This paper reviews lessons learned teaching online during the pandemic and calls upon researchers to further investigate the anecdotal and accidental success of the author.

Background and Discovery

FLEXESOL™ was created in the first pandemic summer. In March, SUNY Genesee Community College shut down most in-person operations and classes began meeting on Zoom or asynchronously. International students had to decide if they would stay or go home. Health and political directives were constantly changing. By April, the intensive summer ESOL courses had been postponed until fall. This delay allowed for the discovery of content delivery appropriate for multilevel students in multiple time zones. Prior to the pandemic, online teaching in ESOL was often rejected for pedagogical and discipline-related reasons. However, circumstances dictated that technology be adopted. Over the summer of 2020, Intensive English Programs (IEPs) shrank, and many colleagues were furloughed. Political decisions changed frequently, with student visas in flux. This uncertainty made the decision to use HyFlex simple: students would have the option to attend a live class in-person, online synchronously by Zoom, or by completing work online asynchronously (Klaiber, 2021, p. 6).

Training and Preparation

GCC Instructional Designer-led training, specifically with guidance from Judith Littlejohn and Harold Strassner, provided the foundational basis of training and preparation. Beyond that there were many online training sessions during the summer of 2020. SUNY Remote Teaching Institute, TESOL (Teachers of English to Speakers of Other Languages) International, NYSTESOL, and Oxford University Press webinars all provided more information on teaching remotely and/or using the HyFlex modality. Additionally, Nearpod and Playposit offered tools to deliver content outside of Blackboard, the LMS in use at the time. Significantly, FLEXESOL™ stems from Dr. Brian Beatty's HyFlex work, and Dr. Helaine Marshall's SOFLA™: Synchronous Online Flipped Learning Approach. When fall 2020 semester arrived, SUNY GCC's ESOL courses were ready for students worldwide (Klaiber, 2021, p. 7).

Ultimately and unsurprisingly, FLEXESOL™ provided the pliancy required to satisfy institutional and political mandates, but it did not prove to be a recommended practice for ESOL students. Data indicate students from that time developed English reading and writing levels at appropriate rates, but those who joined class from distant time zones or asynchronously struggled

to keep up with authentic listening and speaking tasks once they received visas and came to campus. However, elements of FLEXESOL™ do provide instructors with the ability to serve students in multiple locations at once. Most beneficially and of note for instructors of Developmental English is the recording and posting of lectures and other materials in the LMS for asynchronous student participation. Having videos and materials online allows students to keep up with class. If applied to Developmental English, hybrid classes taught with HyFlex technology could address the issue of low attendance.

Application of ESOL Strategies to Developmental English

The flipped classroom approach, deployment of embedded tutors who can function in the room or online for group work, and the recording of mini lectures with closed captioning for students with disabilities all support increased student success in a class that meets synchronously. Despite offering recordings for later viewing, an emphasis on active participation in-person or synchronously online must be highly encouraged to increase a feeling of connectedness and provides for greatest success (Klaiber, 2021).

Each semester, composition instructors teach the importance of knowing the audience. Developmental English courses in 2022 must also address audience. Who are the students? What do they want? Anecdotally, students in Developmental courses say they prefer to learn in the classroom and not online synchronously. However, in the GCC geographical region, offering a hybrid, synchronous option that allows students to attend F2F whenever possible, but Zoom whenever necessary, is the best option to increase student success rates. Harsh Western New York winters are made easier for students when they know they can skip the long, snowy drive and still attend class. The syllabus makes it clear that students should attend regular class meetings as often as possible. Recordings and materials are available later for students who need to cover the content again or to fill in gaps in understanding, but they are not meant to take the place of regular class meetings as they would in a HyFlex course.

RTDE readers already recognize the non-cognitive factors that can form concrete barriers to completion in the Transitional Studies area. By applying strategies that worked for Non-Native English-speaking international students during the pandemic to Native English speakers in Developmental English courses, there was an unexpected rise in success rates in courses such as ENG 091 – Grammar and Paragraph Mastery and ENG 100 – Introduction to Composition. More students persisted and completed the courses than before. For example, one section that typically had a 60% pass rate jumped to 75%.

Exploring the Role of Other Potential Factors

Modality is not the only change that took place during the time of COVID-19 in my Developmental English courses. Prior to the pandemic, and with the support of Provost Dr. Kate Schiefen, a team of GCC faculty including Director JoNelle Toriseva, Assistant Professor Toni Boyd, Associate Professor Julie Jackson-Coe and others had won grants to participate in the SUNY Developmental English community led by Dr. Matt Conte. Low success and completion rates in New York State had led to efforts to revitalize and improve upon and/or reduce the number of Developmental courses. Convenings and webinars included training for ALP

(Accelerated Learning Program) from Professor Peter Adams in collaboration with NYCLSA (New York College Learning Skills Association), training on trauma-informed teaching at

Onondaga Community College, training for IRW (Integrated Reading and Writing) from Professor Barbara Murphy, and training about the anti-racist syllabus of Professor Asao Inoue. Faculty had been updating and improving Developmental English courses to support Multiple Measures Placement and Pathways initiatives. Under the circumstances, it is difficult to tell if other changes to the course may have played a role in the increased completion rate. However, this underscores the need for further research.

Tips for Improved Completion and Success Rates

Increased participation and engagement by students leads to increased student completion and success.

In addition to an engaging instructor and an approachable embedded tutor, Developmental English students in a mixed modality need a variety of activities, robust readings with high expectations, mini lectures, a flipped classroom approach, low-stakes drafting using the process approach with e-portfolio submissions at the end of term, and plenty of individual assistance during workshop time. Scaffolding, discussion of readings, firm and repeated expectations of frequent participation, and a syllabus and introductory class that explicitly prepare students for these activities should all be employed. The LMS course shell should be well-organized and include checklists and easy to find rubrics and assignments with model essays. In addition, using OneDrive or Google Drive with group access to projects online improves participation.

Expectations of participation in a culture of mutual respect and responsibility encourage students to continue to join class regularly whether they attend in-person or with technology. This support and cooperation in turn increase the overall quality of the work. Students in ENG 091, for example, can advance directly to ENG 101 if their portfolios meet the requirements of the rubric. Researchers could track an increase in students advancing more quickly than in prior years.

Conclusion and Recommendations

To summarize, good things are happening in Developmental English right now. Some of the success may be due to technology, and some may be due to the influence of other initiatives. Only research can confirm these suspicions. Busy community college practitioners who have full teaching loads and lack resources often cannot perform the research their colleagues at larger institutions can. In future, partnership with researchers is welcome. In the meantime, a strong recommendation to adapt a Hybrid course using HyFlex technology with firm rules for attendance in-person or online synchronously is advised.

References

Klaiber, Kathleen M. (2021, Spring). FLEXESOL ™: Pandemic Practice. *NYCLSA Newsletter,* 6-7. Retrieved from http://www.nyclsa.org/newsletter.html

Klaiber, Kathleen M. (2021, November 12). FLEXESOL™ and Implications for Developmental English. [Conference Presentation Slides].

Biographical Information

Kate Klaiber is Associate Professor of ESL and English at SUNY GCC in Batavia, New York and teaches ESOL and Developmental English courses annually. She holds an M.A. in Applied Linguistics from the University of Utah and has won SUNY Chancellor Awards for Excellence in Teaching and Excellence in Scholarship and Creative Activities. She is Rochester/Buffalo regional co-chair of NYSTESOL and a long-time member of NYCLSA.

Placement Reform and the Nontraditional Student

By Donna Kessler-Eng, Ph.D.

Associate Professor, English
Bronx Community College
The City University of New York

Author Note
I have no conflicts of interests to disclose.
Correspondence concerning this article should be addressed to Donna Kessler-Eng, Department of English, Bronx Community College, 2155 University Ave. Bronx, NY, 10453. Email: Donna.Kessler-Eng@bcc.cuny.edu

Abstract

The goals of placement reform and the elimination of developmental education at community colleges were to decrease the misplacement of students and to provide students with quicker access to college-level courses to improve retention and student success rates. However, the new placement reforms may be preventing some nontraditional students from attending community colleges.

Keywords: developmental education, nontraditional student, placement reform, high-stakes testing, GED/TASC, corequisite courses, prematriculation programs

Introduction

Two major reforms in education have been taking place in community colleges across the nation: the phasing out of stand-alone developmental education courses in favor of credit-bearing corequisite courses and the use of placement mechanisms that rely heavily on high school GPA instead of high-stakes testing. The elimination of long sequences of developmental education courses allows for faster access to credit-bearing courses in math and English. Studies have shown that getting rid of long sequences of remedial classes increases student success rates (Bahr et al., 2019). Additionally, community colleges are moving away from using high-stakes skills testing to determine student placement. Instead, many community colleges are using placement algorithms that rely heavily on high school GPA to determine if students should be placed into credit-bearing writing courses, corequisite writing courses, or prematriculation developmental education programs.

While relying on high school GPAs to assess students' academic abilities has been shown to be more accurate than relying on high-stakes testing (Belfield and Crosta, 2012; Woods et al., 2018), there are exceptions. Using placement mechanisms that rely heavily on high school GPAs may not accurately determine the placement of nontraditional students. Nontraditional students, the students most community colleges serve as open admissions institutions, are commonly defined as those students who are over the age of 24 who have life responsibilities, such as working full-time or being parents that prevent them from fully focusing on their educations. Other definitions of nontraditional students include background (race and gender), being a commuter student, and enrollment in trade programs (Jones & Watson, 1990). This brief study will define nontraditional students as those who received a GED/TASC certification rather than a high school diploma.

The skills of GED/TASC students, students with lengthy interruptions in their education, and students with international high school degrees may or may not be accurately assessed when using placement mechanisms that rely heavily on high school GPAs (Bahr et al., 2019). The goals of placement and developmental education reforms were to decrease misplacements and increase access to education, but in the case of nontraditional students, placement reform may not be doing so. Looking at the placement data of Bronx Community College (BCC) since the City University of New York (CUNY) has been using its new placement index, a disproportionate number of GED/TASC students are being placed into the "deep developmental" need in English category, which means that these students will be encouraged to enroll in prematriculation programs rather than college courses. Nontraditional students who would have been able to attend college based upon skills test placement are being put into prematriculation

programs instead. The placement reforms that now rely heavily on GPA need reform when it comes to the English course placement of nontraditional students. The placement of nontraditional students should be determined by using multiple means of placement assessment, including skills testing and self-directed placement.

Bronx Community College's GED/TASC Students and Placement Reform

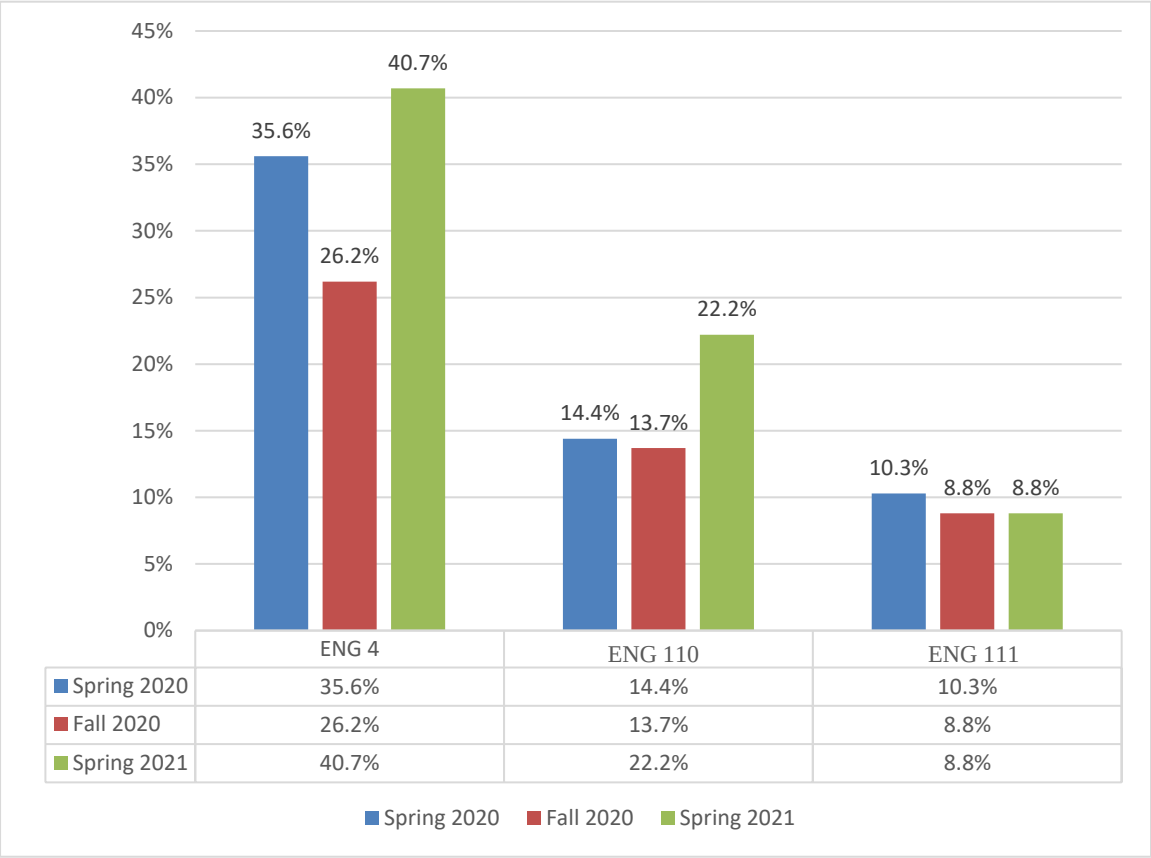
Like many other university systems, CUNY has been phasing out developmental education courses in math, English, and reading. CUNY will no longer offer non-credit developmental education courses by the fall of 2022. CUNY has replaced developmental education courses with corequisite courses that combine developmental education instruction with first-year writing (FYC) courses, thereby giving students faster access to FYC courses. In the spring of 2020, CUNY stopped using placement exams and started using a placement algorithm that relies heavily on high school GPA while also using SAT/ACT and/or Regents scores. Since CUNY will have phased out all remedial courses by the fall of 2022, students who are determined to have developmental needs are no longer placed into developmental education courses. Instead, if they are determined to have "deep developmental" need in English, which is flagged by having an English Proficiency Index (EPI) score of below 50, they are encouraged to enroll in CUNYStart, which offers a prematriculation program in English. Students with "light developmental" need, an EPI of 50-64, are placed into corequisite English courses, and if they have an EPI of 65 or more, they are placed into traditional credit-bearing FYC courses.

Beginning in the spring of 2020 and through the spring of 2021, Bronx Community College offered an experimental developmental English course (ENG 4). This course combined two semesters of developmental reading courses and two semesters of developmental writing courses into a one semester course that offered an integrated developmental reading/writing curriculum. During the semesters this course ran, students were given the option to take a developmental reading/writing course that allowed them to become matriculated students and part of the campus community. The other option at the time for this cohort of "deep developmental" need students was to enroll in CUNYStart, a prematriculation program that would not allow students to take college courses and become a part of the college community. The hope in designing ENG 4 was that it would be viewed by the university as a developmental corequisite reading/writing course that moved students forward quickly towards FYC while preparing them academically for a credit-bearing first semester writing course and allowing them to take other college courses. But since ENG 4 was not a credit-bearing course, the university would not allow this course to continue and so Bronx Community College stopped offering this accelerated developmental reading/writing course in the spring of 2021.

At Bronx Community College, incoming nontraditional GED/TASC students are more likely to be placed into the "deep developmental" need category than traditional students are. The following chart shows the percentages of student placements during the semesters ENG 4 was offered at BCC. ENG 4 was the course students with "deep developmental" need could take, ENG 110 was a corequisite FYC course that students with "light developmental" need could take and students determined to not have any developmental need in English were placed into ENG 111, BCC's first-semester composition course.

Figure 1

Percentage of GED/TASC Students in First-Semester English Courses Using EPI

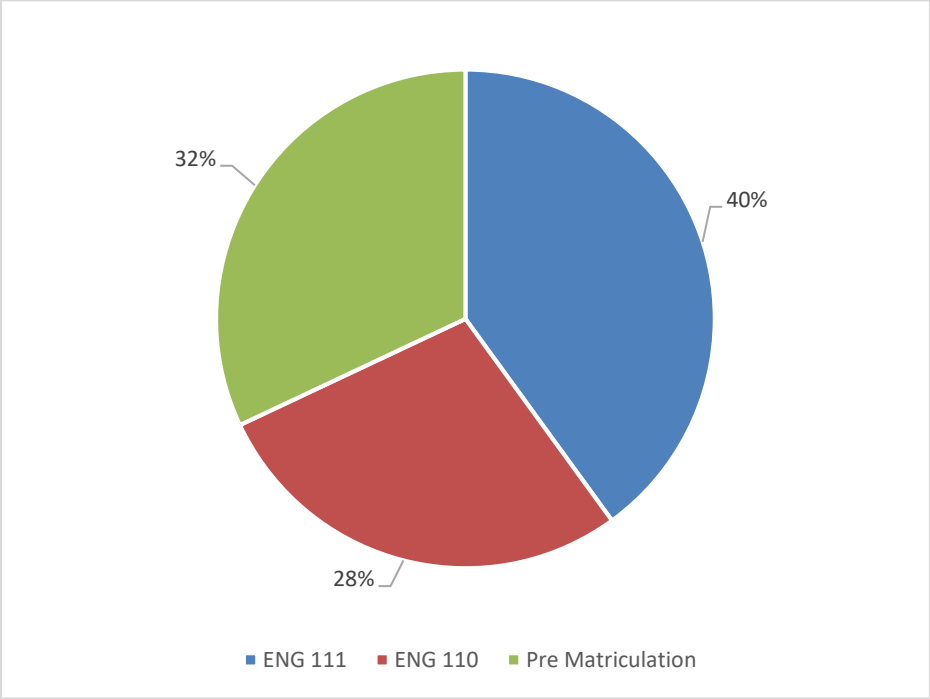


Source: BCC Office of Institutional Research (OIR)

A study conducted in 2019 by Bronx Community College's Office of Institutional Research and Office of Academic Affairs found that a significant number of students who placed into the "deep developmental" need category using the EPI placement algorithm would have placed into credit-bearing or corequisite courses if their placement had been determined by using high-stakes testing. The study analyzed data for incoming students English course placements for Spring 2018 and Fall 2018 found that 40% of the students that were placed in the "deep developmental" need in English category would have placed into corequisite FYC (ENG 110) or traditional FYC (ENG 111).

Figure 2

"Deep Developmental" Need Students Placement Using High-Stakes Testing



Source: BCC Office of Academic Affairs (OAA) & Office of Institutional Research

Studies have shown that nontraditional students' skills levels are not easily assessed by using high school GPA (Bahr et al., 2019). Nontraditional students may have more life challenges than traditional students (BCC OAA/BCC OIR, 2019), but their skills levels may be the same or stronger than traditional students.

Discussion

Community colleges have traditionally been open admissions institutions. The current educational reforms of using multiple measures of placement based largely on high school GPA and the end of developmental education are putting some nontraditional students access to a community college education at risk. GED/TASC students who are being placed into the lowest level cohort of students by relying on high school GPAs for placement may be denying some students college admission, students who would have gained admission if skills testing were used at the time of enrollment. The end of developmental education courses and the movement away from skills testing is putting some GED/TASC students at a disadvantage. These two educational reforms were designed to increase educational access and equity, but since GED students usually do not have GPAs for the new placement algorithm to use in their placement formulas, GED students who have the skills necessary to be placed into corequisite and traditional FYC courses are being placed into prematriculation programs instead.

Recommendations

Currently at BCC, reading and English faculty have been working together to design and pilot an experimental corequisite English course, ENG 100, that will replace ENG 4. ENG 100 will offer students who are placed into the "deep developmental" need cohort the opportunity to attend college and take college courses rather than the prematriculation program in CUNYStart. Nontraditional students with strong skills who were misplaced into the "deep developmental need" cohort by the EPI may do well in this experimental corequisite course, but this has yet to be studied as the course has been offered for the first time in the fall of 2021. Another option to help assess nontraditional students' placement would be to also use the very skills testing that was eliminated to determine the placement of these students. In the past, studies have recommended that a "combination of placement tests and transcripts" (Scott-Clayton et al., 2014) be used for student placement, and this may be the best way to determine GED/TASC student placements. Finally, many nontraditional students are aware of their own academic strengths and weaknesses. Self-directed placement in additional to testing and transcripts may all work well together to help ensure that nontraditional students are not misplaced.

Conclusion

At many community colleges, high-stakes placement exams have been replaced with placement algorithms that rely heavily on high school GPAs. While studies have found that high GPAs are the most accurate means of determining student placement (Belfield and Crosta, 2012; Woods et al., 2018), this is not true in all cases. Nontraditional students such as those who have GEDs do not have GPAs that will accurately determine their placement. Some of these students are being under placed into prematriculation programs and thereby being denied college admission. The new placement reforms should be reformed so that nontraditional students are accurately placed.

References

Bahr, P. R., Fagioli, L. P., Hetts, J., Hayward, C., Willett, T., Lamoree, D., Newell, M.A., Sorey, K., & Baker, R. B. (2019). Improving placement accuracy in California's community colleges using multiple measures of high school achievement. *Community College Review*, 47(2), 178-211. https://doi.org/10.1177/0091552119840705

BCC Office of Academic Affairs (OAA) & Office of Institutional Research (2019). "Deep Developmental" Need Students Placement Using High-Stakes Testing. Bronx Community College, The City University of New York.

BCC Office of Institutional Research (2019). Percentage of GED/TASC Students in First-Semester English Courses Using EPI. Bronx Community College, The City University of New York.

Belfield, C. R., & Crosta, P. M. (2012). Predicting Success in College: The Importance of Placement Tests and High School Transcripts. CCRC Working Paper No. 42. *Community College Research Center, Columbia University*. Retrieved from https://eric.ed.gov/?id=ED529827

Jones, D. J., & Watson, B. C. (1990). *High-Risk Students and Higher Education: Future Trends. ASHE-ERIC Higher Education Report No. 3*. ASHE/ERIC Higher Education Reports, The George Washington University, One Dupont Circle, Suite 630, Washington, DC 20036-1183. Retrieved from https://eric.ed.gov/?id=ED321726

Scott-Clayton, J., Crosta, P. M., & Belfield, C. R. (2014). Improving the targeting of treatment: Evidence from college remediation. *Educational Evaluation and Policy Analysis*, *36*(3), 371-393. https://doi.org/10.3102/0162373713517935

Woods, C. S., Park, T., Hu, S., & Betrand Jones, T. (2018). How high school coursework predicts introductory college-level course success. *Community College Review*, *46*(2), 176-196. https://doi.org/10.1177/0091552118759419

When Academic Support Is Not Enough: Who Are the Students Left Behind?

By Laura Jacobi

Communication Studies Department, Minnesota State University, Mankato, United States

Author Note

Laura Jacobi https://orcid.org/0000-0001-5190-5182

I have no known conflict of interest to disclose.

Correspondence concerning this article should be addressed to Laura Jacobi, Communication Studies Department, 230 Armstrong Hall, Minnesota State University Mankato, Mankato, Minnesota 56001; laura.jacobi@mnsu.edu

Abstract

While most students who seek academic support succeed in their courses, some still fail or withdraw. What can we learn about them? In this study, 6,299 undergraduates were enrolled in courses supported with Supplemental Instruction (SI), a form of peer-facilitated academic support open to students in challenging courses. Mean final course grades and success rates of students who attended SI with different levels of frequency were examined to determine the impact of SI by session attendance frequency. Mean final course grades and success rates of students with potential barriers to success defined in previous literature (underrepresented minority, first-generation, and remedial enrollment) were also examined to assess the influence of such potential barriers. One-way ANOVAs and chi-square analyses reveal that the more often students attended SI and the lower their barrier level, the higher their mean final course grades and likelihood of success in the course. A deeper analysis of the demographics of the 75 students who failed or withdrew despite attendance at 5 or more SI sessions is also conducted and confirms the significance of the barriers that traditionally interfere with student success. Implications are discussed along with suggestions pertaining to how to best support the students left behind.

Keywords: Supplemental Instruction; academic support; underrepresented minority; first-generation; remedial

When Academic Support is not Enough: Who are the Students Left Behind?

The findings are consistent across studies—participation in academic support programs leads to positive outcomes for students who partake. Supplemental Instruction (SI), a peer-facilitated academic support model in which proficient students facilitate weekly study sessions in support of students in challenging courses, is associated with a whole host of positive benefits, including: improved course grades (Bowman et al., 2021; Channing & Okada, 2020; Congos & Mack, 2005; Crisp & Taggart, 2013; Dawson et al., 2014; Gasiewski et al., 2012; Oja, 2012; Peterfreund et al., 2007-2008; Rabitoy et al., 2015; Shaya et al., 1993; Sucher & Pardue, 2008); higher course pass rates (Crisp & Taggart, 2013; Oja, 2012; Peterfreund et al., 2007-2008; Petrucci & Rivera-Figueroa, 2021); persistence in taking subsequent courses (Ogden et al., 2003; Peterfreund et al., 2007-2008); retention (Bowman et al., 2021; Channing & Okada, 2020; Crisp & Taggart, 2013; Ogden et al., 2003; Shaya et al., 1993; Dawson et al., 2014; Terrion & Daoust, 2011-2012; Zaritsky & Toce, 2006); and higher graduation rates (Bowles et al., 2008; Dawson et al., 2014; Grillo & Leist, 2013-2014). Although most students succeed with support from SI, the unfortunate reality is that not all students succeed—even when they participate a reasonable amount. Who are the students left behind, and why do they fail?

Some studies suggest that the biases inherent in institutional and societal structures may reduce the chances for success of specific groups of students in college: underrepresented minorities, first-generation students, and students needing remedial support (Ishitani, 2003; Massey et al., 2002; Rath et al, 2007). In other words, although academic support programs such as SI may help these students, the aid may not be sufficient to result in passing course grades. For example, several studies refer to the lower graduation rates of minority students (e.g., Cox, 2011; Grillo & Leist, 2013-2014; Light & Strayer, 2002). In fact, the most recent data from the U.S. Department of Education (based on all students who started at four-year institutions in fall 2013) reveal differences in graduation rates between white and minority groups of students; 66.6% of whites graduated within six years, while only 44.3% of African Americans and 57.8% of Hispanics graduated in the same time frame.

First-generation students, "students whose parents did not complete a baccalaureate degree," also face challenges (Higher Education Act of 1965). Engle and Tinto (2008) claim that first-generation students are nearly four times more likely to leave higher education after the first year than non-first-generation students. Additionally, students who need remediation and must enroll in developmental courses lack the basic skills necessary for college success (Scott-Clayton et al., 2014). As a result, they often incur additional expenses (Hennessey et al., 2021; Hilgoe et al., 2016; King et al., 2017), postpone their graduation (Hilgoe et al., 2016; King et al, 2017), or do not graduate at all. In fact, studies show that undergraduates who fail their developmental courses are more likely to withdraw from higher education (Benken et al., 2015; Fike & Fike, 2008; Shields & O'Dwyer, 2017), and only 52% of students who attend four-year universities and need remediation complete a degree (Bailey, 2009).

Finally, barriers to success may be even greater when students face more than one of them. For example, some studies show that the lower retention and graduation rates of minority students is a result of other obstacles, such as lower income, challenges associated with being a first-generation college student, and segregation (Ishitani, 2003; Reason, 2009). However, there is a gap in the literature in this area. Yue et al. (2018) claim that "there are limited studies on how SI affects the performance of at-risk students" (p. 20). Additionally, Yue et al. note the lack of studies upon how student performance is affected by increasing frequency of SI visits. Using a

rigorous approach and starting with a sample size of 8,500 students, Bowman et al. (2021) did assess impact of SI by level of attendance. However, low attendance in SI (22-26% of students enrolled) resulted in attendance groupings at low levels of attendance (i.e., 0 sessions, 1, 2-4, and 5+) and did not allow for exploration of differences of impact at higher levels of attendance, where previous research has found significant differences in course grades and equity gaps (i.e., Yue et al., 2018).

This study aims to fill these gaps in the literature. The purpose of this study is to assess the impact of *frequency of SI visits* and group membership in roles that have traditionally acted as *potential barriers to success* (i.e., underrepresented minority status, first-generation status, and remedial status) upon course GPAs and success and then to do a deeper analysis of the students who fail or withdraw from the course despite participation in a minimum of five SI sessions. Such an analysis may help to gain insight into the needs and circumstances of the students who fail despite academic support, ultimately aiding academic support program coordinators with the development of intentional interventions to increase such students' chance of success.

Literature Review

While the many studies cited earlier reveal the positive impact of SI upon *all* students, some studies have also explored the potential for a differential impact upon underrepresented groups of students such as minority students, first-generation students, and students enrolled in developmental courses in higher education.

Underrepresented Minority Students

Some studies have found larger benefits of SI for underrepresented minority students (URM) in particular (Bowman et al., 2021; Buchanan et al., 2019; Fresno State Supplemental Instruction, 2016; Grillo & Leist, 2013-2014; Peterfreund et al., 2007-2008; Petrucci & Rivera-Figueroa, 2021; Rath et al., 2007; Rabitoy et al., 2015; Treisman, 1992). For example, Buchanan et al. (2019) examined comparison groups (i.e., white/minority and traditional/nontraditional) on attendance in SI sessions, final course grades, and graduation rates to determine the impact on minority and nontraditional students. Controlling for previous achievement with beginning term GPA, the authors found that attendance at SI sessions is a significant predictor of final course grades for all students. Additionally, for minority students, SI attendance is positively correlated with final course grade, regardless of level of previous achievement. In a similar vein, Treisman (1992) used SI classes to boost the performance of underperforming African American students at the University of California Berkeley. SI classes brought up their performance to the point at which they performed better in the calculus course than the Chinese American students who had previously been the highest performing group.

Using a propensity score analysis approach to eliminate self-selection bias, Bowman et al. (2021) explored the efficacy of different levels of participation in SI in boosting course grades and increasing retention with 8,500 students in 21 courses from two different semesters. Their findings suggest that attendance at any number of SI sessions led to a 25%-35% decrease in the likelihood of receiving a DFWI grade and resulted in an approximately 4% increase in the number of retained students. Bowman et al. also found a differential impact by race/ethnicity since SI attendance was associated with 5%-11% gains in retention for URM students (vs. 3% for non-URM students) and a 34%-50% decline in DFWI rate for URM students (vs. 20%-30%).

Using a collection of approximately 12,000 student-associated data from San Francisco State University's institutional records, Peterfreund et al., (2007-2008) found that the SI group performed better in 14 of 15 courses (all except Pre-Calculus). The increase in pass rates was particularly impressive for students from underrepresented minorities. The largest differences in pass rates between non-SI participants and SI participants of URM were in Biology I (25% difference), Physics I (17% difference), and Calculus I (15% difference). Rath et al. (2007) examined the impact of SI upon 1,526 students in an introductory biology class at San Francisco State University and found more significant gains among students from URM populations; for example, out of the 101 URM SI attendees, 78 passed the course (vs. the 52 students who would be expected to pass assuming the same distribution as the non-SI attendees).

Using a realist evaluation framework to determine which students benefited under what conditions from SI, Petrucci and Rivera-Figueroa (2021) assessed student performance of SI attendees and non-attendees in STEM courses in a large urban Hispanic-serving community college. Results indicate that increasing numbers of students passed their courses with increasing SI session attendance. Students were also significantly more likely to pass if they attended any SI sessions at all (71.6% passed compared to 50.8% of non-SI attendees).

In the Fresno State Supplemental Instruction (2016) study, the equity gap between URM students and other students nearly closed when students attended 16 or more SI sessions (i.e., mean SI course grade of 2.91 for URM students who attended 16 sessions vs. 3.0 for non-URM SI attendees). Finally, Rabitoy et al. (2015) found that among mediating variables (number of SI sessions and the gender and race of SI leaders and course instructors), the number of SI sessions attended was the strongest predictor of a higher final course grade ($\beta = .21$, $p < .001$). This relationship was stronger for students of color ($\beta = .23$, $p < .001$) than for white students ($\beta = .16$, $p < .001$). Along with the results of Fresno State Supplemental Instruction, these results indicate that regular attendance is key to success, even more so for students of color.

First-generation Students & Other

Despite the paucity of research assessing the impact of SI *only* upon first-generation students, there are studies that examine impact upon students with a variety of demographics in addition to first-generation status (i.e., underrepresented minorities, Pell Eligible, and remedial status). For example, the goal of Kornblum et al.'s (2017) study was to "demonstrate the benefit of SI workshops in a majority of first-generation, underrepresented minority, predominantly academically underprepared student population" (p. 2). The results of self-efficacy surveys, physics and math grades, pre- and post-tests, and focus group data from students in first year experience courses convey positive benefits for these groups of students. Their ending mean course GPA was 2.9 (vs. 2.2 and 2.45 of control group GPAs), and their completion rate was 81% (vs. 9.4% and 6.3% in control group samples). Additionally, qualitative and quantitative survey and focus group data reveal the positive experiences of students. Williams (2014) investigated the influence of SI upon final grades in introductory science courses in a community college; although small effect sizes, findings suggest a stronger positive effect on the final grades of Black, Hispanic, and first-generation students. Finally, Yue et al. (2018) found that the higher a student's *disadvantage index* (i.e., extent of disadvantage measured when students had one or more of the following: underrepresented minority student status, Pell eligibility, first-generation student status, remedial status), the lower their academic performance and the higher the performance gap. However, the authors discovered an interaction effect with number of SI visits,

such that the more SI visits attended by disadvantaged students, the higher their course grades and the lower the performance gap. In fact, the gap was eliminated with attendance at 16 or more sessions due to the higher gains achieved by disadvantaged students (.96 average improvement in grade) versus non-disadvantaged students (.63 average grade improvement).

Students Supported with Remediation

Finally, there are also studies that have explored the impact of SI on students who are supported with remediation. Two of these studies examined SI as an intervention to support remedial students enrolled in co-requisite courses. For example, Hennessey et al. (2021) compared the impact of a traditional model and a co-requisite model, which provided tutoring, SI, or laboratories overseen by an instructor as interventions. The difference in the proportion of students who completed college algebra was significantly greater for students enrolled in the co-requisite developmental math model. In other words, the co-requisite laboratory led to better retention and higher passing rate. In Mireles et al. (2014), students were given the opportunity to enroll in a regular college algebra if they committed to use of academic support (i.e., FOCUS intervention). FOCUS participants had greater percentage of passing grades (85%) than the comparison group (59.3%) and a lower DFW rate (15% vs. 40.7%). Both studies confirm the significance of SI in enhancing the course performance of remedial students.

Hypotheses & Research Question

Based on the strength of previous literature revealing the positive impact of SI upon mean final course grades and course success rates of *all* students, the following hypotheses are proposed:

H1a: The more often students attend SI sessions, the higher their mean final course grades.

H1b: The more often students attend SI sessions, the higher their likelihood of success in the SI-supported course (defined by a C- or better final course grade).

Based on previous literature which presents URM status, first-generation status, and remedial status as potential barriers to student success, the following hypotheses are proposed:

H2a: The more potential barriers to student success due to URM student status, first-generation student status and/or remedial student status, the lower the mean final course grades.

H2b: The more potential barriers to student success due to URM student status, first-generation student status and/or remedial student status, the lower their likelihood of success in the SI-supported course (defined by a C- or better final course grade).

To explore an area not previously explored, the following research question is advanced:

RQ: What can be learned about the students who fail or withdraw even after attending 5 or more SI sessions?

Materials and Methods

Participants

This study included 6,299 undergraduate students from a mid-sized Midwestern university enrolled in 18 SI-supported courses in four semesters from Fall 2019 to Spring 2021. Among the 18 SI-supported courses, 13 were STEM courses in the following disciplines: biology (N = 383), health (N = 162), programming (N = 436), physics (N = 637), statistics (N = 544), and mathematics (N = 403); and 4 were non-STEM courses offered in accounting (N = 1,117),

economics (*N* = 1,853), anthropology (*N* = 479), social statistics (*N* = 141), and writing (*N* = 144). Of the 6,299 students, 4,111 attended 0 SI sessions (65.3%); 1,522 attended 1 to 4 SI sessions (24.2%); 392 students attended 5 to 9 SI sessions; and 271 students attended 10 or more SI sessions (4.3%). Sixty-one percent of students were male (*N* = 3,822), and 39% were female (*N* = 2,462). Most students were white (68.7%, *N* = 4,330), followed by 19% students of color (*N* = 1,199), and 11.5% international students (*N* = 724). Just 4.3% of students were enrolled in a remedial course (*N* = 268). Additional demographics can be found in the right column in Table 1.

Table 1

Demographics

	Unsuccessful 5+ SI Session Attendees (*N* = 75)		Successful 5+ SI Session Attendees (*N* = 588)		All Students Enrolled (*N* = 6299)	
	n	%	*n*	%	*n*	%
Gender						
Female	26	34.7	282	48	2462	39.1
Male	49	65.3	304	51.7	3822	60.7
First-generation Status						
Yes	37	49.3	186	31.6	2232	35.4
No	36	48	388	66	3958	62.8
URM Status						
Student of color	34	45.3	125	21.3	1199	19
International	7	9.3	95	16.2	724	11.5
White	33	44	360	61.2	4330	68.7
Race						
Asian	7	9.3	19	3.2	235	3.7
Black	19	25.3	53	9	402	6.4
Hispanic of any origin	6	8	31	5.3	310	4.9
Two/more races	2	2.7	21	3.6	233	3.7
White	33	44	360	61.2	4330	68.7
*International Student	7	9.3	95	16.2	724	11.5
Remedial Status						
Yes	6	8	26	4.4	268	4.3
No	69	92	562	95.6	6032	95.7
Potential Barriers to Success Index						
No barriers	19	25.3	246	41.8	2791	44.3
1 barrier	29	38.7	230	39.1	2426	38.5
2 barriers	19	25.3	84	14.3	883	14.3
3 barriers	5	6.7	9	1.5	51	.8
College						
CSET	58	77.3	365	62.1	2403	38.1
SBS	11	14.7	120	20.4	2473	39.3
COB	6	8	80	13.6	1117	17.7
Arts & Humanities	0	0	13	2.2	144	2.3
Allied Health	0	0	10	1.7	162	2.6

*Although "International Student" is not a race, upon admission, students self-identify into a racial category on a demographic form. This is one of the categories from which students choose.

Structure of SI

Rather than targeting specific populations of students, SI is a form of peer-facilitated academic support that is offered to all students in difficult courses. Developed in 1973 by Deanna Martin, the goal of SI is to enhance student performance and retain students (Martin & Arendale, 1992). To meet these goals, undergraduate students who perform well in difficult courses are hired as *SI Leaders* and trained (with advanced facilitation skills and collaborative learning strategies) to facilitate study sessions (UMKC, 2021). In the SI sessions, SI Leaders use collaborative learning strategies to engage students with difficult content and practice problems. In addition to facilitating study sessions, SI Leaders also attend the course(s) they support, maintain open communication with the professor of the course, and hold office hours to offer one-on-one support to students who desire it (UMKC, 2021).

Data Collection

Following IRB approval, at the end of each semester, SI session attendance data gathered with the use of Google forms at SI sessions were entered onto an Excel spreadsheet. The spreadsheet was sent to the Office of Institutional Research, where student success data (including final course grades and success rates) and demographic information (including race, gender, and first-generation status) was added and the data deidentified (names and student IDs removed). Analyses were conducted using the deidentified data.

To avoid the influence of unaccounted factors that may affect the success of SI, data were collected and compiled from multiple classes over several semesters. Channing and Okada (2020) claim that such compiling helps to "randomize class characteristics and student demographic trends" (p. 245).

Variables

One dependent variable in the study was final course grades. This was a continuous variable ranging from 0 (F) to 4.0 (A). "Half grades" (i.e., +/- grades) were assigned appropriate scores along the spectrum. For example, a D- was .67, while a D was 1.0 and a D+, 1.33. The other dependent variable, coded as a categorical variable per final course outcomes, was course success. A final grade of C- or higher was coded as "successful," and a D, F, or W was coded as "unsuccessful." Incomplete grades were excluded from analysis.

There were two independent variables. The first included frequency of SI session visits (converted to categorical variables to represent 0 sessions, 1-4 sessions, 5-9 sessions, and 10 or more sessions). Most SI studies assessed programs based on dichotomous participation status (i.e., between SI attendees and non-attendees). According to Yue et al. (2018), this dichotomous assessment is problematic and "may overlook the more complicated effects of SI participation because students may participate in SI to various degrees" (p. 24). Therefore, SI session attendance was defined by levels of frequency as explained above.

The second independent variable was the *Potential Barriers to Success Index* or PBSI (coded as categorical variables to reflect 0 barriers, 1 barrier, 2 barriers, or 3 barriers). Potential barriers in the PBSI could have included any of the following: underrepresented minority status (URM), first-generation status (FG), and/or remedial enrollment status (RE). In this study, underrepresented minorities included *all* students of color *and* international students. Although

some studies include only African American, Hispanic, and American Indian groups as underrepresented minorities per the Sullivan Commission (2004), all students of color may face obstacles in their school careers as a result of systemic institutional racism. In addition, international students are often excluded from the definition of underrepresented minorities since they may be more academically prepared than native students in the United States. However, international students were included as URM in this study due to the potential challenges they face as a result of language barriers and acculturation processes. Students were coded with remedial enrollment status if they were enrolled in either the developmental algebra or English course. Most students (44.3%, N = 2,791) were coded as 0 on the PBSI since they were not a URM student, a first-generation student, or a student enrolled in a remedial course; this was followed by students who faced one barrier (38.5%, N = 2,426), two barriers (14%, N = 883), and three barriers (.8%, N = 51).

Data Analysis

Impact of Session Attendance Frequency and Barriers on Mean Final Course Grades

With a continuous dependent variable and two categorical independent variables, a two-way ANOVA was performed to analyze the effect of SI session attendance frequency and level of barriers on mean final course grades (H1a and H2a). Although large enough, sample sizes were significantly different across session attendance groups. Therefore, the test for homogeneity of variance was significant, *Levene* $F(15,5425) = 10.8$, $p = .000$, indicating that this assumption was not met. Because there is not an alternative non-parametric test for a two-way ANOVA, individual ANOVAs were conducted to determine the influence of SI session attendance frequency and level of potential barriers (using the PBSI) upon mean final course grades. Additionally, a robust test of equality of means, the Welch's F test for unequal variances was conducted to confirm significance (Welch, 1951).

Impact of Session Attendance Frequency and Barriers on Course Success

Considering the categorical nature of the dependent (course success) and independent (SI session attendance frequency and PBSI) variables, chi-square tests of independence were performed to examine the relation between session attendance frequency and course success and between barrier level and course success (H1b and H2b). Results of all tests are reported in the Results section.

Examination of Unsuccessful 5+ SI Session Attendees

To understand the needs and circumstances of the students who failed or withdrew after participation in five or more SI sessions (RQ), the mean final course grades of the students within more specific categories by both session attendance frequency and barrier level (i.e., students who attended 0 sessions and had 0 potential barriers, students who attended 0 sessions and had 1 potential barrier, etc.) were examined. Additionally, the demographic data of the 75 unsuccessful students and the 588 successful 5+ session attendees were explored.

Limitations

Self-selection bias has consistently been mentioned as a potential limitation of studies assessing the impact of SI since the data are based solely on a non-random volunteer student sample. However, the size and diversity of the students in this study helped to reduce selection bias. Additionally, in previous studies exploring the impact of SI, SI attendees had similar (and sometimes even lower) high school GPAs and standardized test scores than non-SI attendees (Bowman et al., 2021; Buchanan et al., 2019; Congos & Mack, 2005; Hensen & Shelley, 2003; Peterfreund et al., 2007-2008; Terrion & Daoust, 2011-2012), suggesting that self-selection bias does not play a significant role. Another limitation is the unequal sample sizes between groups of students assessed—both by session frequency attendance and barrier level. Due to the unequal sample sizes, the homogeneity of variance assumption was not met, and it was not possible to examine interaction effects with the use of a two-way ANOVA. However, the Welch's F test offered a robust alternative.

Results

Hypothesis 1a: Impact of SI Session Attendance Frequency on Mean Final Course Grades

Results of a One-way Analysis of Variance (ANOVA) revealed that mean final course grades differed significantly among the four groups based upon session level attendance, $F(3, 5569) = 18.47$, $p = .000$. Because of the unequal sample sizes and potentially substantial differences in variances among groups, a Welch's F test was conducted as well. An alpha level of .05 was used for all subsequent analyses. The One-way ANOVA of students' average course GPA on the measure of SI session attendance frequency revealed a statistically significant main effect, *Welch's* $F(3, 5569) = 31.58$, $p = .000$, indicating a significant difference among the groups and support for H1a. Approximately 1% of the variance in course grade mean was accounted for by level of session attendance, $\omega^2 = .01$. Students who attended 10 or more SI sessions had the highest mean final course grades ($M = 3.34$, $SD = .85$), followed by student participants of 5-9 sessions ($M = 2.97$, $SD = 1.13$), student participants of 1-4 SI sessions ($M = 2.89$, $SD = 1.14$); and students who did not attend any sessions ($M = 2.8$, $SD = 1.25$). Post hoc comparisons, using the Games-Howell post hoc procedure, were conducted to determine which pairs of the sessions attended category means differed significantly. Results in Table 2 reveal increasingly larger course grade mean differences with increased session attendance, with the most significant difference (.54) between non-attendees and students who attended 10 or more.

Table 2

Post Hoc Results for Course Grade Means by Sessions Attended

Sessions Attended	Mean	Mean Differences			
		1	2	3	4
1. 0 sessions	2.80	--			
2. 1-4 sessions	2.89	.09	--		
3. 5-9 sessions	2.97	.17*	.08	--	
4. 10+ session	3.34	.54*	.45*	.37*	--

*$p < .05$

Hypothesis 1b: Impact of SI Session Attendance Frequency on Course Success

A chi-square test of independence was performed to examine the relationship between session attendance frequency and course success. The relation between these variables was significant, X^2 (3, N = 6291) = 77.49, p = .000, *Cramer's V* = .111. Therefore, H1b was supported. The percentage of students who succeeded in the course (i.e., earned a C- or better) increased from 75.6% among those who did not attend any SI sessions to 81% among students who attended 1-4 SI sessions, to 84.2% among those who attended 5-9 SI sessions, and to 95.2% among those who attended 10 or more SI sessions. Conversely, the percentage of unsuccessful students (i.e., earned a D, F, or W) decreased as the number of SI sessions attended increased (from 24.4% among students who did not attend SI, to 19% for 1-4 SI sessions, to 15.8% for 5-9 sessions, and 4.8% for 10 or more SI sessions). The greater the frequency of SI session attendance, the more likely students were to succeed in the course (i.e., earn a grade of C- or better). See Table 3 for frequencies.

Table 3

Number of Students Who Succeeded by Session Attendance Frequency.

		Sessions Attended				
		0 sessions	1-4 sessions	5-9 sessions	10+ sessions	Totals
Successful	Yes	3105	1233	330	258	4926
		(75.6%)	(81%)	(84.2%)	(95.2%)	(78.3%)
	No	1001	289	62	13	1365
		(24.4%)	(19%)	(15.8%)	(4.8%)	(21.7%)
	Totals	4106	1522	392	271	6291
		(100%)	(100%)	(100%)	(100%)	(100%)

Examination of expected values for cells indicated that there were less successful students (3,105 vs. 3,215) and more unsuccessful students (1001 vs. 891) than expected in the "0 sessions" group. There were also consistently more successful students than expected and less unsuccessful students than expected in any of the other groups in which students attended SI sessions. For example, in the "10+ sessions" group, just 13 students were unsuccessful (vs. an expected 59) and 258 were successful (vs. an expected 212). In other words, more SI session attendees than expected passed the course and less non-attendees than expected passed.

Hypothesis 2a: Impact of Barrier Level on Mean Final Course Grades

Results of a One-way ANOVA revealed that mean final course grades differed significantly among the four groups based upon level of potential barriers, F(3,5439) = 32.65, p = .000. Again, due to unequal sample sizes and potentially substantial differences in variances among groups, Welch's F test was conducted as well. Results revealed a statistically significant main effect and support for H2a, *Welch's F*(3, 5439) = 28.57, p = .000. Approximately 2% of the variance in mean final course grade was accounted for by level of barriers, ω^2 = .02. Students without any potential barriers to course success had the highest mean final course grade (M = 2.97, SD = 1.11), followed by students with just one barrier, such as URM, FG, or RE status (M

= 2.8, *SD* = 1.24), and students who had two barriers (*M* = 2.6, *SD* = 1.33); students who faced all three barriers had the lowest mean (*M* = 1.8, *SD* = 1.39). Post hoc comparisons, using the Games-Howell post hoc procedure, were conducted to determine which pairs of the PBSI category means differed significantly. Results are listed in Table 4 and reveal increasingly larger mean differences with increased barriers. Therefore, the most significant mean difference in final course grades is between students who have no barriers as defined by the PBSI and those who have the most (3 barriers), with a mean difference of over a full letter grade.

Table 4

Post Hoc Results for Course Grade Means by PBSI

Sessions Attended	Mean	Mean Differences			
		1	2	3	4
1. 0 barriers	2.97	--			
2. 1 barriers	2.80	.17*	--		
3. 2 barriers	2.60	.37*	.20*	--	
4. 3 barriers	1.80	1.18*	1.01*	.80*	--

*$p < .05$

Hypothesis 2b: Impact of Barriers on Course Success

A chi-square test of independence was performed to examine the relationship between barrier level and course success. The relation between these variables was significant, X^2 (3, N = 6146) = 90.76, p = .000, *Cramer's V* = .122. The lower the number of barriers on the PBSI, the more likely students were to succeed in the course (i.e., earn a final grade of C- or better), confirming H2b. The percentage of students who succeeded in the course (i.e., earned a final grade of C- or better) decreased from 82.6% among those who do not have any barriers to 76.2% among students who faced one barrier, to 69.7% among those who faced two barriers, and to 54.9% among those who faced three barriers. Conversely, the percentage of unsuccessful students (i.e., earned a D, F, or W) increased as the number of barriers increased (from 17.4% among students who did not face any barriers, to 23.8% for students with one barrier, to 30.3% for students with two barriers, and 45.1% for students who face three barriers). In other words, the greater the number of barriers, the less likely students were to succeed in the course (i.e., earn a final grade of C- or better). See Table 5 for frequencies.

Table 5
Number of Students Who Succeeded by PBSI

		Sessions Attended				
		0 barriers	1 barrier	2 barriers	3 barriers	Totals
Successful	Yes	2305	1847	615	28	4795
		(82.6%)	(76.2%)	(69.7%)	(54.9%)	(78%)
	No	484	577	267	23	1351
		(17.4%)	(23.8%)	(30.3%)	(45.1%)	(22%)
	Totals	2789	2424	882	51	6146
		(100%)	(100%)	(100%)	(100%)	(100%)

Examination of expected values for cells indicated that there were more successful students (2,305 vs. 2,176) and less unsuccessful students (484 vs. 613) than expected in the "0 barriers" group. There were also consistently less successful students than expected and more unsuccessful students than expected in any of the other groups where students faced barriers. For example, in the "3 barriers" group, 23 students were unsuccessful (vs. an expected 11) and just 28 were successful (vs. an expected 40). In other words, less students with barriers than expected passed the course.

Research Question: Who are the Unsuccessful Students?

Mean Final Course Grades by SI Session Attendance Frequency & Barriers to Success

To get a better understanding of the influence of session attendance frequency and barriers to success simultaneously, the mean final course grades of specific groups of students by level of attendance and barrier level were examined. This meant a closer look at 16 means since there were 4 session attendance frequency levels and 4 barrier levels. An examination of the mean final course grades indicates a clear rise in course grades with increased levels of SI session attendance and decreased levels of barriers. Within each PBSI category (i.e., 0 barriers; 1 barrier due to a student's role as a URM, FG, or RE student; 2 barriers; all 3 barriers), the course means rise with increasing levels of SI session attendance. The influence of the level of barriers and the level of SI session attendance together becomes clear when comparing students who faced none of the traditional barriers to success and attended 10 or more SI sessions (M = 3.4, SD = .76) with students who faced the most potential barriers to success (URM, FG, and RE) and did not attend any SI sessions (M = 1.56, SD = 1.36). In fact, students with membership in all three roles (URM, FG, and RE) have failing course means at all levels of session attendance until they attend 10 or more sessions (M = 3.08, SD = .83). See Table 6 and Figure 1.

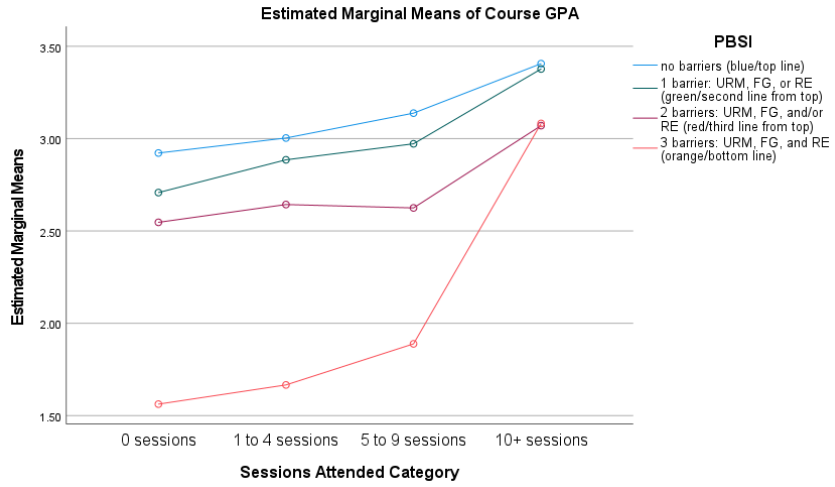
Table 6

Mean Final Course Grades by Level of SI Session Attendance & Barrier Level

	0 Sessions		1-4 Sessions		5-9 Sessions		10+ Sessions	
	M	SD	M	SD	M	SD	M	SD
No barriers	2.92	1.15	3.00	1.06	3.14	.99	3.41	.76
One barrier	2.71	1.30	2.89	1.15	2.97	1.16	3.38	.88
Two barriers	2.55	1.39	2.64	1.28	2.63	1.20	3.07	.92
Three barriers	1.56	1.36	1.67	1.36	1.89	1.54	3.08	.83

Figure 1.

Visual Display of Mean Final Course Grades by SI Session Attendance & Barrier Level



Demographics of the Unsuccessful Students

Seventy-five students out of the 663 students who attended 5 or more sessions did not succeed in the course (11.3%). Of those 75 students, 13 of them (17.3%) had attended 10 or more sessions, and the remaining 62 students attended between 5 and 9 sessions (82.3%), with the majority of that subset of students attending 5 sessions (n = 23, 37.1%) or 6 sessions (n = 19, 30.6%). Of the 13 students who attended 10 or more times from this sub-sample, two students withdrew from the course, and the others earned the following grades: 3 F, 1 D-, 5 D, 2 D+. Of the 62 students who attended 5-9 times from this sub-sample, 24 students withdrew from the course, and the others earned the following grades: 19 F, 15 D, and 4 D+.

A closer examination of the demographics in Table 1 reveals that over 32% of the subset of unsuccessful 5+ SI session attendees faced two (25.3%) or three barriers (6.7%) as a result of their roles as URM, FG, and/or RE students. In contrast, about half that amount (15.8%) of the successful 5+ SI session attendees faced two (14.3%) or three of the barriers (1.5%). More specifically, 49.3% of the subset of unsuccessful 5+ SI session attendees were FG students (compared to 31.6% of the successful 5+ SI session attendees and compared to the 35.4% of all FG students enrolled). Additionally, 45.3% of the subset of unsuccessful 5+ attendees were students of color; this stands in contrast with the 21.3% of the subset of successful students who

were students of color and is substantial considering that 19% of the students enrolled were students of color. Although the second largest percentage of the subset of students who failed included white students (44%), it is important to note that 61.2% of white 5+ SI session attendees passed. Of all 663 5+ SI session attendees, 21.4% of the students of color failed while just 8.4% of the white students failed. The largest percentage of the students of color who failed or withdrew were Black students (25.3%). There were also twice as many RE students in the subset of students who failed (8%) compared to the subset of students who passed (4.3%).

Discussion

Results of this study confirm the findings of previous research, which convey the significance of SI in boosting the course grades of all students (e.g., Bowman et al., 2021; Channing & Okada, 2020; Congos & Mack, 2005; Crisp & Taggart, 2013; Dawson et al., 2014; Gasiewski et al., 2012; Oja, 2012; Peterfreund et al., 2007-2008; Rabitoy et al., 2015; Shaya, et al., 1993; Sucher & Pardue, 2008). The results of this study also reaffirm that URM, FG, and RE students have faced institutional and structural barriers that may reduce their chance for success in college courses, which is also consistent with previous research (e.g., Cox, 2011; Engle & Tinto, 2008; Grillo & Leist, 2013-2014; Hilgoe et al., 2016; Ishitani, 2003; King et al, 2017; Reason, 2009; Yue et al., 2018).

More importantly, this study offers a closer examination of the students who fail in spite of some support with SI. The examination reveals that there is a compounding effect, such that the more barriers to success students face, the less likely they are to succeed—even with some level of academic support. For example, although based on a smaller sub-sample of students, the data reveal that students with all three barriers do not pass the course without attendance at 10 or more SI sessions. Yet, the impact at 10 sessions is profound, in which students move from below passing grades to above a 3.0 mean final course grade. These findings are consistent with previous research. As aforementioned, Yue et al. (2018) found that the higher a student's *disadvantage index*, the lower their academic performance and the higher the performance gap. However, an increase in SI session attendance mitigated risk and boosted course performance. The authors concluded, "Findings from this study indicate how SI participation can help disadvantaged students to close their performance gap with non-disadvantaged students: attending SI sessions on a regular or weekly basis is critical" (p. 24). Other studies have also found that regular attendance at SI sessions is key to success, especially for students of color and/or other at-risk students (e.g., Fresno State Supplemental Instruction, 2016; Grillo & Leist, 2013-2014; Rabitoy et al., 2015).

Why do underrepresented students underperform compared to their peers, and why do these students require higher levels of SI session attendance to succeed but then show more significant gains? Previous research reveals that underrepresented students do not perform at the same level as their peers because they typically attend lower-quality schools that do not prepare them to navigate college, and they may internalize stereotypes that cause them to be less confident in their skills regardless of ability level (Massey et al., 2002; Rath et al., 2007). URM students are also more likely to face hostile campus climates, particularly at predominantly White institutions (Hurtado et al., 2012), leaving them doubting their institution's support of them (Bowman et al., 2021). Together, this means that students with barriers to success start at a lower baseline than their non-disadvantaged peers. The findings of this study and previous

studies confirm this notion. In fact, Rath et al. claim that underrepresented students likely benefit more greatly from SI because they have "more potential for increase" (p. 214).

Since evidence suggests that higher levels of SI session attendance are required for underrepresented students to succeed, how can academic support programs make that happen? Results suggest that identifying students who face obstacles and attracting those students at the beginning of the semester is crucial in order to ensure regular SI attendance and increase the likelihood of course success. Although clearly available at the time of the SI sessions, many of the 5+ SI session attendees in this study may not have started to attend SI until after receiving failing grades on major exams worth a significant portion of their grade. At that point, it may have been too late for such students to comprehend foundational material that had been missed while keeping up with new material; additionally, the early poor exam grade(s) may have been significant enough to prevent them from earning a passing grade at the end of the course.

To attract students who have potential barriers to success, first, efforts should be made to gain a deeper understanding of the invisible or intangible barriers that are present as a result of stereotypical and negative representations of such students. For example, students of color and international students are oftentimes represented in demeaning ways that contribute to differential treatment of them in the educational system and in society as a whole. Such representations may be internalized by these students because the negative portrayals are reinforced repeatedly in media and even by the leaders who are supposed to represent them. First-generation students and remedial students are also often labeled and stigmatized in ways that prevent them from seeing themselves as capable. How can students maintain a positive outlook within a cultural environment in which others expect them to fail?

One potential solution is awareness. It is important for university administrators, faculty, students, and academic support staff to have open conversations about media portrayals of underrepresented students and the impact that such portrayals may have on the academic and social well-being of these students. Such conversations prioritize concerns surrounding diversity, equity, and inclusion and may lead to creative campus solutions.

Beyond an awareness of the perceptions developed and the language used to talk about underrepresented groups of students, in an SI program, it is important to hire diverse SI Leaders. Representation becomes particularly important in attracting URM students as revealed in Rabitoy et al. (2015), who found a larger academic benefit for students from racial-ethnic minorities when the student leaders were people of color. In fact, SI is frequently used to support large lecture courses, often taught by white instructors with passive learning strategies such as lecture, which reinforces a hierarchical relationship between instructor and student and becomes particularly problematic for marginalized groups of students such as underrepresented minorities (Bowman et al., 2021). Bowman et al. claim that depending in part upon the identities of the SI Leader and student, the peer-facilitated and active learning nature of SI offers the opportunity to change those dynamics, which may lead to stronger effects of SI among students from such marginalized groups.

Training SI Leaders to create a safe, inviting, and inclusive environment is also important in attracting students with barriers to success. Many of these students have struggled academically in their school careers and as a result, have a lack of confidence in their skills; a safe and inclusive environment is crucial in supporting such students and enticing them to keep attending. In fact, Rath et al. (2007) assert that it may be the case that URM students have a greater need for the environment created in SI sessions (cooperative, no pressure) than other students and thereby benefit to a greater degree. Johnson et al.'s (2010) findings confirm the

significance of environment to URM students since American Indian students were more likely than European American students to seek support from Supplemental Instruction, in part because it was conducted in a small, personal setting. Finally, in remedial classes where students already feel stigmatized, it may be beneficial to consider alternative models that are similar to SI but reduce the potential stigma because the academic support is a "regular" part of the course utilized by all students in the class (i.e., Learning Assistant model or co-requisite model).

Conclusion

Supplemental Instruction offers a valuable form of support that enhances course performance and increases the chance of success for the majority of students who utilize it. To ensure its benefits for all students, including those who face potential barriers to success (i.e., URM, FG, and/or RE students), universities should consider intentional efforts to attract students who would benefit most and incentive regular attendance. More importantly, universities should include administrators, faculty, and students in open conversations about creating an inclusive campus climate that supports all students.

Future Research

Scholars might consider examining other potential barriers to success. Although it is clear from the findings of this study and others that being an underrepresented minority, first-generation student, and/or remedial student presents obstacles that may interfere with success, there may be other factors that interfere with student success (i.e., motivation level, ability to self-regulate, difficult family/life circumstances). Additionally, since frequent SI session attendance is associated with significant course gains for disadvantaged students, scholars may wish to explore the impact of various attendance motivators in attracting those students.

References

Bailey, T. (2009). *Rethinking developmental education in community college* (Issue Brief No. 40). New York: NY: Community College Research Center Publications.

Benken, B., Ramirez, J., Li, X., & Wetendorf, S. (2015). Developmental mathematics success: Impact of students' knowledge and attitudes. *Journal of Developmental Education, 38*(2), 14-31.

Bowles, T. J., McCoy, A. C., & Bates, S. (2008). The effect of Supplemental Instruction on timely graduation. *College Student Journal, 42*(3), 853-859.

Bowman, N. A., Preschel, S., & Martinez, D. (2021). Does Supplemental Instruction improve grades and retention? A propensity score analysis approach. *The Journal of Experimental Education*, online, 1-25. https://doi.org/10.1080/00220973.2021.1891010

Buchanan, E. M., Valentine, K. D., & Frizell, M. L. (2019). Supplemental Instruction: Underrepresenting academic assistance in underrepresented groups. *The Journal of Experimental Education*, *87*(2), 288-298. https://doi.org/10.1080/00220973.2017.1421517

Channing, J., & Okada, N. C. (2020). Supplemental Instruction and embedded tutoring program assessment: Problems and opportunities. *Community College Journal of Research and Practice*, *44*(4), 241-247. https://doi.org/10.1080/10668926.2019.1575777

Congos, D., & Mack, A. (2005). Supplemental Instruction's impact in two freshmen chemistry classes: Research, modes of operation, and anecdotes. *Research and Teaching in Developmental Education, 21*(2), 43-64.

Cox, B.E. (2011). Life happens: How non-college life events influence racial inequality in four-year graduation rates at selective colleges and universities. Ph.D. dissertation, Pennsylvania State University, University Park (3417713)

Crisp, G., & Taggart, A. (2013). Community college student success programs: A synthesis, critique, and research agenda. *Community College Journal of Research and Practice, 37*(2), 114-130. https://doi.org/10.1080/10668920903381847

Engle, J., & Tinto, V. (2008). *Moving beyond access: College success for low-income, first-generation students.* Washington, DC: The Pell Institute for the Study of Opportunity in Higher Education.

Dawson, P., van der Meer, J., Skalicky, J., & Cowley, K. (2014). On the effectiveness of Supplemental Instruction: A systematic review of Supplemental Instruction and peer-assisted study sessions literature between 2001 and 2010. *Review of Educational Research, 84*(4), 609-639. https://doi.org/10.3102/0034654314540007

Fike, D., & Fike, R. (2008). Predictors of first-year student retention in the community college. *Community College Review, 36*(2), 68-88.

Fresno State Supplemental Instruction (2016, May). *Supplemental Instruction: Helping to reduce the performance gap of traditionally disadvantaged students.* Paper presented at the 2016 International Conference on Supplemental Instruction, Kansas City, MO.

Gasiewski, J. A., Eagan, M. K., Garcia, G. A., Hurtado, S., & Chang, M. J. (2012). From gatekeeping to engagement: A multicontextual, mixed method study of student academic engagement in introductory STEM courses. *Research on Higher Education, 53*, 229-261. https://doi.org/10.1007/s11162-011-9247-y

Grillo, M. C., & Leist, C. W. (2013-2014). Academic support as a predictor of retention to graduation: New insights on the role of tutoring, learning assistance, and Supplemental

Instruction. *Journal of College Student Retention, 15*(3), 387-408. https://doi.org/10.2190/CS.15.3.e

Hennessey, M. M., Kupezynski, L., Hall, K. S., & Peel, L. (2021). Effectiveness of developmental mathematics models on college algebra. *International Journal of Education, 9*(1). http://www.nationalforum.com/Electronic%20Journal%20Volumes/Hennessey,%20Margaret%20Effectiveness%20of%20Developmental%20Math%20Models%20on%20College%20Algebra-IJE%20V9%20N1%202021.pdf.

Hensen, K. A., & Shelley, M. C. H. (2003). Impact of supplemental instruction: Results from a large public, Midwestern university. *The Journal of College Student Development, 44*(2), 250-259.

Higher Education Act of 1965. *1998 Higher Education Act Amendments Subpart 2—Federal Early Outreach and Student Services Programs: Chapter 1—Federal TRIO Program*. Sec. 402A. 20 U.S.C. 1070a–11 https://www2.ed.gov/about/offices/list/ope/trio/triohea.pdf

Hilgoe, E., Brinkley, J., Hattingh, J., & Bernhardt, R. (2016). The effectiveness of the North Carolina early mathematics placement test in preparing high school students for college-level introductory mathematics courses. *College Student Journal, 50*(3), 369-377.

Hurtado, S., Alvarez, C. L., Guillermo-Wann, C., Cuellar, M., & Arellano, L. (2012). A model for diverse learning environments. In J. C. Smart & M. B. Paulsen (Eds.), *Higher education: Handbook of theory and research* (Vol. 7, pp. 41-122). Springer.

Ishitani, T. T. (2003). A longitudinal approach to assessing attrition behavior among first-generation students: Time-varying effects of pre-college characteristics. *Research in Higher Education, 44*(4), 433-449.

Johnson, K. A., Okun, M. A., Benallie, M., & Pennak, S. (2010). American Indian students' difficulties in Introduction to Psychology, *Journal of Diversity in Higher Education,* 3(1), 27-42. https://doi.org/10.1037/a0018621

King, J. B., McIntosh, A., & Bell-Ellwanger, J. (2017, January 18). *Developmental education challenges and strategies for reform.* https://www2.ed.gov/about/offices/list/opepd/education-strategies.pdf

Kornblum, S. L., El, Z. K. A., Menezes, G. B., Won, D., & Allen, E. L. (2017). *Enhancing engineering first year experience through Supplemental Instruction.* Conference Proceedings of the American Society for Engineering Education. Available online: file:///C:/Users/Owner/AppData/Local/Packages/Microsoft.MicrosoftEdge_8wekyb3d8bbwe/TempState/Downloads/enhancing-engineering-first-year-experience-fyre-through-supplemental-instruction%20(1).pdf

Light, A., & Strayer, W. (2002). From Bakke to Hopwood: Does race affect college attendance and completion? *Review of Economics and Statistics, 84*(1), 34-44.

Martin, D., & Arendale, D. (1992). *Understanding the Supplemental Instruction model*. Retrieved from the University of Minnesota Digital Conservancy, https://hdl.handle.net/11299/200469.

Massey, D. S., Charles, C.Z., Lundy, G. F., & Fischer, M. J. (2002). *The source of the river: The social origins of freshmen at America's selective colleges and universities.* Princeton, NJ: Princeton University Press.

Mireles, S. V., Acee, T. W., & Gerber, L. N. (2014, Fall). FOCUS: Sustainable Mathematics Successes. *Journal of Developmental Education, 38*(1), 26-30, http://www.jstor.com/stable/24614012

Ogden, P., Thompson, D. Russell, A., & Simons, C. (2003). Supplemental Instruction: Short- and long-term impact. *Journal of Developmental Education, 26*(3), 2-6.

Oja, M. (2012). Supplemental Instruction improves grades but not persistence. *College Student Journal, 46*(2), 344-349.

Peterfreund, A. R., Rath, K. A., Xenos, S, & Bayliss, F. (2007-2008). The impact of Supplemental Instruction on students in STEM courses: Results from San Francisco State University. *Journal of College Student Retention, 9*(4), 487-503. https://doi.org/10.2190/CS.9.4.e

Petrucci, C. J., & Rivera-Figueroa, A. M. (2021). Student participation in Supplemental Instruction in STEM courses at a large urban community college in California. *Community College Journal of Research and Practice, 45(*(7), 498-516. https://doi.org/10.1080/10668926.2020.1724575.

Rabitoy, E. R., Hoffman, J. L., & Person, D. R. (2015). Supplemental Instruction: The effect of demographic and academic preparation variables on community college student academic achievement in STEM-related fields. *Journal of Hispanic Higher Education, 14*(3), 240-255. https://doi.org/10.1177/1538192714568808

Rath, K. A., Peterfreund, A. R., Xenos, S. P., Bayliss, F., & Carnal, N. (2007). Supplemental Instruction in Introductory Biology I: Enhancing the performance and retention of underrepresented minority students. *CBE—Life Sciences Education, 6,* 203-216. https://doi.org/10.1187/cbe.06-10-0198

Reason, R. D. (2009). Student variables that predict retention: Recent research and new developments. *Journal of Student Affairs and Research Practice, 46*(3), 482-501.

Scott-Clayton, J., Crosta, P., & Belfield, C. (2014). Improving the targeting of treatment: Evidence from college remediation. *Educational Evaluation and Policy Analysis, 36*(3), 371-393.

Shaya, S. B., Petty, H. R., & Petty L. I. (1993). A case study of Supplemental Instruction in biology focused on at-risk students. *Bioscience, 43*(10), 709-711, Retrieved from https://www.jstor.org/stable/1312343

Shields, K., & O'Dwyer, L. (2017). Remedial education and completing college: exploring differences by credential and institutional level. *Journal of Higher Education, 88*(1), 85-109. https://doi.org/10.1080/00221546.2016.1243943

Sucher, B. J., & Pardue, N. (2008). The impact of Supplemental Instruction on student progression. *Paper presented at the annual meeting of the American Association of Colleges of Pharmacy.* http://www.allacademic.com/meta/p261518_index.html

Sullivan Commission on Diversity in the Healthcare Workforce (2004). *Missing persons: Minorities in the health professions. A Report of the Sullivan Commission on Diversity in the Healthcare Workforce*. http:// www.aacn.nche.edu/media-relations/SullivanReport.pdf

Terrion, J. L., & Daoust, J. (2011-2012). Assessing the impact of Supplemental Instruction on the retention of undergraduate students after controlling for motivation. *Journal of College Student Retention, 13*(3), 311-327.

Treisman, U. (1992). Studying students studying calculus: A look at the lives of minority mathematics students in college. *The College Mathematics Journal, 23*(5), 362-372.

University of Missouri, Kansas City [UMKC]. (2021). International center for Supplemental Instruction website. http://info.umkc.edu/si

U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Spring 2002 through Spring 2013 and Winter 2013-14 through Winter 2019-20, Graduation Rates component; and IPEDS Fall 2013, Institutional Characteristics component. (This table was prepared August 2020.) https://nces.ed.gov/programs/digest/d20/tables/dt20_326.10.asp

Welch, B. L. (1951). On the comparison of several mean values: An alternative approach. Biometrika, 38, 330-336.

Williams, T. S. (2014). *Influences on science education: The use of Supplemental Instruction on academic success in introductory science courses at a two-year community college.* (Ph.D. Dissertation), Colorado State University, Fort Collins, CO. Available online: https://dspace.library.colostate.edu/bitstream/handle/10217/88547/Williams_colostate_0053A_12680.pdf?sequence=1&isAllowed=y

Yue, H., Rico, R. S., Vang, M. K., & Giuffrida, T. A. (2018). Supplemental Instruction: Helping disadvantaged students reduce performance gap. *Journal of Developmental Education, 41*(2), 18-26.

Zaritsky, J. S., & Toce. A. (2006). Supplemental Instruction at a community college: The four pillars. *New Directions for Teaching and Learning, 106,* 23-31. https://doi.org/10.1002/tl.230