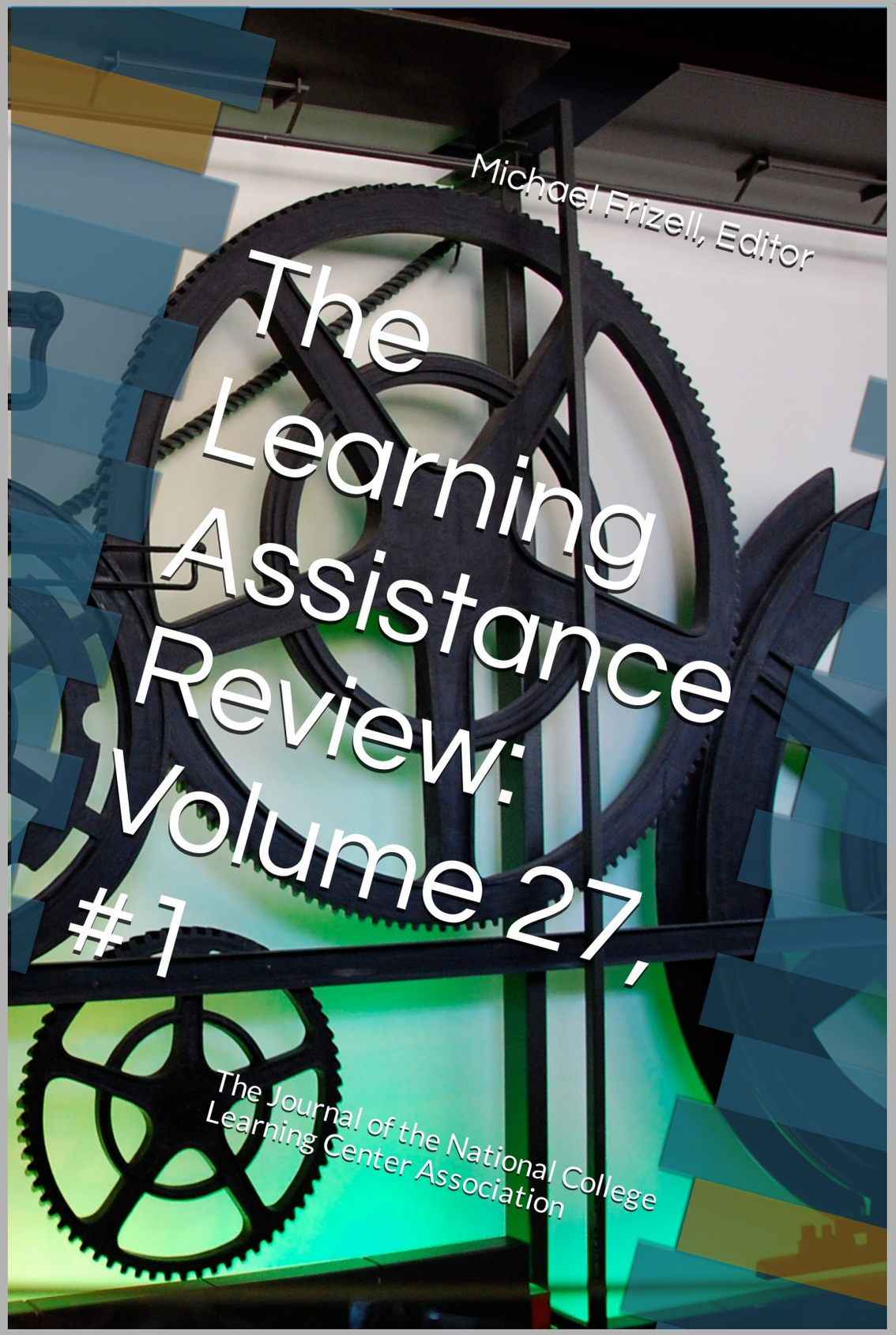


NATIONAL COLLEGE LEARNING CENTER ASSOCIATION
NCLCA

Volume 27, #1 Spring 2022
Editor: Michael Frizell
Designer: Michael Frizell

Published by the National College Learning Center Association, https://nclca.wildapricot.org/.

ISSN 1087-0059

Amazon ISBN 9798800729962
Printed using KDP on Amazon

Editor, Layout, & Design

Michael Frizell, M.F.A., is the current president of the National College Learning Center Association. As the first person to be elected twice to the role, he served as Immediate Past President, President, and Vice President from 2016-2019 after a stint as Corresponding Secretary from 2011-2012. Michael earned the NCLCA Certified Learning Center Professional (Level 4) lifetime achievement designation in 2012 and has served on the Frank Christ Outstanding Learning Center Award Committee, President's Outstanding Learning Center Award Committee, Innovative Use of Technology Award Committee, and the Conference Committee. He was also the first chair of the Immediate Past-President's Council from 2018-2020.

In addition to his leadership in NCLCA, since 2012, Michael has served as the editor of *The Learning Assistance Review,* NCLCA's peer-reviewed journal. *TLAR* seeks to foster communication among higher education learning center professionals by publishing two issues a year. During the COVID-19 crisis in 2020, he published a collection of essays, *Rising to the Challenge: Navigating COVID-19 as Higher Education Learning Center Leaders*, describing how learning center leaders reacted to campus-wide shutdowns.

Michael is the Director of Student Learning Services at Missouri State University, where he serves as co-director of the Bear CLAW (Center for Learning and Writing). He received a B.A. degree in Theatre from College of the Ozarks, an M.A. in Theatre from Southwest Missouri State University, an M.A. in Creative Writing from Missouri State University, and an M.F.A. from the University of Arkansas at Monticello. Additionally, Michael serves as an adjunct faculty member for the Theatre & Dance Department at MSU. He teaches and directs the In-School Players, a group of performers who travel to local elementary schools and perform for grades K-5. He also teaches a capstone course in writing for the Honors College. Michael's commitment to a servant-leadership philosophy is evidenced in his extensive institutional service and commitment to professional organizations. His research interests include the impact of learning centers on students' success, persistence and retention efforts, assessment, and academic self-efficacy. His creative work for TidalWave comics consists of creating graphic novels about famous musicians, athletes, politicians, and actors while writing several fiction titles.

About *The Learning Assistance Review*

The Learning Assistance Review is an official publication of the National College Learning Center Association (NCLCA). NCLCA serves faculty, staff, and students in the field of learning assistance at two- and four-year colleges, vocational and technical schools, and universities.

NCLCA's Definition of a Learning Center

The National College Learning Center Association defines a learning center at institutions of higher education as interactive academic spaces which exist to reinforce and extend student learning in physical and/or virtual environments. A variety of comprehensive support services and programs are offered in these environments to enhance student academic success, retention, and completion rates by applying best practices, student learning theory, and addressing student-learning needs from multiple pedagogical perspectives. Staffed by professionals, paraprofessionals, faculty, and/or trained student educators, learning centers are designed to reinforce the holistic academic growth of students by fostering critical thinking, metacognitive development, and academic and personal success.

Editorial Board

Table of Contents

Letter from the Editor

Michael Frizell
Missouri State University

Learning centers have struggled to regain their footing in the pandemic's aftermath. While some report during the National College Learning Centers Monthly Member Meetings (3Ms) that students are slowly returning and seeking support, most state that their centers are slow, and the students aren't seeking help at the same levels they did before the pandemic forced our colleges to shift focus and support students wherever they were – online.

I'm not going to argue the efficacy of in-person support over online as I believe student success units can effectively support their student communities using multiple modalities. But there's something psychological about seeing empty chairs and bored tutors sitting around the center like the Maytag repairman, waiting for something to happen.

It's not as if the need for our services has declined. At Missouri State University, academic coordinators and chairs for Greek Life tell me with dismay that their chapters are on the verge of finding themselves on grade probation for the first time in their histories. I theorized that faculty, thrust into online teaching for perhaps the first time in their careers, were holding the line, responding to student emails faster than ever while mentoring struggling students through challenging courses. However, many faculty tell me that

they'd love to do that if only the students would answer their pleas. My tutors, course mentors, writing and presentation consultants, and writing fellows tell me that they talk about our services in their classes, student organizations, and intramural teams. Students nod and say, "Yeah, I need to make an appointment soon," only to not follow through with their mumbled oaths.

When I look at my data, I keep calling the COVID-19 years "asterisk years" because the statistics don't make much sense.

If the shutdown and reorganization of our services made us feel like we were holding our breath, the relaxing of mandates designed to curb the spread of COVID-19 has the country emitting a large sigh.

Maybe we're all tired.

Our students have navigated their courses from wherever they sheltered for two years. Although there's some comfort in that, it's easy to turn the computer off and fool ourselves into believing that "out of sight, out of mind" solves problems. Perhaps we grew too content in our corners of the world. The extra step or steps it takes to access support when we need it was too much to think about while we navigated supply chain shortages, relying on DoorDash while binging *Bridgerton* when we weren't staring at a computer screen, hoping to make sense of pre-recorded lectures and an avalanche of reading.

So, what now?

I don't have all the answers to that. If I did, I'd write a book and go on tour. Instead, I've spent that last semester like most of you – balancing the new, online approaches while offering our tried-and-true in-person services. In addition to all the things I'd do during a typical semester, I started rethinking the structure of our center and how we approach student success on our campus. I suspect many of you are doing the same things. I'm trying to see the positive side: We have a chance to emerge from this lackluster year more decisive. The center may not look as before, and that's okay. NCLA's definition of a learning center states, in part, that "learning centers are designed to reinforce the holistic academic growth of students by fostering critical thinking, metacognitive development, and academic and personal success." This mandate requires that learning center personnel be creative, flexible, innovative, and empathetic to the needs of our students.

So, we'll do what we always do: Adjust.

Michael Frizell, April 11, 2022

Academic Outcomes and Experiences of Freshman Students in Mathematics Courses During the COVID-19 Pandemic

Jennifer E. Clinkenbeard

California State University, Monterey Bay

Martin V. Bonsangue

California State University, Fullerton

Abstract

This article reports on a study of academic experiences and outcomes for a sample of 1,346 freshman students who completed a virtually taught first-year mathematics course during the fall 2020 semester. Overall student achievement during the fall 2020 semester, during which courses were taught in a virtual modality, remained at the same level as the previous five fall semesters in which courses were taught in a traditional face-to-face modality. While approximately 66% of students preferred face-to-face courses over virtually taught courses, 18% indicated a preference for virtual courses. Overall, this study found evidence that offering both face-to-face and virtual first-year mathematics courses may be a viable and sustainable option going forward.

Keywords. Freshman, mathematics, COVID-19, achievement, equity

Academic Outcomes and Experiences of Freshman students in Mathematics Courses During the COVID-19 Pandemic

Introduction

Over the past 20 years, distance or online education has become increasingly common. However, fully online course offerings in mathematics for introductory coursework at the college and university level have remained limited (Shalby, 2021). While some institutions have offered a few sections of a course offered in an online or hybrid modality, the vast majority of course offerings were fully face-to-face. Hybrid or flipped modality classes, while focusing on student-centered learning activities, often did not decrease the amount of face-to-face contact time (e.g., Cronjort et al., 2020). These practices have been shown to increase student persistence and achievement in mathematics coursework, especially for students from underrepresented backgrounds (Freeman et al., 2014). For fully online education to work well on a large scale, the American Mathematical Association of Two-Year Colleges has said that instructor training in online pedagogy, tools, and practices is necessary, together with institutional commitment to support faculty to acquire these skills (Blair, 2006). These and other factors may have contributed to hesitancy to adopt online modality mathematics courses on a large scale. In addition, most students who enrolled in a virtual rather than a face-to-face mathematics course did so by choice (Comas-Quinn, 2011).

On March 11, 2020, the World Health Organization declared COVID-19 as a global pandemic (Branswell & Joseph, 2020). As a result, virtually every student was suddenly taking her or his courses in a virtual modality. The real-time nature of this shift produced a unique moment in education. By Fall 2020, colleges and universities were able to plan on offering most of their courses in a virtual modality.

Our study focuses on the experiences and academic outcomes of freshman students enrolled in fully virtual mathematics courses during the pandemic. To distinguish this situation from online teaching and learning pre-pandemic, we refer throughout this paper to "virtual teaching" (VT). In this context, VT refers to fully synchronous (real-time) online instruction via Zoom, as compared to traditional face-to-face (FF) courses. Our goal was twofold: first, to document freshman students' experience and academic outcomes during a truly unique moment in history; and second, to investigate the implications of this experience and how we may effectively adjust course offerings and choices for students as we navigate "the new normal." Specifically, we investigated the following research questions:

RQ1. How did academic outcomes for freshman students taking virtual courses compare with freshman students from previous semesters taking face-to-face courses?

RQ2. What factors influenced freshman students' preferences for taking virtual or face-to-face courses?

In this sense, the present study is essentially a large-scale program evaluation that may be helpful in informing mathematics programs at both two-year and four-year institutions considering offering more virtual mathematics courses as we move into a post-pandemic era.

Review of Literature

There is rich historical literature describing and documenting the impact of the student experience in college, both academically and socially. Dr. Alexander Astin, founding director of the Higher Education Research Institute (2021), documented the performance, experience, and attitudes of undergraduate students at colleges and universities across the nation for more than 50 years. Pascarella and Terenzini (1991) described the profound impact that the college experience can have, both positively and negatively, upon the lives of young adults. Astin (1993) and Tinto (1994) each identified factors underlying student attrition and what colleges and universities can do to reduce it. Tinto's celebrated model for student retention centers around building inclusive educational and social student communities. Nearly 20 years later, Tinto (2012) revisited these themes from the perspective of why some students complete college, why some do not, and how institutions can meaningfully support student success for an increasingly diverse population.

Each of these studies identified the student's first year in college as often being the most critical.

Bailey et al. (2015) applied this framework to the specific needs of community colleges and their students. Drew (1996, 2011) described institutions and programs that successfully supported the work of students in the disciplines of science, technology, engineering, and mathematics and how institutions and departments can adapt and implement effective programs. Key factors for students, especially those from traditionally underrepresented groups, included academic support, financial assistance, and professional opportunities. Central to this research is the overarching construct that what institutional leaders and educators do and believe matters deeply. Moreover, what happens during the student's first year in college can have a lasting impact on her or his subsequent academic trajectory and professional choices.

Research regarding pre-pandemic online instruction helps to provide an important context for this study. Anderson (2011) created a theoretical model which posits four overlapping dimensions for learning. These dimensions include learner-centered, knowledge-centered, assessment-centered, and community-centered. Within the context of online learning specifically, Anderson defined and valued interaction in online learning as a key component of adapting in-person pedagogical practices to a virtual setting. However, virtual instruction can also

be impacted by limitations of technology performance and access (Comas-Quinn, 2011).

Recent studies have explored the impact of the college student experience in a virtual setting. As part of a recently funded National Science Foundation study, McCormick (2020) stated, "The impacts of this unexpected transition to distance learning are not equal among students. As universities closed, many students entered resource-limited or stressful domestic situations that are not conducive to learning" (p. 1). Cao et al. (2020), based on a large sample of undergraduate pre-medical students enrolled at universities in China, found that about one-fourth of the students reported mild to high levels of anxiety associated with the pandemic. Specifically identified factors included increased economic challenges, decreased social support, and having a family member who was COVID-19 positive. The authors conclude that "the mental health of college students should be monitored during epidemics" (p. 1). Browning et al. (2021) reported similar findings for a sample of college students taken across seven U.S. states. Copeland et al. (2021) reported on the impact of COVID-19 on college student mental health and wellness, specifically among college freshmen. The authors of the study collected data on approximately 500 college freshmen completing pre- and post-semester assessments as well as nightly surveys of mood and wellness behaviors. The authors concluded that university efforts to

help students cope during the semester had a "modest but persistent impact" on students' mood and wellness behaviors (p. 134). A recent study in Austria and Finland examined psychological characteristics associated with university students' well-being during the pandemic. The results indicated that competence predicted positive emotion in university students during the pandemic and that autonomy and self-regulated learning contributed to intrinsic learning motivation (Holzer et al., 2021).

Much of the current research on the impact of COVID-19 has centered around factors related to students' mental and emotional experiences (e.g., Tonon, 2020). Informed by this work, the current study seeks to extend this research to examine the academic experiences and mathematics course outcomes during the pandemic for freshman students.

Methodology

Context and Survey

The California State University (CSU) is the largest public state university system in the U.S. In fall 2020, more than 480,000 students were enrolled in one of 23 campuses. The CSU is one of the most ethnically and racially diverse university systems in the U.S. One-third of its undergraduates are the first persons in their families to attend college (CSU, 2020). The current study took place at California State University, Fullerton (CSUF), one of the largest universities in the CSU, with more than 41,000 students enrolled in

fall 2020. CSUF is a designated Hispanic Serving Institution and an Asian American and Pacific Islander Serving Institution. CSUF is largely a commuter campus, with about 2% of students living in on-campus or university-sponsored housing (U.S. News, 2021). The mathematics department at CSUF enrolls some 15,000 students each year and employs about 90 faculty, including full-time and adjunct instructors.

A 33-item survey was given to freshman students enrolled in one or more mathematics courses in fall 2020 at CSUF. The survey was divided into eight blocks of questions asking about their experiences in taking online or virtual teaching (VT) classes in fall 2020 as compared with teaching traditional face-to-face (FF) classes in fall 2019 (Appendix 1). The survey was based in large part on surveys used in two major studies, including an NSF-funded research study (Network for Research and Evaluation, 2020) and research conducted by the Conference Board of the Mathematical Sciences (CBMS, 2020). These studies explored the effects COVID-19 had on students' personal lives, academic work, and mental health and the impact on mathematics departments of pivoting from face-to-face to virtual classes.

Sample

The survey was given to freshman students enrolled in a mathematics course during weeks 10 and 11 of the 15-week fall 2020 semester. The survey was given online using Qualtrics software and

took about ten minutes to complete. All mathematics courses were taught in a synchronous (real-time) environment. CSUF Institutional Review Board protocols were closely observed, and all student responses were analyzed and reported in aggregate form. All statistical analyses were done using SPSS, Version 27; missing data were handled using pairwise exclusion. Student course outcome data for each survey participant, including course grade and success or non-success in the course, were taken directly from institutional records and linked to that student's survey response in the data set.

The sample group for this study included students who (1) were enrolled in a mathematics course at CSUF in fall 2020 and completed the survey; (2) self-identified as freshmen on the survey; (3) self-identified their gender as either male or female; and (4) self-identified their ethnicity from one of these categories: African-American/Black, Asian/Asian-American, Hispanic/Latinx, Native American/Indigenous, Pacific Islander, or white/non-Hispanic. A total of 1346 students met all four criteria and were included in the sample (Table 1). Nearly every student (99.1%) self-identified her or his age group as 18-19 years. Four-fifths of the students (80.5%) identified their previous (spring 2020 semester) institution as high school, and 18.4% were previously enrolled at CSUF. Per CSU protocol, students self-identifying as African American/Black, Hispanic/Latinx, Native American/Indigenous, or Pacific Islander

were classified as being from underrepresented minority groups (URM). Students self-identifying as white/non-Hispanic or Asian/Asian-American were classified as being from non-underrepresented minority groups (non-URM). Sixty percent of the respondents self-identified as URM students, and 61.8% as female. Female URM students comprised the largest of the four gender/URM groups (URM males, URM females, non-URM males, and non-URM females) with 525 (39.0%) members. Hispanic/Latinx students comprised 93.9% of the URM group, and Asian/Asian-American students comprised 70.0% of the non-URM group. Three-fifths (60.6%) of the students indicated that they were the first in their families to attend college, and 72.3% indicated that they were receiving financial aid (Table 2).

Table 1

Number (percentage) of freshman students by gender and ethnicity

	African-Amer/Black	Asian/ Asian-Amer	Hispanic/ Latinx	Nat Amer/ Indigenous	Pacific Islander	White/ non-Hisp	Total
Male	11 (0.8)	168 (12.5)	267 (19.8)	0 (0.0)	6 (0.4)	62 (4.6)	514 (38.2)
Female	23 (1.7)	208 (15.5)	493 (36.6)	0 (0.0)	9 (0.7)	99 (7.4)	832 (61.8)
Total	34 (2.5)	376 (27.9)	760 (56.6)	0 (0.0)	15 (1.1)	161 (12.0)	1346 (100.0)

Table 2

Number (percentage) of freshman students by background characteristics

	URM	Non-URM	First in family to attend college	Receiving financial aid	Total
Male	284 (55.3)	230 (44.7)	288 (56.1)	351 (68.3)	514 (38.2)
Female	525 (63.1)	307 (36.9)	527 (63.4)	622 (74.8)	832 (61.8)
Total	809 (60.1)	537 (39.9)	815 (60.6)	973 (72.3)	1346 (100.0)

Results

Course Outcomes

Freshman students typically enroll in one of seven courses during their first year at CSUF, including liberal arts math, introductory statistics, college algebra, precalculus, calculus for the life sciences, business calculus, or first-semester calculus. These courses meet the university general education (GE) quantitative reasoning requirement. At CSUF, a successful grade outcome is defined as having completed the course with a final grade of C or better (per university policy, a grade of C- is considered successful for liberal arts math); any other grade outcome including withdrawing from the course is considered non-successful. All multi-section mathematics courses at CSUF follow common course guidelines, including weightings for exams/assessments, homework assignments, etc., as well as common grading scales. During the fall 2020 semester, exams/assessments were given in a synchronous timed setting with students being required to have their video cameras on throughout the exams.

Aggregate and Subgroup Outcomes

Using a standard 4-point grading scale, the average (mean) grade for freshman students in the fall 2020 sample was 2.57, and the success rate was 81.6% (Table 3). Controlling for gender showed that female students had statistically significantly higher course outcome measures than did males for both average course grade (t =

-3.744, $p < .001$, d$f = 1032$) and course success rate ($t = -2.994$, $p < .003$, d$f = 977$) based on the data in Table 4. Similarly, controlling for URM status showed that non-URM students had significantly higher course outcome measures than did URM students for both average course grade ($t = -7.253$, $p < .001$, d$f = 1344$) and course success rate ($t = -4.355$, $p < .001$, d$f = 1290$). Moreover, disaggregating course outcomes by both gender and URM status revealed statistically significant differences between the four gender/URM subgroups for both average course grade and course success rates using ANOVA (Table 5). Average course grades in the fall 2020 sample for the four subgroups were, in decreasing order, non-URM females (3.01), non-URM males (2.63), URM females (2.46), and URM males (2.24). Course success rates for the same four subgroups were 90.2%, 82.6%, 80.6%, and 73.2%, respectively.

Table 3

Average course grade and success rates for freshman students

		Average course grade		Course success rate	
	N	$\bar{x}$	S_x	$\hat{p}$	S_x
Male	514	2.42	1.218	.774	.418
Female	832	2.67	1.139	.841	.366
Total	1346	2.57	1.176	.816	.388

Table 4

Average course grade and success rates By gender and URM status

	Average course grade		Course success rate	
	URM	non-URM	URM	non-URM
Male	2.24	2.63	.732	.826
Female	2.46	3.01	.806	.902
Total	2.39	2.85	.780	.870

Table 5

Analysis of variance of course outcomes for freshman students

Course Grade		sum of squares	df	mean square	F	Significance
Gender status	Between groups	7.438	11	.676	2.907	.001*
	Within groups	310.279	1334	.233		
	Total	317.718	1345			
URM status	Between groups	19.415	11	1.765	7.762	< .001**
	Within groups	303.344	1334	.227		
	Total	322.769	1345			
Course Success Rate						
Gender status	Between groups	2.242	1	2.242	9.550	.002*
	Within groups	315.476	1334	.235		
	Total	317.718	1345			
URM status	Between groups	4.140	1	4.140	17.465	< .001**
	Within groups	318.618	1334	.237		
	Total	322.759	1345			

Gender/URM Status Subgroups

While differences between the four gender/URM status subgroups were noted in the fall 2020 virtual instruction sample, we wondered how these differences from the fall 2019 face-to-face instruction semester compared with differences during the fall 2020 online semester. Based on institutional records, we compared outcomes for the same four subgroups of all freshman students enrolled in a GE mathematics course in fall 2019 ($n = 3285$) with those in fall 2020 ($n = 3980$). No significant differences between the fall 2019 and fall 2020 groups were observed for the subgroups of URM males, non-URM males, and URM females for both average course grade and course success rate. Significant differences at the .05 level were observed for non-URM females for an average course grade of .30 (95% CI = [.18, .42]) grade points and course success rate

of 5.8 [1.9, 9.7] percentage points, both favoring the fall 2020 virtual semester.

Table 6

Course outcomes for all freshman students enrolled in GE math Fall 2019 and Fall 2020

		Fall 2019		Fall 2020		Difference	
		URM	non-URM	URM	non-URM	URM	non-URM
Average Course Grade	Male	2.00	2.38	2.07	2.49	.07	.11
	Female	2.24	2.61	2.28	2.91	.04	.30^{+}
Course Success Rate	Male	.654	.755	.656	.784	.002	.029
	Female	.717	.817	.727	.875	.010	.058^{+}

$^{+}p < .05$

Previous Years

Freshmen student course outcome data taken from CSUF institutional records provided a basis for comparison of overall student achievement in GE mathematics courses in fall 2020 compared to that during the previous five fall semesters. Other than a few experimental online-only sections of large multi-section courses, all courses from fall 2015 through fall 2019 were taught in traditional face-to-face formats. All classes in fall 2020 were taught in a virtual format. Average course grades and success rates each semester among freshman students enrolled in GE mathematics courses during this period ranged from 2.12 to 2.42 and from 70.7% to 77.3%, respectively. Course outcomes for the fall 2020 semester compared favorably with those from the previous five years, ranking first for average course grade and second for course success rate. Overall, freshmen student enrollment in these courses in fall

2020 (n = 3849) was the highest during the six-semester period (average enrollment = 3110). Moreover, trend lines for each set of course outcome measures indicate a slightly positive rate of change during this time period (Figures 1 and 2).

Figure 1

Average GE mathematics course grade for freshman students, Fall 2015 - Fall 2020

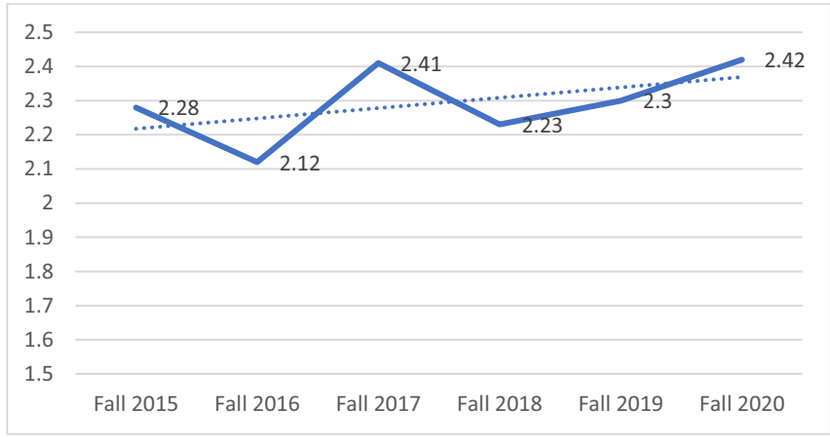
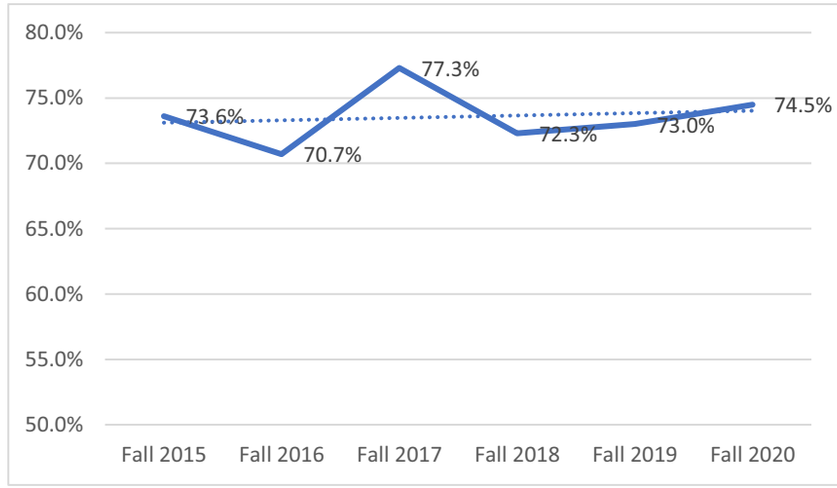


Figure 2

GE mathematics course success rates for freshman students, Fall 2015 - Fall 2020



Standardized Courses

While all multi-section mathematics courses at CSUF follow common course guidelines, the two mathematics courses at CSUF with the greatest enrollments, college algebra, and precalculus, are highly coordinated courses. Each course uses a department-approved common course syllabus, grading standards, and pacing chart. Moreover, all college algebra and precalculus sections use common assessments/exams, a common course final, and prescribed grading rubrics created by the faculty course coordinators. For each course, all exams/assessments given in fall 2020 virtual courses were the same as those given in fall 2019 face-to-face courses. In fall 2019, the department offered 30 sections of college algebra and 20 sections of precalculus, enrolling 987 students and 640 students, respectively. In fall 2020, the department offered 29 sections of college algebra and 15 sections of precalculus, enrolling 1101 students and 577 students, respectively. Since there were no curricular changes in either course from fall 2019 to fall 2020 other than moving from a face-to-face to virtual format, examining freshmen student outcomes in these two courses provides a controlled comparison between the two modalities of delivery. There were no statistically significant differences at the .01 level between fall 2019 and fall 2020 for either course for either average course grade or course success rate (Table 7). Thus, taking college algebra or precalculus in a face-to-face or virtual platform

had no measurable effect on overall student performance in either course.

Table 7

Comparison of Student Outcomes in College Algebra and Precalculus, F2019 and F2020

	Fall 2019			**Fall 2020**			***t*-test statistics**		
	N	$\bar{x}$	S_x	N	$\bar{x}$	S_x	df	t	P
College Algebra									
Course Grade	822	2.448	1.100	910	2.574	1.170	1730	-2.293	.022
Success Rate	822	.766	.423	910	.769	.421	1730	-0.148	.882
Precalculus									
Course Grade	530	2.029	1.140	471	2.100	1.239	999	-0.944	.345
Success Rate	530	.656	.475	471	.665	.472	999	-0.300	.764

Summary

We restate the first research question below:

RQ1. How did academic outcomes for freshman students taking virtual courses compare with freshman students from previous semesters taking face-to-face courses?

Institutional data trends showed that student outcomes for freshmen enrolled in GE mathematics courses in fall 2020 were comparable with those from previous fall semesters. While gender and URM status equity gaps were observed during the fall 2020 virtual semester, these gaps were (non-significantly) smaller for URM males, URM females, and non-URM males compared with those from the previous fall 2019 face-to-face semester. Non-URM female students had significantly higher student outcomes in the fall 2020 virtual semester than in the fall 2019 face-to-face semester.

Moreover, a comparison of student outcomes with those from the five previous fall semesters showed a (non-significantly) increase in student outcome trends. As mentioned previously, real-time assessments/exams were given in a virtual format in fall 2020. Factors such as having access to working technology, including sufficient internet bandwidth, having a quiet and/or private place to take exams, as well as issues related to academic integrity may have contributed to student performance. However, a comparison of two highly standardized multi-section courses showed that fall 2020 course outcomes were comparable to those in fall 2019. In summary, there was evidence that the academic achievement of freshman students enrolled in mathematics virtual courses in fall 2020 was comparable to that of previous freshman students enrolled in face-to-face courses in previous fall semesters.

Course Preferences

The mathematics student survey was separated into eight blocks of questions, including Likert-scale items, background information, and the two open-ended questions mentioned earlier. The eight blocks included:

1. Students' experiences taking virtual courses.
2. Amount of time spent preparing for and taking virtual courses.
3. Responsibility and stress levels.
4. Overall mathematics course experience.

5. Technology and space.
6. Transportation and parking.
7. Demographic information.
8. Open-ended questions: What was the greatest benefit and greatest challenge for you taking mathematics classes in a virtual format?

Survey questions for blocks 1 and 2 were asked using a five-point Likert scale. A lower value (1 or 2) on the Likert scale indicated a strong or somewhat preference for VT classes, a higher value (4 or 5) indicated a strong or somewhat preference for FF classes, and a value of 3 indicated no preference either way. Codes for blocks 3-6 were also based on a five-point Likert scale with response choices dependent upon the questions being asked; block 7 asked about student background information (Appendix 1).

Results

On the survey, freshman students were asked, "Given the choice, would you prefer to have taken this mathematics course in a virtual teaching format or face-to-face teaching format? Table 8 gives the cell frequencies and marginal proportions by gender and URM status.

Table 8

Freshmen student preference for virtual or face-to-face mathematics courses

	Prefer Virtual Format		No Preference		Prefer Face-to-Face Format	
	Male	Female	Male	Female	Male	Female
URM	45	84	41	78	198	363
Non-URM	36	78	40	62	154	167
Total by gender	81 (15.8%)	162 (19.5%)	81 (15.8%)	140 (16.8%)	352 (68.4%)	530 (63.7%)
Total overall	243 (18.1%)		222 (16.5%)		882 (65.5%)	

Of the 1346 students in the sample, 18.1% indicated a preference for virtual format classes, with female students' preference rate of 19.5% slightly higher than that for male students (15.8%). Likewise, 65.5% indicated a preference for face-to-face format classes, with male students' preference rate of 68.4% slightly higher than that for female students (63.7%). About one-sixth (16.5%) of both male and female students indicated no preference. Comparing these three preference groups by URM group status (n = 809) and non-URM group status (n = 537) showed that 15.4% of URM students and 21.2% of non-URM students preferred VT format; 69.3% of URM students and 59.8% of non-URM students preferred VT format; and 15.3% of URM students and 19.0% of non-URM students indicated no preference.

Freshman students' experiences in the virtual mathematics courses seemed to vary. Fifty-three percent of the students in the sample reported that they could communicate effectively with the instructor and peers via online tools. Yet, more than half of the students reported that they kept their video screens on for none or

little of the time during synchronous class sessions. While access to working computers and the internet was generally not a challenge for most students, more than one-fourth of the respondents indicated that having a quiet place to prepare for classes was very (14.3%) or extremely (12.4%) challenging. Not having to commute, find a parking place, or pay for parking was a benefit for more than sixty percent of respondents. While a third of the students (33.3%) thought that the VT experience was better than they had expected, one-fourth (25.2%) thought it was worse. Unsurprisingly, nearly seventy percent of students in the sample indicated that their overall stress levels were somewhat (24.4%) or much greater (44.1%) in fall 2020 than in fall 2019.

Comparison of URM student responses with those of non-URM students showed that URM students preferred FF courses over VT courses at a significantly higher rate than did non-URM students (t = .3504, p < .001), despite neither group reporting more experience in virtual courses prior to the fall 2020 semester (t = -.895, p >.3). URM students reported having significantly higher levels of challenge having access to a working computer and consistent internet than did non-URM students (t > 3.9, p < .001). Access to a quiet place to take synchronous classes and to study appeared to be even more of a challenge for URM students than for non-URM students (t > 7.3, p < .001) (Table 9).

Table 9

Comparison of URM and non-URM students on selected survey items

Variable	URM students		Non-URM students		*t*-test statistics		
	$\bar{x}$	S_x	$\bar{x}$	S_x	d*f*	*t*	*p*
Prefer VT v. FF	3.92	1.227	3.68	1.251	1344	3.504	< .001**
Computer access	1.65	.936	1.46	.810	1254	3.976	< .001**
Internet access	2.20	1.091	1.95	.990	1222	4.428	< .001**
Quiet place for classes	2.67	1.324	2.16	1.210	1214	7.316	< .001**
Quiet place to study	2.81	1.379	2.22	1.265	1214	8.114	< .001**
Prior exper. in VT	2.02	.848	2.06	.819	1342	-.895	.371

More than one-fourth (28.3%) of URM freshman students reported that having access to a quiet space to take classes was "very challenging" or "extremely challenging" as compared with 14.0% of non-URM students. Moreover, more than a third (33.8%) of URM students reported that having access to a quiet space to study was very or extremely challenging as compared with 16.2% for non-URM students. These rates were highest for URM female students, with 30.8% and 36.6% reporting these higher levels of challenges for class space and study space, respectively.

Regression analysis was used to determine the prediction of students' preference for virtual or face-to-face teaching. Using a combined hierarchical/stepwise algorithm, we identified three key sets of independent variables: demographic and high school achievement variables, items about their general experiences during the pandemic, and items specifically about their virtual courses.

These sets were forced into the equation in sequence. Our logic was that students' demographic and high school variables occur first; their general experiences formed the context for their course experiences over the past year. We then asked a series of questions about those virtual course experiences. Within each set, variables were entered stepwise. These were the variables in each set:

1. Demographic and High School Achievement Variables: age, high school GPA, SAT verbal score, SAT math score, dichotomized gender, URM status, first-generation, and financial aid.
2. Pandemic Experience: Responsibility and stress levels (Block 3, four items), technology and space challenges (Block 5, four items), transportation and parking (Block 6, four items), prior VT experience, and working at a paid job.
3. VT Course Experience: Students' VT and FF experiences (Block 1, 7 items), time spent on classes (Block 2, 5 items), overall VT mathematics course experiences (Block 4, 4 items), and mathematics course grade.

When we ran the first regression, four variables from Set 1 entered the equation: URM/Non-URM status, financial aid, gender, and SAT math score. These variables, along with the variables from Set 2, were used for the second regression. The only variable from Set 1 to stay in the equation was URM status. Six variables from Set 2 entered the equation: not driving to campus, overall stress, quiet

space to study, not living on campus, working at a paid job, and school-related stress. These seven variables, along with the variables from Set 3, were used for the third regression. Eight variables in total entered the third regression: URM status (Set 1); not driving to campus, overall stress, and not living on campus (Set 2); and understanding in VT/FF, overall experience in VT/FF, performance in VT/FF, and overall math experience in VT (Set 3). We then recomputed the regression using only this set of eight variables. These variables are shown in Table 10.

Table 10
Regression analysis of student preference for taking VT v. FF courses

Variable	Standardized beta	*t*	*p*
Understanding of the material comparing fall 19 with fall 20	.217	6.240	< .001**
Overall course experience comparing fall 19 with fall 20	.208	5.907	< .001**
Overall course performance comparing fall 19 with fall 20	.137	3.845	< .001**
Overall VT math experience	-.124	-3.487	.001*
SAT-Verbal	-.083	-2.944	.003*
Underrepresented minority status	-.060	-2.366	.018
Prior VT experience	.058	2.593	.010
First in family to attend college	-.054	-2.171	.030
Overall stress level	.054	2.015	.044
Number of units	-.046	-1.997	.046

d*f* = 1067 $R = 0.728$ $R^2 = 0.530$ $F = 27.502$ sig. $F < 0.001$

Use of a hierarchical algorithm allowed us to partition the explained variation as follows:

Variable Set	Total R^2	Change in R^2
Set One: Demographic Variables	.027	.027
Set Two: Pandemic Experience Variables	.218	.191
Set Three: VT Course Experience Variables	.494	.276

Thus, these three sets of variables explain nearly half of the variation (49.4%) in student preference for VT or FF teaching. This analysis shows that students' opinions about the value of VT were primarily driven not by demographic characteristics nor by events and pressures outside the courses. Rather, they were predicted by characteristics of the courses themselves based on the student's perceptions of their understanding of the material in the virtual setting.

Course Preference and Course Outcomes

Mathematics course outcomes for freshman students who indicated that they strongly or somewhat preferred VT courses were compared with those of students who strongly or somewhat preferred FF courses (students who indicated that they had no preference were not included in this analysis). Of the 1346 respondents, 243 (18.1%) indicated a preference for VT courses while 882 (65.5%) indicated a preference for FF courses, a total of 1125 (83.6%) of the sample. T-test comparisons between these two preference groups showed that the VT group had a significantly higher average course grade ($t = 7.057$, $p < .001$) and success rate ($t =$

5.840, $p < .001$) than did the FF group, with differences of .54 (95% CI = [.40, .68]) grade points and 13.7 [9.0, 18.4] percentage points. Controlling for gender showed that the VT preference group of male students had a significantly higher average course grade (t = 2.879, $p < .005$) than the FF preference group of male students by .44 [.17, .71] grade points. Likewise, among female students, there was a difference between VT and FF preference groups for both average course grade of .57 [.40, .74] grade points and success rate of 16.0 [.11, .21] percentage points both favoring the VT group. Each of these differences was statistically significant at the .001 level (Table 11). Academic predictors, including HSGPA, SAT-V, and SAT-M were compared for male and female students. No significant differences in these variables were found for male students preferring VT over FF courses ($t < 1$, $p > 0.1$). Statistically significant differences were found favoring female students preferring VT over FF courses for SAT-V (t = 2.11, $p < .05$) and SAT-M (t = 2.53, $p < .05$).

Table 11

Comparison of fall 2020 course outcomes for students preferring VT v. FF mathematics courses

	Prefer VT courses			**Prefer FF courses**			***t*-test statistics**		
	N	$\bar{x}$	S_x	*n*	$\bar{x}$	S_x	*df*	*t*	*p*
All students									
Average grade	243	2.94	1.022	882	2.40	1.220	450	7.057	< .001**
Success rate	243	.905	.293	882	.768	.423	549	5.840	< .001**
Males									
Average grade	81	2.70	1.237	352	2.26	1.248	431	2.879	.004*
Success rate	81	.815	.391	352	.733	.443	132	1.656	.100

Greatest Benefit and Challenge of Virtual Courses

At the end of the survey, students had the opportunity to respond to two open-ended questions per the CBMS (2020) survey:

Q1. What was the greatest benefit for you taking mathematics classes in a virtual format?

Q2. What was the greatest challenge for you taking mathematics classes in a virtual format?

There were 1234 responses for Q1, representing 91.6% of the freshman students in the sample. An open coding qualitative scheme based on keyword frequencies was used to categorize the responses. Six categories emerged for the greatest benefit of VT: Commuting advantages, increased course access, scheduling advantages, learning new skills, no greatest benefit (explicitly stated), and others. In cases where a respondent mentioned more than one benefit, the benefit given first was used for coding (Table 12). Commuting advantages and increased course access were most often identified as the greatest benefits by student respondents, accounting for 66.7% of the responses. Responses in course access centered around the usefulness of having recorded lectures and access to online course materials. Seven percent of the respondents explicitly stated that they found no greatest benefit in taking virtual mathematics courses (Figure 3).

Table 12
Greatest benefit and greatest challenge of virtual classes identified by freshman students

Greatest Benefit of Virtual Classes	All Students	Students Preferring VT	Students Preferring FF
Commuting advantages	35.7%	34.2%	34.8%
Increased course access	31.0	34.6	29.9
Flexibility of schedule	11.3	14.1	10.2
Learning new skills	7.5	9.8	7.1
No benefits	7.5	1.7	10.3
Other	7.1	5.6	7.7
Greatest Challenge of Virtual Classes			
Lack of student engagement	22.5 %	20.3%	24.2%
Perceived impact on course performance	17.9	9.9	21.2
Feelings of disconnectedness	17.9	15.5	16.9
Faculty-student communication	17.6	16.8	18.1
Space/technology concerns	12.2	18.1	10.2
Increased time demands	4.1	5.2	3.8
Other	7.8	14.2	5.7

There were 1256 responses for Q2, representing 93.3% of the freshman students in the sample. As before, an open coding qualitative scheme based on keyword frequencies was used to categorize the responses. Seven categories emerged for the greatest challenge of VT: lack of student engagement, perceived impact on course performance, faculty-student communication, feelings of disconnectedness, space/technology concerns, increased time demands, and other (only three students stated that there was no greatest challenge). Lack of student engagement was most often identified as the greatest challenge by student respondents, accounting for 22.5% of the responses. Perceived impact on course performance, faculty-student communication, and feelings of

disconnectedness each accounted for about 18% of responses (Figure 4).

Figure 3
Greatest benefit of virtual mathematics courses (pct)

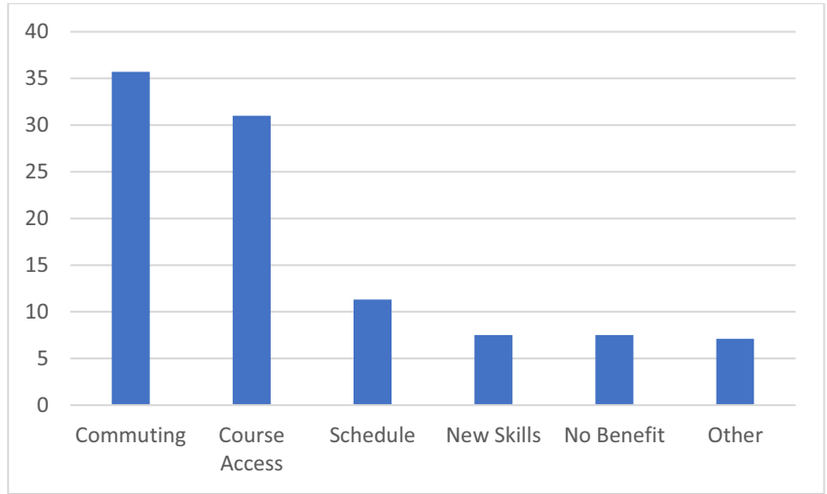
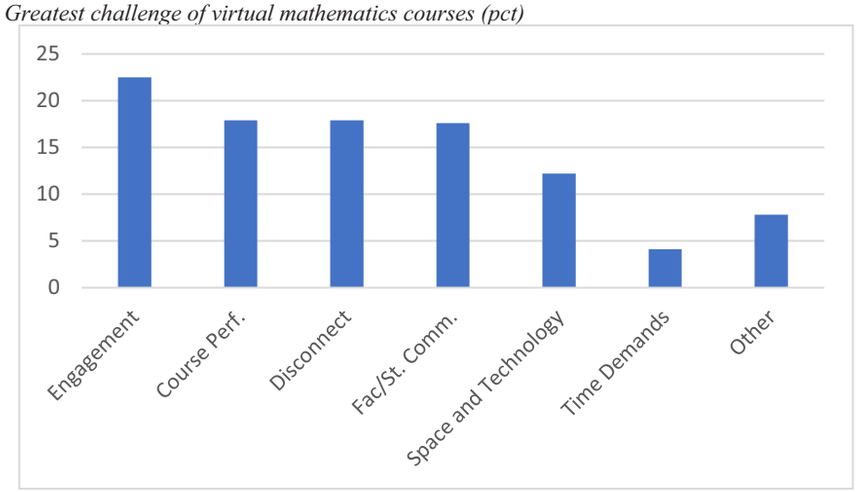


Figure 4
Greatest challenge of virtual mathematics courses (pct)



We compared student response frequencies for the 243 students preferring virtual classes (VT) with those of the 882 students

preferring face-to-face classes (FF). The response rates for Q1 and Q2 were 96.2% and 95.4% for the VT group and 91.1% and 93.4% for the FF group, respectively. The VT and FF groups were comparable for greatest benefit identified in all but one category: more than one-tenth of the FF group explicitly stated that there was no greatest benefit compared with less than 2% of the VT group. The VT and FF groups were comparable for the greatest challenge identified in four categories: engagement, communication, disconnectedness, and time demands. However, 21.2% of students preferring FF classes identified perceived impact on course performance as the greatest challenge of virtual classes as compared with 9.9% of students preferring VT classes. Interestingly, 18.1% of the VT group identified space/technology concerns as the greatest challenge, compared with 10.2% of the FF group.

Summary

We restate the second research question below.

RQ2. What factors influenced freshman students' preferences for taking virtual or face-to-face courses?

Measurable differences were found for both experiences and outcomes in virtual mathematics courses based on course modality preference. Students who preferred face-to-face classes identified understanding of the material as the primary factor, along with course experience and performance. Having consistent internet access and a quiet place to study were identified in survey

responses as being challenges, especially for URM students, but did not appear as significant predictors in the regression equation. Similarly, benefits associated with commuting and time flexibility were identified in survey responses as benefits but did not appear in the regression equation. Prior experience with online courses was not a factor in student preference of VT or FF classes, nor were socioeconomic or prior academic variables other than URM status and SAT-V score, which, though statistically significant, were relatively weak predictors of course modality preference. URM students reported greater challenges associated with internet access and study space than did non-URM students. Nonetheless, the set of students indicating a preference for VT mathematics courses reflected the four gender/URM status group proportions in the larger sample, with non-URM female students being (non-significantly) overrepresented in the VT group (32.1%) compared to the overall sample (22.8%). Open-ended responses showed that two-thirds of students identified the greatest benefit of virtual classes as commuting advantages or increased course access. Conversely, more than one-fifth of the students identified a lack of student engagement as their greatest challenge. Students preferring face-to-face courses identified perceived impact on their course performance at more than twice the rate of students preferring virtual courses

Discussion

The results presented here suggest a complex picture of freshman students' collective experience in taking virtual mathematics courses during the pandemic. While student course outcomes in mathematics courses were at the same level as those in pre-pandemic semesters, there was evidence that many students *felt* that the virtual platform negatively impacted their academic performance (e.g., Saw et al., 2020). Consistent with the report by Cao et al. (2020), seven out of ten students reported higher levels of anxiety in fall 2020 over fall 2019. Factors associated with perceived impact on content understanding and course performance measurably affected student preference for face-to-face versus virtual teaching platforms and may have attributed to increased anxiety levels as well. Female students who preferred virtual teaching courses over face-to-face courses had higher academic predictors and higher course outcomes. However, male students who preferred virtual teaching courses over face-to-face courses did not have higher academic predictors yet had higher course outcomes. Moreover, for both male and female students, actual course outcomes were not a predictor of preference for virtual or in-person courses. Although equity gaps neither widened nor narrowed between gender and underrepresented minority status subgroups, URM students reported challenges associated with study space at twice the rate of non-URM students. This finding is

consistent with McCormick's observation that the impacts of distance learning are not equal among students (2020).

Student comments on the two open-ended questions further support these observations. Among students preferring virtual teaching courses, 35% indicated that having online access to course notes and the recorded lecture was a major benefit as compared to 28% of students who preferred face-to-face courses. Similarly, only 9% of students preferring virtual teaching courses indicated that the virtual modality had an impact on their course performance, compared with 22% of students preferring face-to-face courses. Specific comments from both groups indicated that many students were determined to be successful despite the challenges associated with taking courses in a virtual format.

Regression analyses showed that demographic variables, including gender and URM status, accounted for less than three percent of the variation in student course modality preference. Variables associated with the general pandemic experience, such as responsibility and stress levels as well as technology access, accounted for 19% of the variation. Variables directly associated with virtual course experience accounted for 28% of the variation in student preference for face-to-face versus virtually taught courses. This observation supports Anderson's (2011) model for e-learning, namely, that the actual course experience is far more impactful on shaping student attitudes towards online learning than are factors

associated with student background. Since each of the mathematics courses in the current study was taught in a synchronous modality, it is possible that the real-time setting for student-to-student and student-to-instructor interactions played a role in shaping student attitudes as well.

As stated earlier, the current study is in large part a real-time program analysis that delved deeply into documenting both student outcomes and student experiences in virtually taught mathematics courses for freshman students. This study did not aim to attribute causality for student preference or achievement in virtually taught courses. Rather, its purpose was to try to identify factors that were salient for the students' experiences, and achievement in a virtually taught mathematics course. What emerged was a complex structure that indicates, unsurprisingly, that a variety of factors may play into students' perceptions of their experience. There was evidence that factors associated with the students' perceived learning of the material was central in shaping student preference for in-person as compared with online learning. This suggests that the student, rather than programmatic structures, may be the best resource to determine which type of learning modality is optimal for that individual.

Limitations and Further Research

As with any research, this study has limitations. First, all data were collected at a large public comprehensive institution in an

urban area. While this setting helped to create a diverse sample of students it is unclear the extent to which the results presented here are applicable to other types of institutions. Second, surveys were given towards the end of the semester so that students had enough time to experience virtual learning in their mathematics courses. Thus, student participants were limited to those who were still enrolled in and/or still attending virtual classes at that point in the semester. Institutional records showed that approximately 4.9% of freshman students enrolled in a mathematics course at the beginning of the fall 2020 semester either received a grade of no credit, withdrawal, or unauthorized withdrawal; thus, these students were not represented in the study. Third, all courses in this study were taught in a synchronous environment. Asynchronous, HyFlex, or other blended course modalities may result in different academic experiences and outcomes.

As stated earlier, this study was essentially a large-scale program evaluation with data gathered in real-time. The study found evidence that a non-trivial proportion of freshman students – between 15 and 20 percent – not only preferred virtual over face-to-face mathematics courses but achieved at an equal or higher level than students in face-to-face classes. While the two open-ended questions provided a snapshot of students' expressed experiences, further research is needed to identify specific factors that may be useful in guiding and supporting students who are considering

taking virtual mathematics courses. These factors may also be relevant for students in other STEM disciplines.

Based on this study's results, offering virtual and face-to-face options for multi-section first-year mathematics courses may be a viable way to meet a wider range of student needs and preferences and effectively utilize resources as institutions move into a post-pandemic era (Shalby, 2021). It will be critical for university leaders, faculty, and students to be included in meaningful discussions about how this can best be achieved to ensure equity and access for all students.

References

Anderson, T. (2011). *The theory and practice of online learning* (2nd Edition). A.U. Press.

Astin, A. W. (1993). *What matters in college: Four critical years revisited*. Jossey-Bass.

Bailey, T. R., Jaggars, S. S., & Jenkins, D. (2015). *Redesigning America's community colleges: A clearer path to student success*. Harvard University Press.

Blair, R. (ed). (2006). *Beyond* Crossroads*: Implementing mathematics standards in the first two years of college*. American Mathematical Association of Two-Year Colleges.

Branswell, H. and Joseph, A. (2020, March 11). WHO declares the coronavirus outbreak pandemic. *STAT*. https://www.statnews.com/2020/03/11/who-declares-the-coronavirus-outbreak-a-pandemic/

Browning, MHEM., Larson, L. R., Sharaievska, I., Rigolon, A., & McAnirlin, O. (2021). Psychological impacts from COVID-19 among university students: Risk factors across seven states in the United States. *PLOS ONE 16*(1). https://doi.org/10.1371/journal.pone.0245327

California State University (2020). *Diversity*. http://www2.calstate.edu/impact-of-the-csu/diversity

Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., & Zheng, J. (2020). The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Research*. https://doi:10.1016/j.psychres.2020.112934

Comas-Quinn, A. (2011). Learning to teach online or learning to become an online teacher: An exploration of teachers' experiences in a blended learning course. *ReCALL*, *23*(3), 218–32.

Conference Board of the Mathematical Sciences (2020). *Special COVID-19 impact study survey*. American Mathematical Society. http://www.ams.org/profession/data/cbmssurvey/cbms2020

Copeland, E., McGinnis, E., Bai, Y., Devadanum, V., Rettew, J., & Hudziak, J. (2021). Impact of COVID-19 pandemic on college student mental health and wellness. *Journal of the American Academy of Child & Adolescent Psychiatry*, *60*(1), 134–41. https://doi.org/10.1016/j.jaac.2020.08.466

Cronjort, M., Filipsson, L., & Weurlander, M. (2017). Improved engagement and learning in flipped-classroom calculus. *Teaching Mathematics and its Applications: An International Journal of the IMA, 37*(3), 113–21.

Drew, D. E. (1996). *Aptitude revisited: Rethinking math and science education for America's next century*. Johns Hopkins University Press.

Drew, D. E. (2011). *STEM the tide: Reforming science, technology, engineering, and math education in America*. Johns Hopkins University Press.

Freeman, S., Eddy, S., and McDonough, M. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences of the United States of America*, *111*(23), 8410–15.

Higher Education Research Institute (2021). https://heri.ucla.edu/

Holzer, J., Lüftnegger, M., Korlat, S., Pelikan, E., Salmela-Aro, K., Spiel, C., & Schober, B. (2021). Higher education in times of COVID-19: University students' basic need satisfaction, self-regulated learning, and well-being. *AERA Open.* https://doi.org/10.1177/23328584211003164

McCormick, G. (2020, May 19). *The COVID-19 pandemic affects all college students, but probably not equally.* Phys. Org. https://phys.org/news/2020-05-covid-pandemic-affects-college-students.html

Network for Research and Evaluation in Education (2020). *National study of STEM faculty and students (NSSFS): Impacts of the COVID-19 pandemic.* https://nreeducation.wordpress.com/2020/06/11/example-post-3/

Pascarella, E. T., & Terenzini, P. T. (1991). *How college affects students: Findings and insights from twenty years of research,* Jossey-Bass.

Saw, G. K., Chang, C.-N., Lomelí, U., & Zhi, M. (2020). Gender disparities in remote learning during the COVID-19 pandemic: A national survey of STEM faculty and students, (NREED Data Brief. No 2). Claremont, CA: Network for Research and Evaluation in Education. https://nreeducation.wordpress.com/2020/08/07/gender-disparities-in-remote- learning-during-the-covid-19-pandemic-a-national-survey-of-stem-faculty-and-students/.

Shalby, C. (2021). Cal State online classes are here to stay. *Los Angeles Times*, June 4, A1, 6.

Tinto, V. (1994). *Leaving college: Rethinking the causes and cures of student attrition*. University of Chicago Press.

Tinto, V. (2012). *Completing college: Rethinking institutional action*. University of Chicago Press.

Tonon, G. H. (2020). Student's quality of life at the university: A qualitative study. *Applied Research in Quality of Life*. https:// doi.org/10.1007/s11482-020-09827-0

U.S. News and World Report (2021). Overview of California State University, Fullerton.*US News & World Report*. https://www.usnews.com/best-colleges/california-state-university-univ-1137.

Appendix 1: Freshmen Mathematics Students Survey Codes and Data Summary

Block 1: Students' Experiences. The following items ask you to compare your perceptions and experiences in your VT and FF mathematics courses (response frequencies given in percent).

	VT much better (1)	VT somewhat better (2)	Both about the same (3)	FF somewhat better (4)	FF much better (5)	Mean	SD
Understanding of material	4.2	11.3	27.5	25.3	31.6	3.69	1.153
Attendance in class	17.7	8.5	54.8	7.0	11.9	2.87	1.150
Participation in class	5.5	11.2	33.7	25.6	23.8	3.51	1.133
Academic integrity of class	5.6	6.6	63.1	13.5	11.1	3.18	.915
Receiving feedback on work	8.0	12.2	35.1	24.0	20.4	3.37	1.170
Overall performance in the course	6.2	13.8	28.8	23.3	27.8	3.53	1.206
Overall experience in the course	6.7	11.4	28.6	23.8	29.3	3.58	1.210

Block 2: Time Spent on Classes. The following items ask you to compare the amount of time you spent on the following activities this semester Fall 2020 in a VT setting as compared to the Fall 2019 semester in a FF classroom setting (response frequencies given in percent).

	VT much more time (1)	VT more time (2)	Both about the same (3)	FF more time (4)	FF much more time (5)	Mean	SD
Time spent doing homework	14.9	20.6	37.3	17.2	10.0	2.87	1.164
Time spent studying for exams	11.5	18.6	38.0	21.2	10.6	3.01	1.134
Time spent on projects/writing assn.	9.1	18.3	45.5	17.8	9.2	3.00	1.047
Time spent interacting with other st.	2.1	3.2	10.9	20.0	63.7	4.40	.949
Time spent interacting with instruct.	3.2	6.3	20.7	28.4	41.5	3.99	1.078

Block 3: **Responsibility and Stress Levels.** The following items ask you to compare your responsibility and stress levels in Fall 2019 and Fall 2020 (response frequencies given in percent).

	Much greater in F2019 (1)	Somewhat greater in F2019 (2)	About the same (3)	Somewhat greater in F2020 (4)	Much greater in F2020 (5)	Mean	SD
Family-related responsibility level	4.4	6.6	38.9	29.1	21.0	3.56	1.031
Work-related responsibility level	5.9	8.2	36.4	26.1	23.3	3.52	1.113
School-related responsibility level	6.0	10.6	24.3	29.4	29.6	3.66	1.180
Overall stress level	5.6	5.9	19.8	24.4	44.1	3.96	1.174

Block 4: Overall Mathematics Course Experience. The following items ask about your overall experience of taking mathematics courses in a VT format this semester (response frequencies given in percent).

						Mean	SD
Comm. effectively with instructor and peers via chat, microphone, etc.	Str dis (1) 4.1	Disagr (2) 13.5	Neutr (3) 28.0	Agree (4) 41.5	Str agr (5) 12.1	3.44	1.006
Kept video screen on ___ of the time on during lessons	None (1) 29.1	A little (2) 22.1	Some (3) 19.3	Much (4) 8.5	All (5) 21.0	2.70	1.480
Course exams fairly and accurately assessed students' understanding	Str dis (1) 5.2	Disagr (2) 14.1	Neutr (3) 32.4	Agree (4) 36.3	Str agr (5) 12.0	3.36	1.032
Overall experience taking mathematics courses in VT format	Much worse than exp (1) 6.9	Worse than exp (2) 18.9	About as expected (3) 41.5	Better than exp (4) 25.0	Much better than exp (5) 8.3	3.10	1.017
Prefer VT or FF format for taking math courses	Strongly prefer VT (1) 5.5	Somewh at prefer VT (2) 12.6	No preferenc e (3) 16.4	Somewh at prefer FF (4) 24.7	Strongly prefer FF (5) 40.9	3.83	1.242
Compared to non-math courses, taking a VT math course was:	Much worse (1) 6.1	Worse (2) 18.5	About the same (3) 48.7	Better (4) 20.4	Much better (5) 6.3	3.02	.941
Overall experience taking non-mathematics courses in VT format	Much worse than exp. (1) 3.0	Worse than exp. (2) 14.7	About as expected (3) 52.5	Better than exp (4) 23.9	Much better than exp (5) 5.9	3.15	.849
Prefer VT or FF format for non-math courses	Strongly prefer VT (1) 4.6	Somewh at prefer VT (2) 13.9	No preferenc e (3) 18.3	Somewh at prefer FF (4) 26.9	Strongly prefer FF (5) 36.3	3.76	1.209

Block 5: Technology and Space. How challenging were the following aspects of technology and space taking classes in a VT setting for you (response frequencies given in percent)?

	Not at all ch. (1)	Slightly ch. (2)	Mod. ch. (3)	Very ch. (4)	Extremely ch. (5)	Mean	SD
Consistent computer access	64.1	19.5	12.6	2.6	1.2	1.57	.892
Consistent internet access	33.8	36.8	18.4	7.5	3.4	2.10	1.059
Cons access to quiet place for class	31.0	23.5	22.9	13.2	9.4	2.47	1.304
Cons access to quiet place to prepare	29.3	22.9	21.0	14.3	12.4	2.58	1.365

Block 6: Transportation and Parking. The following items ask about transportation and parking while taking classes in a VT format this semester (response frequencies given in percent).

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree/disagree (3)	Somewhat agree (4)	Strongly agree (5)	Mean	SD
VT was worth it since I did not have to drive to campus	10.0	10.5	16.3	28.5	34.6	3.67	1.314
VT was worth it since I did not have to find a parking place	9.0	7.1	19.5	25.6	38.7	3.78	1.276
VT was worth it since I did not have to pay for parking	7.5	6.9	16.6	23.3	45.5	3.92	1.254
VT was worth it since I did not have to live on or near campus	14.6	11.4	26.3	17.9	29.9	3.37	1.390

Block 7: Background Information. The following items ask about background information (response frequencies given in percent).

								Mean	SD
Major area of study	Arts (1) 6.0	Bus/Ec (2) 17.7	Comm (3) 4.2	Educ (4) 1.9	Eng/CS (5) 17.5				
	HHD (6) 12.1	HSS (7) 11.7	Math (8) 2.5	Sci (9) 13.7	Other/und 12.7				
Prior experience taking courses in VT setting	None (1) 29.6	A little (2) 41.0	Some (3) 25.5	A lot (4) 3.7				2.03	.837
No. of units taken in Fall 2020	1-6 (1) 4.2	7-12 (2) 22.1	13-15 (3) 55.1	16-18 (4) 18.5	19+ (5) 0.2			2.89	.754
No. of hrs/week working paid job	0 (0) 56.1	1-5 (1) 3.6	6-10 (2) 5.9	11-20(3) 17.4	21-30(4) 12.3	31-40(5) 4.8		1.41	1.740

Closing the Achievement Gap: Flipped Business Calculus with Embedded Peer Support

Sunny Le & Cherie Ichinose
California State University, Fullerton

Abstract

On March 13th, 2020, a proclamation declaring a national emergency concerning the Novel Coronavirus Disease (Covid-19) outbreak would require all educational institutes to execute an indefinite distance learning plan. Instructors immediately pivot while providing students with rich and relevant learning experiences. This study compared overall course achievement between students enrolled in traditional synchronous online business calculus courses and a large section (120 students) using the flipped model with embedded peer support. Results showed students in the large section had significantly higher passing rate and a narrower achievement gap between the underrepresented minority students and their counterparts.

Keywords: business calculus, flipped classroom, embedded peer support, the achievement gap

Closing the Achievement Gap: Flipped Business Calculus with Embedded Peer Support

Introduction

In the book *Management Challenges for the 21st Century*, Peter F. Drucker wrote, "Online Learning may make traditional freestanding undergraduate colleges obsolete within 25 years" (1999, p.101). In 2011, Clayton Christensen predicted that by the year 2019, more than 50% of instruction would be delivered online (Christensen et al., 2011). Moreover, in 2014, Ichinose reflected on the experiences and lessons learned while teaching online. Comparing teaching experiences between bricks-n-mortar settings and the virtual one, Ichinose (2014) noted:

> First, it must be said that online schooling is not for everyone. It is not for every student, nor is it for every teacher. Some individuals are not well-suited for online schools, just as others are not well-suited for traditional schools. Both education models have unique characteristics that, depending on the person, can be seen as an advantage or disadvantage. (para. 4)

These authors could not have predicted that on March 13th, 2020, a proclamation declaring a national emergency concerning the Novel Coronavirus Disease (COVID-19) outbreak would require all instructions to be delivered online. Due to the sudden change of this unprecedented circumstance, it's become necessary for researchers to assess students' achievement in virtual learning environments.

This paper will present the results of flipping an online business calculus class with embedded peer support. Our conceptual model will address the following two research questions:

1. How does the course achievement of students in the traditional synchronous online business calculus courses compare with the flipped online business calculus with embedded peer support?
2. Was there a difference between groups with respect to closing the achievement gap between underrepresented minority students and their counterparts?

Literature Review and Pedagogical Model

Synchronous vs. Asynchronous

Online instructors debate the use of synchronous versus asynchronous educational environments. Some argue synchronous instruction does not allow the necessary time for reflection (Giesbers et al., 2014; Lou et al., 2006; Richardson & Swan, 2003; Simonsen & Banfield, 2006; Warschauer, 1997). Others argue asynchronous interactions are not engaging and rigorous enough for higher education (Reese, 2015) and do not provide the necessary strong social presence with their instructor, which fosters a strong sense of participation in the class (Anderson & Kuskis, 2007; Digital Learning Collaborative, 2019).

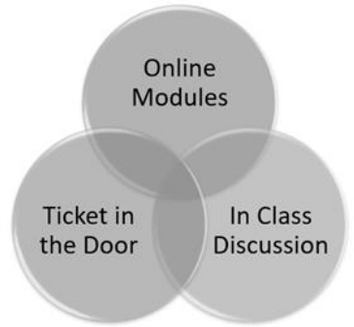
The balance between each environment is critical. Students can interact solely asynchronously through online content, but as

Holden and Westfal (2010) suggested, this may be more appropriate for drills and practice activities. In asynchronous environments, while students have access to the course content at any given time, they may not necessarily interact with peers and the instructor. However, Anderson (2003) suggested synchronous environments are "particularly rich and encourage the development of social skills, collaborative learning, and the development of personal relationships amongst participants as components of the learning process" (p. 9). During the COVID-19 pandemic, the Conference Board of the Mathematical Sciences (CBMS) reported that the online synchronous "was most commonly used format" (p. 88) in the mathematics or statistics department among different higher education institutions such as two-year college, four-year private and public universities (Kirkman et al., 2022).

Online Flipped Classroom

The flipped classroom model inverts traditional instruction and transforms class time from instructor-led lectures to student-led discussions. Students acquire content knowledge before class and engage in rich classroom discussions surrounding problem-solving. Figure 1 demonstrates the components of a successful flipped three-part model. Results from these studies indicate the flipped model led to improved academic outcomes for students overall, with a more considerable increase for Hispanic/Latinx students (Clinkenbeard, 2018, 2020; Ichinose & Clinkenbeard 2016).

Figure 1
Three-Part Flipped Class Model



The flipped classroom model provides the ideal balance and synergy between asynchronous and synchronous learning modalities. Online modules consist of pre-recorded and interactive video lessons with embedded questions. Each lesson is between seven to twelve minutes long. Ticket-in-the-door (TITD) worksheets are used to determine students' understanding after completing the pre-recorded video lesson. The online modules and TITDs are completed before arrival at each class session. In class, the faculty member facilitates discussion of the topic via small group activities. The benefits translate similarly to the online synchronous setting. Rather than students participating physically in a class by moving their desks together in groups, they interact in small groups via break-out rooms during the live course in virtual classrooms.

Asynchronous Online Modules

First, students interact with the course content via online modules uploaded directly on the institution's learning

management system (LMS) in the flipped model. Each module provides the necessary mathematical background knowledge to participate in the related synchronous discussions. Before a due date, students can complete these lessons at their own pace by pausing, rewinding, and re-watching as needed. Johnson (2010) describes the benefits of this asynchronous activity:

> If I didn't understand what was being taught, I could go back and listen to the lecture again. I didn't feel the anxiousness to learn the material that minute. I knew if I needed extra time to grasp information, it was there. Having the access to the lectures at any time provided me with the flexibility of listening to it as often as I wished. (p. 190)

Upon completing the module, the LMS automatically records the students' responses to the embedded quiz in the grade book and provides immediate feedback. This computer-generated response offers the students the opportunity to use the feedback to attempt similar problems (Engelbrecht & Harding, 2004; Zerr, 2007). The prompt feedback helps keep students on the right track and reinforces the students' feeling of progress (Lou et al., 2006). This additional feedback reinforcement increases student engagement and creates a more enjoyable learning experience (O'Dwyer et al., 2007; Suh & Moyer, 2007; Zerr, 2007). When students work hard to solve a particular problem, they experience a feeling of accomplishment, which ultimately leads to the willingness to

continue engaging in mathematics (National Council of Teachers of Mathematics [NCTM], 2000).

Asynchronous Pre-Class Assessment

Next, students complete a pre-class assessment or TITD, which serves as the basis for the synchronous class discussion. TITDs are different from a traditional warm-up or entry ticket where students complete class tasks upon arriving. The "any-time" TITD assessment allows students more time for synthesis, enhances learning, and allows students to reflect upon the material before participating in class (Lou et al., 2006; Richardson & Swan, 2003; Simonsen & Banfield, 2006; Warschauer, 1997). Unlike synchronous settings, students do not need to feel pressured to produce an on-the-spot solution. Still, they can reflect on their previous mathematical knowledge to come up with answers at their paces (Richardson & Swan, 2003). Reflection is essential for learning mathematics (Donovan & Bransford,2005; NCTM, 2002).

Synchronous In-class Discussions

Students lead a discussion from the beginning of class by presenting the pre-class assessments rather than passively listening to the lecture. Transitioning to this active learning space has shown an increase in student self-efficacy, sense of social belonging (even in a large class), increased content retention and course performance, and closed the gap in learning gains between non-underrepresented students and underrepresented students (Cornell

University Center Teaching Excellence, 2012; Legg &Wilson, 2009; Tebben,1995). Moreover, listening to students' presentations also creates an opportunity for the instructor to check for understanding and modify discussion based on student needs, which creates an individualized learning environment.

When the initial content is delivered by computer, an instructor can reallocate instructional time to focus on discussion extending the mathematical dialogue to previous background knowledge or other subject areas (Hagerty & Smith, 2005). Consequently, the instructor can foster a more profound mathematical understanding and discourse (Smith et al., 2003; Warschauer, 1997). Collectively, instructors and students can share their ideas, elaborate on their thought processes, and connect new to previously learned concepts (Simonsen & Banfield, 2006).

Validating student achievement and encouraging group interaction within the online mathematical classroom creates a foundation for students to receive assistance from various sources, including their peers. Helping students feel part of a learning community is critical to accessibility, persistence, learning, and satisfaction (Hiebert et al.,1987; Twigg, 2004). Further, this sense of community encourages students to contribute to class discussions, decreases students' feelings of anxiety, and increases academic performance (Freeman et al., 2010; Tebben, 1995).

Embedded Peer Support - Apprenticeship

The idea of an apprentice is not new. For years the term *apprentice* included: "craft/trade apprenticeships, student or technical apprenticeships, and graduate apprenticeships" (Hawkins, para. 2, 2008). Apprentices typically work alongside an expert who provides real-time, hands-on training opportunities in a specified field. In the K-12 setting, teaching apprenticeship is now synonymous with co-teaching or apprentice teaching (Friend et al., 2015). Cook and Friend (1995) defined co-teaching as "two or more professionals delivering substantive instruction to a diverse or blended group of students in a single physical space" (p. 14). Considering technological advances in education, mentor teachers and apprentices can also gain rich co-planning and co-teaching experiences in the virtual space.

Apprentices are an integral part of the flipped classroom. With the presence of the teaching apprentices, less advanced students can receive additional real-time support in these flipped classrooms. The interaction between students and the apprentices reflects a peer-to-peer support atmosphere rather than an instructor-to-student environment. Studies have shown that students often report feeling more comfortable seeking help from their apprentices before addressing their questions to the instructor (Miller et al., 2001; Tsuei, 2011). Tucker et al. (2020) also emphasized the benefit of embedded peer support in their study. The study showed that

students, who participated in at least one course with embedded peer support (apprentices), performed better and built a stronger sense of belonging (Tucker et al., 2020).

Institutional Context

This study aims to measure differences in achievement between students in traditional synchronous online business calculus courses with a flipped online business calculus course with embedded peer support at an urban, 4-year public university in Southern California. With approximately 38,000 enrolled students, the sample university is a part of the California State University (CSU) system with 23 campuses across California.

The study presented in this paper utilized students' information collected by the university, such as sex, ethnicity, major, and final course grades. The university report includes the following ethnic groups: American Indian/Native American, Hispanic/Latino, Black/African American, Asian/Asian American, White, Native Hawaiian/Pacific Islander, and Not Specified (Two or More Ethnicities/Races). The underrepresented minority population (URM) consists of Hispanic/Latino, Black/African American, American Indian/Native American, and Native Hawaiian/Pacific Islander students. The non-underrepresented minority population (non-URM) consists of Asian/Asian American and White students. The plus/minus system was used when assigning a student's final course grade. Definition of each letter grade and its grade point

average (GPA) is A+/A = 4.0, A- =3.7, B+ =3.3, B = 3.0, B- = 2.7, C+ = 2.3, C = 2.0, C- = 1.7, D+ = 1.3, D=1.0, D- = 0.7, and F/W/WU = 0.0.

Business Calculus

Business calculus is a traditional non-trigonometric calculus course that satisfies the calculus requirements for the students in the College of Business and Economics. Topics include differential and integral calculus with applications in business and economics. Table 1 shows the enrollment and GPAs (2020-2021 academic year) for similar business calculus courses throughout several campuses in the CSU system (CSU Student Success Dashboard, 2021).

Table 1

Enrollment and GPA between URM and Non-URM

CSU Campus	non-URM enrollment	URM enrollment	non-URM AVG. GPA	URM AVG. GPA	GPA Gap
CSU Sample	611	563	2.47	2.03	0.43
CSU A	72	80	2.83	2.72	0.11
CSU B	487	622	2.66	2.2	0.46
CSU C	19	13	1.93	2.06	-0.13
CSU D	317	180	2.94	2.48	0.46
CSU E	932	437	3.37	3.1	0.27
CSU F	516	96	2.86	2.51	0.35

When compared to six other CSU campuses, the university in our study (CSU Sample) had the second-highest URM enrollment (n = 563) and the lowest URM average GPA (2.03) in business calculus courses. The achievement gap between URM and non-URM students is relatively high (0.43, the second-highest in the selected group). With an alarmingly low success rate for URM students in

business calculus at CSU Sample, it was necessary to reevaluate the course structure and implement additional in-class support to increase the passing rate for URM students and bridge the achievement gap.

Sample

At CSU Sample, recorded data shows that 536 students completed business calculus (with a letter grade) in Spring 2021. However, 43 students in this sample withdrew from the course or stopped coming to class and received a W or WU, respectively. Another 60 students did not report their race and ethnicity in the official records. Thus, the final sample size used in this study decreased to 433 students. In this sample, approximately 50.3% of students were men (n = 218) and 49.7% were women (n = 215). The student populations consist of 52% URM (n = 225) and 48% (n = 208) non-URM. Table 2 shows an indifferent distribution of URM and non-URM students in the experimental group (students who self-enrolled in the large-size synchronous flipped course) and the control group (students who self-enrolled in a regular-size synchronous course).

Table 2
The distribution of URM and non-URM students

Group	URM	Non-URM
Experimental (large size, flipped, synchronous online)	53 (51%)	51 (49%)
Control (regular size, non-flipped, synchronous online)	172 (52%)	157 (48%)
Total	**225 (52%)**	**208 (48%)**

Coordinated Course Structure

All the business calculus classes observed in this study are part of a coordinated group, which means all sections of the course cover the same topics over a similar schedule, have a standard grading policy, and general course rules. Due to the pandemic and the shift to online learning, the sample university hosted all mathematics courses synchronously, requiring instructors to provide live instruction for these courses. During the synchronous instruction, exams are proctored by the instructor live on Zoom meeting or live using Proctorio - a third-party built-in proctoring software provided by the university. The course coordinator is responsible for overseeing assessments and enforcing course standards. Thus, every exam's difficulty level and rigors stay consistent across all sections.

Instructional Format

Students in the experimental group participated in the online flipped classroom modality. Before class, students completed a series of online lesson modules and Ticket-in-the-door (TITD) worksheets. A TITD accompanied each lesson to access students' understanding of the lesson presented in the video module. Students led the discussion about topics learned before class during the live course. From the student's presentation, the instructor and the apprentice would evaluate where students struggled to address any misconceptions with the material before moving on to the

whole class discussion. The remaining 75-minute class time was allocated to problem-solving and group work. Students actively solved more challenging and applied problems in small groups and presented their solutions at the end.

Apprentices

The experimental large-size class employed embedded peer supports using teaching apprentices (TA). TAs are undergraduate mathematics majors interested in teaching mathematics at the secondary or college/university level. Their responsibilities include attending all live synchronous class sessions, facilitating small group discussions in and outside of class, holding weekly office hours, and meeting with the faculty member for lesson planning and in-class activities. TAs are selected based on a rigorous application and interview process. Hiring qualifications include overall GPA, letters of recommendation, personal statement, and performance in a group interview. Selected apprentices then participate in a week-long summer professional development program focused on active learning in online and bricks-and-mortar settings.

With a 1:30 TA-student ratio, four apprentices (TA) were assigned to the experimental class with 116 enrolled students. Besides regular responsibilities, the four TAs also posted announcements about class information such as weekly recaps, upcoming assessments, and additional resources to understand

course concepts better. Because of the large-sized class, the TAs were reported as the first point-of-contact for students and had more frequent contact with students than the instructor did.

Results

Overall Course Achievement

Table 3 shows the percentage of students who successfully passed the business calculus class (with a grade of C or better). It is worth noting that the rate of students who passed the course with a C or better is 14.4% higher in the experimental group (83.7% compared to 69.3%). A Chi-square analysis yields a p-value of 0.0042 (Chi-square value = 8.211), which suggests that the overall course achievement rate (without W/WU grades) in the Spring 2021 semester is statistically dependent on activities in the experimental group.

Table 3

Descriptive Statistics Comparison in Pass/Fail rate for business calculus students

Group	Pass	Fail
Campus-wide	315 (72.7%)	118 (27.3%)
Control group	228 (69.3%)	101 (30.6%)
Experimental group	87 (83.7%)	17 (16.3%)

Overall Course Achievement for URM and non-URM students

Table 4 and Table 5 present the pass/fail rate for URM students and non-URM students, respectively. The data reveals a significant difference between the pass and fail rate for URM students and

suggests that URM students are four times more likely to pass the business calculus in the experimental group.

Table 4
Descriptive Statistics Comparison in Pass/Fail rate for underrepresented (URM) students

Group	# of URM students pass (%)	# of URM students fail (%)
Campus wide	152 (67.6 %)	73 (32.4 %)
Control group	109 (63.4 %)	63 (36.6 %)
Experimental group	43 (81.1 %)	10 (18.9 %)

$\chi^2_{(1)} = 5.83, p < 0.05$

Table 5
Descriptive Statistics Comparison in Pass/Fail rate for non-underrepresented (non-URM) students

Group	# of non-URM students pass (%)	# of non-URM students fail (%)
Campus-wide	163 (78.4 %)	45 (21.6 %)
Control group	119 (75.8 %)	38 (24.2 %)
Experimental group	44 (86.3 %)	7 (13.7 %)

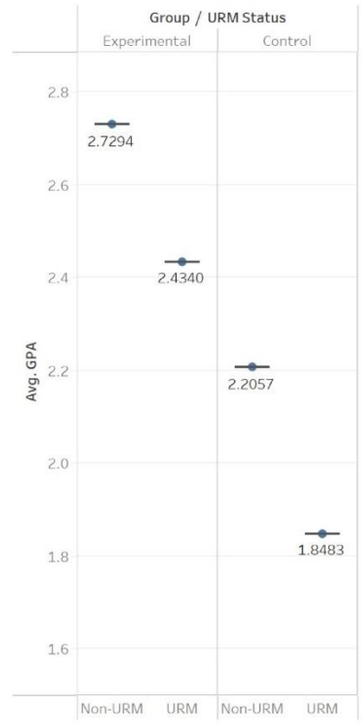
$\chi^2_{(1)} = 2.49, p > 0.05$

Overall Letter Grade Earned for URM and non-URM students

The overall pass/fail rates for students (URM, non-URM, general population) in the experimental group are significantly higher than those in the control group. It is necessary to look at the breakdown of letter grades earned in the business calculus course. The letter grade earned by individual students is converted using the standard GPA scale defined by the CSU system. The average class GPAs for URM and non-URM students in the experimental group were 2.43 and 2.73, respectively, while the class average GPAs for the respective groups were 1.85 and 2.21 in the control group

(Figure 2). The GPAs result shows that students (both URM and non-URM populations) in the experimental group earned higher grades than their counterparts in the control group.

Figure 2
Average GPA for URM and non-URM population in the experimental and control group



Achievement Gap for URM and non-URM

Reported data reveals a higher GPA for URM and non-URM students in the experimental group, with 2.73 vs. 2.21 for non-URM students and 2.43 vs. 1.85 for URM students. It is also apparent that the GPA gap in the experimental group is narrower (0.30) compared to a difference of 0.36 in the control group. To further investigate if

the GPA gap is significant, t-test analyses were performed for each group, and results are presented in Table 6.

Table 6
t-tests for Mean GPA Comparisons between URM and non-URM students

Group (nonURM - URM)	Sample difference	Standard Error	df	t	Significance (p-value)
Control	0.357	0.138	326.981	2.589*	0.010*
Experimental	0.295	0.217	100.588	1.361	0.177

*$p < .05$.

Table 6 shows a statistical difference in letter grades earned by URM and non-URM students in the control group, not the experimental group. This result suggests that URM and non-URM students performed indifferently in the large-size synchronous course.

Discussion, Implication, and Conclusion

Due to the nature of this paper's posthoc study, care must be taken when interpreting the analysis results. The initial investigation revealed a positive impact of a combination between flipped model pedagogy and teaching apprenticeship in large-size synchronous business calculus courses. All three components: synchronous class, active learning technique, and embedded peer support, improved the course grade in all student groups and narrowed the achievement gap between URM and non-URM students at the sample university. Furthermore, our analysis points strongly to an indifferent performance between URM students and

their counterparts in the experimental group. This result proposes a promising success for synchronous large-sized classes using the flipped classroom and embedded peer support model.

No one could have predicted that on March 13th, 2020, a proclamation declaring a national emergency concerning the Novel Coronavirus Disease (Covid-19) outbreak would require all instruction to be delivered online. We can count on educational innovators striving to implement the best practices for their students. The online flipped class with embedded peer support lays the foundation for future online active learning spaces. Mathematics learning is no longer static and constrained to the pages of a traditional textbook but relatively is limitless in the experiences in the virtual world.

Limitation and Future Research

Although our preliminary data analysis presented encouraging findings for online synchronous large-size classes, there are several limitations. The first is selection bias. Students self-enrolled in the course without prior knowledge of the in-class teaching apprenticeship or flipped model pedagogy. The second is the nature of the cross-sectional study. Our study examined the course records for all business calculus classes over only one semester. To institutionalize the findings of this study, an emulation of flipped classrooms with embedded teaching apprentices is necessary for different mathematics courses such as college algebra and intro to

statistics. The third is the nature of a descriptive statistics study. We can't make causal implications about how or if the embedded peer support and flipped model classroom pedagogy improve student success in business calculus courses.

Instructors need to understand how and to what extent the combination of such factors: flipped classrooms, teaching apprenticeship, and synchronous instruction contribute to the students' achievement in large-sized online mathematics courses. Educators would benefit from the following future research questions with comprehensive evaluations on the role of each factor:

1. How does the flipped classroom pedagogy support an active learning environment while promoting online community-building mobility in a large synchronous online mathematics course?
2. What are the positive long-term effects on graduation rates for students that participated in a large-size synchronous online flipped mathematics course?
3. How does the role of the teaching apprentice affect students' course performance and faculty perception of classroom experience in a large synchronous online flipped mathematics course?

References

Anderson, T. (2003). Getting the mix right again: An updated and theoretical rationale for interaction. *International Review of Research in Open and Distance Learning*, *4*(2), 1-14.

Anderson, T., & Kuskis, A. (2007). Modes of interaction. In M. G. Moore (Ed.), *Handbook of distance education* (2nd ed.). (pp. 295-310). Mahwah: Lawrence Erlbaum Associates.

Christensen, C. M., Horn, M. B., & Johnson, C. W. (2011). *Disrupting class: how disruptive innovation will change the way the world learns* (Updated and expanded new ed.). McGraw-Hill.

Clinkenbeard, J. (2020). Who Benefits? Student Achievement in Flipped and Traditional College Algebra by Gender and Ethnicity: *MathAMATYC Educator 11*(3).

Clinkenbeard, J. (2018). Achievement in Flipped College Algebra and Precalculus: A Multiyear Study: *MathAMATYC Educator 10*(1), 5-11.

Connecting with your students: Center for Teaching Innovation. Connecting with Your Students | Center for Teaching Innovation. (n.d.). Retrieved October 26, 2021, from https://teaching.cornell.edu/teaching-resources/building-inclusive-classrooms/connecting-your-students.

Cook. L., & Friend, M. (1995). Co-teaching: Guidelines for creating effective practices. *Focus on Exceptional Children*, *28*(3), 1-17.

CSU Student Success Dashboard: Course GPA Equity Gaps. Retrieved October 26, 2021, from https://csusuccess.dashboards.calstate.edu/public/faculty-dashboard/achievement-gaps-gpa (Requires Student/Faculty login).

Digital Learning Collaborative. (2019). Snapshot 2019: A review of K-12 online, blended, and digital learning. Retrieved from https://www.digitallearningcollab.com.

Donovan, M. S., & Bransford, J. D. (Eds.). (2005). *How students learn mathematics in the classroom*. Washington, DC: National Academies Press.

Drucker, P. F. (1999). *Management challenges for the 21st century* (1st ed.). Harper Business.

Engelbrecht, J., & Harding, A. (2004). Combining online and paper assessment in a web-based course in undergraduate mathematics. *Journal of Computers in Mathematics and Science Teaching*, *23*(3), 217-231.

Freeman, T. M., Anderman, L. H., & Jensen, J. M. (2010). Sense of belonging in college freshmen at the classroom and campus levels. *The Journal of Experimental Education*, *75*(3), 203-220.

Friend, M., Embury, D., & Clarke, L. (2015). Co-Teaching Versus Apprentice Teaching: An Analysis of Similarities and Differences. *Teacher Education and Special Education*, *38*(2), 79-87.

Giesbers, B., Rienties, B., Tempelaar, D., & Gijselaers, W. (2014). A dynamic analysis of the interplay between asynchronous and synchronous communication in online learning: The impact of motivation. *Journal of Computer Assisted Learning*, *30*(1), 30–50.

Hagerty, G., & Smith, S. (2005). Using the web-Based interactive software ALEKS to enhance College Algebra. *Mathematics and Computer Education*, *39*(3), 183-194.

Hawkins, T. H. (2008). What Is an Apprentice? *Education & Training*, *50*(1), 24-27.

Hiebert, J. (1997). *Making sense: Teaching and learning mathematics with understanding.* Heinemann, 361 Hanover Street, Portsmouth, NH 03801-3912.

Holden, J. T., Westfall, P. J. L., & Gamor, K. I. (2010). An instructional media selection guide for distance learning–Implications for blended learning. *Implications for Virtual Worlds. Boston MA, United States Distance Learning Association USDLA*.

Ichinose, C. (2014). A Teacher's Experience: What I Learned Working in Online Schools. *Education Week.*

Ichinose, C., & Clinkenbeard, J. (2016). Flipping college algebra: effects on student engagement and achievement. *The Learning Assistance Review*, *21*(1), 115–129.

Johnson, K. P. (2010). Never say never: Opening new doors to online learning. *The Journal of Continuing Higher Education*, *58*, 189-192.

Kirkman, E., Blair, R., & Barr, T. (2022). *The impact of covid-19 on undergraduate mathematical.* Notices of the American Mathematical Society. Retrieved January 1, 2022, from https://www.ams.org/profession/data/cbms-survey/CBMS-COVID-Survey-Final-Report3.pdf**.**

Legg, A. M., & Wilson, J. H. (2009). E-mail from professor enhances student motivation and attitudes. *Teaching of Psychology*, *36*(3), 205-211.

Lou, Y., Bernard, R. M., & Abrami, P. (2006). Media and pedagogy in undergraduate distance education: A theory-based meta-analysis of empirical literature. *Educational Technology Research and Development*, *54*(2), 141-176.

Miller, Groccia, J. E., & Miller, M. S. (2001). *Student-Assisted Teaching: A Guide to Faculty-Student Teamwork.* Anker Publishing Company, 176 Ballville Road, PO Box 249, Bolton, MA 01740-0249.

National Council of Teachers of Mathematics (2002). *Principles and standards for school mathematics. Reston*, VA: National Council of Teachers of Mathematics.

O'Dwyer, L. M., Carey, R., & Kleiman, G. (2007). A study of the effectiveness of the Louisiana algebra 1 online course. *Journal of Research on Technology in Education*, *39*(3), 289 - 306.

Reese, S. A. (2015). Online learning environments in higher education: Connectivism vs. dissociation. *Education and Information Technologies*, *20*(3), 579–588.

Richardson, J. C., & Swan, K. (2003). Examining social presence in online courses in relation to students' perceived learning and satisfaction. *Journal of Asynchronous Learning Networks*, *7*(1), 68-88.

Simonsen, L., & Banfield, J. (2006). Fostering mathematical discourse in online asynchronous discussions: An analysis of instructor interventions. *Journal of Computers in Mathematics and Science Teaching*, *25*(1), 41-75.

Smith, G. G., Ferguson, D., & Caris, M. (2003). The web versus the classroom: Instructor experiences in discussion-based and mathematics-based disciplines. *Journal of Educational Computing Research*, *29*(1), 29-59.

Suh, J., & Moyer, P. (2007). Developing students' representational fluency using virtual and physical algebra balances. *Journal of Computers in Mathematics and Science Teaching*, *26*(2), 155-173.

Tebben, S. L. (1995). Community and caring in a college classroom. *Journal for a Just and Caring Education*, *1*(3), 335-344.

Tsuei, M. (2012). Using synchronous peer tutoring system to promote elementary students' learning in mathematics. *Computers and Education*, *58*(4), 1171–1182.

Tucker, Sharp, G., Shi, Q., Scinta, T., & Thanki, S. (2020). Fostering historically underserved students' success: An embedded peer support model that merges non-cognitive principles with proven academic support practices. Review of Higher Education, *43*(3), 861–885. https://doi.org/10.1353/rhe.2020.0010

Twigg, C. A. (2004). Using asynchronous learning in redesign; reaching and retaining the at-risk student. *Journal of Asynchronous Learning Networks*, *8*(1), 7-15

Warschauer, M. (1997). Computer-mediated collaborative learning: *Theory and practice. The Modern Language Journal*, *81*(4), 470-481.

Zerr, R. (2007). A quantitative and qualitative analysis of the effectiveness of online homework in first-semester calculus. *Journal of Computers in Mathematics and Science Teaching*, *26*(1), 55-73.

Piloting the Learning Assistant (LA) Model in a Large Lecture General Chemistry Course

Tito S. Sempértegui, Jennifer L. Bebergal, & Brittanney J. Adelmann
Florida Atlantic University

Abstract

Studies have demonstrated the positive impact of the Learning Assistant (LA) model on student learning across various disciplines, demographics, and course types. In order to investigate the effect of exposure to the LA program on student learning and success in a large Chemistry course, a pilot was launched in one of two sections of General Chemistry II at Florida Atlantic University (FAU) in spring 2020, with the addition of LAs as the sole experimental variable. The researchers hypothesized that the LA model positively impacts equity in the classroom with increased learning gains across student demographics. A t-test was used to determine the significance in differences between student exam scores in the LA and non-LA section. The researchers found that student learning was significantly higher in the LA section versus the non-LA section ($p<0.01$). Students participating in the LA section (N=275) had

stronger outcomes than students in the non-LA section (N=290). In addition, students in the LA section were more likely to pass the course, enroll in the subsequent (Organic Chemistry) course within one year, and were more likely to be retained at the institution. These success rates held for all students, particularly for students historically underrepresented in chemistry.

Keywords: Learning Assistant, collaborative learning, active learning, equity in education, student success

Piloting the Learning Assistant (LA) Model in a Large Lecture General Chemistry Course

Introduction

Across higher education, student learning and success as measured by content knowledge, course grades and retention to the major is a concern for faculty and administrators alike. A major focus of higher education research has centered around persistence and graduation rates (Astin, 1993 and 1999; Bean & Metzner, 1985; Bebergal, 2003; Eimers & Pike, 1997; Pascarella & Terenzini, 2005; Tinto, 1975 & 1987). Retention and graduation in STEM disciplines has received the greatest attention as completion rates in these areas are often lower than in other academic areas of study (Chen, 2013).

Low pass rates in gateway STEM courses, specifically chemistry, can lead to attrition or prevent students from progressing within

their major (Stone, et al., 2018). This limits their ability to pursue advanced degrees and careers in medicine, research, and other vital scientific areas. The problem is exacerbated for students from historically underrepresented populations (Barbera, et al., 2020; Freeman, et al., 2015; Graham, et al., 2013; Rennar-Potacco, 2019). Academic support programs have been developed to assist students in improving content understanding and course pass rates with positive results (Arendale, 2001; Grillo & Leist, 2013; Skoglund, et al., 2018). While students utilizing peer-led programs such as tutoring and Supplemental Instruction (SI) show increased learning and course outcomes, these interventions impact students outside of the classroom, which limits the effect for students who do not or are not able to attend (Rennar-Potacco, 2019). The researchers in this study identified a more equitable intervention that impacts all students in the course through a curricular peer-led model. The study was designed to investigate the effect of exposure to the LA program on student learning, student success, and equity in a large lecture Chemistry course at Florida Atlantic University (FAU).

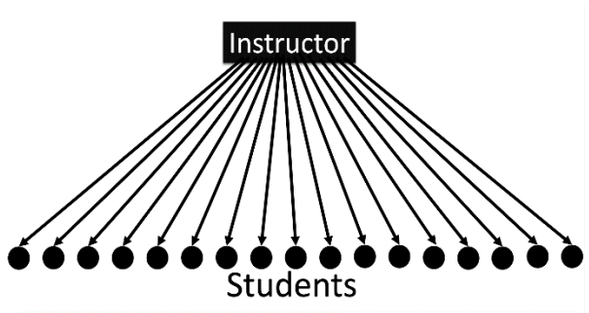
The Learning Assistant (LA) Model

The Learning Assistant (LA) program is an evidence-based model of embedded academic support that assists faculty in redesigning their courses to incorporate many of the best practices in teaching (Barrasso & Spilios, 2021). Undergraduate LAs, trained

through a pedagogy course, work with faculty (both during class and in weekly prep sessions) to facilitate active learning and collaborative group work for all students in the course. Research shows that ideally, collaborative learning group size ranges from three to six students (Burke, 2011). In the LA model, students are grouped together as a semester-long learning team, allowing them to immediately apply concepts learned in class. The LAs and instructor move among the groups to help with the learning process as students identify and fill in gaps in knowledge related to course content. As a result, students within the course become responsible for their own learning as they engage the content with peers.

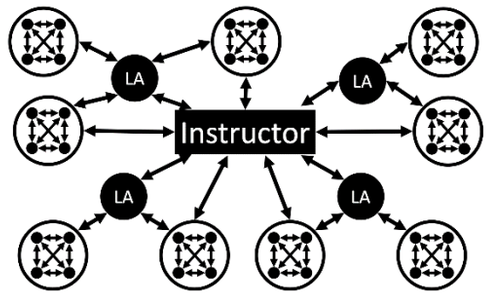
The LA model is adaptable and can evolve to meet the vision of faculty and needs of students in any college classroom environment. In traditional large lecture classrooms, the communication between students is limited and much of the faculty interaction is one-way (Figure 1). It is challenging for the students to be connected to both the faculty member and the course content, which can lead to attrition from the course, the discipline, and even the institution.

Figure 1
Traditional Lecture Course (Image from Learning Assistant Alliance, 2018)



In the LA model, the student-centered redesign (Figure 2) encourages communication between students, and curricular involvement by everyone in the course. This engagement leads to feelings of belonging and support, which can increase course completion as well as persistence within the major and institution.

Figure 2
Course with LA Model (Image from Learning Assistant Alliance, 2018)



Purpose of the Study

The purpose of this study was to investigate the effect of exposure to the LA program on student learning and student success in a large lecture Chemistry course at Florida Atlantic University (FAU). The research questions guiding this study were:

1. Does use of the LA model correlate with student learning and success in a large lecture chemistry course?
2. Does use of the LA model correlate with equity in the classroom resulting in stronger student outcomes for historically underrepresented groups?
3. Does the LA model correlate with continuing student enrollment at the institution overall and into subsequent chemistry courses?

The first research question involved a quantitative analysis of exam outcomes between students in LA and non-LA sections along with comparison of course outcomes based on grade and overall pass rates. The second research question focused on a quantitative analysis of course grades as it related to demographic background including race, gender, and first-generation college status. The final research question measured continuation both at the institution and in the Chemistry course sequence following participation in a course supported with the LA model.

Literature Review

Beginning in 2001 at the University of Colorado, Boulder, over 100 LA Programs have now been implemented worldwide. National research studies have shown the wide impact of these programs on learning gains, DFW rates, retention rates, and effects on underrepresented students (Barrasso & Spilios, 2021).

Increases in learning gains for students in LA courses have been described across the literature (Miller et al., 2013; Otero et al., 2006; Otero & Finkelstein, 2010; and Otero, 2015). Herrera & Van Dusen (2018) found that students in LA classes had learning gains 1.6 times greater than in traditional courses, and that coupling LA support with collaborative learning is correlated with higher learning gains than collaborative learning alone. LA usage is associated with improved concept inventory scores (White et al., 2016) and students in LA-supported courses perform better on exam questions requiring higher order cognitive skills (Sellami et al., 2017). The research by Sellami (2017) found that the learning gains were even more pronounced for underrepresented minority students in LA courses as compared to courses without LAs.

With increases in learning gains, it is not surprising that research has shown DFW rates (percent of enrolled students who earn grades of D, F, or withdraw) improve in LA supported courses (Alzen, et. al, 2017; Alzen, et. al, 2018), with even greater improvements for students of color (Van Dusen et al., 2015; Van

Dusen et al., 2016; Van Dusen & Nissen, 2019). Additional studies have shown a greater decrease in course failure among nonwhite and first-generation students as compared with majority groups when the LA program is implemented (Alzen, et. al, 2018). The program has been shown to mitigate disparities in the achievement of students based on gender and ethnicity, which leads to increases in equity and a reversal of traditional learning gaps for minoritized students. Additionally, it can reduce barriers to individual advancement in their degree program and provide students of all backgrounds with equal opportunities, (Adelmann et al., 2021).

Research has also shown that the LA program has a positive impact on retention (McQuade et al., 2020). A recent study showed students enrolled in an LA course in year one have a 3% increase in retention to year two over students not exposed to the LA program in their first year. This increase grows to 4% for students one standard deviation below the average high school GPA (Alzen & Otero, 2021). Attrition often occurs due to lack of connection in the classroom. This is largely prevalent in high enrollment courses. These large lectures, often utilized to teach gateway courses, appear at first glance to be cost-effective. However, high student-to-faculty ratio leads to high failure rates, which can result in students switching majors or leaving the institution (Crisp et al., 2009). The addition of LAs increases the ratio of support and can negate this trend.

Background Information

About FAU

The pilot program described in this study took place at Florida Atlantic University (FAU). FAU was founded in 1961 as the fifth public university in the state. Serving more than 30,000 undergraduate and graduate students across ten academic colleges, the University ranks as the most ethnically and culturally diverse in Florida's State University System. In 2017, FAU received federal designation as a Hispanic- Serving Institution (HSI) with over 25% of full-time undergraduate students being of Hispanic descent.

About Chemistry at FAU

The Department of Chemistry & Biochemistry in the Charles E. Schmidt College of Science at FAU offers a variety of undergraduate and graduate programs (FAU Chemistry department website http://chemistry.fau.edu/). Key service courses within the department enroll over 5,300 students annually. The average annual enrollment in these courses (fall, spring, summer) are: General Chemistry I (1900), General Chemistry II (1200), Organic Chemistry (1400), and Organic Chemistry II (900). The DFW rates are traditionally high in these courses. While the DFW rate for the course in the pilot study (Chemistry II) is not as high as other science courses at the institution, the three-year average DFW rate prior to spring 2020 was 22.68%, with 723 of the 3,188 students

enrolled during that period failing to complete the course with a passing grade.

Within the Chemistry department, peer-led team learning has been provided through "Chem bonding" and "Orgo bonding" models to support students in Chemistry I and Organic Chemistry I. Additional academic support is provided through trained peer tutors and Supplemental Instruction (SI) Leaders by the Center for Teaching and Learning. Student participation in academic support has historically been strong for General Chemistry. In the spring term before the pilot (spring 2019), 399 unique students had 2,321 visits for Chemistry II tutoring (n=291) and SI (n=2,030). This has established a culture of student engagement with academic resources and peer-based support in chemistry at FAU.

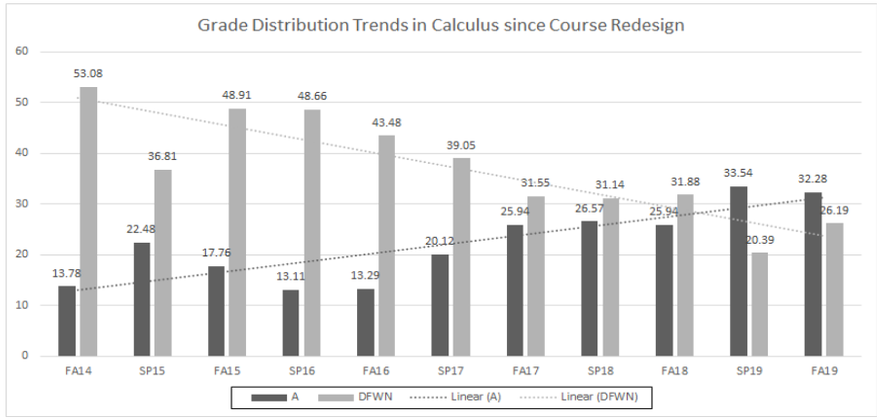
About the LA Program at FAU

In 2014, Florida Atlantic University staff began the process of transforming the curriculum in Calculus I to implement the LA model. The LA program in Calculus has led to significant decreases in DFW rates, with the average rate in Calculus I cut in half over the past four years. Prior to the implementation of the LA model, the DFW rate averaged 48-56% each semester. In 2018-2019, the DFW rate dropped to 21-28%. Findings showed that students in FAU LA courses (Calculus I and later, Calculus II) earn higher grades across all levels of high school preparation with the effect most pronounced for students entering with lower high school GPAs.

The DFW rates in Calculus I declined while the number of students earning an A increased (Figure 3).

Figure 1

Students in Calculus courses with LAs have higher % of A's and lower DFW rates



Beyond grades, a diverse group of students commented on how the LA model helped them truly learn Calculus:

(Sophie, Calculus I student) Instead of directly guiding me to the right answers or reassuring me when I had no idea what I was doing… [the LAs] would ask me what I think the first step is and why. If it was incorrect, they wouldn't tell me but would ask why… or is there a better step that can be taken. Eventually, I became better at using deductive reasoning and problem solving…by asking myself the same questions on my own.

(Leon, Calculus I student) I have taken several courses with, and without, [LAs]. It is only when a learning assistant is

present that I feel most confident in my success within that course. With a learning assistant present, I can seek help from a student who successfully passed the course.

(William, Calculus I and II student) With an LA helping you as you learn, they can call you out on your mistakes as soon as they happen. Not only is this a phenomenal advantage because it helps ease the frustration of not knowing why you are having trouble, but it makes it almost impossible for bad habits to take root.

(Abigail, non-traditional FAU student in Calculus II) Any time my group was stuck on a problem, we called the LA to guide us back towards the solution. Unlike tutoring, where there is a time gap between lecture, homework, and a session, the LAs were a few steps away.

(Olivia, Calculus I student) Sometimes I felt that I had a stupid question where I was completely embarrassed to ask the professor… In those times, I would go into the breakout room with some of my classmates and finally felt comfortable asking our LA, since they are also a student… If I hadn't asked those questions, I can't say with confidence that I would have passed that course.

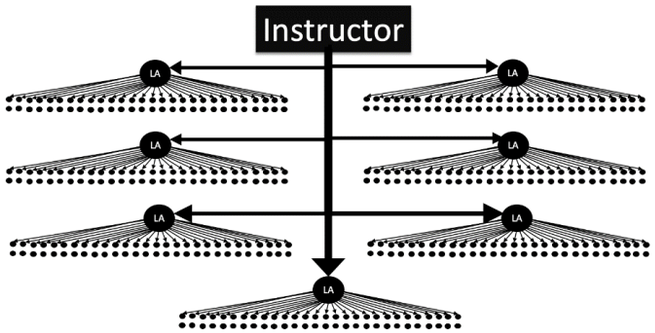
Description of the Pilot

Based on national outcomes and outcomes seen in Calculus at FAU, General Chemistry II was redesigned by faculty to include the

LA model and piloted in spring 2020. The LA program was introduced into one of two sections of this STEM gateway course, with the intent to assess the relationship between LA exposure and student performance in a high enrollment science course at FAU. During the registration period for the term, students randomly selected one of the two Chemistry sections based on section day/time and availability. Both sections were taught by the same instructor and students were unaware which section contained the LA model.

In the pilot section, seven LAs were present in the large auditorium and were assigned to designated zones within the classroom to support the 275 enrolled students. While specific groups were not assigned, each LA was responsible for working with approximately 40 students. Multiple-choice questions were asked throughout the lecture, and students were encouraged to discuss the questions with three or four nearby students and respond using I-clickers®. The LA role was to assist students in their zone during these collaborative activities by asking questions to elicit student thinking and promoting engagement and shared understanding of concepts. (Figure 4)

Figure 2
Pilot of LA in General Chemistry – class format



In the control section, LAs were not included, but other variables remained the same: instructor, content, format, and grading scale. The results from the control cohort were compared against historical institutional data results of the same course taught the previous academic year in the same format. The researchers investigated the effect of exposure to the LA program in the class by comparing the results of the first two exams in the pilot and control sections. The pilot was suspended after the first eight weeks of the semester when the move to remote instruction due to the COVID-19 pandemic occurred. Since LA support in-person was no longer possible, and the introduction of online LAs would have changed the design of the study, the decision was made to remove the LA component from the course. Although the program was only included in the first eight weeks, the researchers analyzed whether there was an impact on final course outcomes, retention to the next semester, and enrollment in Organic Chemistry.

Methodology

This study was conducted by evaluating historical data from General Chemistry II during the spring 2019 and 2020 semesters. This lower-division course is traditionally taken in the spring semester by first year students to fulfill a major requirement for baccalaureate degree programs in biology, chemistry, physics, and psychology. The focus of the study was to quantitatively correlate the use of the LA model with changes in student success rates (DFW rates, grade distribution, and institutional retention) and to compare instruction with and without the model by using an experimental/quasi experimental research design. Students were classified into two groups: LA participant or non-participant. Demographic data was provided by the institutional research department on campus. Statistical tools, including t-test, mean, and standard deviation, were used to measure group differences and statistical significance of the outcome data.

Description of Participants

In spring 2020, 565 students enrolled across two sections of General Chemistry II. This was divided into 275 students in the LA section and 290 in the non-LA section. Student demographics between the two groups were similar (Table 1), with 72.4% of students in each section classified as female and 28-29% of students identifying as Hispanic. The LA section had 21.1% of students

identified as Black compared to 19.3% in the non-LA section. The outcomes were also compared to the spring 2019 Chemistry II students as a control. The two sections in the control semester had 580 total students (compared to 565 in spring 2020) with similar demographics (70.5% female; 19.5% Black; 29.7% Hispanic).

Table 1
General Chemistry II Demographic Descriptors Spring 2019 and 2020

	Spring 2019	Spring 2020 Control (no LAs)	Spring 2020 Pilot (with LAs)
CHM 2046 Enrollment	580 total	565 total (290)	565 total (275)
Female	70.5% (409)	72.4% (210)	72.4% (199)
Black	19.5% (113)	19.3% (56)	21.1% (58)
Hispanic	29.7% (172)	29% (84)	28.4% (78)

Description of Study Design

The sections evaluated in this study were taught in the same classroom with similar enrollment sizes and demographic breakdown (see Table 1). The instructor, curriculum, and mode of instruction were the same, allowing comparison of outcomes between experimental and control sections. The only difference was the presence or absence of the Learning Assistants in the classroom.

To investigate the first research question, average grades on Exam I and II for students in the LA section were compared to students in the non-LA section. Exam means and standard deviations were calculated using Microsoft Excel. To control for a potential difference in outcomes based on time of day of the course section, exam scores from the 2020 sections were compared to the

exam scores from the 2019 sections which were taught at the same day and times. Similarly, final course grades and overall pass rates were analyzed and compared between the two groups. To address the second research question, analysis of outcomes was conducted based on race, gender, and first-generation college status. To examine the third research question, retention to the next term and enrollment in subsequent Chemistry courses were measured to investigate the long-term impacts of the LA program.

Findings

Due to COVID-19, the Chemistry course moved from in-person to online instruction halfway through the semester. Based on this change, the LA model was only utilized in the first eight weeks of the sixteen-week term. Despite this limitation, outcomes for students in the LA section mirrored the positive outcomes described in the literature. Students in the LA section of the course demonstrated greater competency as they earned higher average scores on each of the first two exams (3.84 and 4.08 points higher respectively) as compared to students in the non-LA section (Tables 2 and 3). These results were statistically significant ($p<.01$). The scores were also compared to exam results from the previous academic year, before the addition of the LA model. These scores from spring 2019 aligned with the spring 2020 exam scores for the non-LA section. As the 2019 sections were taught by the same

instructor, in the same classroom, and at the same time of day as the 2020 sections, it further demonstrates the likelihood that the difference in outcomes was due to the inclusion of LAs in the course. It is unlikely that there were other mitigating factors that could explain the difference in student outcomes between the control and LA groups.

Table 2
Chemistry II Exam 1 Grade Analysis

Spring 2020 General Chemistry II Exam 1 Grade Analysis	LA Section	Non-LA Section
Mean	68.20455	64.35563
Variance	201.3344	214.6681
Standard Deviation	14.18923634	14.65155728
Observations	264	284
df	545	
t Stat	-3.12342	
P(T<=t) two-tail	0.001883	
t Critical two-tail	1.964326	

Table 3
Chemistry II Exam 2 Grade Analysis

Spring 2020 General Chemistry II Exam 2 Grade Analysis	LA Section	Non-LA Section
Mean	66.27376	62.19485
Variance	198.1996	211.2645
Standard Deviation	14.07833713	14.53493981
Observations	263	272
df	533	
t Stat	3.297262	
P(T<=t) two-tail	0.001041	
t Critical two-tail	1.964425	

Students in the LA section passed the course with a grade of C or better at a 3.7% higher rate than in the non-LA section (Table 4), with students in the LA section earning A's at a significantly higher rate (41.5% as compared to 30.3% for the non-LA section). This 11.1% difference in A's (Figure 5) continues to show the increased capacity building provided through the LA model. Although the LAs were only included in the course during the first eight weeks of the semester, final course outcomes were significantly higher for the LA section (Table 5) by over 5% ($p<.001$).

Table 4
Student Pass rates Spring 2020 in LA as compared to non-LA section

	SPRING 2020 CHM 2046-001 With LA		SPRING 2020 CHM 2046-002 Without LA		Change
	Count	%	Count	%	
Passing (A,B,C,P)	254	92.4%	257	88.6%	**3.7%**
Not Passing (D,F,W)	21	7.6%	33	11.4%	
	275	100.0%	290	100.0%	

Figure 3
Grade distribution in Chemistry pilot

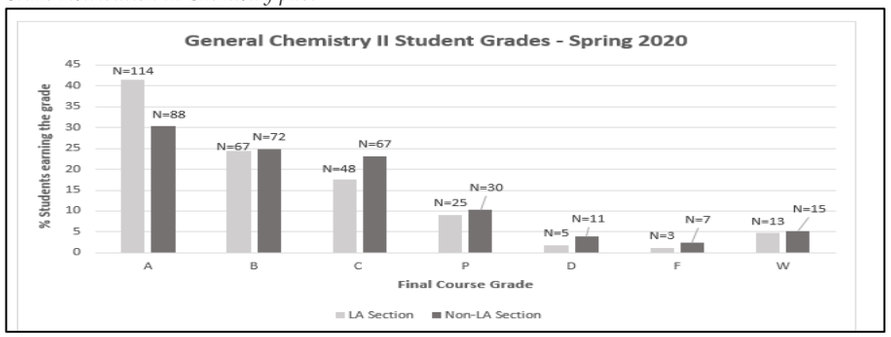


Table 5
Final course outcomes – Chemistry II Spring 2020

	LA Section	Non-LA Section
Mean	81.10479	76.09091
Standard Deviation	14.4878	16.00253
Variance	209.8962	256.081
Observations	263	276
df	536	
t Stat	3.816496	
P(T<=t) one-tail	7.56E-05	
t Critical one-tail	1.647701	
P(T<=t) two-tail	0.000151	
t Critical two-tail	1.9644	

Course Outcomes Based on Race, Gender, Ethnicity and First-Generation College Status

A number of factors impact student success in a course. Often, students who are historically underrepresented in a discipline struggle to find success. As described in the literature review, research has found that while all students benefit from the LA model, students from these underrepresented backgrounds often have greater positive gains as compared to majority students. This was found to hold in the pilot.

Black students passed the LA section of the course at 91.38% as compared to the non-LA section where Black students passed at a rate of 85.71%. This provided a greater than 5.5% higher passing rate for these students if they took the course with the LA model. Additionally, this group had a higher chance to earn a course grade of A (36.2%) as compared to those Black students who took the course without LAs (19.64%). The non-LA Black students who

passed were most likely to earn a final course grade of C (35.71%) as compared to only 20.7% of the Black students in the LA section who earned a C. (Table 6)

Table 6
Outcomes for Black Students

Spring 2020 General Chemistry II Outcomes for Black Students	LA Section	Non-LA Section
Final Course Grade	*% earning grade*	
A	36.20%	19.64%
B	24.10%	25.00%
C	20.70%	35.71%
P	10.34%	5.36%
TOTAL Pass (A, B, C, P)	91.38%	85.71%
D	3.44%	3.57%
F	0.00%	3.57%
W	5.17%	7.14%
TOTAL non-Pass (D, F, W)	8.62%	14.29%

Students who identify as Caucasian saw the benefit of the LA model on their course grades as white students in the LA section earned A's at a 13.24% higher rate (44.21% to 30.97%). While the overall course pass rates were equivalent between the LA and non-LA groups for white students, the students in the LA sections performed significantly better overall as measured by course grades (Table 7).

Table 7
Outcomes for White Identifying Students

Spring 2020 General Chemistry II Outcomes for White Students	LA Section	Non-LA Section
Final Course Grade	***% earning grade***	
A	44.21%	30.97%
B	24.21%	23.01%
C	16.84%	26.55%
P	8.42%	14.16%
TOTAL Pass (A, B, C, P)	93.68%	94.69%
D	1.05%	2.65%
F	2.10%	0.88%
W	3.16%	1.77%
TOTAL non-Pass (D, F, W)	6.32%	5.31%

As a Hispanic Serving Institution (HSI), outcomes for Hispanic identifying students are an institutional priority. Hispanic students in the LA pilot passed the course (89.74%) at an 8.79% higher rate than those not in the LA section (80.95%) (Table 8).

Table 8
Outcomes for Hispanic Identifying Students

Spring 2020 General Chemistry II Outcomes for Hispanic Students	LA Section	Non-LA Section
Final Course Grade	***% earning grade***	
A	28.20%	30.95%
B	30.77%	28.57%
C	24.36%	14.29%
P	6.41%	7.14%
TOTAL Pass (A, B, C, P)	89.74%	80.95%
D	1.28%	7.14%
F	1.28%	3.57%
W	7.69%	8.33%
TOTAL non-Pass (D, F, W)	10.26%	19.05%

While prior studies have shown that the LA model has a strong positive impact on first-generation students (Alzen, et. al, 2018), the pilot in this study did not show a difference in outcomes for first-generation college students (N=120). Both the LA and non-LA sections showed a pass rate of 88.33% for this population. Within

this study, the institutional classification for first-generation college students was used, which is that neither of the student's parents completed college (Table 9).

Table 9
Outcomes for First-Generation College Students

Spring 2020 General Chemistry II Outcomes for First-Generation College Students	LA Section	Non-LA Section
Final Course Grade	***% earning grade***	
A	25.00%	30.00%
B	36.67%	26.67%
C	21.67%	25.00%
P	5.00%	6.67%
TOTAL Pass (A, B, C, P)	88.33%	88.33%
D	1.67%	3.33%
F	0.00%	3.33%
W	10.00%	5.00%
TOTAL non-Pass (D, F, W)	11.67%	11.67%

In terms of gender, women are often underrepresented in chemistry (Stockard, et al., 2021). The pilot showed only a modest difference in pass rates for women (91.96% to 89.05%) between the sections. The data did however show a higher percentage of women earning As in the LA section (39.70%) as compared to the non-LA section (30.48%) (Table 10).

Table 10
Outcomes for Female Student

Spring 2020 General Chemistry II Outcomes for Female Students	LA Section	Non-LA Section
Final Course Grade	*% earning grade*	
A	39.70%	30.48%
B	24.62%	24.76%
C	18.09%	23.33%
P	9.55%	10.48%
TOTAL Pass (A, B, C, P)	91.96%	89.05%
D	2.51%	4.76%
F	0.00%	1.90%
W	5.53%	4.29%
TOTAL non-Pass (D, F, W)	8.04%	10.95%

Enrollment in Organic Chemistry

Students who complete General Chemistry II often enroll in the next course in the chemistry sequence, Organic Chemistry. The researchers examined whether participation in the LA model in Chemistry II led to increased likelihood of the student enrolling in the subsequent course within one year. In the LA pilot, students who took General Chemistry II with LAs enrolled in Organic Chemistry I within one year at a rate of 61.8%. This is compared to only 53.1% for students who took the General Chemistry II course that semester without the LA model; (Table 11) a difference of 8.7%.

Table 11
Enrollment in Organic Chemistry

	SPRING 2020 CHM 2046-001 With LA Enrolled in CHM 2210 within 1 year			SPRING 2020 CHM 2046-002 Without LA Enrolled in CHM 2210 within 1 year			Change
	Count	%			Count	%	
Enrolled	170	61.8%		Enrolled	154	53.1%	8.7%
Not Enrolled	105	38.2%		Not Enrolled	136	46.9%	
	275	100.0%			290	100.0%	

Retention to the University

Research has shown that students who take courses within the LA program have increases in retention rates (McQuade et al., 2020). This held true through the pilot. Students who took General Chemistry II with LAs in spring 2020 were retained to the fall semester at a 92% rate. Retention for the non-LA Chemistry II students was only 86.9% (Table 12). This 5.1% higher retention rate for the LA students exceeds previously published data.

Table 12
Retention at the University for LA as compared to non-LA participants

	SPRING 2020 CHM 2046-001 With LA Retention - Enrolled FALL 2020			SPRING 2020 CHM 2046-002 Without LA Retention - Enrolled FALL 2020			Change
	Count	%			Count	%	
Enrolled	253	92.0%		Enrolled	252	86.9%	5.1%
Not Enrolled	22	8.0%		Not Enrolled	38	13.1%	
	275	100.0%			290	100.0%	

Qualitative Results

A student perception of teaching survey administered at the end of the semester highlighted the positive feelings that students had about the pilot program. In response to the question "What did you

like most about this course," students specifically identified the assistance of the LAs:

- I really appreciated the Learning Assistants.
- The LAs were so helpful in every way… I would like to thank each and every one of them for such a great job this semester.
- The interactive iclicker questions that allowed group work
- Learning assistants and group iclickers
- I liked the lectures before quarantine. Having learning assistants around for the i-clicker questions was such a big help. There were times when I couldn't understand what the question was asking, and the learning assistants were able to help.
- I like how helpful the LAs were, especially during lecture before the stay-at-home orders.
- I enjoyed having the LAs in class. It can be intimidating to ask questions in front of a 200-person lecture, so I liked that I was able to ask an LA about things I didn't fully understand.
- The LAs were very helpful and they helped guide us through all the steps of a problem.

Discussion

Why General Chemistry II was Selected

This paper describes an adaptation of the LA Program to General Chemistry II during the first eight weeks of a sixteen-week semester and its effects on student success. This course was selected for the pilot based on a variety of factors. In addition to the culture of peer-led support established for Chemistry courses and the high number of students earning a DFW in Chemistry II as described previously, the course was also selected based on its role as a gateway course into several majors. Student failure to complete the course with a passing grade could inhibit their progression in a variety of STEM areas. A higher percent of students earning A's in the course could impact student completion of degree programs, continuation of scholarships, and matriculation into graduate and professional programs. Based on the success of the LA model in Calculus at FAU which cut the DFW rate in half and increased the percentage of students earning final course grades of A as compared to C, the decision was made to implement the LA model to improve pass rates and major completion. Chemistry II student success can also have an impact on institutional metrics which affect state funding. Finally, instructor interest was a primary motivation for selecting this course for the pilot. The faculty member attended the LA International Workshop in Boulder, Colorado in October 2019 and

felt that the model was a good fit for his course. He was willing to put in the effort to transform the course and implement the model within a short timeframe, maintain the control group, and assess outcomes from the pilot.

LA Model Impact on Student Learning and Success in a Large Lecture Chemistry Course

Evaluation of data from the two exams given during the first half of the spring 2020 semester indicated that students with LA support significantly outperformed students without LA support by approximately four points on average. Even though the program was suspended after eight weeks, review of student records in the LA section indicated that students with LA support completed the course with a grade of C or better at a 3.7% higher rate compared to students without LA support. Final course outcomes were significantly higher for the LA section by over 5%. The magnitude of the reported change in final grade is large enough to be the difference between a passing grade of C and a C-, as the latter could result in graduation delays and attrition from the institution or major. These results can have implications for outcomes in future chemistry courses, overall GPA, continuation of scholarships, and acceptance to graduate and professional programs. While existing literature (Herrera & Van Dusen, 2018) describes a positive relationship between cooperative learning and student success, the results from this study highlight the effect of LAs in the classroom

as more beneficial than simple cooperative learning alone. The LA impact translated to course success even in this shortened period. Therefore, the use of this pedagogical tool is highly recommended. While the results of this study are correlational, the researchers suggest there can be causational relationship between the LA model and student outcomes as controls were included in the study. Further investigations should review the effect of the LA model on specific course content, impact on students' higher-order cognitive skills, and evaluation of student perception of their learning gains.

LA Model Impact on Equity in the Classroom and Outcomes for Historically Underrepresented Groups

This report also evaluated the effects of the intervention in course outcomes based on student demographic data. Students that identified as Black in the LA section had a 5% higher passing rate compared to Black identifying students not supported by the model. Specifically, Black students were more likely to obtain A's and fewer C's if they participated in the LA-supported section. The implications from these results are far-reaching, affecting students long-term GPA, retention, financial aid, and post-graduation outcomes. Students who identify as Hispanic or Caucasian also saw the benefit of the LA model on their course grades, and women in the LA supported section had a 10% higher rate of earning A's compared to women in the control course.

These positive impacts on underrepresented populations in chemistry and the sciences can have long-lasting effects on the continuation of people identifying as female, Black and Hispanic into key science fields, including scientific research, medical and professional careers, and the teaching of science. While many diverse students at the pilot institution take chemistry courses from faculty who may not identify with the same gender, race, or ethnicity, students are exposed to near peers with demonstrated success in the chemistry curriculum who may look more like they do. This results in feelings of inclusivity and the belief that someone "like them" can do it, so they can too. The idea, "if I see it, I can be it" can promote their continuation and confidence in pursuing their dreams.

LA Model Effect on Continuing Student Enrollment at the Institution Overall and into Subsequent Chemistry Courses

This study measured the impact of the LA program on student retention to the subsequent term. The researchers found that students in the LA section continued to the fall semester at a 5.1% higher rate than students in the section without LAs. While there is a significant cost to the LA model, these data illustrate the potential Return on Investment (ROI) for an institution. Implementation of the LA model in this course cost the institution approximately $21,000 for the term. While direct causation is not implied, sixteen additional students were retained in the section of the course with

the LAs as compared to the non-LA section. For each student who enrolls for another year, the University saves $3,994.80 in tuition (excluding fees) based on 2020 figures (Adelmann, et. al., 2021). If six of those students were retained because of this initiative, the institution would see positive revenue benefits and increases in state performance funding. Additionally, retention is key in helping students meet their personal and professional goals.

The study also reviewed the longitudinal effect of the intervention by evaluating the percent of the students that subsequently registered in Organic Chemistry. Based on the distribution of student majors, most students in this pilot were expected to register in organic chemistry within a year. Effectively, 61.8% of the students in the LA-supported course continued in the chemistry sequence, but only 53.1% of the students in the non-LA course did so. Delays in continuation within the chemistry sequence can be detrimental to students' overall completion of many degree programs. It is essential that students develop the content knowledge, skills, and confidence in the General Chemistry courses to be successful across the remainder of the curriculum. The factors that influenced this reduced future enrollment should be further analyzed by evaluating student decision making through a qualitative study. The researchers hypothesized that the clear application of learning and confidence students built by working

with near peers in the LA section, increased the belief in their ability to succeed in the subsequent Organic Chemistry courses.

Limitations of the Study

The findings of this report are limited and preliminary because of the short period of time in which the program was instituted. Although student characteristic variables and grade distribution for them were available, the design of the study did not include student-matched characteristics and exam results to enable factor analysis at this level. Another limitation of this study was the inability to place students in more traditional LA learning teams. Due to quick implementation and the large lecture/auditorium style classroom, it was difficult to intentionally seat students with the same group for each lecture. Students were simply encouraged to work with other students around them as the LAs walked through the lecture hall during active learning sessions. Based on the high enrollment and budget limitations, the ratio of students to LAs was 40:1 with a more ideal ratio ranging between 20-30:1. A final limitation of the study that the researchers found was the impact of COVID-19. Plans had to be altered when the shift to remote learning occurred and it was decided to cease the LA pilot for General Chemistry II halfway through the semester. Because of this, there was limited formalized collection of qualitative data to describe the experience of the students in the LA section as compared to the non-LA section as was originally planned. Due to the move to remote

instruction, only the first two course exams were proctored in person. Therefore, final course grades and outcomes may have been impacted by the change in testing and course structure.

Conclusion

The pilot of the LA program within a large lecture General Chemistry II course at FAU had positive outcomes and warrants the expansion of the model. Results are consistent with research that has been done previously within the LA community. This study added to the growing body of evidence that the model can have strong positive impacts on student learning, increased outcomes in terms of grades and course pass rates, particularly for those from underrepresented backgrounds in chemistry, and increases in persistence for students who take the course with LAs. The pilot demonstrated that LAs add value as compared to simply providing opportunities within the classroom for collaborative and engaged learning. While many LA programs incorporate the model within smaller labs, recitation, and small lecture courses, this study demonstrated the effectiveness of the model in a large lecture class. Additional research to match students in LA and non-LA sections across academic factors that are predictive of success in the course would further add to the literature on this model. As this study was cut short due to COVID-19, future studies can focus on the impact of the model in a large lecture course for a full semester and its

effect across demographics. As the world around us changes and more courses are moving to the use of multiple teaching modalities (synchronous, asynchronous, hybrid in-person/online), future studies on the effect of the LA model across a variety of course structures could be another avenue for investigation.

References

Adelmann, B. J., Bebergal, J. L, & Mireles-James, J. (2021, April 2). Learning Reimagined: Expanding the Learning Assistant (LA) Model across the Curriculum to Transform Teaching through Student-Centered Collaborative Learning. FAU QEP Proposal.Retrieved July 7, 2021, from https://www.fau.edu/provost/qep.php.

Alzen, J. L., Langdon, L., & Otero, V. K. (2017). The Learning Assistant model and DFW rates in introductory physics courses. *Physics Education Research Conference Proceedings*, 36–39. https://doi.org/10.1119/perc.2017.pr.004.

Alzen, J. L., Langdon, L. S., & Otero, V. K. (2018). A logistic regression investigation of the relationship between the Learning Assistant model and failure rates in introductory STEM courses. *International Journal of STEM Education, 5(1)*, 1–12. https://doi.org/10.1186/s40594-018-0152-1.

Alzen, J. L. & Otero, V. K. (2021). *The Learning Assistant model in introductory STEM courses and Year 2 Persistence* [Manuscript in preparation.] School of Education, University of Colorado, Boulder.

Arendale, D. (2001). Supplemental instruction (SI): Review of the research concerning the effectiveness of SI from University of Missouri-Kansas City and other institutions from across the United States. https://files.eric.ed.gov/fulltext/ED457797.pdf.

Astin, A. W. (1993). *What matters in college: Four critical years revisited.* San Francisco: Jossey-Bass.

Astin, A. W. (1999). Student involvement: A developmental theory for higher education. *Journal of College Student Development, 40*(5), 518–537.

Barbera, S. A., Berkshire, S. D., Boronat, C. B., & Kennedy, M. H. (2020). Review of Undergraduate Student Retention and Graduation Since 2010: Patterns, Predictions, and Recommendations for 2020. *Journal of College Student Retention: Research, Theory & Practice, 22*(2), 227–250. https://doi.org/10.1177/1521025117738233.

Barrasso, A.P., & Spilios, K.E. (2021). A scoping review of literature assessing the impact of the learning assistant model. *IJ STEM Ed* 8, 12. https://doi.org/10.1186/s40594-020-00267-8.

Bean, J. P., & Metzner, B. S. (1985). A conceptual model of nontraditional undergraduate student attrition. *Review of Educational Research, 55*, 485–540.

Bebergal, J. L. (2003): Predicting retention of first-year college students. [Doctoral dissertation, Florida Atlantic University].

Burke, A. (2011). Group work: How to use groups effectively. *Journal of Effective Teaching*, 11(2), 87-95.

Chen, X. (2013). STEM Attrition: College Students' Paths Into and Out of STEM Fields (NCES 2014-001). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. https://nces.ed.gov/pubs2014/2014001rev.pdf.

Clark, K., James, A., & Montelle, C. (2014). "We definitely wouldn't be able to solve it all by ourselves, but together…": group synergy in tertiary students' problem-solving practices. *Research in Mathematics Education*, 16(3), 306–323. https://doi.org/10.1080/14794802.2014.950687.

Crisp, G., Nora, A., & Taggart, A. (2009). Student characteristics, pre-college, college, and environmental factors as predictors of majoring in and earning a STEM degree: An analysis of students attending a Hispanic serving institution. *American Educational Research Journal, 46(4)*, 924–942. https://doi.org/10.3102/0002831209349460.

Eimers, M. T., & Pike, G. R. (1997). Minority and nonminority adjustment to college: Differences or similarities? *Research in Higher Education, 38*(1), 77–97.

Freeman, M. L., Martinez, M., & Gonzalez, K. P. (2015). Increasing College Completion for Latino/as in Community Colleges: Leadership and Strategy. *New Directions for Higher Education*, 2015(172), 71–80. https://doi.org/10.1002/he.20154.

Gillies, R. & Ashman, A. (2003). Co-operative learning: The social and intellectual outcomes of learning in groups.

Graham, M. J., Frederick, J., Byars-Winston, A., Hunter, A.-B., & Handelsman, J. (2013). Increasing persistence of college students in STEM. *Science, 341*(6153), 1455–1456. https://doi.org/10.1126/science.1240487.

Grillo, M. C., & Leist, C. W. (2013). 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: Research, Theory & Practice, 15*(3), 387–408. https://doi.org/10.2190/CS.15.3.e.

Herrera, X.C., Nissen, J., & Van Dusen, B. (2018). Student outcomes across collaborative-learning environments. *Physics Education Research Conference Proceedings,* 2018, 1–4. https://doi.org/10.1119/perc.2018.

Johnson, D. W., & Johnson, R. T. (2009). An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning. Educational Researcher, 38(5), 365–379. https://doi.org/10.3102/0013189X09339057.

MacGregor, J. (1992). Collaborative Learning: Reframing the Classroom. In Collaborative Learning: A Sourcebook for Higher Education (pp. 37–40).

McQuade, A., Nissen, J.M., & Jariwala, M. (2020). Characteristics of institutions with Learning Assistant programs: An equity investigation. *American Association of Physics Teachers*, 2020 PERC Proceedings. https://doi.org/10.1119/perc.2020.pr.McQuade.

Miller, P. M., Carver, J. S., Shinde, A., Ratcliff, B., & Murphy, A. N. (2013). Initial replication results of learning assistants in university physics. AIP Conference Proceedings, 1513, 30–33. https://doi.org/10.1063/1.4789644.

Otero, V., Finkelstein, N., McCray, R., & Pollock, S. (2006). Who is responsible for preparing science teachers? Science, 313(5786), 445–446. https://doi.org/10.1126/science.1129648.

Otero, V., Pollock, S., & Finkelstein, N. (2010). A physics department's role in preparing physics teachers: The Colorado Learning Assistant model. *American Journal of Physics*, 78(11), 1218–1224. https://doi.org/10.1119/1.3471291.

Otero, V. (2015). Recruiting and educating future physics teachers: Case studies and effective practices. In C. Sandifer & E. Brewer (Eds.), Effective Practices in Preservice Teacher Education (pp. 107–116). *American Physical Society*. Accessed 5 March 2021. http://www.phystec.org/webdocs/EffectivePracticesBook.cfm.

Pascarella, E. T., & Terenzini, P. T. (2005). How college affects students: A third decade of research. Jossey-Bass.

Rennar-Potacco, D., Orellana, A., Chen, P., & Salazar, A. (2019). Rethinking Academic Support: Improving the Academic Outcomes of Students in High-Risk STEM Courses With Synchronous Videoconferencing. Journal of College Student Retention: Research, Theory & Practice, 20(4), 455–474. https://doi.org/10.1177/1521025116678854.

Sellami, N., Shaked, S., Laski, F. A., Eagan, K. M., & Sanders, E. R. (2017). Implementation of a Learning Assistant program improves student performance on higher-order assessments. *CBE Life Sciences Education, 16(4)*, 1–10. https://doi.org/10.1187/cbe.16-12-0341.

Skoglund, K., Wall, T. J., & Kiene, D. (2018). Impact of Supplemental Instruction Participation on College Freshman Retention. *The Learning Assistance Review, 23*(1), 115. https://eric.ed.gov/?id=EJ1170114.

Stockard, S., Rohlfing, C. M., & Richmond, G. L. (2021). Equity for women and underrepresented minorities in STEM: Graduate experiences and career plans in chemistry. Proceedings of the National Academy of Sciences Jan 2021, 118(4) e2020508118; https://doi.org/10.1073/pnas.2020508118.

Tinto, V. (1975). Dropout from Higher Education: A theoretical synthesis of recent research. *Review of Educational Research, 45*(1). 89-125.

Tinto, V. (1987). *Leaving College: Rethinking the causes and cures of student attrition.* Chicago: The University of Chicago Press.

Van Dusen, B., Langdon, L., & Otero, V. (2015). Learning Assistant Supported Student Outcomes (LASSO) study initial findings. *Physics Education Research Conference Proceedings*, 343-346. http://dx.doi.org/10.1119/perc.2015.pr.081.

Van Dusen, B., White, J.-S. S., & Roualdes, E. A. (2016). The impact of Learning Assistants on inequities in physics student outcomes. *Physics Education Research Conference Proceedings*, 360–363. http://dx.doi.org/10.1119/perc.2016.pr.085.

Van Dusen, B., & Nissen, J. (2019). Equity in college physics student learning: A critical quantitative intersectionality investigation. *Journal of Research in Science Teaching,* 57. http://dx.doi.org/10.1002/tea.21584.

White, J.-S. S., Van Dusen, B., & Roualdes, E. A. (2016). The impacts of Learning Assistants on student learning of physics. *Physics Education Research Conference Proceedings*, 384–387. https://doi.org/10.1119/perc.2016.pr.091.

Book Review: A Review of *The Rowman & Littlefield Guide to Learning Center Administration*

Joshua Clements
Abraham Baldwin Agricultural College

If you've read *The Rowman & Littlefield Guide for Peer Tutors* (Sanford, 2020), then you may have a preview of what you will find in *The Rowman & Littlefield Guide to Learning Center Administration* (Sanford & Steiner, 2021). While the former is a guide meant for peer tutors, which may also be useful to administrators, the latter is a deeper foray into peer tutoring programs in higher education. One gives us the bones and essence of peer tutoring; the next fleshes out our understanding and the bigger picture.

The first chapter in the *Guide for Learning Center Administration* orients us to the purpose of learning centers: active, collaborative learning. In clear language, Sanford and Steiner articulate that learning centers are "student-led" and "student-serving" while also allowing the student to "do the work of being a student." This grounding encourages administrators to remember their purpose: not to serve faculty or other administrators but to be a voice and advocate for students.

After a brief history and description of various models of learning centers in chapter two, Sanford and Steiner spend chapter three discussing the four main types of peer tutoring, e.g., drop-in labs, individual sessions, workshops, and classroom based. Whichever your facility uses, you may find valuable insights on how to strengthen your program. If you are interested in adding or changing your existing system, you may also find the descriptions offered in the book helpful in making your decision.

The next two chapters are, in my opinion, the meat of the book. Under the headings "Students as Employees" and "Tutor Training," the authors discuss hiring, training, and evaluating our student staff members. Whether you need help with the hiring cycle, interview questions, or faculty referrals, they touch on it. You will also find a section on creating a positive culture and involving tutors as decision-makers in the learning center. In the training segment, the authors recap the tutor training topics that were explained in more detail in the *Guide for Peer Tutors*. Though it is a brief overview, the information carries over to a section about ideas for tutor training.

These two chapters illustrate a shift in thinking about how we see learning centers. The tenor reminded me of an article in *The Learning Assistance Review* from a few years ago. Accordingly, Breslin et al. (2018) suggest a "Students as Colleagues" paradigm, meaning we embrace a mentor/mentee approach in our learning centers. This means working alongside the tutors rather than above

them for the administrator. Seeing our peer tutoring staff as colleagues helps incorporate our tutors into our training, research, and development, among other things. Breslin et al. (2018) argue that it is hard to claim a learner-centered focus "if the students are only at the center of receiving services and not at the center of developing them" (p. 51). Sanford and Steiner embrace and embody this idea in their *Guide for Learning Center Administration*.

The later chapters delve into the essentials of designing your learning center facility, collaborating with other campus resources, and advertising your services to bring the students into the space. We would be remiss if we did not consider the lighting, furniture, and other amenities that add to the overall aesthetic of our facilities and create an inviting ambiance.

The last chapter covers another important but often neglected topic for learning centers: Assessment. Without evaluating our programs, how can we know if our efforts are effective? I often use the phrase, "What gets measured gets changed" to illustrate useful modifications to a program or study. Sanford and Steiner stress a similar sentiment when they affirm that assessment drives areas such as funding, planning, and ultimately change. Whether you are collecting data, analyzing data, or utilizing the data to reach a goal for the center, this guide covers the topic.

For anyone researching peer tutoring or learning centers, the references section of this book is a treasure trove. It is packed with the latest publications and has a few oft-cited gems. I have added several to my collection that I had not found previously.

Overall, I think the *Guide to Learning Center Administration* covers the topic well and offers an up-to-date, well-nuanced insight into the field. If you are new to the profession, consider it a primer to get started. If you have been involved in learning centers for several years, you may find it a welcome refresher to spark new ideas. While I feel that the book could have covered various topics with more depth, I also understand the book's purpose was to offer a map of sorts and guide the field. In that regard, I feel it is largely successful.

References

Breslin, J. D., Kope, M. H., O'Hatnick, J. L., & Sharpe, A. G. (2018). Students as Colleagues: A Paradigm for Understanding Student Leaders in Academic Support. *Learning Assistance Review (TLAR)*, *23*(2).

Sanford, D. R. (2021). *The Rowman & Littlefield Guide for Peer Tutors*. Rowman & Littlefield Publishers.

Sanford, D. R. & Steiner, M. (2020). *The Rowman & Littlefield Guide for Learning Center Administration*. Rowman & Littlefield Publishers.

Best Practices in Educational Technology Implementation in Two-Year Community College Writing Centers

John Findura
New Jersey City University

Abstract

Using a qualitative approach based on grounded theory, this study explored the best practices of educational technology implementation in 2-year community college writing centers utilizing interviews with writing center administrators. Sociocultural development theory, as well as social learning theory, were applied to frame the results. Each participant's responses were coded according to grounded theory using open, axial, and selective coding. Three major themes were discovered which in turn led to the uncovering of five best practices for educational technology implementation in the participants' writing centers that may be broadly applied to 2-year community college writing centers in general.

Best Practices in Educational Technology Implementation in Two-Year Community College Writing Centers

Introduction

Student success is determined in higher education using various metrics in various ways. From graduation rates to employment rates and average annual salary measures for recent grads, each school looks at these metrics differently and makes different internal choices in order to reach their goals. Juszkiewicz (2019), Lerner (2019), and Whaley (2016) all make arguments that at the 2-year community college level, two of the most important metrics are graduation rate and retention. North (1984, 1995) realized almost three decades ago the importance that the writing center plays on exactly these two specific areas and their relationship to writing centers has been underscored in a variety of studies, including Aunkst (2019) and Bielinska-Kwapisz (2015).

Now in the 3rd decade of the 21st century, we are understanding the effects of educational technology on student learning, from K-12 to higher education (Icard, 2014). As more and more technology is being introduced into the classroom, it is also being introduced into other academic support areas often grouped under the label of Learning Assistance Centers, of which one part is the writing center. Lerner (2019) notes that there is little research currently being done on this important aspect of college learning. Lerner (2019) goes on to state that many studies focus only on student outcomes, where

grades are ultimately seen as the last word in student achievement. There is, however, the confidence that is built up in a student which, unfortunately, is much more difficult to gauge. What is even more problematic to express is what the writing center administrator sees in each student, as these administrators are often the ones who watch the growth of a student not just over the course of a single semester, but many times over several years, and it is this subjective view that can lead to the positive implementation of new methods and practices, particularly involving technology, in the writing center.

The Problem

One tool that the writing center often has at its disposal is educational technology in some form. Yet the use of "best practices," while common and often defined in education, even in learning assistance centers from K-12 to 2- and 4-year schools (Zhbanova & Fincher, 2019), the question of best practices in terms of educational technology implementation is rarely studied. Even less understood is the specifics of the 2-year community college writing center, of which there are currently no established best practices for the implementation of educational technology. This study seeks to remedy that by providing a baseline of what those best practices currently are as well as what they should be, by speaking directly to the administrators of writing centers and letting them discuss educational technology implementation in 2-year

community college writing centers themselves from their own points of view and their own experiences.

Relevant Literature

Murphy and Law's (1995, p. 65) statement that "the single most important and most quoted essay in writing center scholarship" is North's (1984) seminal publication "The Idea of a Writing Center" is still as true in 2021 as it was when they first wrote it. Much of the last 35 years' worth of research on writing centers has either hinged on North's (1984) essay or railed against it. North (1984) claims that

> in a writing center the object is to make sure that writers, and not necessarily their texts, are what get changed by instruction. In axiom form it goes like this: Our job is to produce better writers, not better writing (p. 438)

This claim is still a mantra of most, if not all, of those active in the field. One aspect that North did not touch on was technology in writing centers, as at the time of his essay the only real technology in use in college writing centers were pen, paper, and the occasional typewriter. Technology in education, however, has become a game changer, especially during the last two decades. As Secretary of Education Arne Duncan (2012) said in a speech almost a decade ago:

> It's no exaggeration to say that technology is the new platform for learning. Technology isn't an option that schools may or may not choose for their kids. Technological competency is a

> requirement for entry into the global economy—and the faster we embrace it—the more we maintain and secure our economic leadership in the 21st century.

As for the effectiveness of the writing center in general, when studying student success, Vance (2016) found that "No significant difference in retention based on gender, ethnicity, or personality types was revealed—only their use of tutoring showed a difference in the data" (p.41). Vance (2016) also states that "students who went to tutoring were significantly more likely to be retained and have a higher grade-point-average" (p.41) than students who did not attend tutoring. While GPA and retention rates are not alone a singular sign of success, for community colleges, both of those metrics figure prominently into what those institutions consider "success," with a focus specifically on retention rates (Whaley, 2016; Juszkiewicz, 2019).

Davis (2016), Zhbanova and Fincher (2019), as well as Pannoni (2015) all note in their studies that many community college students fall into the category of needing some type of remediation, including developmental classes. They also found that it is this group of students who most frequently utilize learning assistance centers, including writing centers. These findings encourage a deeper look into the practices of these centers to elucidate how they are able to achieve this "success" (Whaley, 2016; Juszkiewicz, 2019).

Herold (2016) writes that the many types of technology currently available to students is not only greater than at any time before, but it allows students to show what they have learned in ways that go beyond the writing of traditional essays. Herold (2016) names a great deal of free software and applications that can assist students in creating new and original ways of producing content to showcase what they have learned, where students who are already familiar with smartphones can turn that smartphone into an almost professional-level video laboratory capable of producing professional-quality presentations, videos, and multimedia performances.

Wilson (2017) writes that technology in all aspects of students' home, work, social, and school lives has now reached the point where it is omnipresent. Wilson (2017) goes on to write that implementing technology in the writing center is important, yet there has been neither a sustained effort to quantify what the best practices in this area are nor what they should be.

Alber (2015) along with Hargreaves and Fullan (2012) use a working definition of "best practices in education" as existing practices that already possess a high level of widely-agreed effectiveness. The issue in the realm of educational technology implementation in 2-year community college writing centers is not that there are no existing practices that are effective, but rather, because of the isolation writing center administrators and staff often

find themselves in from other writing center administrators and staff, due to either geography or the inability to attend specialized conferences, the issue is that no one has yet looked into what the widely-agreed upon effective practices actually are. That specific area is the focus of this study.

Theoretical Framework

This study is based on Vygotsky's (1978) sociocultural development theory, which complements Bandura's (1963) social learning theory, as a broad lens, and is further refined with Charmaz's (2014) take on grounded theory as it attempts to develop a deeper, more objective understanding of what writing center administrators currently understand best practices to be when it comes to educational technology implementation in two-year college writing centers.

Vygotsky (1978) contends that for full cognitive development, and therefore learning, social interaction is required. When individuals learn by interacting it provides a valuable means of instruction that not only the students but the writing tutors working with them can benefit from (Powell & Kalina, 2009). In this type of interaction, learning moves back and forth between parties, not just from instructor-to-learner, creating a more fulfilling experience.

Bandura (1977) wrote that individuals are most likely to adapt to a new model or behavior if they see that the outcomes it produces are what they value. When synthesized with Vygotsky's (1978)

theory, when it comes to education, if a certain behavior shows improved success in students, instructors are more likely to model that behavior than if it does not show improved student success. With these two theories synthesized, the concept of "best practices" can be discerned as a constant modeling of behaviors that have shown success, and when these behaviors no longer show success, they are then moved on from in search of new success-generating behaviors (Vance, 2016).

In order to study these "success-generating behaviors," or "best practices," the population of this study is made up of two-year community college writing center administrators, located predominantly but not exclusively in the northeastern United States, who utilize writing and/or reading assistance software in their centers.

Data Collection

A series of interviews containing open-ended questions were used to elicit the view of 13 2-year community college writing centers administrators on what they perceive as a best practice when it comes to technology in writing centers in general, and their writing center in particular. These interviews allowed for the capture of the open-endedness that Charmaz (2014) recommends when conducting intensive interviewing. All interviews were recorded and transcribed using the Otter.ai software. The answers to all interviews and open-ended questions were then coded using a

three-part coding system (open, axial, and selective) to tease out themes and then analyzed to determine what best practices have emerged from their responses. These interviews were conducted using the Webex conferencing platform.

In writing the findings there are a great number of quotes from the participants. The reasoning for this is based on the "portraiture" work of Sara Lawrence-Lightfoot where allowing the subjects to speak in-depth and incorporating their own words into the research assists in "capturing the complexity, dynamics, and subtlety of human experience" (2020, n.p.). Especially in qualitative research, Lawrence-Lightfoot's model allows using the participants' own narrative to underscore "the balance of structure and improvisation as well as order and creativity" (2020, n.p.). These lengthy quotes help in validating the experiences and ideas of the participants. It also fits into Brown's (2021) concept of "wholehearted living" where she asks "What were their main concerns, and what were the patterns and themes that defined their Wholeheartedness?" (n.p.).

Research Questions

The following are the research questions that this study set out to answer:

Q1: What do Writing Center Administrators perceive as being the best practices in the implementation and use of educational technology in their writing centers?

Q2: How have Writing Center Administrators seen technology as being beneficial to their students at their writing centers, if at all?

Q3: What kinds of future educational technology functionalities would Writing Center Administrators view as the most important for writing center assistance and why?

Participants

The participants in this study were made up of 13 Writing Center Administrators at 2-year community colleges in Connecticut, New Jersey, New York, and Pennsylvania. Each administrator was selected because their location utilized some type of technology in their day-to-day writing center operations. Each participant took part in a 30-45-minute interview guided by 10 questions pre-vetted by experts in the field. Of these experts, two are former Board Officers for national learning assistance organizations as well as 2-year community college learning center administrators with over 35 years of combined experience while the third has worked as a faculty liaison to a 2-year community college Writing Center for the last decade. Each interview was conducted over Webex video conferencing software and then transcribed by Otter.ai. The transcripts were then uploaded to Atlas.ti, where they were then subjected to open, axial, and selective coding. The 13 participants were then randomized and assigned one of the following

pseudonyms: Michael, Carol, Gregory, Marcia, Peter, Janice, Robert, Cynthia, Alice, Oliver, Rachael, Sam, and Brady.

Findings and Interpretations

Following intense interviews and the subsequent reading and coding of their transcripts, themes located within them emerged and scrutiny of those themes has brought answers to the three research questions this study originally set out to find. The intention of these answers is to fill a gap in the knowledge of the best practices of educational technology implementation in 2-year community college writing centers.

Q1: Best Practices in the Implementation and Use of Educational Technology in Writing Centers and the Administrators' Relationship to Them

While there was great variety in the way each participant chose to verbalize their thoughts on what makes the best practices in the implementation and use of educational technology in their writing centers, after close examination and analysis of the interview transcripts, there were five key themes, or best practices, that all 13 participants, in some way, referenced. Those key themes are

1. Assess your technology needs
2. Technology is a tool that does not exist in a vacuum
3. The "human connection" is not only needed, but necessary
4. Practices that apply to face-to-face writing assistance

with a pen and paper also apply to writing assistance that uses technology

5. The more integrated and seamless the technologies are, the easier and more effective it is for all stakeholders.

Assess Your Technology Needs. Like purchasing any product, there can be an overwhelming number of choices when looking at educational technology solutions that can be brought into a writing center. There are countless demos, sales pitch emails, and product names emblazoned on giveaways at every conference relating to writing centers, with each product making promises laid out in pages of data. It is necessary, however, to conduct a needs assessment for your own center before purchasing or leasing hardware or software to make sure that it will effectively address the issues you need it to address. Even though there may be multiple similarities between student populations and needs between different writing centers, every writing center has its own identity and mission and it needs to be recognized that not every technology is "one size fits all." The more specific you can be during your assessment, the more likely you are to end up with a technology that meets the needs of the students and the center as a whole.

Michael, a writing center administrator in the New York City-metropolitan area, gave the example of his center using GoBoard for virtual writing sessions, but found that the actual technology was

loaded with functions that were not necessary to the writing center's mission and instead was a much better fit for math and science tutoring. As Michael stated, "the ideal way for me to do writing tutoring, and I think for others of my colleagues as well, is to just use a screen share." He then noted that there are a great deal of other platforms, such as Zoom, that are much more aligned to the needs of his center and that did not contain functionalities that he found superfluous.

Carol, the writing center administrator of a suburban New York State community college, also provided an interesting example of this where she states:

we did have a smart board at one time (…) but for some reason that was taken away and replaced with a 72-inch screen TV that I can use as a giant monitor to conduct workshops. But I sort of liked the smartboard because you could actually draw on it. I can't put a marker on the television screen. So we have a giant whiteboard next to it. So I'm going back and forth between the two screens.

Introducing a technology without a clear reason or specific need puts the writing enter administrator in the awkward position of having an often expensive piece of hardware or software that, because of the cost of the item and the budget resources of the center, the administrator feels forced to find a use for or else find themselves in the equally unenviable position of explaining why a

particular technology is sitting in the corner unused. As Cynthia, the administrator of a writing center at an urban New Jersey college stated, "when you look past the initial enthusiasm around new technology, and you break it down to actual functionality," the decisions can sometimes make themselves.

Technology is a Tool That Does Not Exist in a Vacuum. The second "best practice," that technology is a tool and it is up to the writing center staff to make sure that tool is used in the most constructive way, was another major practice that quickly emerged. Each participant had at least one example of a tool that they were given access to where the proper support behind it was not included, resulting in a piece of technology that ended up being used without a clear direction on how best, or sometimes even why, to implement it. There are countless technologies that exist that can be implemented into a writing center, but their effectiveness is dependent upon how the writing center uses that particular technology. Simply "throwing" a piece of technology at a problem does not fix anything. Cynthia recounted when her center used a software that provided notice of errors in grammar and/or syntax in student writing, but did not explain the concepts behind it, and instead just provided a correction. That created situations where students now have a grammatically correct paper but do not know why it is now correct nor understand why their original essay

contained errors. Those students, in fact, have not actually learned anything.

Something that is as simple as sharing a Google Doc to allow a writing center tutor to work in real-time with a student on a piece of writing is not reinventing the wheel, but there are some centers that have access to do this, yet for one reason or another, do not employ it even though it could be of great benefit to their student population. This is a tool that, according to those administrators who employ it in their center, see not only a positive reaction from the students but from the tutors as well. As Marcia, the writing center administrator at an New York City-area college stated, "it's a tool and you utilize it as you think about the best way to deliver the experience with the tools at your disposal" before adding that "this is the job and these are just new tools and methods to use to do the job."

The scenario provided by Cynthia can also mean that technology that is not yielding the positive results that it was implemented to achieve may either be employed in a way that does correspond to the results that were expected, or that the technology itself is not a particularly good fit for that writing center. Marcia mentioned utilizing Livescribe smartpens in her center only to find out that while the technology involved was useful, the learning curve to successfully use the technology was so high that it created a barrier to any type of beneficial implementation before adding that

"technology is really meant to be a tool to sort of overcome some kind of obstacle." Gregory, the writing center administrator of a rural New Jersey institute, also brought up this same issue when he stated that, as not only the Writing Center Administrator but a member of the college's Advising and Retention Committee,

> we talk all the time of what are the barriers that we're trying to reduce. So keeping that in mind and figuring out what are kind of the least intimidating tools that we have available in order to get that student buy-in. And sometimes just kind of walking students through it can be helpful.

The act of being "helpful" is a basic function of the writing center (North, 1984).

The "Human Connection" is Not Only Needed, But Necessary. Another refrain from all 13 participants was that, regardless of the technology being used and its effectiveness, there needs to be a human connection involved not only for the students, but for those writing center tutors who work with the students. As Sam, the writing center administrator at an urban New York City college, stated that during the current virtual tutoring taking place due to the COVID-19 pandemic "many of the tutors are just calling our help desk so that they can hear a human voice." Marcia, noted that "the technology needs to allow the practitioner to be able to use the technology in such a way that there is a strong enough sense that the human touch is still there." Cynthia stated that "the most

important thing is it doesn't matter what tool you have, if you don't make an attempt to figure out how best to help someone then it doesn't matter what you have."

All the participants view the tutor as the most important component of any writing assistance experience regardless of how good the technology being used may be. Sam clearly states this when he says

> I'm imaginative when it comes to what kind of technology we could have because I still think that it's about the human interactions for students. And it's about seeing the tutors as role models, you know, as a sign of hope.

The administrator of the writing center at a multi-campus Pennsylvania school, Peter, similarly states that "what I'm learning is that, you know, that human element is so, so important. And I think we take it for granted a lot when we're working face-to-face." He further goes on to note that his current goal is "making things more human and less uncomfortable" for his students. Marcia adds, in regards to having to lean more heavily on technology during the pandemic, that writing center professionals need to "give yourself some latitude, you know, you're gonna make mistakes, the students might be frustrated when they first get going. But, just everybody take a beat and realize that this is unprecedented territory we're in and we're doing a great job at doing things that have never been done before."

Michael also shared many of these same sentiments stating that, when it comes to using remote learning platforms, "Zoom is always preferable because as I said, it's all about having a conversation with students." He also added that "they can get their questions answered that way and work with somebody in person. There's that personal connection." Cynthia plainly stated that "the human connection is definitely essential" before adding that

> I think that that really does kind of encapsulate the whole idea that Ed Tech should be as good or as close of a mirror, a representation, of what a human interaction would look like without a human actually being there. So it shouldn't feel disconnected. It shouldn't feel like you know, "I'm the machine here, a robot here." It's like receiving a call from a robot instead of a live person.

Until that stage of sophistication with educational technology is reached, where Artificial Intelligence can replicate the entirety of the human experience, the human remains the most important part of the solution.

Practices That Apply to Face-To-Face Writing Assistance With a Pen and Paper Also Apply to Writing Assistance That Uses Technology. Cynthia was very engaged with the idea that while technology can be used in a multitude of ways and scenarios, writing center tutors and administrators must still rely on the basic tenets of one-on-one tutoring assistance whether or not technology

is being employed. She articulates this as "the most important thing is it doesn't matter what tool you have, if you don't make an attempt to figure out how best to help someone, that's it, it doesn't matter what tool you have." Just as in traditional technology-free interactions, Cynthia feels that "I think the best practice would be part of the philosophy of meeting the students where they are, wherever, wherever they are, and what they bring to the table, (…) how to foster this, how to address areas [of need]," which is the overarching philosophy of technology-free writing assistance.

Oliver, the writing center supervisor at a large Pennsylvanian college, recalled a meeting with his writing center staff where he communicated to them to

> remember the same practices you did in the center, (…) you still need to question, not just give the answer, you still need to give the students time to think and to talk and to work. So, mostly reinforcing that what they're doing now, as much as possible, is what they did in the center.

Michael shared a very similar take, stating "pretty much everything that applies to in-person tutoring is going to apply to virtual tutoring as well." From simple courtesies, such as being on-time for appointments, to actively listening during a session and reflecting back to the students, regardless of the method as assistance, these things are still a vital part of the interaction between student and writing center tutor. They add comfort to a

situation that many students are uncomfortable to begin with: that of admitting they need help, and then actually asking for it.

While many of the participants spoke specifically about virtual tutoring due to the COVID-19 pandemic, they also realized that these same approaches are important in in-person sessions where technology is being used. All participants reiterated that it is the writing tutor that is ultimately responsible for ensuring that their students understand the technology that they are using. Almost all of the participants spoke of how one of the most valuable things their writing tutors can do is to make the student feel comfortable with the technology that they are working with, be it the schools' LMS, sharing a Google Doc, or even being able to properly save an essay to the correct location so that they have access to it at a later time.

The More Integrated and Seamless The Technologies Are, The Easier and More Effective It Is For All Stakeholders. One of the biggest concerns of all 13 participants was that a great deal of the technology they currently utilize do not interact with other technologies they use. A writing center that uses TutorTrac as its scheduling, tracking, and reporting software can seamlessly integrate into Ellucian's Colleague software, which many schools use to centralize student information. TutorTrac can then pull student information from Colleague to populate student contact information and schedules. Likewise, the Canvas LMS integrates

well with Google Suite, which not only makes scheduling appointments easier, but it allows links to writing center services being placed directly in the course shell. Some participants referenced their school using a student management software that did not integrate with their writing center scheduling, tracking, and reporting software, leading to myriad issues with meeting the student's needs.

Michael has found that, given the choice, students gravitate towards the technology that they find the easiest to use. There is already a certain level of stress involved with taking classes and then another level of stress when it comes to realizing you need assistance and then asking for it. Unfamiliarity with specialized software that operates under a different set of commands than what the students are familiar with can be one stressor too many and result in students avoiding not just that technology, but the writing center as a whole. Marcia used the phrase "ease and flow" when describing what she felt was most effective in a writing center technology while suburban New Jersey located Janice used the words "more seamless" in describing her hopes for future technology.

All participants agreed that one of the most important missions of the writing center is the removal of barriers for students, and sometimes those barriers come in the form of things that are actually trying to help the student, such as new technologies. This

also is reflected in Marcia's earlier comments about the Livescribe smartpen which, technically, did what it promised to do, but was so difficult to become comfortable with that it ultimately became a barrier itself.

Q2: Benefits of Technology to Students in Writing Centers

All 13 participants stated that, in some way, they see technology as being beneficial to the students who use their writing centers. Even those who favor a writing tutor physically sitting across the desk from a student going over their essay on a piece of paper with a pen recognize that technology is a useful and necessary tool, especially looking towards the not-so-distant future. Even those who state they are not as "tech-savvy" as their colleagues or even their own students see that, when push came to shove and they were forced to embrace some type of virtual writing tutoring, when used in the right ways, technology can be a tool to reach students who may not have been accessible without the technology.

Having the ability to assist students synchronously and/or asynchronously via video conferencing or by uploading work to be reviewed by a tutor allows students who traditionally may not have access to such services, like those working full-time, parents of young children, or even deployed military personnel, to be able to receive the same level of assistance as the more traditional full-time 18-22 year-old college student. This becomes extremely important at the 2-year community college level where non-traditional students make up a much larger percentage of the total student population than 4-year institutions, with almost 75% of enrolled 2-year community college students falling into the non-traditional category (National Center for Education Statistics, 2019).

The ability to use a scheduling, tracking, and reporting software has also greatly improved the functionality of the writing centers, as it is not only easier to coordinate and track student visits, but software such as TutorTrac, WCOnline, or even proprietary systems, allow writing center administrators to monitor whatever measures they use in constituting student success. This ability to monitor student needs allows for much faster response times when addressing those needs, whether it is reaching out to remind a student of a study group or even contacting counseling services if a student appears overwhelmed or feeling the effects of stress. Marcia even noted that giving the students the ability to book their own appointments through their scheduling software embedded on their website "made the front desk much more approachable and easily accessible" which is a tremendous help when many of your students may have special needs and need that one-on-one interaction away from large groups of people.

Q3: Future Educational Technology for Writing Centers

Questions asked to the participants regarding what types of technologies or functionalities would they like to see available in the future drew very interesting responses with most of the participants

responding with, to paraphrase, "That's a great question. No one has ever asked me that before." It appears then that whatever research is being conducted by the companies creating these technologies, they have not reached out to any of these participants, which begs the question of exactly who they are speaking with about the special needs of 2-year community college writing centers, if at all? Many products on the market seem aimed at 4-year colleges with greater budgetary resources and a different student population. It may also necessitate more open lines of communication between writing centers and college Information Technology departments, as all participants noted that any technology requests must at some point go through their IT department.

By far, however, the most popular answer was a variation on the theme of better integration between systems currently in use and systems that are capable of supporting multiple functions in order to reduce the need for training staff and teaching students a particular software that they may only need to use a handful of times. Gregory talked about being able to utilize the campus LMS, Canvas, which the students are already familiar with instead of having to use another service to assist students virtually. Currently, this can lead to confusion since students now need to not only be comfortable using the writing center's platform, but they also need to be aware that it is a different platform to begin with.

Robert's response included

> what I would love to see is my having my tutors have tablets or a touchscreen notebook type deal, where they can physically mark up a paper just like they would in person, right? They have a stylus or a pen and are able to circle words, put in inserts, have it be much more organic than structured in the way that Word wants us to structure those reviews and that formatting.

What is of interest here is that there are tablets and touchscreen devices that do allow for this, but because of budgetary restrictions, even procuring one of these devices is cost-prohibitive to say nothing of being able to outfit the entire writing center tutoring staff. Because of this there is a premium on technologies that can be implemented in conjunction with what the center already has in use without necessitating large scale upgrades of equipment or software.

Rachael makes the following case:

> we still need something that's easy to use and user friendly. And because not all of our students, even though we think our students are tech savvy, because they use Facebook, and Twitter, or TikTok or whatever, that doesn't mean they can sit down and write a paper. And I think that writing a paper on a telephone, which some students do, is very difficult. So to do

that, I would be looking for something that's easy for a student to come in and use.

This is ultimately the heart of the matter: whatever technology is implemented, it must, in some way, help the student. College is stressful and can be confusing to even the most prepared individual, so utilizing technologies that are confusing or do not really have a direct impact on helping the students achieve success may not be wasteful, but certainly may not be the most appropriate investments and instead of adding ease to the students' day only adds another learning curve and its' own layer of stress.

Recommendations

Imagine what a redesigned student experience would look like with the implementation of these best practices: A first-year, first-time college student logs into their course shell for the first time. They are already a bit unsure of how college operates, other than being repeatedly told that it is "much different" than high school. They know that there are obvious differences, but honestly, they are not exactly sure what those differences are.

As they scan their course they see, on the right-hand side of their screen, a picture of a smiling face with the words "Need assistance with your writing? Click here!" The student quickly realizes that the photo of a writing tutor helping another student isn't some third-party marketing campaign nor is it a generic model with their college name photoshopped onto the t-shirt they are wearing; no,

this is a real picture of a real peer, a real person at this school who can help if need be.

The student, who is worried about the amount of writing their Intro to Psychology course seems to require, clicks on the link and is taken to the Writing Center's homepage. This homepage features actual photos of the writing center along with pictures and short bios of each writing tutor. There is Tim, a third semester Literature major, Julie, a professional tutor with a BA in Creative Writing, Anna, a fourth semester student who is also the Vice-President of the Student Government Association. The different types of assistance available are all written out and explained, from one-on-one in-person appointments to asynchronous essay uploads to virtual study groups.

Initially nervous about the different tools they would need to access this type of assistance, the student finds that it is much simpler to take advantage of than first thought. By entering their Student ID number, they are presented with a drop-down menu of all the courses they are currently registered for. The student clicks on Psych-101. A calendar pops up displaying the days and times that are available for the next two weeks, along with the available tutor's name, a link to their bio, and whether they are a Professional Tutor or a Peer Tutor. The student is also prompted to choose either "In-Person" or "Virtual." Because they are working full-time, they are glad to see that there is a virtual option, and even happier to see

that the virtual platform is the same one being used for their classes so there isn't the need to learn how to navigate another technology.

But right now the student doesn't really need to meet with a tutor, the student just wants to know if they did their Works Cited pages correctly in APA format. Luckily, there is a button in the middle of the screen to submit an essay for asynchronous assistance. The student clicks on the button and is prompted to enter the course, the section, what the assignment is, and a list of boxes to check off if assistance is needed with that particular item, from grammar to verb tenses to…APA works cited pages! The student clicks that box, attaches their Google Doc, and hits submit. Immediately a notification pops up thanking them for uploading their assignment and lets them know that they will receive a response within 24 hours from a Peer Tutor named Daniel.

Later that day the student notices an email from the Writing Center. It includes a copy of their essay that has notes electronically written on it explaining the proper way to format the Works Cited page along with a link to the college's own Online Writing Lab, which has its own updated citation engine. The response was quick, friendly, personal, and helped a lot. Daniel even wrote that if they need further assistance or have any questions, to feel free to ask for him by name next time, as Daniel is himself a Psychology major.

What the student perhaps did not see was the effective coordination of technologies and humans behind the scenes: the

purposeful way the Writing Center was linked to the course shell, the way that by simply entering their Student ID number the Writing Center was able to pull their course information from the college's main database, the way the entire school had integrated the Google Suite and didn't need them to change to a Microsoft Word doc to upload the paper, the way the Writing Center Administrator saw what the assignment was and what kind of help was needed and was able to direct that assignment to a particular writing tutor who had a very firm grasp of APA format along with an understanding of that Psychology course, and the way that tutor, who was also working from an off-campus location, was able to provide feedback by using a tablet and stylus to give the more personal look of ink on a page when describing how to format in APA before attaching the link to the citation machine.

That is a scenario that has worked out well for the student, which is the main goal of any educational endeavor, as well as for the Writing Center as a whole as they were able to deliver a meaningful solution to an academic need for a student who may not otherwise have been able to get that assistance. Not only that, but it was simple and intuitive for the student to use without them needing to learn to operate any software or hardware that they were not already familiar with due to everything already being integrated at that school.

In order to achieve that type of seamless process there are a number of actions that should be taken according to the answers found to the research questions posed in this study. The first is the start of implementing the uncovered best practices into daily use in the 2-year community college writing center. All five of the best practices, 1) Assess your technology needs, 2) Technology is a tool that does not exist in a vacuum, 3) The "human connection" is not only needed, but necessary, 4) Practices that apply to face-to-face writing assistance with a pen and paper also apply to writing assistance that uses technology, and 5) The more integrated and seamless the technologies are, the easier and more effective it is for all stakeholders, may at first appear to be common sense ideas, but as logical as they may seem, they have never been codified before, and many, if not most, writing center administrators may be unaware that these practices are in fact "best practices" and therefore would be of assistance in their own centers. Some of these best practices are also easy to forget as most writing assistance has gone virtual since the beginning of the COVID-19 pandemic, such as remembering that that no matter how impressive the technology is, there still needs to be a human connection to help keep students grounded and not feel as though they have simply been passed off to a machine.

The second takeaway is that technology in the writing center works best when it is treated as a tool and not as a cure, as writing

center administrators have seen numerous technologies as being beneficial to their students, their writing center employees, to themselves, and to their programs as a whole. When used correctly, these technologies do have a positive impact on students. When used incorrectly or carelessly, technology just becomes another burden, another stressor, on students who are already in need of additional academic assistance. This academic assistance is the main reason they are attending the writing center in the first place.

The third takeaway is that writing center administrators must become more involved, or as involved as they can be, in the decision-making process of what technology eventually ends up in their center. There needs to be clear lines of communication between the writing center administrator and the person that they report to, as well as communication with the Information Technology department to see what works, what does not work, and what possibilities exist for bringing technology into the writing center. While they may not have direct control of their budget, writing center administrators should become more comfortable in the drafting of proposals to those who do have control over the budget allocations that they receive.

Further Study

There are many areas left for further study that have come to light during this research. The following is a list of questions that appeared during the 13 interviews with the writing center

administrators when asked what they felt were important questions for future research into educational technology implementation into college writing centers:

1. What are the best practices for educational technology implementation in 4-year college writing centers? Do they look different from 2-year community college writing center best practices?
2. What is the difference in the technologies being used in 2-year community college writing centers and 4-year college writing centers?
3. What specific effects does budget have on implementing educational technology into college writing centers?
4. Which educational technologies show the greatest rates of student success in 2-year community college writing centers?
5. Is there a difference in the best educational technologies for use in 2-year community college writing centers and 4-year colleges?
6. What are the student views of educational technology in 2-year community college and 4-year college writing centers?
7. Writing center efficacy in face-to-face versus virtual tutoring sessions

Conclusions

The arrival of educational technology in 2-year community college writing centers has been necessary to meet the demands of a

generation that has grown up in an educational system that has become dependent on technology to ensure that their students are able to assimilate into a world where technology is omnipresent. From traditionally technology-heavy occupations in medicine and the sciences to agriculture and raising livestock, there are no longer areas that technology does not touch. Of all of these areas, the most important is not just the education of our youth, but the education and continuing education of our entire population.

Technology may not be able to solve all problems, but it allows us to better equip ourselves to take the steps necessary to solve many of those problems ourselves. At the 2-year community college, the writing center is often a major hub of activity where students congregate not only to improve their writing, but to talk through ideas and gain new understanding of what it means to write, to think critically, to become more familiar and comfortable with language as a whole and, ultimately, what it means to be a successful college student.

The educational technology that is used in the 2-year community college writing center needs to assist the student in reaching their educational goals, but in order to do so it must not add new levels of stress by having to learn complicated software or a piece of equipment. The technology must appear to be a more natural progression from what they are already comfortable using. The more comfortable they are in using the tools they already have

familiarity with will lead to a greater reinforcement of what they are learning, which is ultimately the goal of any learning assistance center, writing or otherwise.

The five best practices outlined in this study, 1) Assess your technology needs, 2) Technology is a tool that does not exist in a vacuum, 3) The "human connection" is not only needed, but necessary, 4) Practices that apply to face-to-face writing assistance with a pen and paper also apply to writing assistance that uses technology, and 5) The more integrated and seamless the technologies are, the easier and more effective it is for all stakeholders, will be of assistance to 2-year community college writing center administrators no matter where they are in their implementation of educational technology. For those who have yet to introduce any, these five best practices will serve as a roadmap for how best to begin that implementation. For those currently using educational technology, they may find new and useful information within this research that they may use in order to further refine their existing practices. For others, these findings may simply act as a reinforcement that what they are currently undertaking in their own writing centers aligns with the prevailing best practices in the field.

This research is not an end unto itself; instead, it is with great hope and anticipation that these best practices will lead others in this field to continue to innovate and find new ways of using

educational technology in the 2-year community college writing center to further assist the students that they serve, and, in turn, those students will find the success that a college education can ultimately lead to.

References

Alber, R. (2015, May 29). *Defining "best practice" in teaching*. Edutopia.org. https://www.edutopia.org/blog/defining-best-practice-teaching-rebecca-alber

Aunkst, B.D. (2019). *A correlational study of the relationship between help-seeking behavior and writing self-efficacy* [Doctoral dissertation, Liberty University]. Liberty University Scholar's Crossing. https://digitalcommons.liberty.edu/doctoral/2262/

Bandura, A. (1963). *Social learning and personality development*. Holt, Rinehart, and Winston.

Bandura, A. (1977). *Social Learning Theory*. New York, NY: General Learning Press.

Bielinska-Kwapisz, A. (2015). Impact of writing proficiency and writing center participation on academic performance. *International Journal of Educational Management, 29*(4), 382-394.

Brown, B. (2021). Trust in emergence: Grounded theory and my research process. https://brenebrown.com/the-research/

Charmaz, K. (2014). *Constructing grounded theory (2nd ed.)* SAGE.

Davis, E.K. (2016). *A quantitative study of community college students' disability stigma* (Doctoral dissertation). [Doctoral dissertation, Morgan State University]. Maryland Shared Open Access Repository (MDSOAR). http://hdl.handle.net/11603/9898

Duncan, A. (2012, March 8) The new platform for learning. U.S. Department of Education. https://www.ed.gov/news/speeches/new-platform-learning

Hargreaves, A. & Fullan, M. (2012). *Professional capital: Transforming teaching in every school*. Teachers College Press.

Herold, B. (2016). Literacy gets a personalized makeover. *Education Week, 35*(17), 1-4.

Icard, B. (2104). Educational technology best practices. *International Journal of Instructional Technology and Distance Learning, 11*(3), 38-41.

Juszkiewicz, J. (2019). Trends in community college enrollment and completion data. *American Association of Community Colleges*. https://www.aacc.nche.edu/wp-content/uploads/2019/05/CCEnrollmentMarch2019Final.pdf

Lerner, N. (2019). Growing pains in the golden age: Writing centers in the twenty-first century. *College English, 81*(5), 457-466.

Lawrence-Lightfoot, S. (2020). Portraiture. http://www.saralawrencelightfoot.com/portraiture1.html

Lawrence-Lightfoot, S. & Davis, J. H. (1997). *The art and science of portraiture*. Jossey-Bass

Murphy, C. & Law, J. (1995). *Landmark Essays on Writing Centers*. Routledge.

North, S.M. (1984). The idea of a writing center. *College English, 46*(5), 433-446.

North, S.M. (1995). Revisiting "The idea of a writing center." *Writing Center Journal, 15*(1), 7-18.

Pannoni, A. (2015, August 26). 4 ways community college life differs from the 4-year college experience. *U.S. News & World Report*. https://www.usnews.com/education/community-colleges/articles/2015/08/26/4-ways-community-college-life-differs-from-the-4-year-college-experience

Powell, K.C. & Kalina, C.J. (2009). Cognitive and social constructivism: Developing tools for an effective classroom. *Education 130*(2)*,* 241-250.

Vance, L.K. (2016). Best practices in tutoring services and the impact of required tutoring on high-risk students [Doctoral dissertation, Eastern Kentucky University]. Encompass. https://encompass.eku.edu/cgi/viewcontent.cgi?article=1439&context=etd

Vygotsky, L.S. (1962). *Thought and Language*. MIT Press.

Vygotsky, L.S. (1978). *Mind in Society*. Harvard University Press.

Whaley, A.N. (2016). Identifying and implementing best practices to retaining community college students: An appreciative inquiry [Doctoral dissertation, Capella University]. ProQuest (No. 10164300).

Wilson, J. (2017). Associated effects of automated essay evaluation software on growth in writing quality for students with and without disabilities. *Reading and Writing, 30*(4), 691-718.

Zhbanova, K.S. & Fincher, M. (2019). Best practices for talented and gifted students at community colleges. *Journal of Applied Research in the Community College, 26*(1), 127-139.

Book Review: *The Rowman & Littlefield Guide to Learning Center Administration*

Tina Romanelli

Meredith College

The newest offering in the Theory & Practice for Peer Tutors and Learning Center Professionals series, *The Rowman & Littlefield Guide to Learning Center Administration*, co-authored by the series editors, provides a succinct and comprehensive overview of running a successful tutoring program in higher education. Though a few competing texts are on the market, Sanford and Steiner's guide is likely to be the go-to source for professionals new to the field or who need a foundation of published scholarship because of its brevity, clarity, and accessibility.

At 183 pages long, including the index, this *Guide to Learning Center Administration* is extremely brief. In some places, this amounts to an overview of the information that could be handled in depth (Chapter 4, "Students as Employees," is not twenty pages long and fails to address important issues like supply and demand and managing gaps in services due to the cyclical nature of student employment, for example.). Still, the manageable size makes the book very valuable as a kind of "get started guide" in Learning Center administration. Indeed, the book has several places where

getting a brand new center up and running seems to be the goal. For example, chapter 2, "Program Structure, Vision, and Mission," contains lots of information that is likely already decided for the administrator beginning a new role in an already established organization, as is the information shared in Chapter 6, "Designing the Physical Space of the Center." The authors know this, of course: "It's rare for learning program administrators to be able to weigh in on the location for their program," they write (82). Both chapters contain valuable information about aspects of the structure and physical space that LCAs can address and those we frequently have little control over, however.

The underlying argument is the idea that a learning center necessitates peer tutoring as its foundational practice. The preface states this unequivocally: "What learning centers all have in common, and what makes a learning center a learning center, however, is peer tutoring" (vii). This premise defines the boundaries of the book and, because of the book's bibliographic location, the field. However, it is an arguable thesis, and it would be interesting to see what the counterargument might look like. NCLCA and its affiliate organizations have many professional tutors, success coaches, and other non-student employees in their ranks. Given Sanford and Steiner's argument, it is interesting to see how few chapters are dedicated to dealing with peer tutors. For more information, the authors direct curious readers to Daniel Sanford's *Rowman & Littlefield Guide to Peer Tutoring* (2019). Chapters 1, 3, 4, and 5 address working with current students in various ways. Focusing on the administrator's role as facilitator, the hiring cycle, student leadership roles within the center, and accommodating tutors' growth over time are some examples of sections with interesting takes on working with students that can be helpful for LCAs at any stage of their career.

Overall, the most useful chapters are the final three. Sanford and Steiner offer important information and guidance on how to minimize the duplication of efforts and funding for student success across campus in Chapter 7, "Collaborating with Campus Partners," especially with the implicit focus on managing up and providing feedback to our supervisors and administrators on how to facilitate those collaborations. The section on "Advisory Councils" is also extremely useful and could conceivably be implemented for little to no cost at any time. There are several good ideas and lots of good guidance on marketing to students with social media. For those of us for whom there are generational gaps between ourselves and our student employees and clients, knowing that social media should be interactive rather than informational is extremely helpful as an example. Finally, assessment utility is a major feature throughout the book. Each chapter contains "Questions for Program Assessment" that can be edited and shaped into strategic plans and comprehensive program assessment pieces. The final chapter helps

define assessment terms for people new to the field and discusses reporting in detail.

Throughout the book, the language is straightforward and clear. The authors avoid jargon and theories but still cite many sources to back up their claims about learning and peer tutoring. Another great feature of the book is the extensive reference list that can serve as a comprehensive reading list of published research relating to these topics. Nonetheless, there are a few places where the authors use language that could alienate administrators who have less than total control over their spaces and budgets. For example, in "Students as Employees," the authors write, "Paying tutors on a 'by appointment basis,' offering compensation only for those times when students make appointments with them, is an execrable practice that shows little regard for the value of tutors" (53). While we are all looking forward to a post-pandemic environment and (we hope) post-pandemic budgets where we can perhaps claim ideal circumstances again, comments like this one can be depressing to read for people who have been trying to keep online centers afloat on their campuses for a lot less money.

This second contribution to a much-needed series of scholarly work is a fairly quick and very valuable read for all Learning Center administrators, especially those who have the opportunity to open a new center or who have the ear of higher administration who can help them make changes to the structure or space of their existing

centers. It truly distinguishes itself with its well-researched information and its ease of reading. There are opportunities for deepening the conversation that has already been published, and administrators who would like a more comprehensive view of what a center can be and do should consider them. Complementary texts include Laura Sanders, David Reedy, and Michael Frizell's 2018 edited collection *Learning Centers in the 21st Century: A Modern Guide for Learning Assistance Professionals in Higher Education* and Penny Turrentine's 2019 *Everything You Ever Wanted to Know About Learning Centers (And Then Some)*. Sanford and Steiner's book is a worthy addition to this short but extremely useful reading list!

References

Sanford, D. and Steiner, M. (2021). *The Rowman & Littlefield Guide to Learning Center Administration: Leading Peer Tutoring Programs in Higher Education*. Lanham, MD: Rowman & Littlefield.

What are We to Each Other? How Practitioners Make Sense of Relationships with Peer Educators

James D. Breslin[1], Joannah L. O'Hatnick[2],

Alexandra D. Schmied[3], & Maryann H. Kope[2]

[1]Bellarmine University

[2]University of Guelph

[3]Temple University

Abstract

Peer educators, central to the work we do in academic support and more broadly in higher education, have deep impacts on student learning, development, and success. The ways that academic support professionals in the field make sense of their relationships with peer educators can impact the structure, function, and efficacy of support programs and services. This exploratory project provides the first empirical study that attempts to understand how professionals conceptualize their relationships with peer educators. Based on an expansive survey deployed across Canada and the United States, key findings include an inconsistent lexicon, a complex set of power dynamics, and an array of unacknowledged assumptions about these relationships. A critical examination of these power dynamics and assumptions may help practitioners further enhance their programming.

Keywords: Peer educator, relationships, academic support, supervision, leadership

What Are We to Each Other?
How Practitioners Make Sense of Relationships with Peer Educators

Peer educators have long played a role in many systems of higher education. Over the last century, as higher education has evolved from a tool of the elites to reproduce systems of inequality to an espoused mechanism to create opportunity for social mobility for the masses, peer educator-based academic support programs have become an increasingly deployed strategy for fostering student success. While peer educators contribute in meaningful ways to student learning and development, and represent a highly cost-effective support, the research in our field has paid little attention to the relationships between peer educators and the professional or academic staff who hire, supervise, and support them.

Scaffolded upon our previous conceptual work (Breslin et al., 2018) regarding these critical relationships, this article details the results and analysis of our pre-pandemic survey of peer educator supervisors and managers of units with peer educator-based academic support programs at colleges and universities in both the United States and Canada. Recognizing that this work is nascent in

our field, we began with a single research question: how do academic support professionals make sense of their relationships with peer educators? While the field is replete with information about peer-educator-based program structures (for example, Supplemental Instruction and tutoring models) and the benefits of peer-educator programs for the students who use the services and the peer educators themselves, we hold that the ways we as professionals make sense of our relationships with peer educators are both important to our work and largely unexamined.

As social scientists, we acknowledge that the ways professionals in our field make sense of peer educators, the kinds of work we include them in, the language we use with and about them, and the extent to which we include them in program or department decision making, all have the potential to influence the efficacy of our work. Therefore, this exploratory research seeks to understand how contemporary professionals make meaning of these relationships. We recently introduced a new paradigm (Breslin et al., 2018) that seeks to describe how academic support professionals conceptualize relationships with peer educators. That conceptual work undergirds this research and provides a useful lens through which we have constructed this research and analyzed the data.

Review of the Literature

As discussed in our previous work (Breslin et al., 2018), little research explicitly examines the relationship between peer educators and supervisors in the academic support field or more broadly in higher education, though a more recent focus on peer educators as leaders suggests a heightened awareness of the influence of peer educators on postsecondary academic support work. For example, Young, Hoffman, and Frakes Reinhardt (2019) use the lens of Lave and Wenger's legitimate peripheral participation theory to acknowledge peer educators' presence within the academic community, though they do not explore how peer educators' relationships with their supervisors might influence their sense of belonging within the community. In their exploration of the challenges of a lack of common terminology to describe peer educators, Keller and Porter (2020) also acknowledge the vital roles of peer educators within postsecondary institutions in North America, yet their call to action for peer educator supervisors focuses on following best practices for training and supervision, rather than on examining the reciprocal relationship between supervisor and peer educator.

An evolving concept of peer educators, and thus of their relationship with supervisors, is more evident in the literature published in response to the COVID-19 pandemic, such as *TLAR*'s special issue, *Rising to the Challenge: Navigating COVID-19 as Higher*

Education Learning Center Leaders, in which Bleakney and Holsinger (2020) note peer educators' perceptions of themselves as leaders. An explicit example of the changing relationship between professional staff and peer educators lies, perhaps, in Kelly et al.'s *TLAR* submission (2020), which takes the form of a transcribed Zoom call in which peer educators are given equal voice to the professional staff they work with. However, such examples in the published research literature are few and far between. While we suspect that current trends of incorporating equity, diversity, and inclusion initiatives more deliberately into our conceptualizations of academic support work will overlap with research on peer leadership to produce more discussion about peer educator-supervisor dynamics and relationships, these dynamics are not yet evident in the published literature.

Methods

Having established the relevance and need for better understanding the ways professionals make meaning of their relationships with peer educators, and recognizing the rather sparse existing literature, we envisioned this exploratory study as a first step. Our central research question asks how professionals make sense of these relationships, and we determined that we could best begin to address this question through a largely quantitative survey project. We explored various systems of higher education in English-speaking countries and chose to focus our efforts on the

United States and Canada. While there are some meaningful differences between the systems of higher education in each country, the structure and function of higher education, and indeed the cultural contexts themselves, are sufficiently similar to warrant studying them together.

The students as colleagues paradigm (Breslin et al., 2018) provided a helpful framework both conceptually and practically. Building on the themes of that work, we identified several domains or dimensions through which we could understand professionals' conceptualizations of their relationships. As social scientists, we are familiar with the limitation of self-reported perception and sought to ask participants questions that focus less on self-reporting how they think or feel and more on their actions, decisions, and experiences. We intended to use these reported behaviors, taken together, to help us understand overall the ways professionals conceptualize relationships with peer educators.

More specifically, we identified the following domains: hiring and training, responsibilities and compensation, performance review processes, supervisory issues, and funding and institutional support. We also asked a series of demographic questions to help disaggregate the results. We drafted several survey questions for each domain and compiled them into a moderate-length survey of 52 questions. Our threaded approach included designing domain-specific questions to provide an overall understanding of the

behaviors and attitudes of professionals in that area, and then analyzing the response data across domains to allow for a more comprehensive understanding of how (i.e., using what paradigm) supervisors make sense of relationships with peer educators. We asked colleagues in both Canada and the United States to serve as beta testers for the survey. They provided valuable insight on item clarity, time to complete the instrument, ways to make our phrasing more consistent, and thoughts on possible language colloquialisms across such a geographic expanse. The research project was approved by the institutional review boards of the two sponsoring institutions, one in the United States and one in Canada. With a final instrument in place, we solicited participants from several e-mail lists, professional association online communities, and social media. The survey was open for about four weeks.

Results

A total of 240 respondents interacted with the instrument and we received 164 complete survey responses. Because this was an exploratory project and we had an indeterminate number of colleagues who were invited to participate, it is not possible to calculate an actual response rate. Moreover, as the field of academic and learning support is still developing across both the United States and Canada, there is little reliable data regarding the number of positions at postsecondary institutions that might be included in our area of professional practice. We recognize that this clearly

limits some of the generalizability of our results and hope future research may build on this foundation.

The full survey instrument (which the authors will be glad to provide) was divided into several constructs. Recognizing that the field does not currently have an operational paradigm for conceptualizing these relationships, and that self-reported conceptual understanding can often result in data that reflects what participants may think researchers want to hear, we tried to develop constructs and questions that aid us in deriving meaning from actual programmatic decisions, language, and behaviors in the field. The brief sections below detail responses in each construct as well as basic demographic descriptive information about the respondents, their programs, and institutions.

Demographics

A plurality of respondents (43%) were relatively new to supervising peer educators, having done so for three years or less. A full 25%, though, reported having 10 or more years of supervisory experiences, providing a range of perspectives across various lengths of service. Nearly 48% of respondents indicated that they had served as peer educators themselves. Nearly all respondents (91%) had completed or were currently making progress toward an advanced degree (i.e., beyond a Bachelor's). Survey respondents represented a range of postsecondary institutions, with 15% of respondents coming from institutions with fewer than 2500

students, 34% from institutions of 2500 to 10,000 students, 18% from institutions of 10,000 to 20,000 students, and 32% from institutions with more than 20,000 students. The number of peer educators in the programs supervised by survey respondents also reflected a similar broad range, with 20% of respondents supervising a program with 10 or fewer peer educators, 38% supervising a program of 11-30 peer educators, 29% supervising a program of 31-50 peer educators, and 20% supervising a program with more than 50 peer educators. Survey respondents who supervised more than one peer educator program were instructed to base their responses in the survey on the largest peer educator program they supervised. Our analysis yielded little relationship between the size of the institution and the size of the peer educator program. Thirty-one percent of respondents were from Canada. Further geographical breakdowns were not conducted due to the small sample size.

Table 1
Supervisor Demographics

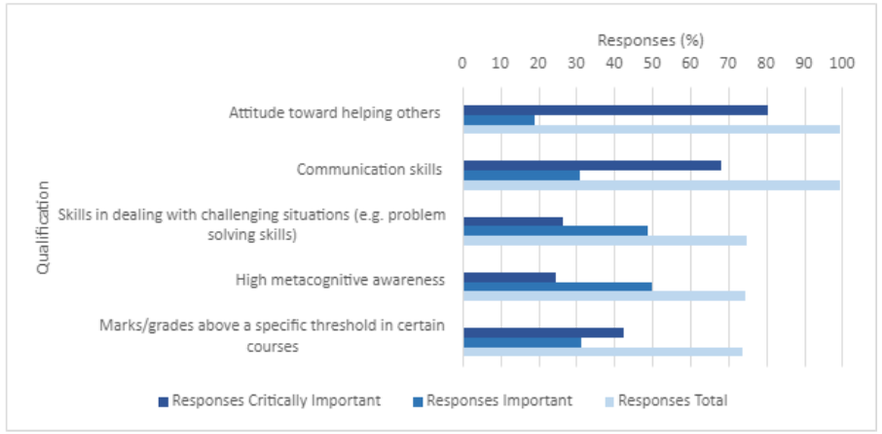
	Responses	
Variable	N	%
		Length of Supervision
Less than 1 year	15	10.20
1-3 years	49	33.33
4-6 years	29	19.73
7-9 years	17	11.56
10 years or more	37	25.17
		History as a Peer Educator
Yes	78	47.56
No	86	52.44
		Highest Level of Education Completed
Bachelor's	40	22.22
Master's	99	55.00
Second Master's	10	5.56
Doctoral	31	17.22
		Size of Peer Educator Program
1-10	32	19.51
11-20	38	23.17
21-30	15	9.15
31-40	22	13.41
41-50	25	15.24
Over 50	32	19.51
		Institution Location
Canada	51	31.10
USA	111	67.68
Other	2	1.22

Note: "History as a Peer Educator" details if the supervisor was a peer educator themselves. "Doctoral" in Highest Level of Education includes one respondent with a JD. "Other" Institution Location includes two respondents outside of Canada and the United States and are not included in the data analysis.

Hiring and Training

Respondents were presented with a list of possible terms that might refer to peer educators in their program and asked which terms they use when advertising for position openings. The most used terms included peer (25.5%), student (19.3%), leader (14.9%), and mentor (8.3%) while the least used terms were manager (0%), supervisor (0.2%), colleague (0.4%), and professional (1.1%). Respondents were asked to indicate how important a range of qualifications are in the hiring process. Two options were ranked as critically important by nearly every respondent: "attitude toward helping others" and "communication skills." Next, the option of "skills in dealing with challenging situations" was ranked as critically important or important by more than 75% of participants. The next five most highly ranked qualifications, and the only additional response options to be rated as critically important or important by more than 50% of respondents, include "high metacognitive awareness," "marks/grades above a specific threshold in certain courses," "GPA or average above a specific threshold," "recommendation from faculty or staff," and "knowledge of, or specialization in, a particular discipline (major, minor, etc.)."

Figure 1
Top Five Hiring Qualifications

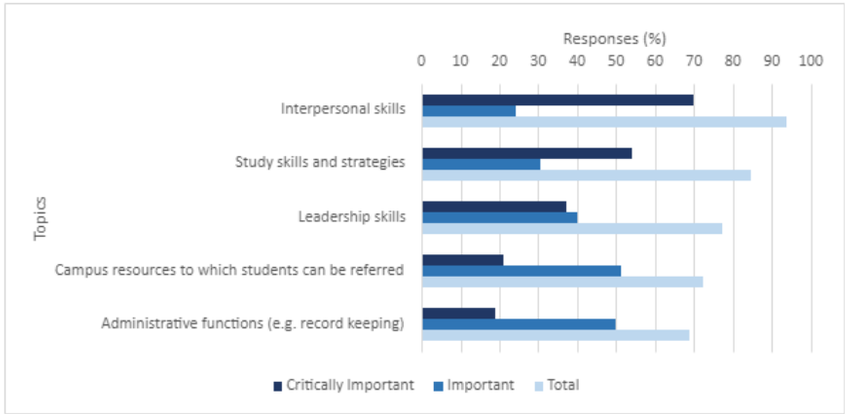


Note: Figure 1 details the top five hiring qualifications and skills that were ranked "Critically Important" or "Important".

Questions around peer educator training practices demonstrate a wide range of variation in the field across both Canada and the U.S. The most common response in terms of quantity of training, in hours, was 22 or more total hours, though it is worth noting that 24 (14.6%) respondents indicated 10 or fewer hours of training either prior to or during the peer educators' provision of services. When asked to indicate the level of importance of various topics in peer educator training, those most often deemed critically important or important included interpersonal skills (93.3%), study skills and strategies (84.7%), leadership skills (76.7%), and campus resources to which students can be referred (63.2%). The three training topics identified most often as not at all important were assessment of

academic support programs (48.8%), history of the program and/or department (33.7%), and institutional hierarchy (33.3%).

Figure 2
Top Five Training Topics



Note: Figure 2 details the top five training topics that were ranked "Critically Important" or "Important"

Responsibilities and Compensation

The reported responsibilities of peer educators cluster strongly around direct service provision, whether in the form of tutoring, study skills support, or delivering other specific student-facing services. More variation was shown in other kinds of responsibilities, which included management or administrative functions such as assessment, marketing and promotion, and participation on committees or special projects. Of special note, 64% of survey respondents indicated that their peer educators did have some responsibilities related to assessment, yet almost half (49%) of respondents indicated that assessment was "not at all important" in their training.

Nearly one third (32.5%) of respondents indicated that they have peer educators who themselves supervise other students in similar roles. Among those programs, the kinds of additional responsibilities peer educators in supervisory roles are most often delegated include administrative tasks, coordinating existing services, developing new resources, and hiring new peer educators. It was notable that only 30.1% of respondents who have peer educators serving in supervisory roles indicated that such students engage in disciplinary action concerning their direct reports with oversight from their staff supervisor.

Table 2
Responsibilities for Peer Educators Who Supervisor Other Peer Educators

Rank	Variable	Responses (%)		
		Primary or total responsibility	Some responsibility	Total
1	Supervise other students in similar roles	59.62	38.46	98.08
2	Adminstrative tasks	23.08	65.38	88.46
3	Advise individual students on learning/study strategies	23.08	59.62	82.7

Even while most peer educators are compensated monetarily for their labor (80.7%), this aspect of the role seems to be de-emphasized by those who supervise peer educators. When asked to rank the top three benefits of serving as a peer educator which they highlighted to prospective applicants in the hiring process, respondents identified concepts such as the impact on the student experience, professional skill development, and leadership. Only 12% of respondents selected making money among their top three

benefits. For peer educators who receive monetary compensation, the pay is typically an hourly rate (80.2%), above the mandated minimum wage in the area (75.2%), and typically cannot be set by the staff member who supervises the peer educators. In addition to course credit, non-monetary compensation reported include mentoring by staff or senior students (21.7%), informal networking opportunities (17.9%), staff organized social activities (13.5%), and specific workspace they can access for personal use (12.4%).

Performance Review Processes

A majority (72.6%) of respondents indicated that peer educators in their programs receive regular performance reviews. However, 18.5% of those are not a formal, documented process. This may be related to the finding that only 57.1% of respondents reported that there are opportunities for peer educators to be promoted to roles with increased responsibility, and that even among those who have such opportunities 21.5% do not provide increased monetary compensation for the peer educator.

Supervisory Issues

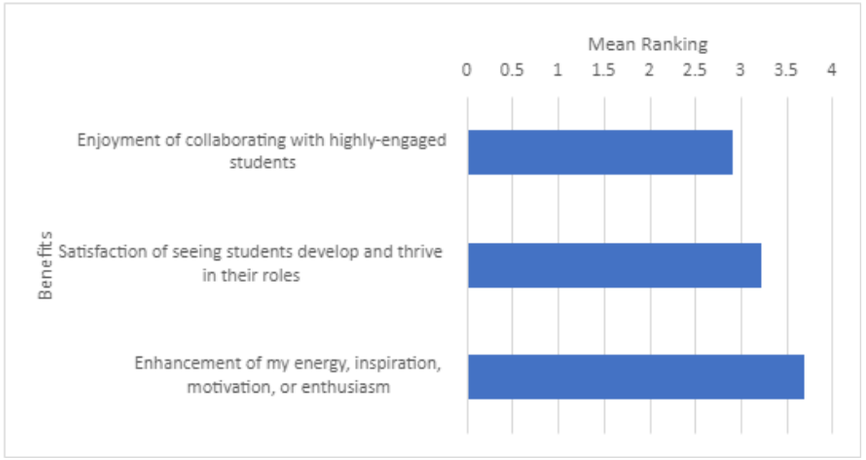
Respondents indicated a wide range of variability in terms of how many peer educators they supervise. Presented with band of 10 (e.g., 1-10, 11-20, etc.), the two most common responses were that respondents supervise 11-20 peer educators (24.1%) and more than 50 peer educators (23.5%). Additional responses to this question were distributed across the other options. With a similarly broad

distribution, respondents most frequently indicated that in their job descriptions 21-30% of their time is to be allocated to peer educator supervision (18.6%). When asked which words best describe respondents' relationships with the peer educators they supervise, the most common responses included supervisor (70.6%), mentor (58.9%), and coach (31.3%), whereas only 19% included "colleague."

In terms of qualitative experiences in supervising peer educators, respondents were asked to rank their top three benefits and top three challenges in working with peer educators. Top benefits included "satisfaction of seeing students develop and thrive in their roles" and "enjoyment of collaborating with highly-engaged students," while top challenges were "finding sufficient time to train and supervise peer educators appropriately" and "concerns for peer educators who need help and determining how to help them." Respondents were also asked to reflect more broadly on the use of peer educators within higher education by ranking the top three drawbacks, challenges, or issues related to the use of peer educators. The highest ranked drawbacks included "managing student turnover" (34.2%), "achieving a consistently high quality of service" (25%), and "establishing the credibility of service with staff, faculty, or administration" (14.6%).

Figure 3

Top Three Benefits of Working with Peer Educators



Note: Figure 3 details the top three recorded benefits of working with peer educators. Respondents were asked to rank benefits "with 1 being most important". Therefore, a mean closer to 1 yields a higher ranking.

Funding and Institutional Support

Only 78.1% of respondents report that their program has "permanent or base funding," suggesting that more than one in five programs operate on "soft" budgets. For those who lack base funding, 73.3% think it is a "very good possibility" that funding will continue next year, but only 46.7% find it a "very good possibility" for the "next few years." Fewer than 15% of respondents report that their program has been featured in fundraising campaigns or extra-institutional media efforts in the last five years.

Discussion

This exploratory research project began with one unifying research question: how do academic support professionals make

sense of their relationships with peer educators? While the preceding Results section provides a robust overview of the collective responses to our survey questions, as social scientists we embrace an analytic process that centers both collaboration and consensus. The authors reviewed, manipulated, and considered the survey response data individually, and came together in a series of conversations to consider what meaning we can make from these data in service to answering our central research question.

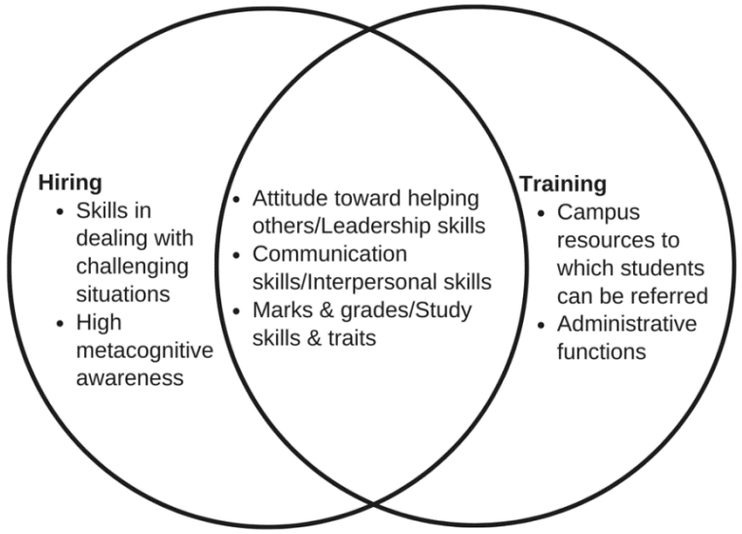
The results of this work are the subsections below, each representing a theme or thread that emerged when the data presented above are placed into conversation with each other and in the context of relevant literature. While the Results section is organized to reflect the structure of the survey instrument, this section is organized around the meaning and themes we make from the data.

Notions of Leadership

Our survey questions about hiring practices and training topics identified leadership as an emerging theme for understanding the evolving role of peer educators. Although 77% of respondents ranked leadership skills as an important or critically important training topic (the third highest ranking of all training topics), just 23% of survey respondents identified prior leadership experience as important or critically important. This discrepancy between the value of prior leadership experience in hiring practices and the

importance of training in leadership skills leads us to raise more questions about our work as peer educator supervisors: Why do few of us seem to value prior leadership experience when hiring peer educators? Does the emphasis on leadership training suggest that supervisors consider all peer educators, by the very nature of their roles, to be leaders? How do peer educator supervisors define leadership skills, and how do they train students in these skills?

Figure 4
Hiring Qualifications vs. Training Topics



Note: Figure 4 shows a Venn Diagram comparing and contrasting the top five hiring qualifications and the top five training topics.

Notions of leadership emerge again when we compare hiring criteria for peer educators to the hiring criteria for professional staff positions in academic support. When hiring peer educators, survey

respondents most highly valued "soft skills," such as attitude towards helping others, communication skills, and problem-solving skills; their secondary criteria for hiring focused on the peer educators' knowledge or skills in the classroom, as evidenced by hiring criteria such as GPA and faculty recommendations. At the bottom of the list of important qualifications lies prior experience, whether as a leader or in similar peer educator roles. This ranking suggests that supervisors may assume that peer educators lack relevant experience, or it may indicate that academic success, as evident through GPA or a faculty recommendation, is seen as a proxy for experience. The de-emphasis on prior experience and the emphasis on student "output" through grades or faculty recommendations contrasts with the standard hiring practices for professional positions, which tend to value prior experience but minimize evidence of prior academic excellence in specific areas. Indeed, the wide range of educational backgrounds of survey respondents would indicate that specific academic qualifications (i.e., demonstrated academic excellence in a specific field of study) are not desired or deemed necessary for professional staff, yet they are considered essential for peer educators. While we acknowledge that peer educators do not have the equivalent levels of experience or knowledge of their supervisors, we hold that peer educators bring experience to their roles and, through the professional nature of their work, are more similar than different to their full-time

professional colleagues. We encourage our colleagues throughout North America to examine more closely their hiring practices for both peer educator and professional roles and to explore ways in which these hiring practices can be better aligned.

Supervisor as Benign Leader

A further exploration of our survey results leads us to conceptualize peer educator supervisors as most often taking on the role of "benign leader" to the peer educators under their tutelage. We define "benign leaders" here as supervisors who perceive themselves in roles higher than, and distinct from, that of their peer educator colleagues, and who view themselves in a positive light, as bestowers of knowledge and skills to their student staff. The use of "mentor" and "coach" as common terminology for describing the relationship between the peer educator supervisor and peer educator – rather than, for example, "colleague" – suggests that supervisors place their work with peer educators within a hierarchy rather than in a reciprocal relationship. Despite a somewhat hierarchical perspective, the survey respondents value their peer educators and their time with them, with 88% indicating that their peer educators have adequate access to supervision, despite the somewhat contradictory reported need for more time for training and supervision. When asked about the benefits to working with peer educators, supervisors indicated many personal and altruistic outcomes, yet few supervisors indicated the type of benefits that

tend to emerge from working with colleagues on a more equal footing, such as gaining knowledge or learning skills from others. The possibility of peer educators contributing substantially to program design, assessment practices, or research seems to have occurred to few of our survey respondents. Or, if these ideas have occurred, they have taken a backseat to the more pressing needs of direct service delivery to students.

With the understanding that a sense of ownership enhances engagement, motivation, and work performance (Brown et al, 2014), our data show that a sense of program ownership is rather mixed. When asked to rank the top three "owners" of peer educator-based services, 44% of respondents indicated that peer educators have some program ownership, which suggests slightly more than half of the survey respondents felt that their peer educators were not major "owners" of services, despite the fact that the peer educators are usually the direct service providers. When we overlay this finding with the limited ways in which some, but not all, survey respondents provide opportunities for peer educators to contribute to departmental decisions and actions outside of service provision, varying portraits of peer educator supervisors emerge. While some supervisors may indeed see themselves as "benign leaders" ready to extend their helping mentality to the peer educators they employ, other supervisors provide evidence of embracing a more empowering vision for their peer educators. For a profession that

often claims to be student-centered, including student staff in decision making may be a clear way to understand and address student needs. These findings reveal some of the complexity in the data, specifically that these intersecting notions of leadership, ownership, and student-centered approaches may not always be working in concert unless professionals are taking an intentional approach to the relationships they forge with peer educators.

Language

As noted in the CRLA white paper, "peer education is a robust, diverse practice across colleges and universities" (Keller & Porter, 2020, p. 12), yet the lack of unifying terminology impedes the ability of the field, and of practitioners in the field, to communicate its value to the broader higher education community. In our survey, we too noted inconsistent and imprecise use of language.

The words "peer" and "student" were the only terms consistently used by survey respondents to describe peer educator positions when advertising position openings, but even these terms were mentioned in fewer than half of the responses. This lack of clear, precise language was evident throughout the data. The words used in peer educator position advertisements, the terms supervisors use for themselves, and the names of programs all vary considerably.

While an effective understanding of peer educator/supervisor relationships does not require consistent language, we find that this

level of variability is high even for a functional area in higher education. We know that how people talk about something is a manifestation of how they think about it. So, for example, the varied responses to how our respondents describe their relationships to their peer educators (most often supervisor, mentor, and coach) help us understand these relationships as complex, multilayered, and a blend of the professional and educational. Like most relationships, they're complicated. Moreover, the rather small number of responses that indicated terms like "colleague" also reveals a distance at which supervisors situate themselves from their peer educators. Not correlated with age, geography, or any other relevant factors, we find that this represents a mostly pervasive way that professionals conceptualize these relationships.

Finally, regarding language, the combination of inconsistent or imprecise descriptions of what peer educators are, coupled with a conceptualization of peer educators that does not situate them as colleagues, may be making it more challenging for professionals to share the narratives around their program effectively. This may be part of the reason why so few respondents indicate that their work is part of a larger, extra-institutional narrative, or why an alarmingly high proportion, more than one in five, have not obtained base funding.

Precarity

When taken together and in context, one surprising theme is the rather pervasive sense of precarity that professionals have regarding their peer educator programs. Beyond the uncertainties around funding, we also heard our participants clearly state that they don't have sufficient time to train, supervise, and support peer educators effectively; that they overwhelmingly feel a need to "prove" the value and contributions their peer educator programs provide; and that they struggle to ensure a consistently high quality of service. These issues all suggest a sense that professionals who are responsible for administering peer educator programs feel immense pressure to deliver impactful services on relatively meager budgets with little overall institutional support. That sounds awfully stressful to us!

In attempting to develop an understanding of the relationships between peer educators and their supervisors, the stress that may likely result from precarious positions is highly salient. Stress has negative impacts not just physically and mentally for individuals, but also on relationships. The survey data suggest that supervisors are consumed by the neoliberal and bureaucratic tasks assigned to them by their institutions, and at the same time are still attempting to eke out opportunities to serve as mentors, coaches, and other supporting roles for peer educators.

Simultaneously, supervisors are clearly aware that the overall performance of peer educators is at the very core of the performance

of the programs for which they are responsible. This adds to our multilayered understanding of these relationships. Supervisors want to build relationships, foster trust, contribute to learning and development, and the like, and all the while they are pressured to achieve neoliberal aims like "maximizing productivity" from their peer educators. This speaks to the complexities that arise when students become peer educators and that we find is at the heart of understanding these relationships: how does identity salience (Torres et al, 2009) function when peer educators are at once both students and employees?

Moreover, how does this pervasive sense of precarity diminish possible outcomes for peer educators, both as students and employees, and their relationships with their supervisors? While certainly a fertile area for future research, our data here suggest that supervisors may perhaps report that they rarely have adequate time and resources to address the domains of these relationships in a way that maximizes benefits to the peer educators. In other words, we believe many supervisors feel caught betwixt and between, trying to forge meaningful relationships that are easily corrupted by the push to serve more, do more, impact more. We hope that future research will also examine the ways that peer educator and supervisor relationships might vary when levels of precarity at the program level are considered.

Conclusions

Our exploratory work on understanding these relationships has yielded rich data and allows us to construct some initial answers to the research question. The results reveal a complex set of relationship dynamics, predicated on a foundation that professionals view themselves as benign managers of peer educators who primarily deliver support services to their fellow students. As we might expect in any interpersonal relationship, the full story is much more complicated.

Professionals report benefitting personally from the work of peer educators but seem to characterize any mentoring or development as unidirectional. Practitioners set very high expectations for the skills and abilities peer educators will bring to the work, and to their performance, but are largely reticent to include them in tasks or opportunities that may be related to their work, such as program development and assessment. Professionals seem confident in the ability of peer educators to deliver effective, high-quality programming, but struggle to convince other stakeholder groups of the legitimacy or efficacy of such a model. These intricate dynamics may be understood as a set of tensions we have identified in these relationships and each could be a topic for further study.

We distill two major findings that emerge from these tensions, emanating from the threads and themes in our data. First, the range of responses from colleagues who participated in the study across Canada and the United States demonstrate that as much as

professionals engage intentionally with peer educators, they do not spend significant time considering (and hence there is little consensus regarding) how they think about their relationships with peer educators. These relationships are replete with opportunity, power dynamics, emotions, intellectual curiosity, and the like, but remain largely unconsidered.

The second major finding is that professionals certainly understand the abilities and contributions that peer educators make to be critical to their own work and to the success of their programs, but they generally seem reticent to accept (or even consider) peer educators as equals. While, admittedly, peer educators are students and not full-time employees, if the missions of our programs center student learning and development, then perhaps it is time for practitioners to evaluate our own internal biases, in addition to the ways our bureaucratic institutional cultures serve to reinforce such biases.

To be clear, we do not intend to fault our colleagues for these perspectives. In fact, given what we know about neoliberal, capitalist workplace cultures (Harvey, 2007; Lynch, 2010; Quaye et al., 2019), such conceptualizations make perfect sense. We instead hope that this initial research will spark new, robust, meaningful conversations about how we conceptualize these relationships. The work we ask of peer educators is great, and as the survey data here shows it requires critical thinking skills, metacognitive awareness,

and a certain amount of subject matter expertise. However, we find the work and outcomes of our peer educators warrant more than relegating them to "paraprofessional" or some other "less than" status.

We know that the landscape for higher education is a challenging one, that we are called to do more with less, and that many professionals feel a genuine sense of precarity or scarcity. We hope this research, data, and findings help illuminate a path forward that rejects a zero-sum approach to our work in academic support and higher education, embracing the ideals and values of our field, namely that we have the most meaningful impact when we work together. We further call for conversations in the field that consider and position peer educators as colleagues. They already make immense contributions to our programs, they bring invaluable skills and perspectives that are critical to the work, and we can maximize learning, development, and personal growth for all when we reframe leadership as something contextual and that is shared among colleagues.

References

Bleakney, J., & Holsinger, J. (2020). Student workers as learning & writing center leaders on a residential campus. *The Learning Assistance Review*, *25*(2), 287-292.

Breslin, J. D., Kope, M. H., O'Hatnick, J. L., & Sharpe, A. G. (2018). Students as colleagues: A Paradigm for understanding student leaders in academic support. *Learning Assistance Review*, *23*(2).

Brown, G., Pierce, J. L., & Crossley, C. (2014). Toward an understanding of the development of ownership feelings. *Journal of Organizational Behavior*, *35*(3), 318-338.

Harvey, D. (2007). *A brief history of neoliberalism*. Oxford University Press, USA.

Keller, P. & Porter, H.D. (2020). A terminological study of peer education in higher education [white paper]. *College Reading and Learning Association*. https://crla.net/images/whitepaper/CRLA_2020_WhitePaper_Peer_Ed_FA.pdf

Kelly, A., LaChance, J., Mirza, S., & Torma, K. J. (2020). Collaborative leadership: Growing and reflecting as a team during COVID-19. *The Learning Assistance Review*, *25*(2), 273-286.

Lynch, K. (2010). Carelessness: A hidden doxa of higher education. *Arts and Humanities in Higher Education*, *9*(1), 54-67.

Quaye, S. J., Aho, R. E., Beard Jacob, M., Domingue, A. D., Guido, F. M., Lange, A. C., Squire, D., & Stewart, D.-L. (2019). *A bold vision forward: A framework for the strategic imperative for racial justice and decolonization*. Washington, DC: American College Personnel Association.

Torres, V., Jones, S. R., & Renn, K. A. (2009). Identity development theories in student affairs: Origins, current status, and new approaches. *Journal of College Student Development, 50*(6), 577-596.

Young, D. G., Hoffman, D. E., & Frakes Reinhardt, S. (2019). An exploration of the connection between participation in academic peer leadership experiences and academic success. *Journal of Peer Learning*, *12*(1), 45-60.

Update the Dots before Connecting Them: Learning Styles in the 21st Century

Joshua Clements

Abraham Baldwin Agricultural College

Abstract

This article responds to Just & Bruner's (2020) call for connecting the dots of student under-preparedness. While many of the suggestions in the essay are useful in the 21st century, the inclusion of learning styles is questionable. The following is a review of the current literature regarding learning styles and why they are not needed in the 21st-century classroom.

Keywords: Learning styles, student success

Update the Dots Before Connecting Them: Learning Styles in the 21st Century?

Student under-preparedness is a growing issue for colleges, but there is a shortage of literature on how to best combat the problem (Just & Bruner, 2020). Reasons for this deficiency can be attributed to policies such as No Child Left Behind (NCLB) and the tendency of K-12 to teach to the test (Trolian & Fouts, 2011). The added

stressors of the COVID-19 pandemic exacerbate all of these problems and present new ones. It is not hard to see why incoming students have such trouble meeting higher education standards.

Another major issue, according to Just and Bruner (2020), is the inversion of the Pareto principle or 80/20 rule when students get to college. Accordingly, in the K-12 system, student learning stems mainly from the teacher while in the classroom environment. When the students come to the higher education setting, the learning will now be 20% in the classroom while the other 80% is up to the student through reading materials and other supplemental items. This calculation may also be seen in the Carnegie credit unit wherein three credit hours are generally assigned to a classroom course: one hour for in-class instruction and two for out-of-class instruction.

Learning assistance programs exist for successful students as much as for struggling students, but the changes in learning environment from K-12 to college have caused an uptick in referrals to support services such as developmental courses, mental health counseling, and tutoring. These increases in recommendations indicate a much larger problem to be solved: the divide between K-12 policy and higher education expectations and standards.

Just and Bruner (2020) suggested countering the divide using a series of seminars on such items as time management skills, strategic planning for homework, and motivation versus procrastination. The recommended items include productive skills college students need to navigate their educational journey successfully. These suggestions are direly needed at campuses across the country and logically follow as useful methods to meet the needs of the current generation.

One concern with the suggestions made by Just and Bruner (2020) is their addition of learning styles and the need to apply them in higher education. The inclusion of learning styles is problematic and contrary to other points in their suggested list, such as the student's ownership of learning and personal/academic responsibility. The nature of this essay is to illustrate issues with using learning styles, describe the field of learning styles in its current scope, and explain possible reasons for their continued use.

Problems With Using Learning Styles

To briefly illustrate the scope of learning styles theories, a survey of the major theories is needed. Widely used theories include Dunn and Dunn's (1990) learning styles model with categories such as environmental, emotional support, sociological composition, physiological, and psychological elements, meaning these external stimuli in the learning environment influence student learning. Kolb's (1984) experiential learning styles labels students according

to stages of learning, which includes accommodators, convergers, divergers, or assimilators. Honey and Mumford's (2000) Learning Styles Questionnaire is similar in construct to Kolb's but classifies students as activists, reflectors, theorists, and pragmatists. The last main learning style is the VAK method (Fleming & Mills, 1992), which is an acronym for how students prefer information to be shared with them: visual, auditory, and kinesthetic. A read/write category was added later to create VARK. In just this small sample, one may find the field confusing when looking at it in its entirety. The next issue is the constructs on which the theories are formed.

A significant area of contention with learning styles is evaluating and employing the theories. Dembo and Howard (2007) suggested that faulty research laid the foundations of learning styles theories. They argued that the *validity* (Does the test measure what it claims to?), *reliability* (Can the test be replicated?), and *application* (Are the results usable and practical?) are all questionable in the majority of learning styles studies.

The issues highlighted by Dembo and Howard (2007) and others were corroborated and built upon by subsequent studies. Pashler et al. (2009) articulated what might be sufficient evidence to validate learning styles theories and found the literature lacking in support. In their review, An and Carr (2017) found

that the frameworks of many learning styles did not explain the underlying mechanisms and that measures of learning styles were based on self-reports and lacked reliability. Additionally, in their review, there was no link between achievement and objective learning.

Barry and Egan (2018) discussed the ambiguity of the terms within the learning styles literature and the poorly defined concepts. Given these issues, they suggested that such research "should be questioned as to its specificity, practical utility and validity" (p. 34). The methodological criterion is one controversy, but how do learning styles apply to actual learning?

Researchers have started critically evaluating the effectiveness of learning styles in their respective fields. For instance, recent scoping reviews in counseling education (Aafjes-van Doorn et al., 2021) and medical education (Davies-Kabir & Aitken, 2021) agree that learning styles are not beneficial to effective learning in these fields. Many studies have built upon a foundation of empiricism started by Pashler et al. (2009). These studies found no scientifically proven support for the idea that matching information presentation to students' learning styles equates to real learning (An & Carr, 2017; Husmann & O'Loughlin, 2019; Rogowsky et al., 2015; Rogowsky et al., 2020).

At issue is the conflation of learning with preference. Reiner and Willingham (2010) argued that differences in a student's capacity to

learn various content areas are not the same as that student's preference for a style of instruction. Yet, the two are often conflated (Willingham et al., 2015). Reiner and Willingham (2010) also suggest that students differ in their interests and background knowledge, which influences their ability to learn new concepts. All of this illustrates that, yes, students are individuals, each with their own learning journey. However, it does not mean that their preference or style is related to their learning.

Rogowsky et al. (2015) demonstrated that differences in learning styles did not significantly predict differences in learning aptitude. Accordingly, their results showed that adult learners' preferred learning style is not their aptitude for learning. A style may refer to how a student desires to learn a concept, but ability is how well that student can learn it (Willingham et al., 2015). The analogy used by Willingham et al. (2015) to illustrate this difference is that of two basketball players wherein both share the ability to play, but one may prefer to take more risks than the other. The question of whether or not that preference is beneficial for the player arises.

For the last forty years, researchers have argued that learners are not always aware of what they do not know, particularly with what is best for their learning (Clark, 1982; Kirschner & van Merriënboer, 2013; Massa & Mayer, 2006). This reality provides

another area of concern in learning styles theories, particularly because they equate preference with objectivity. Building on the work of Clark (1982,1989) and the term *mathemathantic*, which describes the phenomenon of a learning strategy that harms student learning, Kirschner (2017) stated, "what people prefer is not, per definition, what is best for them... the question arises as to whether learners actually 'know' what is best for them" (p. 167). With learning styles, the methods often tell us what the students prefer, but what is preferred is not usually what is best for the individual (Husmann & O'Loughlin, 2019; Kirschner & van Merriënboer, 2013).

Moreover, if learning styles are effective, they will be effective both in the classroom and out of it. Husmann and O'Loughlin (2019) found that was not the case. In their study, 67% of students (n = 426) used study strategies contradicting their scores on a VARK inventory. Also, the students who used a study method in line with their VARK category performed no differently in the class than those who did not use a designated VARK-appropriate strategy.

Papadatou-Pastou et al. (2018) demonstrated that some teachers feel they can rightly judge a student's learning style based on interactions with the student and provide anecdotal evidence to support that claim. Nevertheless, teachers' assumptions about their students' learning styles did not correlate with the self-reported learning styles of the students. Complicating the matter, all of the

teachers in the study reported their belief that tailoring their teaching to the students' learning style helps them learn better.

Another area of contention with teaching to students' preferences or perceived strengths is that the act rarely incentivizes the students to engage or work on their weaknesses. While there is evidence supporting a "strengths-based" approach to education (Lopez & Louis, 2009), giving students an excuse to disregard their weaknesses as not their preferred learning style is problematic (Papadatou-Pastou et al., 2021). Additionally, students often allege that their professor did not teach to their learning style as an excuse for poor academic performance or simply not wanting to read course material because they are visual learners (Frost-Camilleri, 2021).

The opposite of this may also be true. Dembo and Howard (2007) suggested that the appeal of learning styles lies in the promise of simple solutions to educational problems, and they offer teachers an excuse for poor student performance. The issue is that this belief shifts the emphasis of learning from the supposed learner to the teacher. Where is the agency for the students and responsibility for their learning (Vaughn, 2020)? Also, Pashler et al. (2009) suggested that emphasizing learning styles may be appealing because parents and students feel like it encourages educators to treat them as individuals. This allows students and parents to blame the teacher for poor performance

instead of evaluating whether their study habits and efforts in the class are sufficient.

An additional problem with learning styles theories is the impracticality of distinguishing individual attributes. Advocates of learning styles and similar systems such as Gardner's multiple intelligences (Rousseau, 2021) or even Universal Design for Learning (Boysen, 2021; Murphy, 2021) have argued that people are not fixed in a learning style and that an individual may encompass more than one style at a time even though the process of creating and employing distinct categories implies a certain amount of fixation. One promoter of learning styles even stated, "The number of attributes that distinguish one type of learner from another is uncountably large. Encompassing most of them in a single theory would be virtually impossible, and even if it could be done, the model would be too cumbersome to be of any practical use" (Felder, 2020, p. 4). Other research attempting to support the use of learning styles theories acknowledged the restrictive nature of focusing on a single methodology for teaching (Dantas & Cunha, 2020).

One last key issue, and arguably the one with the most harmful implications, is the act of pigeonholing or labeling students and putting them into fictional boxes. Kirschner and van Merriënboer (2013) suggested at least three problems with pigeonholing learners: "Many people do not fit one particular style, the information used to assign people to styles is often inadequate, and there are so many

different styles that it becomes cumbersome to link particular learners to particular styles" (p. 173). The general method of discovering a person's learning style is through self-reported surveys, and there are over 70 different styles to choose from (Coffield et al., 2004).

Instead of this fixation on categorical thinking, educators should know that the brain is an amazing part of the human anatomy with numerous inputs, outputs, and myriad complexities (Coch, 2018). The conversation about how neuroscience and psychology apply to education and learning is much more nuanced than any category created by learning styles proponents. Due to brain plasticity, educators should avoid attempts to predict a learner's potential, especially when the categories themselves are not based on empirical evidence (Sankey & Kim, 2018). Scott (2010) contended, "rather than being a harmless fad, learning styles theory perpetuates the very stereotyping and harmful teaching practices it is said to combat" (p. 5). With the potential for harm so great, where do learning styles stand in the 21st century?

Current Status of Learning Styles

One prominent researcher on learning styles related her experience to watching a scary movie where the monster keeps coming back regardless of what is thrown at it (Hall, 2016). She suggested that, in the case of learning styles, "no matter what

we've hit it with, the thing won't die" (p. 18). Other writers have compared learning styles to ugly sweaters where one gets a little enjoyment for a brief period wearing them but realizes that they are a gimmick and would seem out of place in everyday use (Barclay, 2017). Despite these assertions, the discussion is still ongoing.

Newton et al. (2021) found that 91% of papers published since 2015 on learning styles (n = 112) highlighted the theories' supposed positive effects and utility despite the growing evidence indicating otherwise. Papadatou-Pastou et al. (2021) demonstrated that educators might conflate and combine the numerous learning styles approaches to create a 'mix and match' model. These studies illustrate Coffield's (2013) assessment that the learning styles field is "theoretically incoherent and conceptually confused" (p. 1).

Researchers such as Kirschner and van Merriënboer (2013), Howard-Jones (2014), and Kirschner (2017) have previously called for a critical evaluation of current practice and for empirical research to guide education. Others suggest that much of the research supporting learning styles has not engaged the significant body of evidence that the theories are unsubstantiated (Barry & Egan, 2018; Newton, 2015). Still, others request for the field of education to ask more and better questions about what is taught and how (Kim & Sankey, 2018) and advocate for a crossover of education and neuroscience disciplines (Coch, 2018).

While the theoretical underpinnings of learning styles and other neuromyths have been questioned, the practical utility of using these theories is murky waters indeed. They may act as a placebo wherein mere belief in them is enough to manifest a change in learning (Sankey & Kim, 2018), but other factors are likely present, and this assessment does not deny the potential harm caused by the beliefs. Barry and Egan (2018) as well as Knoll et al. (2016) both agreed that learning styles may have limited utility in that they encourage students to think about how they learn, but that this effect should be tempered by the realization that preference is not a limiting factor in a student's learning. Given the status of learning styles, why do they persist in education?

Reasons for Continued Use of Learning Styles

Reasons for continued belief in learning styles include previously held opinions primarily due to early childhood education, anecdotal evidence and intuition, non-scientific thinking, the proliferation of the theories in popular culture, and finally, the excitement of learning one's style. Teaching learning styles to young students is one reason the theories are embedded in the adults who become teachers themselves. In their multi-year study, Kim and Sankey (2018) found that the pre-service teachers who believed in learning styles theories were more confident in their belief than those who were more skeptical of

the theories. These beliefs are often deep-seated due to their use in childhood and high school education, with nearly half of respondents in Kim and Sankey's (2018) study reporting their schoolteachers as the genesis of the ideas. Attempts to change these beliefs in many educators fail due to the human mind being "loyal to what it has known and used for a longer period, even when confronted with the incorrectness of that knowledge" (de Bruin, 2020, p. 6).

Research in other areas such as misinformation and disinformation illustrated that "Objective truth is less important than familiarity; we tend to believe falsehoods when they are repeated sufficiently often" (Lewandowsky et al., 2020, p. 5), a process called the *illusory truth effect*. As the falsehood is shared and not questioned, belief in its truthfulness grows and the more lodged into the human consciousness it becomes. Even when corrections are made to these fallible beliefs, the misinformation continues to operate subconsciously to influence an individual's thought processes through an effect called the *continued influence effect*, meaning that the corrective measures may not "translate into attitude or behavior change" (Lewandowsky et al., 2020, p. 6).

Many of these beliefs follow the educators into their classrooms. Any positive performance from their use is taken as evidence to support the views without question, providing the individuals with anecdotal proof. Menz et al. (2021) found in their study of pre-

service teachers that belief in learning styles stemmed largely from personal experiences and stories from others. These experiences add to confirmation bias. Previous research has alluded to confirmation bias as one reason why learning styles persist in education (Reiner & Willingham, 2010). With confirmation bias, coherent stories are formed based on the information a person has (and likes). These stories then supersede statistics or any other kind of evidence through an effect Kahneman (2011) called "WYSIATI: what you see is all there is" (p. 85) and offer an illusion of validity to an "unfounded intuition" (p. 239). The emphasis on intuitive thinking creates problems in many human endeavors, including education. Acknowledging this problem is the first step toward change. The second is to apply more critical thought to the field and use scientific evidence where possible.

Some researchers have questioned the practice of evidence-based education (Wrigley, 2018), while others have called for a more pragmatic approach (Newton et al., 2020). Still others suggest educators teach students to think like scientists, meaning they should be equipped with the skills needed to create sound arguments and evidence-based research while recognizing poorly designed and biased research (Schmaltz et al., 2017). Unfortunately, many teachers are not trained in this manner. What hope is there that they can teach others to do so? Some

may take offense and argue that intuition and personal judgment are sufficient evidence. The problem with basing practice on judgment alone is human judgment is often rife with problems, namely the myriad biases that impair one's view of a given situation or idea (Kahneman, 2011).

Beliefs in learning styles and their implications are not limited to the educational setting. They carry over into the non-education environment, most likely due to average citizens hearing the theories during their school career. Nancekivell et al. (2020) found that most respondents to their survey (n = 331) believed learning styles predicted career outcomes, a longer-lasting implication than just that of learning in the classroom.

Two other interesting findings in their study were that there was little difference between non-educators' and educators' assumptions about learning styles, and that belief in learning styles declined as the respondents who were educators shifted from elementary school through to higher education. The only factor that Nancekivell et al. (2020) found to significantly predict educators' beliefs in learning styles was the age of the students they taught. van Dijk and Lane (2018) observed similar results in their study of misconceptions about the brain, such as learning styles, right-brain/left-brain learners, and dyslexia. They found that higher education faculty correctly identified the myths at a statistically higher rate than general education and special education teachers.

They were also more prone to choose the "Do Not Know" option, possibly indicating their willingness to question their own knowledge.

A possible reason for the fixation of belief in learning styles in the early education experience that was not discussed by Nancekivell et al. (2020) is that many high school teachers and higher education faculty are not exposed to learning styles in pedagogical classes to the extent that early childhood and middle school teachers are (Hughes et al., 2020). Another might be that the upper-level teaching professions generally engage in more deliberation about their content, a process shown to reduce beliefs in inaccurate information (Nyhan, 2021).

A final and perhaps most alluring reason for the enduring nature of learning styles is they can be exciting to discover. Pashler et al. (2009) argued that most learning styles taxonomies borrow from Jungian psychology in that they lump people into distinct categories or "types." Early learning styles theorists such as Felder (2020) admit to being influenced by Jung's theories and the subsequent Myers-Briggs Type Indicator (Myers, 1962). Based on this information, there is a certain appeal to learning what "type" of person one is and what his or her future entails. Reading the horoscopes in the daily newspaper or discovering which Hogwarts house one might be in offers a similar

experience. While it is fun and appealing, it is unnecessary for education and learning.

Can Beliefs Be Changed?

To combat the prevalence of neuromyths and lack of evidence-based teaching paradigms, the field of education needs a solution that may also help students' under-preparedness. Building on a tradition set by Carl Sagan (1996), there is a drastic need for more skepticism in teaching and education. The essence of this skeptical thinking is to recognize erroneous ideas and ill-supported practices. Some of the items included in Sagan's (1996) "baloney detecting" tool-kit are independent confirmation of facts (*allow neuroscience to confirm or deny the efficacy of learning styles*, see Grospietsch & Lins, 2021), substantive debate (*the learning styles debate has been considerably one-sided for many years*, see Newton et al., 2021), Occam's Razor (*with over 70 different styles in the literature, there is no simple answer*, see Coffield et al., 2004), falsifiability of hypothesis (*it is near impossible to disprove learning styles*, see Willingham et al., 2015), and carefully designed and controlled experiments with reproducible results (*for reasons learning styles experiments are often problematic*, see Pashler et al., 2009).

A person does not have to be a scientist to think like one, nor does every situation call for scientific thinking. There are certainly other ways of generating knowledge and meaning about the world that offer a robust understanding. But to alleviate much of the

guesswork found in education literature, the field would do well to ask more questions instead of simply repeating outdated and outmoded practices (Kim & Sankey, 2018). Pashler et al. (2009) issued a call for an upgrade to education as an institution:

> research—not intuition or standard practices—needs to be the foundation for upgrading teaching and learning. If education is to be transformed into an evidence-based field, it is important not only to identify teaching techniques that have experimental support but also to identify widely held beliefs that affect the choices made by educational practitioners but that lack empirical support. (p. 117)

To borrow a metaphor from General Semantics (Korzybski, 2010), learning styles may have provided a map of student learning at one time, but the map should be updated as the territory is better understood. Just as Google and Mapquest must constantly update their maps to make sure travelers get to where they are going without confusion, educators must also update the maps of how they engage with students. It must be stated that the map is not the territory it describes. The labels put on students are not the students themselves, whether it is converging, kinesthetic, or activist to use some of the major theories.

The labels applied to students and the categories into which they are placed are not concrete or based on factual data (Sankey

& Kim, 2018). They consist of reified concepts. Postman (1976) defined reification as "confusing words with things" (p. 135). In this regard, labels become a kind of "semantic illusion, sometimes referred to as the principle of identity. One of mankind's deepest intuitions is to respond to the symbols he invents as if they 'are' whatever it is that he invented them to symbolize" (p. 136). The categories found in learning styles theories describe tendencies in people but become problematic when taken as imperatives.

For a time, learning styles may have had utility as psychology and neuroscience had not made the discoveries in how learning occurs until recent years. In this case, learning styles labels were not realities, but tools for making meaning in the world. To that end, Postman (1976) argued that "a definition is not a manifestation of nature but an *instrument* for helping us achieve our purposes" (p. 139, emphasis added). But, just as some instruments no longer have practical utility, such as an abacus or slide rule, learning styles have outlived their usefulness if there ever was any. Postman (1976) later asked what purpose is there in using the definition, label, or term? Originally, learning styles were used as attempts to understand student learning. Now, with a better understanding of how students learn, which does not include learning styles, what is the purpose of using them?

What is Needed Instead of Learning Styles

Despite the evidence contradicting learning styles, arguing against the theories has been questioned by recent research. Attempts to discredit the myths in education have their issues. Various training efforts, whether in psychology or neuroscience, and attempts to debunk learning styles may not be the most practical method for dissuading belief in the theories (Newton & Salvi, 2020). Pearson (2020) suggested a more diplomatic approach that accounts for the personal views of the educators. Instead of arguing against learning styles, opponents of the theories should redirect the conversation toward growth mindsets (see Dweck, 2008) and brain plasticity, both of which highlight resilience and the ability to adapt when challenged.

Other researchers suggest the field of education focus on proven teaching methods (Donoghue & Hattie, 2021; Dunlosky et al., 2013a). Promoting proven effective techniques such as retrieval practice, spaced learning, and practice tests may be the answer (Newton & Salvi, 2020). Indeed, too often, students use strategies such as rereading, highlighting, flashcards, and Quizlet as their primary study methods. These techniques are not the best ways to learn and likely keep students from using more beneficial methods (Dunlosky et al., 2013b). The problem with asserting that teachers should teach students updated learning strategies is that education departments are still introducing new

educators to invalidated methods (Kim & Sankey, 2018; Nancekivell et al., 2020). Dunlosky et al. (2013b) stated, "students are not being taught the best strategies, perhaps because teachers themselves are not schooled in them" (p. 53). Dunlosky et al.'s (2013b) statement may be the reason current educators and professionals are still calling for the use of learning styles.

Discussion

This article has argued that students discovering their learning style is not a strategy needed in 21st-century education. Calls for the use of learning styles are antithetical to many of the problems the authors hope to assuage. Just and Bruner (2020) suggest that by only focusing on testing, educators miss the "opportunity to aid the students in *true learning* that consists of a foundational skillset of reading and processing materials according to their learning style" (p. 135, emphasis added). "True learning" is not defined in this context, but, to date, many studies illustrate that knowledge of a person's learning style or preference has little bearing on whether or not the student learns better according to their chosen style (Husmann & O'Loughlin, 2019; Knoll et al., 2016; Massa & Mayer, 2006; Pashler et al., 2009; Rogowsky et al., 2015; Rogowsky et al., 2020).

If student under-preparedness largely stems from K-12 education practices (Just & Bruner, 2020), then suggesting bringing K-12 practices up into higher education does not logically follow.

Higher education faculty do not need any other excuse for students to give for not learning in the classroom. Giving credence to statements like, "I didn't do well in his class because he didn't teach using my learning style," is hardly the way forward.

Another area of contention with Just and Bruner's (2020) suggestion to use learning styles is tied to their admission that learning in the college setting lies mainly outside the classroom, even citing the Pareto principle. According to this logic, if learning styles are effective for learning, students' study habits outside the classroom should also align with their preferred style. Husmann and O'Loughlin (2019) demonstrated the problems with this assumption. Most students do not use their VARK preference in their study habits, and those who do show no difference academically from those who do not.

The history and narratives surrounding learning styles are vast, but troubled. To this point, "With such a long and storied history of different approaches, one would expect that if matching learning styles could produce measurable and consistent improvements in learning we would have ample evidence to this effect" (Dembo & Howard, 2007, p. 105). Even after fifteen more years of legitimate research against learning styles, they are arguably just as prevalent as ever in education circles. Instead of focusing on items with little evidence of learning effectiveness, educators should encourage

student agency through other methods suggested by Just & Bruner (2020) such as better time management and study habits, and students taking propriety of their learning.

References

Aafjes-van Doorn, K., Nissen, K. J., & Chen, Z. (2021). Learning styles in counseling: a scoping review of the empirical evidence. *Counselling Psychology Quarterly*, 1-25. https://doi.org/10.1080/09515070.2021.1908961

An, D., & Carr, M. (2017). Learning styles theory fails to explain learning an achievement: Recommendations for alternative approaches. *Personality and Individual Differences*, *116*, 410-416. doi: 10.1016/j.paid.2017.04.050

Barclay, M. (2017). Learning styles: The ugly Christmas sweaters of education. *I4Blog.* https://www.franklin.edu/i4/blog/learning-styles-ugly-christmas-sweaters-education

Barry, M., & Egan, A. (2018). An adult learner's learning style should inform but not limit educational choices. *International Review of Education*, *64*(1), 31-42. https://doi.org/10.1007/s11159-017-9694-6

Boysen, G. A. (2021). Lessons (not) learned: The troubling similarities between learning styles and universal design for learning. *Scholarship of Teaching and Learning in Psychology*. https://psycnet.apa.org/doi/10.1037/stl0000280

Clark, R. E. (1982). Antagonism between achievement and enjoyment in ATI studies. *Educational Psychologist*, *17*(2), 92-101.

Clark, R. E. (1989). When teaching kills learning: Research on mathemathantics. *Learning and instruction: European research in an international context*, *2*, 1-22.

Coch, D. (2018). Reflections on neuroscience in teacher education. *Peabody Journal of Education*, *93*(3), 309-319. doi:10.1080/0161956X.2018.1449925

Coffield, F. (2013). Learning styles: time to move on. *Lifelong Learning in Europe*, *4*, 2013.

Coffield, F., Moseley, D., Hall, E., & Ecclestone, K. (2004). *Learning styles and pedagogy in post-16 learning: A systematic and critical review.* London: Learning & Skills Research Centre (http://www.LSRC.ac.uk).

de Bruin, A. B. (2020). Debunking myths in medical education: The science of refutation. *Medical education*, *54*(1), 6. https://orcid.org/0000-0001-5178-0287

Dantas, L. A., & Cunha, A. (2020). An integrative debate on learning styles and the learning process. *Social Sciences & Humanities Open*, *2*(1), 100017. https://doi.org/10.1016/j.ssaho.2020.100017

Davies-Kabir, M., & Aitken, G. (2021). Learning styles in medical education: a scoping review. *MedEdPublish*, *10*. https://doi.org/10.15694/mep.2021.000169.1

Dembo, M. H., & Howard, K. (2007). Advice about the use of learning styles: A major myth in education. *Journal of college reading and learning, 37*(2), 101-109.

Donoghue, G. M., & Hattie, J. A. C. (2021). A meta-analysis of ten learning techniques. *Frontiers in Education, 6,* 581216. https://doi.org/10.3389/feduc.2021.581216

Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013a). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest*, *14*(1), 4-58. https://doi.org/10.1177/1529100612453266

Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013b). What works, what doesn't. *Scientific American Mind*, *24*(4), 46-53.

Dunn, R. (1990). Understanding the Dunn and Dunn learning styles model and the need for individual diagnosis and prescription. *Reading, Writing, and Learning Disabilities*, *6*(3), 223-247.

Dweck, C. S. (2008). *Mindset: The new psychology of success*. Random House Digital, Inc.

Felder, R. M., & Silverman, L. K. (1988). Learning and teaching styles in engineering education. *Engineering Education, 78*(7), 674–681.

Fleming, N. D., & Mills, C. (1992). Not another inventory, rather a catalyst for reflection. *To improve the academy*, *11*(1), 137-155.

Frost-Camilleri, L. (2021). It is time to let go of learning styles. *Fine Print (0159-3978)*, *44*(3), 3–7.

Grospietsch, F., & Lins, I. (2021). Review on the prevalence and persistence of neuromyths in education–Where we stand and what is still needed. *Frontiers in Education,* 250. https://doi.org/10.3389/feduc.2021.665752

Hall, E. (2016). The tenacity of learning styles: a response to lodge, Hansen, and Cottrell. *Learning: Research and Practice,* 2(1), 18-26. doi:10.1080/23735082.2016.1139856

Honey, P., & Mumford, A. (2000). *The learning styles helper's guide*. Maidenhead: Peter Honey Publications.

Howard-Jones, P. A. (2014). Neuroscience and education: myths and messages. *Nature Reviews Neuroscience*, *15*(12), 817-824. doi:10.1038/nrn3817

Hughes, B., Sullivan, K. A., & Gilmore, L. (2020). Why do teachers believe educational neuromyths? *Trends in Neuroscience and Education*, 100145. https://doi.org/10.1016/j.tine.2020.100145

Husmann, P. R., & O'Loughlin, V. D. (2019). Another nail in the coffin for learning styles? Disparities among undergraduate anatomy students' study strategies, class performance, and reported VARK learning styles. *Anatomical sciences education*, *12*(1), 6-19.

Just, R., & Bruner, D. (2020). Connecting the dots: Preparing for the underprepared. *Learning Assistance Review, 25*(1), 131-142.

Kahneman, D. (2011). *Thinking, fast and slow*. Macmillan.

Kim, M., & Sankey, D. (2018). Philosophy, neuroscience and pre-service teachers' beliefs in neuromyths: A call for remedial action. *Educational Philosophy and Theory*, *50*(13), 1214-1227. 10.1080/00131857.2017.1395736

Kirschner, P. A. (2017). Stop propagating the learning styles myth. *Computers & Education*, *106*, 166-171. http://dx.doi.org/10.1016/j.compedu.2016.12.006

Kirschner, P. A., & van Merriënboer, J. J. (2013). Do learners really know best? Urban legends in education. *Educational psychologist*, *48*(3), 169-183. doi:10.1080/00461520.2013.804395

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development.* Englewood Cliffs, NJ: Prentice-Hall.

Korzybski, A. (2010). Selections from science and sanity*: An introduction to non-Aristotelian systems and general semantics*, 2nd ed. Institute of General Semantics.

Lewandowsky, S., Cook, J., Ecker, U. K. H., Albarracín, D., Amazeen, M. A., Kendeou, P., Lombardi, D., Newman, E. J., Pennycook, G., Porter, E., Rand, D. G., Rapp, D. N., Reifler, J., Roozenbeek, J., Schmid, P., Seifert, C. M., Sinatra, G. M., Swire-Thompson, B., van der Linden, S., Zaragoza, M. S. (2020). The debunking handbook 2020. https://sks.to/db2020

Lopez, S. J., & Louis, M. C. (2009). The principles of strengths-based education. *Journal of College and Character*, *10*(4). doi:10.2202/1940-1639.1041

Massa, L. J., & Mayer, R. E. (2006). Testing the ATI hypothesis: Should multimedia instruction accommodate verbalizer-visualizer cognitive style? *Learning and Individual Differences*, *16*(4), 321-335. https://doi.org/10.1016/j.lindif.2006.10.001

Menz, C., Spinath, B., & Seifried, E. (2021). Where do pre-service teachers' educational psychological misconceptions come from?. *Zeitschrift für Pädagogische Psychologie*. https://doi.org/10.1024/1010-0652/a000299

Murphy, M. P. (2021). Belief without evidence? A policy research note on Universal Design for Learning. *Policy Futures in Education*, *19*(1), 7-12. doi:10.1177/1478210320940206

Myers, I. B. (1962). *The Myers-Briggs Type Indicator: Manual*. Consulting Psychologists Press. https://doi.org/10.1037/14404-000

Nancekivell, S. E., Shah, P., & Gelman, S. A. (2020). Maybe they're born with it, or maybe it's experience: Toward a deeper understanding of the learning style myth. *Journal of Educational Psychology*, *112*(2), 221. https://doi.org/10.1037/edu0000366

Newton, P. M. (2015). The learning styles myth is thriving in higher education. *Frontiers in Psychology*, *6*, 1908. https://doi.org/10.3389/fpsyg.2015.01908

Newton, P. M., & Salvi, A. (2020). How common is belief in the learning styles neuromyth, and does it matter? A pragmatic systematic review. *Frontiers in Education, 5*, 270. https://doi.org/10.3389/feduc.2020.602451

Newton, P. M., Da Silva, A., & Berry, S. (2020). The case for pragmatic evidence-based higher education: A useful way forward?. *Frontiers in Education 5*, 271. https://doi.org/10.3389/feduc.2020.583157

Newton, P. M., Najabat-Lattif, H. F., Santiago, G., & Salvi, A. (2021). The learning styles neuromyth is still thriving in medical education. *Frontiers in Human Neuroscience*, 435. https://doi.org/10.3389/fnhum.2021.708540

Nyhan, B. (2021). Why the backfire effect does not explain the durability of political misperceptions. *Proceedings of the National Academy of Sciences*, *118*(15). https://doi.org/10.1073/pnas.1912440117

Papadatou-Pastou, M., Gritzali, M., & Barrable, A. (2018). The learning styles educational neuromyth: lack of agreement between teachers' judgments, self-assessment, and students' intelligence. *Frontiers in Education*, *3*, 105. https://doi.org/10.3389/feduc.2018.00105

Papadatou-Pastou, M., Touloumakos, A. K., Koutouveli, C., & Barrable, A. (2021). The learning styles neuromyth: when the same term means different things to different teachers. *European Journal of Psychology of Education*, *36*(2), 511-531.

Pashler, H., McDaniel, M., Rohrer, D., & Bjork, R. (2009). Learning styles: Concepts and evidence. *Psychological science in the public interest*, *9*(3), 105-119.

Pearson, J. (2020). Engaging a belief in learning styles to encourage a growth mindset. *Performance Improvement*, *59*(7), 19-24. https://doi.org/10.1002/pfi.21927

Postman, N. (1976). *Crazy talk, stupid talk: How we defeat ourselves by the way we talk and what to do about it*. Delacorte Press.

Rogowsky, B. A., Calhoun, B. M., & Tallal, P. (2015). Matching learning style to instructional method: Effects on comprehension. *Journal of educational psychology*, *107*(1), 64. http://dx.doi.org/10.1037/a0037478

Rogowsky, B. A., Calhoun, B. M., & Tallal, P. (2020). Providing instruction based on students' learning style preferences does not improve learning. *Frontiers in Psychology*, *11*, 164. https://doi.org/10.3389/fpsyg.2020.00164

Riener, C., & Willingham, D. (2010). The myth of learning styles. *Change: The magazine of higher learning*, *42*(5), 32-35.

Rousseau L. (2021). "Neuromyths" and multiple intelligences (MI) theory: A comment on Gardner, 2020. *Frontiers in Psychology*, *12*, 720706. https://doi.org/10.3389/fpsyg.2021.720706

Sagan, C. (1996). "The fine art of baloney detection." *The demon-haunted world: Science as a candle in the dark*. Ballantine books.

Schmaltz, R. M., Jansen, E., & Wenckowski, N. (2017). Redefining critical thinking: Teaching students to think like scientists. *Frontiers in Psychology*, *8*, 459. https://doi.org/10.3389/fpsyg.2017.00459

Scott, C. (2010). The enduring appeal of 'learning styles'. *Australian Journal of Education*, *54*(1), 5-17.

Trolian, T. L., & Fouts, K. S. (2011). No child left behind: Implications for college student learning. *About Campus*, *16*(3), 2-7. https://doi.org/10.1002%2Fabc.20061

van Dijk, W., & Lane, H. B. (2020). The brain and the US education system: Perpetuation of neuromyths. *Exceptionality*, *28*(1), 16-29. doi:10.1080/09362835.2018.1480954

Vaughn, M. (2020). What is student agency and why is it needed now more than ever?. *Theory Into Practice*, *59*(2), 109-118. doi:10.1080/00405841.2019.1702393

Willingham, D. T., Hughes, E. M., & Dobolyi, D. G. (2015). The scientific status of learning styles theories. *Teaching of Psychology*, *42*(3), 266-271. doi:10.1177/0098628315589505

Wrigley, T. (2018). The power of 'evidence': Reliable science or a set of blunt tools? *British Educational Research Journal*, *44*(3), 359-376. doi:10.1002/berj.3338

Evaluating the Effectiveness of Academic Coaching for College Students

Sunder Singhani[1], Kate McLaren-Poole[2], & Renee A. Bernier[3]

[1]Department of Counselor Education

[2]Office of Institutional Research

[3]Academic Achievement Center

Bridgewater State University

Abstract

The effectiveness of academic coaching at a mid-sized public university was evaluated for the spring 2020 semester by examining the change in academic performance and retention to the fall 2020 semester. Coaching effectiveness was evaluated across three different groups of undergraduate students. Two of the groups were academic recovery programs and one was comprised of students in good standing. Student data from the Office of Institutional Research (OIR) was analyzed for coached students and non-coached students using an ex-post-facto, quasi-experimental design. Results indicated that coached students in good academic standing had a significant increase in cumulative GPA of 0.12 from pre to post semester. For academically at-risk students in the two academic recovery programs, Freshman Grade Point Recovery and Summit, the results showed a significant increase of 0.55 and 0.54 in

cumulative GPA respectively, and a significant increase of 0.42 and 0.89 in term GPA compared to matched non-coached groups respectively. Retention rates to the fall 2020 semester were higher for all coached students compared to matched non-coached groups.

Keywords: Academic coaching, program evaluation, learning assistance, academic performance, student retention

Evaluating the Effectiveness of Academic Coaching for College Students

College student retention, persistence, and completion have long been the dominant lenses through which student success has been analyzed and evaluated (Mayhew et al., 2016; Tandberg & Hillman, 2014; Tinto, 2006; Veenstra, 2009). Persistence rate is defined as the percentage of first-year students who return to college in their second year to continue their education at *any* institution, whereas retention rate is the percentage of first-year students who return specifically to the same institution (National Student Clearinghouse Research Center [NSCRC], 2021). According to NSCRC (2021), the overall persistence rate across all institutions in the United States dropped by two percentage points, from 75.9% in the fall 2018 cohort to 73.9% in the fall 2019 cohort, while the retention rate dropped by 0.8%, from 67.0% to 66.2% in the same time frame.

Retention and persistence rates had been stable for four years prior, so this trend is disconcerting, given that the baseline numbers were already unsatisfactory. From National Center for Education Statistics (NCES; 2021) data, the average percentage of first-year four-year degree students from 2014 to 2019 cohorts that do not return to their institution is about 19%. For part-time students, this percentage for the same set of cohorts drops further to 55.5% (NCES, 2021).

The data referenced above indicate that retention and persistence are major challenges for institutions in the nation and emphasize the need for heightened focus on interventions grounded in student retention and persistence. Academic coaching emerged as an intervention in 2000 for improving student retention and success (Bettinger & Baker, 2014). In the last decade, several institutions have started academic coaching programs using different approaches to implementation (Robinson, 2015). Based on their review of academic coaching programs across 101 institutions in the nation, Robinson (2015) proposed a definition of academic coaching, which involves an interpersonal relationship between the student and coach where the coach helps the student to become aware of their values, interests, purpose, and passion, and then helps develop those qualities in the student. For the purpose of this research and as academic coaching is viewed by the current institution, academic coaching is defined as an interpersonal relationship between a

coach and a student which helps the student to: (a) improve their awareness of purpose, strengths, values, and interests, (b) enhance self-regulation skills, (c) build learning strategies for college-level academics, and (d) engage in the university community.

Despite the proliferation of academic coaching programs, there is a dearth of empirical studies evaluating the effectiveness of these programs. This article reviews the literature on academic coaching as an intervention as compared to other interventions used by institutions, and the literature on the limited set of empirical studies available on this topic. The academic coaching program at Middletown State University (MSU), a mid-sized, suburban, northeastern, public university, is also described. The academic coaching program at MSU is assessed based on student learning outcomes and student retention, and the specific program evaluation questions are presented. The results of the program evaluation are documented with the discussion and conclusion subsequently. Since this was a single-semester evaluation that spanned the start of the COVID-19 pandemic, the effects of the pandemic are also discussed.

Literature Review

Bettinger and Baker (2014) identify three major barriers to college student success and retention: lack of access to appropriate information (Bettinger et al., 2012; Deil-Amen & Rosenbaum, 2003; Goldrick-Rab, 2010), students' academic preparation and

performance (Adelman, 2006; Bettinger & Long, 2009; Calcagno & Long, 2008), and lack of integration into the university community (Bloom & Sommo, 2005; Tinto, 2006). Interventions, such as learning communities, student success courses, academic advising, and summer bridge programs, seek to increase retention and persistence (Bettinger & Baker, 2014). Academic coaching, as a postsecondary student support initiative, dates back twenty years, to the advent of InsideTrack, a third-party provider that partners with college and universities to provide coaching to incoming students (Bettinger & Baker, 2014). InsideTrack was rolled out in the 2000-2001 school year and has coached more than 2.6 million students nationally (InsideTrack, 2021). Once a student is matched with an InsideTrack coach, the coach provides support for prioritization, goal setting, planning, and organization, for academic and non-academic activities (Bettinger & Baker, 2014).

At first glance, the academic coaching model seems closely aligned with the broader concept of college mentorship, with a mentor being defined as someone who helps students to address the aforementioned barriers by suggesting learning strategies, building relevant non-academic skills, like time management and goal setting, and referring them to additional college resources (Bettinger & Baker, 2014). However, mentoring, whether faculty or peer mentoring, is considered more informal and broader compared to the formal processes and specific areas covered by academic

coaching (Robinson, 2015). Mentors rely on their personal experience and may use less in-depth knowledge of topics to guide students, whereas coaches are trained to respond to specific student challenges and provide in-depth strategies to guide them (Robinson, 2015). Another support mechanism provided in higher education is academic advising. Academic advisors typically guide students with overall degree planning, major selection, course selection and registration by semester, adherence to institutional policies/procedures, and referrals to other resources (McClellan & Moser, 2011; Robinson 2015). They generally have high student caseloads and meet with students once or twice in a semester unless there are special circumstances. Academic advisors do not spend as much one-on-one time with students as coaches, so they lack the depth of relationship, and they are not trained to help students with self-regulation and study skills for better learning outcomes (Robinson, 2015). In some institutions, these functions may overlap or be part of the same department.

Other support mechanisms in higher education that may be confused with academic coaching are counseling and tutoring. Counselors at colleges are licensed professionals who help students with their mental health, wellbeing, education, and career goals (Kaplan et al., 2014; Robinson, 2015). Academic coaching "does not hold the stigma of therapy, yet it provides comprehensive assessment of the whole student experience which includes

environmental, psychological, and skills-based concerns" (Robinson, 2015, p. 116). This indicates some overlap in services, but coaching provides referrals to counseling when it is clear that the problems a student is facing are based on mental health challenges. Tutoring, as an academic support, is purely based on subject knowledge and specific content-oriented study skills (Robinson, 2015). Tutors help students with challenges in specific courses and serve as role models because they are generally senior students who have already taken those courses (Robinson, 2015). Unlike tutoring, academic coaching provides foundational skills that span all coursework and is not content-specific.

The effectiveness of academic coaching programs has been evaluated in a handful of empirical studies (Alzen et al., 2021; Bettinger & Baker, 2014; Capstick et al., 2019; Lehan et al., 2018; Robinson & Gahagan, 2010; Sepulveda et al., 2019), which are examined next. The largest study (N=13,555) was done using InsideTrack data across 2- and 4-year programs, public and private not-for-profit, and proprietary colleges (Bettinger & Baker, 2014). In this study, students were randomly assigned to a coaching group (n=8,049) or a control group (n=5,506). The researchers found that the coached students had 5% and 12% better retention than students who had not received coaching, after six months and one year of the coaching semester, respectively. One limitation of this study was that the students were older, nontraditional students, with an

average age of 31. Also, InsideTrack employs full-time professional coaches while most institutions use internal staff for academic coaching. For example, some institutions may use part-time undergraduate or graduate students, while others may hire full-time staff members.

Lehan et al. (2018) explored the effects of academic coaching on student retention for graduate students in an online degree program. They selected 160 students who had received coaching at least once in a 3-month period and built a matched sample for comparison from students who had not received coaching after controlling for demographic and academic variables. Their results showed that coached students were 2.66 times more likely to stay in college than students who did not attend coaching. Surprisingly, in a later study, Lehan et al. (2020) found that this retention advantage did not translate to degree completion unless the students continued to have coaching contact throughout their program. Since this study was conducted on graduate students in online degree programs, its findings cannot be generalized to undergraduate, face-to-face degree programs.

In a pilot study, Sepulveda et al. (2019) investigated the effects of academic coaching on retention and cumulative GPA at the end of the first year at a mid-sized, western, public university. Their findings showed no differences between 46 participants who experienced brief academic coaching and 45 participants who did

not undergo coaching on measures of retention and GPA. Although the results were not statistically significant, potentially due to inadequate sample size, the mean cumulative GPAs were higher for the experimental group compared to the control group. From another academic coaching program for the academic year of 2007-2008 at the University of South Carolina, Robinson and Gahagan (2010) report that 92% of the coached students (N=182) improved their GPA. The details on this study were limited, so no comparisons can be made.

In recent years, there have been two studies that are like the work highlighted in the present study (Alzen et al., 2021; Capstick et al., 2019). The academic coaching programs at both institutions invite students who are academically at risk, with cumulative GPAs below 2.0, to participate in coaching. Both of these studies compared the academic performance and retention of coached students to a group of students who had not attended coaching. Capstick et al. (2019) reported an average of 0.5 increase in semester GPA for fulltime coached students compared to the non-coached students in the intervention semester and an increase in retention to the following semester by 18.1%. Alzen et al. (2021) reported an average increase of 0.3 in semester GPA for coaching participants (i.e., at least one session attended) and an average increase of 0.5 in coaching completers (i.e., at least three coaching sessions attended) over coaching non-participants. Retention to the following semester

was higher for coaching participants by 10%, and for coaching completers by 15%, over coaching non-participants. All of the above results for these two studies were statistically significant. Capstick et al. (2019) used a non-equivalent groups design while Alzen et al. (2021) used a quasi-experimental design. The current research is like the Alzen et al. study in that it uses a quasi-experimental design and builds matched comparison sets from the non-coached student population based on certain criteria. In addition to the students who have cumulative GPAs of less than 2.0, it also includes data for students with higher GPAs who attended coaching and compares them to non-coached students.

Academic Coaching at Middletown State University

Middletown State University (MSU) is a mid-sized, suburban, northeastern, public university. In the 2019-2020 academic year, there were 10,881 total students, with 61% female, 75% full-time, 25% students of color, and 87% undergraduate students.

Program Description

The Academic Achievement Center (AAC) at MSU, whose mission is to empower students to access, discover, and achieve, houses four departments: Academic Advising, for first-semester freshmen and special populations, Learning Assistance, Student Accessibility Services, and Testing Services. Learning Assistance includes both tutoring and academic coaching. While tutoring focuses on what to learn, academic coaching focuses on how to

learn. Academic coaches work with students to develop themselves as learners so that they can be successful in any course, any program, any semester, focusing particularly on the following skills: goal-setting and motivation, time and task management, learning strategies, organization and prioritization, professional academic communication, research and library resource support, stress management, test preparation, and test anxiety management, and self-advocacy in the utilization of other university services. In response to the shift to online education, necessitated by the COVID-19 pandemic, academic coaches now also discuss how to be successful online learners. Academic coaching is a free service, accessible to any MSU undergraduate or graduate student. The academic coaching staff is comprised of one coordinator and eight graduate assistants who are enrolled in a graduate program at MSU, typically in a human services department. They spend an average of two academic years in their role. At the start of their tenure, they undergo extensive training in both the procedures and policies of the AAC at large, as well as those of their specific area within the AAC. Their initial training also includes introductions to pivotal campus partners, such as the Counseling Center, Registrar's Office, and Career Services, to ensure a firm understanding of the campus partnerships they might find most beneficial for referrals to students.

Students schedule academic coaching appointments online, through Accudemia (2020). They have the option of scheduling either a 30- or 60-minute appointment with a coach. Prior to the first appointment, they complete an intake form to indicate their reasons for seeking coaching and how they heard about the service. The information gathered through the intake form serves as the foundation of the first meeting, to identify and discuss the student's unique needs. Also, in the first meeting, academic coaches will review a set of academic coaching expectations, work with the student to identify their academic goals, establish goals for the coaching relationship, and schedule a follow-up meeting. A successful academic coaching partnership requires the cultivation of a relationship where the student can develop trust and confidence in their coach, and ultimately themselves as college-level learners. This partnership aims to develop a student as a self-advocate who is accountable to themselves and their learning journey. To maximize this development, weekly or biweekly meetings are recommended, though no formal schedule is mandated.

MSU academic coaching also offers coaching for two special populations of students – students in the Freshman Grade Point Recovery (FGPR) and Summit programs. A student in the FGPR program is a first-year student (0-23 earned credits) who is on academic probation, which is defined as having a cumulative GPA below 2.00. A student in the Summit program is a readmitted

student or a student with a GPA below 2.0 saved by the Academic Standards Committee appeal process. The goal of these mandatory academic recovery programs is to provide an academic support system for these students to enable them to achieve good academic standing, defined as a cumulative GPA of 2.00 or higher, and re-enter the university with the support that reintroduces them to academic standing and policies. FGPR and Summit support include orientation sessions, group advising sessions, and individual appointments with both an assigned academic advisor and academic coach over the course of the semester. This is in an effort to provide students an opportunity to re-evaluate the circumstances by which they arrived at their current academic standing, determine how they might make different decisions should they be faced with similar obstacles again, set goals for future success, and develop a personalized set of strategies to help them achieve those goals.

In addition to providing one-to-one coaching support in this near-peer model, academic coaches deliver classroom presentations by faculty invitation and group presentations to student organizations, as requested. The presentations introduce academic coaching as a service and address topics, such as stress management, motivation and goal setting, active learning strategies, and time and task management. Academic coaching is also often included as a component of cross-departmental and cross-divisional programming, providing support to initiatives like first-year

Athletics and Recreation programming and Summer Bears bridge programming out of the division of Student Success and Diversity.

Program Evaluation

For this study, cumulative GPA and term GPA were used as measures of academic performance. Student retention was measured from the spring 2020 semester to the fall 2020 semester as continued enrollment or graduation. To state the program evaluation questions succinctly, some shorthand notations are used. The prefix "AC" is used to indicate usage of academic coaching and "non-AC" is used for non-usage of academic coaching during the spring 2020 semester. The following program evaluation questions were designed to evaluate academic coaching for the groups of FGPR, Summit, and General Population students separately: a) what is the pre-/post-semester change in cumulative GPA for AC students, b) how does the term GPA of AC students compare to a matched group of non-AC students and c) how does the retention of AC students to the following semester (i.e., fall 2020) compare to a matched group of non-AC students?

Method

The impact of academic coaching on cumulative GPA, term GPA, and retention to the following semester for Summit, FGPR, and General Population students was examined using an ex-post-facto, quasi-experimental design. This research design was chosen because effectiveness was evaluated after implementation of the AC

program using historical administrative data for analysis and because students could not be randomly assigned into AC or non-AC groups due to the voluntary nature of AC for General Population and Summit participants and mandatory AC sessions for FGPR students. Participation in the Summit and FGPR programs are for specific populations of academically at-risk students. The AC service for General Population students is advertised through new student orientation, admitted student days, faculty emails, class presentations, community and student email announcements, social media platforms, the university mobile app, and referrals from student accessibility services, the academic advising department, and other university services. Though participation in AC for FGPR, Summit, and General Population students could not be randomly assigned, comparison groups were developed by the Office of Institutional Research for each of these three populations using inverse propensity weights. The matched comparison groups of non-AC students enrolled in the spring 2020 semester were developed based on student class year (to help control for experience in college and credits earned), full-time/part-time status (to help control for credit load during the spring 2020 term), and pre-semester cumulative GPA (to help control for academic achievement prior to the spring 2020 term). Students with missing pre-term cumulative GPA and non-degree students were excluded from the analysis. In addition, all undergraduate and graduate

students are eligible to avail of the free academic coaching, however, graduate students do not utilize this service as heavily as the undergraduate students and therefore were excluded from the analysis.

Participants

Participants included FGPR, Summit, and General Population students. FGPR students are required to use academic coaching at least once so the registration hold for the next semester can be lifted. Summit students are strongly encouraged to use academic coaching but not required. All other students utilize academic coaching voluntarily. For the spring 2020 semester, there were 203 undergraduate degree-seeking students who utilized academic coaching across the FGPR, Summit, and General Population groups and who also had a pre-term cumulative GPA. The distribution of AC students across these three groups for the spring 2020 semester was: General Population (79, 38.9%), FGPR (107, 52.7%), and Summit (17, 8.4%). As is evident from these numbers, most of the AC students in the spring 2020 semester were in the combined FGPR and Summit groups and hence were considered academically at-risk (124, 61%). Undergraduate student class-year for all AC students was distributed as follows: Freshman (131, 64.5%), Sophomore (21, 10.3%), Junior (22, 10.8%), and Senior (29, 14.3%). AC students were comprised of 110 (54.2%) female and 93 (45.8%) male students. The racial and ethnic breakdown of AC participants

was: White (122, 60.1%), Black or African American (40, 19.7%), Hispanic (24, 11.8%), Two or more races (7, 3.4%), Cape Verdean (2, 2.0%), Asian (3, 1.5%), and Unknown (3, 1.5%). The average number of visits for each group were: FGPR (*M*=1.73), Summit (*M*=1.94), and General Population (*M*=3.46).

Procedure

Students met one or more times with academic coaches in 30- or 60-minute appointments. Generally, a student met with the same coach throughout a semester, but there were rare cases when a student met with multiple coaches. All appointments were made using the Accudemia system. Academic coaches had available times logged into Accudemia, so a student picked a coach based on their availability and scheduled one or more appointments. Accudemia allows for the scheduling of recurring appointments. The scheduling of an appointment sent an email to the student and the academic coach with the date and time of the appointment.

Prior to the COVID-19 pandemic, coaching appointments were held in person, in a designated academic coaching space within the Academic Achievement Center. After the start of the pandemic, the appointments were held over Zoom, utilizing Accudemia's integration with Zoom. Accudemia kept track of missed, canceled, and rescheduled appointments, and the duration of the appointments. It also stored other profile information for the

student, such as major, cumulative GPA, race/ethnicity, gender college, year, and academic standing.

Measures

The effectiveness of the AC program was analyzed separately for the FGPR, Summit, and General Population groups. First, the effectiveness of academic coaching was evaluated using a paired samples t-test to examine change in cumulative GPA pre-and post-term for AC students in the Summit, FGPR, and General Population groups. In addition, one-way ANOVAs to compare spring 2020 term GPA for AC students and matched comparison groups were conducted for the Summit, FGPR, and General Population groups. The effectiveness of the AC program was also measured by comparing student retention or graduation by the fall 2020 semester for each of the three AC groups and their comparison groups.

Results

The results of cumulative GPA, term GPA, and retention analyses are presented separately for FGPR, Summit, and General Population students.

FGPR Group

The FGPR group was comprised of 107 students, 106 of which were at freshman class status in spring 2020. FGPR students are required to use academic coaching at least once so the registration hold for the next semester can be lifted. A paired-samples t-test was conducted to determine differences in pre-term (*M*=1.42, *SD*=.47)

and post-term (*M*=1.97; *SD*=.66) cumulative GPA. Results of the test determined that post-term cumulative GPA was significantly higher than pre-term cumulative GPA (*t* (106)=-12.67, p<.001).

A one-way ANOVA was conducted to compare the effect of AC on term GPA for FGPR students and their matched comparison group. The comparison group was comprised of students who were not in the FGPR program and who did not attend an AC session. The comparison group was matched to the FGPR group using inverse propensity weighting on the following variables: student class year, full-time/part-time status, and pre-semester cumulative GPA. The one-way ANOVA revealed that there was a statistically significant difference in term GPA for the FGPR and matched comparison group (F (1,8023)=[10.83], p=.001). Students in the FGPR group earned significantly higher term GPA (*M*=2.33) in spring 2020 compared to the matched group (*M*=1.91).

Table 1

One-Way Analysis of Variance of Term GPA for AC Status (FGPR and Comparison Group)

Source	*df*	*SS*	*MS*	*F*	*p*
Between Groups	1	18.91	18.91	10.83	.001
Within groups	8,023	14,007.42	1.75		
Total	8,024	14,026.32			

In addition, retention rates (percentage of students still enrolled or graduated by the following semester) were calculated for the FGPR and matched groups. Overall, 74% of FGPR students retained or graduated in to fall of 2020 compared to 70% of the non-AC

comparison group despite starting the semester with a similar mean cumulative GPA.

Table 2

Retention for FGPR & Comparison Group students by class year spring 2020 to fall 2020

Class Year spring 2020	Total N		Mean GPA Start of spring 2020		Graduated by fall 2020		Still Enrolled in fall 2020		% Retained or graduated	
	AC	Non-AC	AC	Non-AC	AC	Non-AC	AC	Non-AC	AC	Non-AC
Freshman	106	7892	1.42	1.30	0	0	78	5513	74%	70%
Sophomore	1	74	1.84	1.69	0	0	1	52	100%	70%
Total	**107**	**7966**	**1.43**	**1.30**	**0**	**0**	**79**	**5565**	**74%**	**70%**

Note. FGPR is for freshman students who are not in good standing. These students may have progressed by a semester to be Sophomores, hence the empty Junior and Senior rows.

Summit Group

The Summit group was comprised of 17 students distributed across all class levels. Summit students are encouraged to use academic coaching, but it is not required. A paired-samples t-test was conducted to determine differences in pre-term (M=1.33, SD=.48) and post-term (M=1.87, SD=.43) cumulative GPA. Results of the test determined that post-term cumulative GPA was significantly higher than pre-term cumulative GPA (t (16)=-6.10, p<.001).

A one-way ANOVA was conducted to compare the effect of AC on term GPA for Summit students and their matched comparison group. The comparison group was comprised of students who were not in the Summit program and who did not attend an AC session. The comparison group was matched to the Summit group using

inverse propensity weighting on the following variables: student class year, full-time/part-time status, and pre-semester cumulative GPA. The one-way ANOVA revealed that there was a statistically significant difference in term GPA for the Summit and matched comparison group (F (1, 8028)=[7.22], p=.007). Students in the Summit group earned significantly higher term GPA (M=2.89) in spring 2020 compared to the matched group (M=2.00).

Table 3

One-Way Analysis of Variance of Term GPA for AC Status (Summit and Comparison Group)

Source	*df*	*SS*	*MS*	*F*	*p*
Between Groups	1	13.44	13.44	10.83	.007
Within groups	8,028	14,941.24	1.86		
Total	8,029	14,954.68			

In addition, retention rates (percentage of students still enrolled or graduated by the following semester) were calculated for the Summit and matched groups. Overall, 82% of Summit students retained or graduated by the fall 2020 compared to 68% of the non-AC comparison group despite starting the semester with similar mean cumulative GPA.

Table 4

Retention for Summit & Comparison Group students by class year spring 2020 to fall 2020

Class Year spring 2020	Total N		Mean GPA Start of spring 2020		Graduated by fall 2020		Still Enrolled in fall 2020		% Retained or graduated	
	AC	Non-AC	AC	Non-AC	AC	Non-AC	AC	Non-AC	AC	Non-AC
Freshman	4	1896	.68	1.35	0	0	4	1279	100%	67%
Sophomore	2	948	1.26	1.71	0	0	2	658	100%	69%
Junior	6	2844	1.37	1.65	0	0	4	1954	67%	69%
Senior	5	2370	1.80	1.83	0	261	4	1303	80%	66%
Total	**17**	**8058**	**1.32**	**1.64**	**0**	**261**	**14**	**5194**	**82%**	**68%**

General Population

The General Population AC group was comprised of 79 students distributed across all class levels. A paired-samples t-test was conducted to determine differences in pre-term (*M*=3.00, *SD*=.62) and post-term (*M*=3.12, *SD*=.52) cumulative GPA. Results of the test determined that post-term cumulative GPA was significantly higher than pre-term cumulative GPA (*t* (78)=-4.10, p<.001).

A one-way ANOVA was conducted to compare the effect of AC on term GPA for General Population students and their matched comparison group. The comparison group was comprised of students who did not attend an AC session in spring 2020. The comparison group was matched to the General Population AC group using inverse propensity weighting on the following variables: student class year, full-time/part-time status, and pre-semester cumulative GPA. The one-way ANOVA revealed that there was no statistically significant difference in term GPA for the General Population and matched comparison group (F (1,8294)=[.180], p=.671). Students in the General Population group earned similar term GPA (*M*=3.15) in spring 2020 compared to the matched group (*M*=3.10).

Table 5

One-Way Analysis of Variance of Term GPA for AC Status (General Population and Comparison Group)

Source	*df*	*SS*	*MS*	*F*	*p*
Between Groups	1	.18	.18	.18	.671
Within groups	8,294	8,043.50	.97		
Total	8,295	8,043.67			

In addition, retention rates (percentage of students still enrolled or graduated by the following semester) were calculated for the General Population and matched groups. Overall, 95% of General Population students utilizing AC retained or graduated by fall 2020 compared to 89% of the non-AC comparison group despite starting the semester with similar mean cumulative GPA.

Table 6

Retention for General Population & Comparison Group students by class year spring 2020 to fall 2020

Class Year spring 2020	Total N		Mean GPA Start of spring 2020		Graduated by fall 2020		Still Enrolled in fall 2020		% Retained or graduated	
	AC	Non-AC	AC	Non-AC	AC	Non-AC	AC	Non-AC	AC	Non-AC
Freshman	21	2244	3.22	3.22	0	0	19	1967	90%	88%
Sophomore	18	1800	2.77	2.80	0	0	18	1584	100%	88%
Junior	16	1636	2.91	3.00	0	1	16	1512	100%	92%
Senior	24	2564	3.04	3.05	10	1143	12	1147	92%	89%
Total	**79**	**8244**	**3.00**	**3.03**	**10**	**1144**	**65**	**6210**	**95%**	**89%**

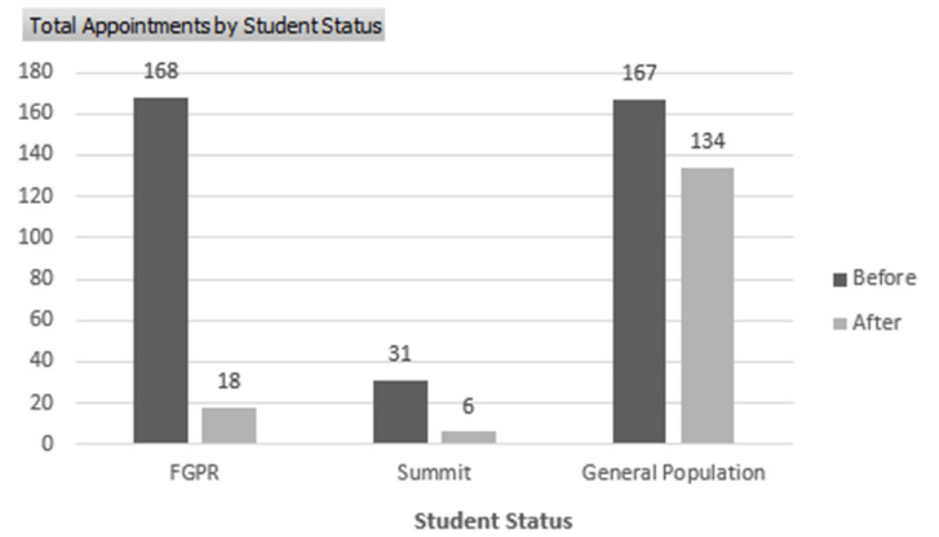
Pandemic Impact

The spring 2020 semester at MSU started on January 22nd, 2020 and ended on May 12th, 2020. Spring break started on March 7th and due to the pandemic, students did not return to campus after spring break. Academic coaching resumed services online and appointments over Zoom started on March 25th, 2020. Essentially, there was a loss of 7 working days. There were 32 working days recorded before the pandemic started and 34 working days afterward. Figure 1 shows the drop in the number of appointments after the start of the pandemic. The bigger drop in FGPR student

appointments may be due to the requirement of having one appointment to lift their registration hold, which may have been satisfied earlier in the semester.

Figure 1

Chart of appointments before and after the start of the pandemic



Discussion

Retention, persistence, and completion are major challenges for higher education institutions in the nation. The major barriers to academic success and retention for students are lack of access to appropriate information, students' academic preparation and performance, and lack of integration into the university community (Bettinger & Baker, 2014). In the past, institutions have implemented various interventions to address these barriers, such as academic advising, faculty/peer mentoring, counseling, and tutoring (Robinson, 2015). Academic coaching is another such intervention

that addresses all the aforesaid barriers to student success and retention (Robinson, 2015). Academic coaching programs vary in their definition and implementation of coaching. At MSU, academic coaching provides various services geared towards student success and retention for academically at-risk students and students in good standing.

In the current work, the academic coaching program at MSU was evaluated for the spring 2020 semester using ex-post-facto, quasi-experimental design. The program was evaluated for FGPR, Summit, and General Population student groups separately by examining the cumulative GPA changes, term GPA comparisons to matched groups, and student retention comparisons with matched groups. Results indicated that students in academic recovery programs, FGPR and Summit, showed a significant increase of 0.55 and 0.54 in cumulative GPA respectively. This is consistent with the pilot study by Sepulveda et al. (2019), which showed an increase in the mean GPA for the coached students compared to the non-coached students, although this increase was not statistically significant and may be due to the low participation numbers. For the term GPAs, the FGPR and Summit AC students reported a significant increase of 0.42 and 0.89 compared to matched non-AC students respectively. These results are consistent with studies by Alzen et al. (2021) and Capstick et al. (2019), who reported similar

term GPA gains for academically at-risk students with cumulative GPAs below 2.0.

Since the academic coaching service at MSU also works with students in good academic standing, their performance was examined, and the results showed a significant cumulative GPA increase of 0.12 for AC students. However, the term GPA for these AC students (M = 3.15) compared to a matched group of non-AC students (M = 3.10) was not significantly different (p=0.671). This may be because all AC students were examined together in one group regardless of the number of meetings they attended, and the majority of these students attended only one meeting. In the future, multiple groups can be developed for analysis depending on the number of coaching appointments attended, similar to the approach used by Alzen et al. (2021) in classifying students into Participants (i.e., 1-2 meetings attended) and Completers (i.e., 3 or more meetings attended) separately. As compared to the FGPR and Summit students, it is also possible that General Population students are less motivated for improving their academic performance because they do not have the fear of dismissal or loss of financial aid. Furthermore, the FGPR and Summit students meet with academic advising at the beginning of the semester at a minimum and possibly other times based on need, which may provide more motivation for them to improve academic performance. The above results could not be compared to prior

studies because none of them have examined the term GPA differences with matched comparison groups for students who are not academically at-risk.

In terms of student retention, the results indicate that the AC students in the spring 2020 semester had better retention in the fall 2020 semester compared to matched non-AC students for all three groups - General Population (95% over 89%), Summit (82% over 68%), and FGPR (74% over 70%). The increase in retention of coached students is consistent with findings reported by Alzen et al. (2021), Bettinger and Baker (2014), Capstick et al. (2019) and Lehan et al. (2018). The services offered by academic coaching at MSU help in improving integration with the university community by providing various referrals to other university services. Engagement is further enhanced because the academic coaches are graduate students studying at the same institution, so they can relate to the students' experiences at the institute. As Tinto (2006) has pointed out, student engagement is the biggest factor in student retention, especially in the critical first year of college. Most of the students using academic coaching at MSU were first-year students (131, 64.5%), and the engagement with academic coaches likely helped with their retention.

The program evaluation results suggest that academic coaching may be helpful in improving academic performance and student retention at MSU. It is important to note that the start of the COVID-

19 pandemic and subsequent online learning may have had an impact on academic performance and retention. As reported above, the number of students using academic coaching and the number of appointments decreased after the start of the pandemic. In the absence of the pandemic, these results may have shifted positively. The general findings for the academic coaching intervention at MSU are consistent with the conclusions of several other prior studies (Alzen et al., 2021; Bettinger & Baker, 2014; Capstick et al., 2019; Lehan et al., 2018; Robinson and Gahagan, 2010). This may be encouraging news for other institutions who are trying to implement academic coaching programs for student success and retention.

Limitations and Future Research

The current program evaluation is a single-semester, single-institution study using ex-post-facto, quasi-experimental design. There is a self-selection bias for the General Population of AC students, though FGPR and Summit students may be motivated by their desire to return to good academic standing to maintain financial aid and avoid academic dismissal. General Population AC students logged an average of 3.46 visits during the spring 2020 semester, whereas the FGPR group had an average of 1.73 visits and Summit an average of 1.94 visits. For a more robust investigation of academic coaching as an intervention, a future study could cover multiple semesters over multiple institutions with random

assignments for an experimental design. Bettinger and Baker (2014) had some success with that design using the InsideTrack data, however, InsideTrack is an external agency, and most of the higher education institutions are implementing the academic coaching service in-house (Robinson, 2015). The intent of the current study was to evaluate just the academic coaching program at MSU for one semester.

The improvement in academic performance and student retention for AC students at MSU could have been due to other factors which were not controlled, such as first-generation status, non-traditional age, financial aid support, tutoring assistance, academic advising, student accessibility services support, counseling, and external workload. Some of the prior studies have accounted for certain demographic factors (Alzen et al., 2021; Bettinger & Baker, 2014; Capstick et al., 2019; Lehan et al., 2018; Sepulveda et al., 2019), but it does not seem that they have accounted for other academic support interventions, such as tutoring, advising, counseling, and accessibility services. These services are all responsible for increasing engagement which is a key factor for student retention (Tinto, 2006). Future research can control for the above factors, especially the usage of other student support services.

Conclusion

The effectiveness of the academic coaching service at a mid-sized public university was evaluated by examining the cumulative GPA changes, term GPA comparisons to matched groups, and student retention comparisons with matched groups. The results suggest that academic coaching can improve academic performance and retention of students for both academically at-risk students and those in good academic standing. This work adds to the body of knowledge available on the effectiveness of academic coaching programs and the rich program description provides insights for colleges and universities interested in implementing such programs.

References

Accudemia [Computer Software]. (2020). Retrieved from https://www.engineerica.com/accudemia/.

Adelman, C. (2006). The toolbox revisited: Paths to degree completion from high school through college. *US Department of Education*.

Alzen, J. L., Burkhardt, A., Diaz-Bilello, E., Elder, E., Sepulveda, A., Blankenheim, A., & Board, L. (2021). Academic Coaching and its Relationship to Student Performance, Retention, and Credit Completion. *Innovative Higher Education*, *46*(5), 539–563.https://doi.org/10.1007/s10755-021-09554-w.

Bettinger, E. P., & Baker, R. B. (2014). The effects of student coaching: An evaluation of a randomized experiment in student advising. *Educational Evaluation and Policy Analysis, 36*(1), 3–19. https://doi.org/10.3102/0162373713500523.

Bettinger, E. P., & Long, B. T. (2009). Addressing the needs of underprepared students in higher education does college remediation work?. *Journal of Human resources*, *44*(3), 736-771. https://doi.org/10.3368/jhr.44.3.736.

Bettinger, E. P., Long, B. T., Oreopoulos, P., & Sanbonmatsu, L. (2012). The role of application assistance and information in college decisions: Results from the H&R Block FAFSA experiment. *The Quarterly Journal of Economics*, *127*(3), 1205-1242. https://doi.org/10.1093/qje/qjs017.

Bloom, D., & Sommo, C. (2005). Building Learning Communities Early Results from the Opening Doors Demonstration at Kingsborough Community College. *MDRC*.

Calcagno, J. C., & Long, B. T. (2008). *The impact of postsecondary remediation using a regression discontinuity approach: Addressing endogenous sorting and noncompliance* (No. w14194). National Bureau of Economic Research. https://doi.org/10.3386/w14194.

Capstick, M. K., Harrell-Williams, L. M., Cockrum, C. D., & West, S. L. (2019). Exploring the effectiveness of academic coaching for academically at-risk college students. *Innovative Higher Education*, *44*(3), 219-231. https://doi.org/10.1007/s10755-019-9459-1.

Deil-Amen, R., & Rosenbaum, J. E. (2003). The social prerequisites of success: Can college structure reduce the need for social know-how?. *The Annals of the American Academy of Political and Social Science*, *586*(1), 120-143. https://doi.org/10.1177/0002716202250216.

Goldrick-Rab, S., D., Harris, J., Benson, & Kelchen R. (2011). Conditional cash transfers and college persistence: Evidence from a randomized need-based grant program. *Institute for Research on Poverty Working Paper,* (1393-11).

InsideTrack. (2021, November 4). *National Coaching Nonprofit Releases Report Highlighting Two Decades of Impact in Education and Student Success.* https://www.insidetrack.org/national-coaching-nonprofit-releases-report-highlighting-two-decades-of-impact-in-education-and-student-success/.

Kaplan, D. M., Tarvydas, V. M., & Gladding, S. T. (2014). 20/20: A vision for the future of counseling: The new consensus definition of counseling. *Journal of Counseling and Development, 92*(3), 366-372. https://doi.org/10.1002/j.1556- 6676.2014.00164.x.

Lehan, T. J., Hussey, H. D., & Shriner, M. (2018). The influence of academic coaching on persistence in online graduate students. *Mentoring & Tutoring: Partnership in Learning*, *26*(3), 289-304. https://doi.org/10.1080/13611267.2018.1511949.

Lehan, T., Shriner, B., & Shriner, M. (2020). It's complicated: The relationship between participation in academic coaching and program completion in online graduate students. *Online Learning Journal*, *24*(3), 19–34. https://doi.org/10.24059/olj.v24i3.2142.

Mayhew, M. J., Rockenbach, A. N., Bowman, N. A., Seifert, T. A., & Wolniak, G. C. (2016). *How college affects students: 21st century evidence that higher education works* (Vol. 3). John Wiley & Sons.

McClellan, J., & Moser, C. (2011). *A practical approach to advising as coaching*. Retrieved https://nacada.ksu.edu/Resources/Clearinghouse/View-Articles/Advising-as-coaching.aspx.

National Student Clearinghouse Research Center. (2021). *Persistence and Retention Fall 2019: Fall 2019 Beginning Cohort*. Retrieved from https://nscresearchcenter.org/wp-content/uploads/Yearly_Success_Progress_Report_Feb2021.pdf.

Robinson, C.E. (2015). Academic/success coaching: A description of an emerging field in higher education (Doctoral dissertation, University of South Carolina).

Robinson, C., & Gahagan, J. (2010). Coaching Students to Academic Success and Engagement on Campus. *About Campus: Enriching the Student Learning Experience*, *15*(4), 26–29. https://doi.org/10.1002/abc.20032.

Sepulveda, A., Birnbaum, M., Finley, J. B., & Frye, S. (2020). Coaching college students who have expressed an interest in leaving: A pilot study. *Coaching: An International Journal of Theory, Research and Practice*, *13*(1), 8-15. https://doi.org/10.1080/17521882.2019.1574847.

Tandberg, D. A., & Hillman, N. W. (2014). State higher education performance funding: Data, outcomes, and policy implications. *Journal of Education Finance, 39*(3), 222-243. http://www.jstor.org/stable/23597610.

Tinto, V. (2006). Research and practice of student retention: What next?. *Journal of College Student Retention: Research, Theory & Practice*, *8*(1), 1–19. https://doi.org/10.2190/4YNU-4TMB-22DJ-AN4W.

Veenstra, C. P. (2009). A strategy for improving freshman retention. *Journal for Quality & Participation*, *31*(4), 19–23.

Pertinent Publishing Parameters

The Learning Assistance Review (TLAR), the national peer reviewed official publication of the National College Learning Center Association (NCLCA), publishes scholarly articles and reviews that address issues of interest to learning center professionals (including administrators, teaching staff, faculty, and tutors) who are interested in improving the learning skills of postsecondary students. Primary consideration will be given to articles about program design and evaluation, classroom-based research, the application of theory and research to practice, innovative teaching and tutoring strategies, student assessment, and other topics that bridge gaps within our diverse profession.

Categories for Submission

Articles

Topics. TLAR will accept manuscripts that address our purpose as defined above. We publish scholarly articles and reviews that specifically address these issues.

Types. TLAR will accept manuscripts following all four of the article types outlined in the American Psychological Association Manual: empirical study and articles on review, theory, and methodology. Follow the APA manual for specific requirements and structure for each type. All manuscripts need a clear focus that draws a

correlation between the study, review, theory, or methodology and learning assistance practices.

Joining the Conversation

Idea Exchange. Discussion directly relates to articles published in TLAR. Submissions are limited to fewer than four paragraphs and are to be constructive idea exchanges. In addition to the name, title, college, and contact information from the submitter, Idea Exchange submissions are to include the details of the referenced article (Title, author, and volume/number, and academic semester/year).

Further Research. These are article submissions that have a stated direct link to prior published TLAR articles. These articles will be considered following the manuscript submission guidelines.

Book Review

Book review requests should be accompanied with two copies of the book to facilitate the reviewing process. Potential book reviewers are urged to contact the editorial team for details.

Manuscript Guidelines

Manuscripts and reference style must be in accordance with the *Publication Manual of the American Psychological Association* (7th ed.). Submissions that do not comply with APA style will be returned to the author(s). Manuscripts must be original work and not duplicate previously published works or articles under consideration for publication elsewhere. The body of the manuscript may range in length from 20 to 30 pages, including all references, tables, and

figures. Longer articles will be considered if the content warrants it. The authors are responsible for the accuracy of all citations and references and obtaining copyright permissions as needed. The only acknowledgments that will be published will be those required by external funding sources.

Submission Guidelines

The title page must include the title of the manuscript (not to exceed 12 words), and the name(s) and institutional affiliation(s) of all authors. The lead author should provide work or home addresses, telephone numbers, and email information where applicable.

The second page should be an abstract of the manuscript.

To start the reviewing process, the lead author will be required to sign a certificate of authorship and transfer of copyright agreement. If the manuscript is accepted for publication, a second authorization agreement must be signed by the author or authors.

Submission Packet

- Cover page
- Original manuscript
- Masked manuscript for review
- Abstract (maximum 100 words)
- Figures and tables according to APA style

Materials emailed to: TLAR@MissouriState.edu

Michael Frizell, MFA Editor, TLAR
Director of Student Learning Services Bear CLAW (Center for Learning and Writing)
Missouri State University
901 South National Avenue
Springfield, MO 65897
Phone: (417)836-5006
Direct E-Mail: MichaelFrizell@MissouriState.edu

Review Process

Author(s) will receive an e-mail notification of the manuscript receipt. The review process may include a peer-review component, in which up to three members of the TLAR editorial board will review the manuscript. Authors may expect the review process to take about three months. Authors may receive one of the following reviewing outcomes:

- accept with minor revisions
- revise and resubmit with editor's review only
- revise and resubmit for second full editorial board review
- reject

As part of the reviewing correspondence, authors will be electronically sent the reviewers rankings and general comments on one document and all the reviewers' contextual markings on one manuscript. Manuscript author(s) must agree to be responsible for

making required revisions and resubmitting the revised manuscript electronically by set deadlines. Manuscript author(s) must abide by editorial revision decisions.

NCLCA Membership Information

The National College Learning Center Association defines a learning center at institutions of higher education as interactive academic spaces which exist to reinforce and extend student learning in physical and/or virtual environments. A variety of comprehensive support services and programs are offered in these environments to enhance student academic success, retention, and completion rates by applying best practices, student learning theory, and addressing student-learning needs from multiple pedagogical perspectives.

Staffed by professionals, paraprofessionals, faculty, and/or trained student educators, learning centers are designed to reinforce the holistic academic growth of students by fostering critical thinking, metacognitive development, and academic and personal success.

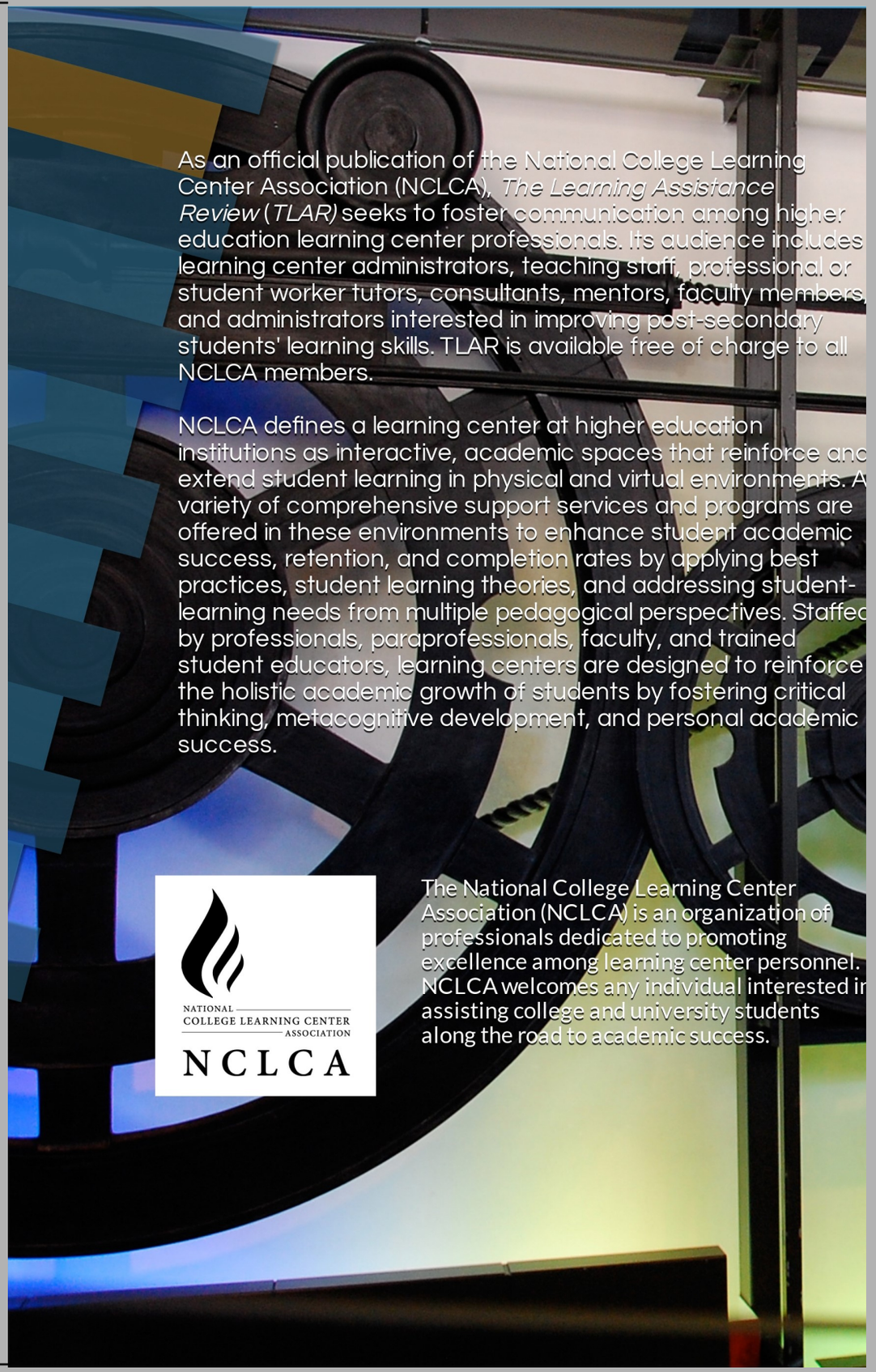
Join NCLCA

NCLCA seeks to involve as many learning center professionals as possible in achieving its objectives and meeting our mutual needs. Therefore, the NCLCA Executive Board invites you to become a member of the Association.

The membership year extends from October 1 through September 30. The annual dues are $50.00. We look forward to having you as an active member of our growing organization.

Membership Benefits

- A subscription to NCLCA's journal, *The Learning Assistance Review*
- Discounted registration for the annual fall conference and Summer Institute
- Regular issues of the *NCLCA Newsletter*
- Voting privileges
- Opportunities to serve on the Executive Board
- Special Publications such as the *Resource Directory* and the
- *Learning Center Bibliography*
- Opportunities to apply for professional development grants
- Access to the Members Only portion of the website, including electronic versions of *The Learning Assistance Review*
- Announcements of other workshops, in-services, events, and NCLCA activities


As an official publication of the National College Learning Center Association (NCLCA), *The Learning Assistance Review* (*TLAR)* seeks to foster communication among higher education learning center professionals. Its audience includes learning center administrators, teaching staff, professional or student worker tutors, consultants, mentors, faculty members, and administrators interested in improving post-secondary students' learning skills. TLAR is available free of charge to all NCLCA members.
NCLCA defines a learning center at higher education institutions as interactive, academic spaces that reinforce and extend student learning in physical and virtual environments. A variety of comprehensive support services and programs are offered in these environments to enhance student academic success, retention, and completion rates by applying best practices, student learning theories, and addressing student-learning needs from multiple pedagogical perspectives. Staffed by professionals, paraprofessionals, faculty, and trained student educators, learning centers are designed to reinforce the holistic academic growth of students by fostering critical thinking, metacognitive development, and personal academic success.
NATIONAL COLLEGE LEARNING CENTER ASSOCIATION
NCLCA
The National College Learning Center Association (NCLCA) is an organization of professionals dedicated to promoting excellence among learning center personnel. NCLCA welcomes any individual interested in assisting college and university students along the road to academic success.