Student Engagement and Universal Design for Learning (UDL): A Community College Case Study

Candice R. Nance
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STUDENT ENGAGEMENT AND UNIVERSAL DESIGN FOR LEARNING (UDL): A COMMUNITY COLLEGE CASE STUDY

A Dissertation

Presented to

The Faculty of the Educational Doctoral Program in Educational Leadership

San José State University

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Education

by

Candice R. Nance

May 2022
The Designated Dissertation Committee Approves the Dissertation Titled

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A COMMUNITY COLLEGE CASE STUDY

by

Candice R. Nance

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May 2022

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ABSTRACT

STUDENT ENGAGEMENT AND UNIVERSAL DESIGN FOR LEARNING (UDL): A COMMUNITY COLLEGE CASE STUDY

by Candice R. Nance

Community colleges have a significant impact on education. The community college population includes some of the most vulnerable students who have the most to gain from educational attainment. The objective of this mixed-methods case study was to investigate the practical implications and impact of Universal Design for Learning (UDL) on student learning, engagement, and sense of belonging. Forty-nine students participated in this study from seven sections of an asynchronous introduction to business course at a California community college during the COVID-19 pandemic. Findings suggested that the UDL intervention increased students’ final grade percentages, exam scores, and group project scores while supporting student engagement and creating a sense of belonging among students. Several recommendations for practice and further research are included before an analysis of a systems model for student learning at community colleges.
“There’s more to life than being a passenger.”

*Amelia Earhart*
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<td>California Community Colleges Chancellor’s Office</td>
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<td>CTE</td>
<td>Career Technical Education; sometimes referred to as Career Education</td>
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<td>DSO</td>
<td>Disability Services Office</td>
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<td>FTES</td>
<td>Full-Time Equivalent Students</td>
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<tr>
<td>LOA</td>
<td>Letter of Accommodation</td>
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<td>HEI</td>
<td>Higher Education Institution</td>
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<td>UD</td>
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Chapter 1. Introduction

The California community college system is the tropical forest of higher education diversity. Admitting all who apply, California community colleges fertilize a richly variegated canopy for learners of all abilities. The system must invest in fertilizing the forest floor to support and sustain this rainforest's interdependent layers. By pollinating efficacious teaching practices that meet all learners' needs, California community colleges can sustain and flourish the rich diversity in their ecosystem.

Overview

The following section quantifies the impact of the California community college system, investigates the changing landscape of higher education, and recounts the development of the inclusive design.

Impact of Community Colleges

Community colleges have a significant impact on education. The California State Department of Education (1960) defines community colleges as two-year lower-division higher-education institutions in the United States, sometimes referred to as junior colleges or vocational schools. Community colleges are one part of a three-tiered public education system in California, partnering with the University of California (UC) and the California State University (CSU) systems (California State Department of Education, 1960). According to the American Association of Community Colleges (AACC), in 2020, the 1,044 community colleges in the U.S. enrolled nearly half of all undergraduates in the nation — 11.8 million students annually. One in every four community college students in the nation attends a California community college. California’s public higher education system depends
more on community colleges than other states (Foundation for California Community Colleges, 2019). California community colleges enroll one in every four Californians aged 18 to 24 (California Community Colleges Chancellor’s Office, 2021e). With more than 2.1 million students at 116 colleges, the California Community College system is the country's most extensive higher education system (California Community Colleges Chancellor’s Office, 2021a). Community colleges are a crucial component of the infrastructure of the higher education network.

**Increasing Diversity in Higher Education**

It is widely reported that the postsecondary student population has become more diverse. According to the American Council on Education (ACE), the percentage of White students in undergraduate enrollment has declined as Hispanic enrollment increased. In the two decades that spanned from 1996 to 2016, the percentage of all undergraduate students identified as being of a race or ethnicity other than White grew from 29.6% to 45% (Espinosa et al., 2019). Concurrently, there has been a measurable shift in the increasing number of students with disabilities enrolling in higher education (McGuire & Scott, 2006; National Center for Education Statistics [NCES], 2019b; Scott et al., 2003).

Unlike most higher education counterparts, community colleges reduced admission barriers for students and illustrated the metaphor of the “open door” policy for equal opportunity in higher education (Kerr & Pannoni, 2020; Vaughan, 2004). According to the NCES (2021b), in the fall of 2019, community colleges enrolled 37% of undergraduate students nationally. The majority of community college students are enrolled part-time (65%)
rather than full-time (35%) (AACC, 2021). This notable diversification of the student population warrants an expansion of inclusive pedagogical practices.

Postsecondary diversity, such as socioeconomic status, educational backgrounds, first-time college students, working students, students with families, and students with various learning needs, challenges instructional effectiveness (Pliner & Johnson, 2004; Polanska, 2013). California community colleges are diverse across all demographics, including re-entry students who are older than traditional college students (Foundation for California Community Colleges, 2019). According to the California Community College Chancellor’s Office (2021g) State of the System Report, in 2019-2020, the California community college system served predominately Hispanic/Latinx (46.04%), White Non-Hispanic (23.60%), Asian (11.38%), and African American (5.58%) students. In the same year, 118,273 (4.78%) students identified as having educationally-related disabilities in the following disability categories: learning disabled (25.80%), psychological disability (21.03%), attention deficit hyperactivity disorder (ADHD) (8.46%), autism spectrum (9.06%), mobility (6.60%), developmentally delayed learner (5.62%), hearing impaired (3.57%), acquired brain injury (3.24%), visually impaired (2.76%), speech/language impairment (0.01%), and other disabilities (13.86%) (California Community Colleges Chancellor’s Office, 2020). This diversity creates a critical instructional opportunity to meet the needs of a wide variety of learners to support students' upward mobility (Scott et al., 2003).

**Design for Inclusion**

Universal Design (UD) is a concept built on variability and inclusivity. The concept was created by Ron Mace, an architect with a disability, during the 1970s (Center for Universal
Design, 1997). Over time, the idea of building things to proactively plan for access for the greatest amount of people spread to other industries, such as in education. A decade later, in the 1980s, the Universal Design for Learning (UDL) framework was developed by the Center for Applied Special Technology (CAST, 2020a) near Boston, Massachusetts, as a scientifically based framework to influence the design of instructional planning to meet the needs of diverse learners (Black & Moore, 2019; Meyer et al., 2014; Tobin & Behling, 2018). Originally developed within the scope of teaching students with disabilities, UDL is now seen as an instructional strategy to provide better teaching strategies for all students (Black & Moore, 2019; Tobin & Behling, 2018). UDL reduces barriers and increases access while maximizing learning for all students. Significant academic research focuses on UDL in K-12 education with emerging, albeit limited, intervention research in higher education. Furthermore, higher education differs significantly from K-12 in terms of the student population, pedagogical practices, and course modalities and, therefore, must be differentiated in its approach from UDL (Black & Moore, 2019; Tobin & Behling, 2018).

**Problem Statement**

It is well documented that educational attainment ensures against economic hardship. Increased educational attainment levels correlate with increased median annual earnings and decreased unemployment probability. The community college population includes some of the most vulnerable students who have the most to gain from educational attainment. However, community college students take more time and units to complete degrees due to part-time student status, acclimating to academic culture, and possible remedial general education. As a gatekeeper to prosperity, faculty face instructional challenges of rampant
learner variability in the classroom with little to no formal teacher training, particularly in Career Education Technology (CTE) fields.

**Economic Prospects for Underserved Students**

With a mission and vision of putting students first (California Community Colleges Chancellor’s Office, 2021f), the California community college system promises students life-changing opportunities through social mobility (California Community Colleges Chancellor’s Office, 2021a). Educational attainment and earnings data illuminate this prosperity prospect. From 2000 to 2018, NCES (2021a) data consistently reported higher median annual earnings for young adults aged 25-34 with higher educational attainment. For example, in 2019, the median earnings of young adults with high school completion were $35,000. Median annual earnings subsequently increased with every level of educational attainment: $39,700 for some college, no degree; $40,000 with an associate degree from a community college; $55,700 with a bachelor’s degree, and $70,000 with a master’s degree or higher (NCES, 2021a).

Educational attainment increases workers’ earnings and reduces unemployment probability (NCES, 2019a). According to educational attainment data in 2019, for people with no disabilities aged 25 and over, unemployment rates were 11.5% for those with less than a high school diploma, 8.8% for high school graduates (with no college), 7.6% for some college or associate degree, and 4.7% for bachelor’s degree and higher (U.S. Bureau of Labor Statistics, 2021b). People with disabilities face additional employment barriers (Hansen & Dawson, 2020). According to the BLS, in 2020, persons with a disability between the ages of 16 to 64 years old were nearly twice as likely to be unemployed (13.4%) compared to
persons with no disability in the same age range (7.9%) (U.S. Bureau of Labor Statistics, 2021a).

**Disproportionate Inequalities for Students of Color**

Minority students face inequalities in employment. The staggering racial inequalities existing across the nation were evident in Silicon Valley in northern California’s San Francisco Bay Area during the COVID-19 pandemic. The regional tech industry, often criticized for its lack of diversity, was spared any notable economic downfall during the pandemic and continued to thrive during a period that saw Black and Hispanic/Latinx workers file 1.5 times more unemployment insurance claims than their White counterparts (Massaro, 2021). The initial concentration of unemployment claims was in lower-income occupations (31%), with the most significant impact in the accommodations and food sector (41%) (Massaro, 2021). Additionally, in the 2021 Silicon Valley Poll, a higher proportion of Hispanic/Latinx and Black or African American participants feel financially insecure compared to White or Asian counterparts, in part due to the perceived high cost of living and lower quality of the standard of living in Silicon Valley (Joint Venture Silicon Valley, 2021).

**A Prolonged and Strenuous Student Journey**

Community college students experience significant adversity in their educational expedition. Many students come with less academic preparation for college-level work. It is well documented that financial constraints, work demands, and family commitments impede the number of credits accumulated each term (Moore & Shulock, 2010; Offenstein et al., 2010). Lower term-credit accumulation and taking breaks from college, or stopping out, results in students taking longer to complete academic programs (Moore & Shulock, 2010;
Offenstein et al., 2010). Additionally, many students struggle with excess unit accumulation before transferring. Students must complete 60 transferrable credits to transfer from a two-year community college to a four-year university. In the 2019-2020 academic year, the average number of units accumulated by associate degree earners in California was a staggering 84 units, significantly higher than the 60-unit transfer requirement (Cal-PASS Plus, 2021). Community college students accumulate excess units through remedial education placements, inefficient course sequencing patterns, and lack of academic preparedness (Community College Research Center, 2018).

**Learner Variability in Community Colleges**

The student diversity that makes the California Community College system so unique also poses several challenges to instructional effectiveness. Community colleges have been criticized for struggling to educate some of the most underserved students (Burns, 2017; Hansen & Dawson, 2020). College instructors must simultaneously meet the needs of students across generations, students with disabilities, students learning English, and students with increasing family and employment demands outside of the classroom. As more students are diagnosed with learning disabilities (LDs), those students are more likely to attend a 2-year community college (Hansen & Dawson, 2020). Additionally, students have varying comfort levels and access to technology, while many struggle with acclimating to an academic environment as first-generation students.

Community college instructors must reduce barriers to inclusion and meet the needs of their diverse study body (Edyburn, 2010). Research has documented that a student’s learning is as unique as their fingerprints (CAST, 2018a; Meyer et al., 2014). Each learner’s brain is
unique and complex due to various factors, such as genetics and environmental influences. A student’s brain consists of three networks: (a) the recognition network, or how sensory information is received in the brain, (b) the affective network, or how information is processed and relayed for meaning at the center of the brain, and (c) the strategic network, or how information is organized within the frontal lobes for a response (CAST, 2018a). The faculty member’s responsibility is to engage learners through all three networks; however, community college faculty typically lack sufficient pedagogical training to do so.

**Insufficient Teacher Preparation**

Community college faculty enter the profession from a variety of professional backgrounds and differ from Ph.D. candidates, who are socialized through graduate programs. Degree and industry experience are often the only qualifications needed for a faculty position. With no training or prior experience in teaching, many faculty members teach in the same ineffective way they were taught (Tobin & Behling, 2018), causing students’ frustration.

Unlike their counterparts in universities, community college faculty focus on teaching rather than research. Nevertheless, they struggle to learn how to teach on their own as current hiring and training practices do not emphasize pedagogical training. The literature on the preparedness of community college faculty is limited (Hansen & Dawson, 2020). To teach in the California Community College system, faculty must meet statewide minimum qualifications for their discipline. For example, an instructor in the field of business management must possess either a master’s degree in business administration, business management, business education, marketing, public administration, or finance; or a
bachelor’s degree in any of the disciplines above and a master’s degree in economics, accountancy, taxation, or law (Arambula & Lovelace, 2019). While community college instructors typically need a master’s degree in order to teach, they are not mandated to attend training on inclusive and effective pedagogical practices; instead, they are implicitly expected to learn on the job (Hansen & Dawson, 2020). Licenses or credentials, which include pedagogical training, are not required to teach in the community college system as they are in the public K-12 system (Arambula & Lovelace, 2019).

Additionally, ongoing faculty professional development programs are inconsistent across college and district boundaries. Hromalik et al. (2020) criticize existing faculty professional development programs that fail to encourage effective classroom practices, lack specific goals, often go without attendee feedback, and suffer from low faculty attendance. Furthermore, instructional reform excludes faculty participation. Integral proponents in the Guided Pathways agenda for community colleges, Bailey, Smith Jaggars, and Jenkins (2015), note that community college faculty have been mainly ignored in instructional reform efforts that cater more to developmental education, tutoring, and supplemental education academic support services.

The consequences of the teacher preparation gap at California community colleges are significant, as significant numbers of professionals receive their training at such colleges. For example, a staggering 7 in 10 of California’s nurses receive their training at a California community college (California Community Colleges Chancellor’s Office, 2021e). California community colleges train 8 in 10 police officers, firefighters, and EMTs. Nearly half of students earning a bachelor’s degree from a University of California campus in science,
technology, engineering, and mathematics (STEM) transferred from a California community college. Furthermore, 29% of University of California graduates and 51% of California State University graduates begin their studies in community colleges, while nearly half of the students earning a bachelor’s degree from a University of California campus in science, technology, engineering, and mathematics (STEM) transfer from a California community college (California Community Colleges Chancellor’s Office, 2021e). More needs to be done to better prepare community college instructors for pedagogical success in the classroom to support student success.

**Acceleration of Distance Education Modalities**

In the spring of 2020, the COVID-19 pandemic accelerated changes in many industries, including the growth of distance education. In the California community college system, distance education debuted in 2001 and steadily climbed to 16% of full-time equivalent students (FTES) in the 2018 – 2019 academic year (California Community Colleges Chancellor’s Office, 2021c). By the 2020 – 2021 academic year, internet-based modalities grew to epic proportions, with 51% of instruction delivered through asynchronous online instruction and 9% delivered simultaneously online, whereas only 39% was delivered through non-distance education methods (California Community Colleges Chancellor’s Office, 2021c). In comparison, in the 2000 – 2001 academic year, 99% of the FTES were in non-distance education methods with no distance education offerings, synchronous or asynchronous (California Community Colleges Chancellor’s Office, 2021c). Hence, pedagogical research must consider the colossal shift to virtual classrooms.
Purpose of the Study

The objective of this mixed-methods case study was to investigate the practical implications and impact of UDL on faculty and the student experience, and more specifically, on student engagement and sense of belonging. The beneficiaries of this research include all the community college constituents. Postsecondary educators will increase their teaching efficacy through learning about and integrating UDL into their classrooms. College students will benefit from more inclusive classrooms to meet their learning needs better. College leaders will be given an inclusive pedagogical framework to help them support student engagement, student academic success, and a sense of belonging on their campuses. Lastly, this research will guide policymakers in developing policies for faculty professional development in inclusionary pedagogies.

Research Questions

The following research questions (RQs) will guide this study:

1. **Mixed-Method RQ:** What are the main factors which influence the effective implementation of UDL?

2. **Quantitative RQ:** How does UDL influence student success in general and student learning in particular?

3. **Mixed-Method RQ:** How does UDL affect student experience, including student engagement and sense of belonging?
Definitions

Table 1 organizes critical terms and definitions to guarantee consistency and clarity throughout this study.

**Table 1**

**Key Definitions**

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<th>Definitions</th>
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<tr>
<td>Career Technical Education (CTE)</td>
<td>A program of study that involves a multiyear sequence of courses that integrates core academic knowledge with technical and occupational knowledge to provide students with a pathway to postsecondary education and careers (California State Department of Education, 2020b)</td>
</tr>
<tr>
<td>Community Colleges</td>
<td>Two-year lower-division higher-education institutions in the United States; were previously referred to as junior colleges or vocational schools (California State Department of Education, 1960).</td>
</tr>
<tr>
<td>Dual enrollment</td>
<td>Also referred to as concurrent enrollment. Authorized by California Assembly Bill 288 in 2015, dual enrollment programs enable high school students to earn college credit through courses that also count toward their high school diploma (California Community Colleges Chancellor’s Office, 2021d).</td>
</tr>
<tr>
<td>First-generation student</td>
<td>A student where neither parent/guardian has an education level above an associate degree (Cañada College, 2021).</td>
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<tr>
<td>Learner variability</td>
<td>Due to genetics and environmental influences, each learner’s brain is complex and unique in how incoming sensory information is received (recognition networks), processed and relayed for meaning at the center of the brain (affective networks), and organized within the frontal lobes for response (strategic networks) (CAST, 2018a).</td>
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<tr>
<td>Pedagogy</td>
<td>The methods and principles used in teaching children</td>
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<tr>
<td>Sense of belonging</td>
<td>A subconstruct of social engagement; is the feeling of acceptance and inclusion within a group of people</td>
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<tr>
<td>Student engagement</td>
<td>A multidimensional construct in the online environment consists of the following components: behavioral engagement, cognitive engagement, collaborative engagement, emotional engagement, and social engagement (Redmond et al., 2018)</td>
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<td>Success rate</td>
<td>The California Community College’s Chancellor’s Office (2022) defines success rate as the rate at which students completed courses with a final grade of A, B, C, or P. Student withdrawals are included in the denominator of the calculation.</td>
</tr>
<tr>
<td>Universal Design for Learning (UDL)</td>
<td>A framework to improve and optimize teaching and learning for all learners based on scientific research into how humans learn (CAST, 2021a)</td>
</tr>
</tbody>
</table>
Limitations

This research study had several limitations to consider when interpreting the findings. First and foremost, this research studied the students and courses of the researcher-practitioner. To mitigate the researcher's influence, the host college’s research office staff withheld student data from the faculty researcher until final course grades were submitted to admissions and records. To manage qualitative validity, this study triangulated multiple data sources, such as researcher field note memos, researcher post-reflections, course materials, student journals, and constructed response questions. Lastly, crucial discrepant information is included and discussed. The research design included an instrument blueprint and items stem design table to map item stems to relevant research to govern quantitative validity.

Additionally, due to the small sample size of the qualitative research, a more extensive historical dataset was used to increase sample size and validity.

To support the integration challenge of mixed-method research designs (Creswell & Creswell, 2018; Fetters & Freshwater, 2015), constructs, codes, and variables were similar or parallel and mapped to instruments to corroborate integrated mixed methods findings. The divergence of qualitative and quantitative data is possible in mixed methods research studies (Creswell & Creswell, 2018). In themes that deviate, the research clarified the divergent results. Using MaxQDA software, the researcher merged the data into a joint display for integrated visual interpretation of data. Despite these epistemological limitations, it is hoped that the results of this research will contribute to the knowledge database of community college academic research.
Delimitations

The researcher conducted this study with community college students enrolled at Cañada College in Redwood City, California, in online Introduction to Business (BUS 100) courses. The courses took place during the COVID-19 pandemic during the summer and fall terms of 2021. Therefore, the findings and results may or may not generalize to other educational institutions, teaching modalities, or settings.

Researcher Positionality

The philosophical worldview proposed in this mixed methods action research was primarily that of a pragmatist. In aligning with John Dewey's views, pragmatism frames this study within a process of inquiry to search for knowledge about participants' beliefs and actions to solve the problem of practice (Morgan, 2014). The pragmatic worldview honors the social, historical, and other contexts impacting the research (Creswell & Creswell, 2018), which was paramount for the site selection in this study.

As a community college instructor with over ten years of experience teaching in the business discipline, the teacher-researcher had mid-career teaching experience. Additionally, the researcher was a first-generation student who graduated from a community college and was familiar with many of the struggles facing community college students inside and outside the classroom. While the researcher had extensive experience teaching in the business discipline and virtual modalities, the researcher was new to UDL implementation at the start of this research and engaged in self-study for UDL implementation through UDL books, articles, and conferences. Through this self-directed professional development
process, the researcher developed a deep understanding of the principles and ideas of UDL without the previous experience of deliberately implementing the UDL framework.

**Summary**

The introduction provided an overview of the impact of the extensive community college system, the increasing diversity within higher education, and the challenges facing community college students today. Chapter Two recounts prominent literature on Universal Design for Learning (UDL), student engagement, and student sense of belonging. Chapter Three discusses the convergent mixed methods design used in this study. Integrated mixed methods findings, discussion, and recommendations for future research are examined in Chapter Four. Chapter Five focuses on developing a faculty professional development program to guide the effective implementation of UDL in a community college course.
Chapter 2. Literature Review

This chapter provides an overview of the literature and theoretical frameworks that ground this study. First, the chapter begins with a description of UD. Then, a foundational review of UDL describes the creation of the UDL framework, benefits and criticisms of UDL, UDL in community colleges, and UDL in distance learning. Next, a student engagement meta-construct review is discussed, focusing on the online student engagement framework. In addition, the theory of transactional distance is described in relation to the revised scale of transactional distance (RSTD) and the Trifecta of Student Engagement framework. Lastly, challenges with the extant UDL literature are debated. Figure 1 maps the ideas, arguments, and concepts from the UDL literature to provide an overview of the literature.

Universal Design (UD)

In the mid-twentieth century in the United States, demand increased for physically accessible environments as World War II veterans returned home, many with disabilities. The paramount Servicemen’s Readjustment Act of 1944, also known as the GI Bill, prioritized federal funding for physically accessible facilities, including higher education spaces. More people with disabilities were moving out of segregated facilities into inclusive and public settings due to criticisms of mental health facilities after World War II (Stroman, 2003; Tobin & Behling, 2018). Most notably, disability advocates joined forces with civil rights activists to demand equal access and opportunity for people with disabilities (Tobin & Behling, 2018).
In 1968, the Architectural Barriers Act (ABA) required that buildings and facilities that utilized federal funds meet specific physical accessibility requirements (U.S. Department of Justice, 2020). Expensive retrofitting techniques caused architects to rethink and change initial building designs for new structures. One such architect, Ron Mace, had a unique perspective as a person who used a wheelchair. His insight created new barrier-free environments for people of all abilities, thus creating Universal Design (UD) in 1988 (CAST, 2021e; Tobin & Behling, 2018). UD concepts exist today in physical environments (i.e., automatic electric doors and sidewalk ramps) and digital environments (i.e., video closed captioning and listening options for online news articles).
In 1997, North Carolina State University created a working group of UD advocates to establish the Principles of Universal Design (North Carolina State University, 2008). Members included architects, product designers, engineers, and environmental design researchers. The group defined UD as creating products and environments that all people could use to the greatest extent possible without adaptation or specialized design (Center for Universal Design, 1997). The group created the seven principles of UD described in Table 2.

**Table 2**

**Universal Design (UD) Principles**

<table>
<thead>
<tr>
<th>Principles</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equitable use</td>
<td>The design is useful and marketable to people with diverse abilities.</td>
</tr>
<tr>
<td>Flexibility in use</td>
<td>The design accommodates a wide range of individual preferences and abilities.</td>
</tr>
<tr>
<td>Simple and intuitive use</td>
<td>The use of the design is easy to understand, regardless of the user’s experience, knowledge, language skills, or current concentration level.</td>
</tr>
<tr>
<td>Perceptible information</td>
<td>The design communicates necessary information effectively to the user, regardless of ambient conditions or the user’s sensory abilities.</td>
</tr>
<tr>
<td>Tolerance for error</td>
<td>The design minimizes hazards and the adverse consequences of accidental or unintended actions.</td>
</tr>
<tr>
<td>Low physical effort</td>
<td>The design can be used efficiently and comfortably and with minimal fatigue.</td>
</tr>
<tr>
<td>Size and space for approach and use</td>
<td>Appropriate size and space are provided for approach, reach, manipulation, and use regardless of user’s body size, posture, or mobility.</td>
</tr>
</tbody>
</table>

*Note.* Adapted from “Principles of Universal Design 2.0,” by Center for Universal Design, 1997 (https://projects.ncsu.edu/ncsu/design/cud/about_ud/udprinciplestext.htm).

The UD principles were seeds that dispersed into the field of education. Students with physical disabilities faced mobility challenges at school and were disadvantaged if they could
not equitably access school facilities. This period signified the germination of UD in education by reducing barriers to the physical environment. This would later continue through the development of Universal Design for Learning (UDL).

**Universal Design for Learning (UDL)**

Over the past few decades, researchers designed various UD models for cognitive access, student support, instructional flexibility, and inclusive teaching (Rao et al., 2014). The prominent UD model in education is the Universal Design for Learning (UDL) framework. In 1984, Anne Meyer and David Rose founded CAST near Boston, Massachusetts (CAST, 2020a). CAST initially focused on assistive technology for students with disabilities through a grant from Microsoft (CAST, 2021e). To provide students equal access to the curriculum, CAST shifted focus from the disability of the student to the disability of the curriculum (CAST, 2021e; Rogers-Shaw et al., 2017; Tobin & Behling, 2018). In 1998, Meyer and Rose designed the UDL framework based on neuroscience and educational research to create accessible, inclusive, and effective learning environments (Griful-Freixenet et al., 2020; Meyer et al., 2014). A core part of neuroscience research revealed that each human’s brain is as unique as their fingerprints (Meyer et al., 2014). This revelation supported the concept of learner variability, which described how genetic and environmental factors create unique brains for each human (CAST, 2018a). Learner variability is the standard in today’s classroom (Rao, 2019) and UDL encourages educators to strategically plan their classrooms for its use.

The framework focuses on three networks for learning: the affective network, the recognition network, and the strategic network. There are a further three principles that
transpose on those networks: multiple means of (a) engagement, (b) representation, and (c) action and expression (CAST, 2018b). The purpose of each principle is to support students to become expert learners who are (a) purposeful and motivated, (b) resourceful and knowledgeable, and (c) strategic and goal-orientated (CAST, 2018b; Meyer et al., 2014). For a linear timeline of significant events and legislation leading up to the creation of UDL, see the UDL chronology in Appendix A: UDL Chronology.

According to CAST (2018b), each principle includes a series of guidelines. For instance, under the first principle of providing multiple means of representation, there are three guidelines: (1) provide options for perception, (2) provide options for language and symbols, and (3) provide options for comprehension (see Table 3). CAST dissects each guideline further into checkpoints. (CAST, 2018b). For instance, guideline one (provide options for perception) consists of three checkpoints: (1.1) offer ways of customizing the display of information, (1.2) offer alternatives for auditory information, and (1.3) offer alternatives for visual information (see Table 3).

These checkpoints provide clarity and detail that guide instructors to best practices. For example, checkpoint 1.2 details the high importance of sound in instruction and indicates that educators must provide alternatives to sound not just for students with hearing disabilities but also for students with memory difficulties and English Language Learners (ELLs) (CAST, 2021b; Meyer et al., 2014; Ralabate & Nelson, 2017; Torres & Rao, 2019). Higher education continues to serve many adult learners who greatly appreciate the ability to use captioning for videos when studying in a noisy environment or at night when family members are sleeping.
<table>
<thead>
<tr>
<th>Principles</th>
<th>Guidelines</th>
<th>Checkpoints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide multiple means of representation</td>
<td>1: Provide options for perception</td>
<td>1.1: Offer ways of customizing the display of information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2: Offer alternatives for auditory information</td>
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<tr>
<td></td>
<td></td>
<td>1.3: Offer alternatives for visual information</td>
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<tr>
<td></td>
<td>2: Provide options for language and symbols</td>
<td>2.1: Clarify vocabulary and symbols</td>
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<td></td>
<td></td>
<td>2.2: Clarify syntax and structure</td>
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<td></td>
<td></td>
<td>2.3: Support decoding of text, mathematical notation, and symbols</td>
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<td></td>
<td></td>
<td>2.4: Promote understanding across languages</td>
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<td></td>
<td></td>
<td>2.5: Illustrate through multiple media</td>
</tr>
<tr>
<td></td>
<td>3: Provide options for comprehension</td>
<td>3.1: Activate or supply background knowledge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.2: Highlight patterns, critical features, big ideas, and relationships</td>
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<tr>
<td></td>
<td></td>
<td>3.3: Guide information processing and visualization</td>
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<tr>
<td></td>
<td></td>
<td>3.4: Maximize transfer and generalization</td>
</tr>
<tr>
<td>Provide multiple means of action and expression</td>
<td>4: Provide options for physical action</td>
<td>4.1: Vary the methods for response and navigation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.2: Optimize access to tools and assistive technologies</td>
</tr>
<tr>
<td></td>
<td>5: Provide options for expression and communication</td>
<td>5.1: Use multiple media for communication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.2: Use multiple tools for construction and composition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.3: Build fluencies with graduated levels of support for practice and performance</td>
</tr>
<tr>
<td>Principles</td>
<td>Guidelines</td>
<td>Checkpoints</td>
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<td>------------------------------------------------</td>
<td>-------------------------------------------------</td>
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<tr>
<td>6: Provide options for executive functions</td>
<td>6.1: Guide appropriate goal setting</td>
<td>6.2: Support planning and strategy development</td>
</tr>
<tr>
<td></td>
<td>6.3: Facilitate managing information and resources</td>
<td></td>
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<tr>
<td></td>
<td>6.4: Enhance capacity for monitoring progress</td>
<td></td>
</tr>
<tr>
<td>Provide multiple means of engagement</td>
<td>7: Provide options for recruiting interest</td>
<td>7.1: Optimize individual choice and autonomy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.2: Optimize relevance, value, and authenticity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.3: Minimize threats and distractions</td>
</tr>
<tr>
<td>8: Provide options for sustaining effort and persistence</td>
<td>8.1: Heighten salience of goals and objectives</td>
<td></td>
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<tr>
<td></td>
<td>8.2: Vary demands and resources to optimize challenge</td>
<td></td>
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<tr>
<td></td>
<td>8.3: Foster collaboration and community</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.4: Increase mastery-oriented feedback</td>
<td></td>
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<tr>
<td>9: Provide options for self-regulation</td>
<td>9.1: Promote expectations and beliefs that optimize motivation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9.2: Facilitate personal coping skills and strategies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9.3: Develop self-assessment and reflection</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Adopted from “UDL guidelines version 2.2,” by CAST, 2018b (http://udlguidelines.cast.org/binaries/content/assets/udlguidelines/udlg-v2-2/udlg_graphicorganizer_v2-2_numbers-no.pdf).
The bedrock of UDL is grounded in research of more than eight hundred peer-reviewed scholarly articles (Novak & Bracken, 2019). Each checkpoint maps to extensive research evidence. For instance, checkpoint 1.2 connects to numerous experimental and quantitative evidence (18 scholarly articles), scholarly reviews, and expert opinions (11 publications) (CAST, 2021c). This foundation in neurological research supports UDL as a substantive pedagogical intervention in education.

In the 1990s, K-12 educators were the first to adopt the UDL framework (Meyer et al., 2014; Tobin & Behling, 2018). K-12 educators are more likely to be aware of the UDL framework than their higher education counterparts due to pedagogical training in graduate school and are more likely to implement UDL in their classrooms (Davies et al., 2013; McGuire & Scott, 2006; Smith, 2012; Tobin & Behling, 2018). When transitioning into higher education, students expect continuity in instructional techniques. As mentioned previously, students arrive at the community college level with more significant variability in their college preparedness skills (Hansen & Dawson, 2020), hence the significance of studying and implementing UDL in the community college environment.

**Benefits of UDL**

Universal Design for Learning offers a solution to several problems in higher education, including supporting hidden students who do not disclose disabilities, connecting students with inclusive curricula, and reducing the need for individual disability accommodations.

**Supporting Hidden Students.** Regulations change when a student with a disability transitions from high school to college. Individualized Education Program (IEP) teams extrinsically support students with disabilities in high school. However, upon transitioning to
higher education, college students must proactively manage and intrinsically self-advocate for disability supports with only supplemental assistance from the disability services office (DSO).

Students’ non-disclosure reasons vary by individual and by the situation. After initial admission to a college, students with disabilities may become ‘hidden’ should they refuse to apply for disability-related services and accommodation. For example, in the 2015-2016 academic year, 19.4% of undergraduate students reported a disability (NCES, 2019b). However, research has shown that only 20% of students with disabilities register in the DSO (Schelly et al., 2011). While each DSO’s application procedure may vary slightly, the process is perceived as cumbersome and time-intensive (Silver et al., 1998; Stentiford & Koutsouris, 2020).

Even community colleges within the same district may have different processes, thereby requiring that students with disabilities apply to each college’s DSO. This is frequently due to funding allocations; since a district contains individual colleges, each DSO is funded through its college budget and not through the district directly. Each time that a given student applies to a college’s DSO, they must provide medical documentation of their disability, such as a previous Individualized Education Plan (IEP), a Section (504) plan, a psycho-educational evaluation report, or other documentation verifying the student’s diagnosis from a qualified health professional (Cañada College Disability Resource Center, 2021). Students may find it difficult to produce documentation if they have inconsistent health insurance or insufficient support for diagnosing the disability during childhood. Some DSOs provide
testing services for disabilities depending on funding availability. After students have applied, DSOs typically require an in-take appointment for services.

This process can delay access to resources, such as Letters of Accommodations (LOAs), specialized counseling services, and early registration. LOAs can include testing accommodations, such as additional test-taking time, using notes during an exam, or access to a quiet test environment. Some students may need physical accommodations, such as accessible desks, recordings of lectures, or frequent breaks from classes. Other students may utilize notetaking or sign language interpreting services during class.

Once the DSO approves academic support, it is incumbent upon the student to inform each individual instructor of their LOA to access disability supports (Silver, Bourke, and Strehorn, 1998). It is the student’s choice whether to disclose their disability accommodations to each professor. The result of this process is that higher education faculty are not automatically notified of students with LOAs. While students with disabilities are protected by layers of legislation, such as the Americans with Disabilities Act (ADA), the Rehabilitation Act, and state laws, many students still hesitate when disclosing their accommodations to faculty members (Shaw & Van Leuven, 2019; U.S. Department of Justice, 2020). These students can become ‘hidden’ due to fear of faculty’s negative attitudes towards accommodations or the student’s disbelief that their accommodations will help them succeed in the course (Iowa State Center for Excellence in Learning and Teaching, 2015; Schelly et al., 2011). Unfortunately, some college students wait until they are underperforming in a course to disclose their LOAs to their instructors. By implementing the UDL framework, faculty can remove access barriers for students with disabilities and reduce
the number of individual accommodation requests from students (Rao, 2019; Stentiford & Koutsouris, 2020; Tobin & Behling, 2018).

**Reducing Requests for Individual Disability Accommodations.** Incorporating UDL into the curriculum can reduce the need for individual disability accommodations (Tobin & Behling, 2018). As an example, a science professor could provide options for all students to consume course content through text or auditory information by posting multiple sources of information in the Learning Management System (LMS) (see guidelines 1.2 and 1.3 in Table 3). Additionally, faculty could automatically record all online lectures and use automatic transcription services to create an initial transcript of the recording, such as with Otter.ai integration within Zoom video conferencing (see guideline 1.2 in Table 3). While faculty would still need to edit the transcription, the artificial intelligence feature would reduce the overall workload for the instructor. In synchronous online video sessions, instructors could openly encourage students to participate in discussions through the chat feature. Encouraging student chat engagement provides students additional time for formulating their answers and can be especially helpful for students with learning disabilities, English language learners, and timid students (see guideline 5.1 in Table 3). Faculty can also enable automatic live-captioning in video conferencing software so English Language Learners (ELLs) can read the written text as people speak (see guideline 1.2 in Table 3).

**Inclusive Access to Learning.** The COVID-19 pandemic has highlighted the need for inclusive institutions in education. UDL is recognized as inclusive practice for young and adult learners, locally and abroad (Academic Senate for California Community Colleges, 2010; Scott & McGuire, 2017; Tobin & Behling, 2018). The UDL framework is a blueprint
for educators to create multiple pathways for diverse learners to access the curricula, diminish curricula barriers, and empower students (Gawronski et al., 2016; Ralabate & Nelson, 2017; Scott & McGuire, 2017). For instance, educators can use UDL to develop scaffolded vocabulary support for native language learners (Torres & Rao, 2019). Additionally, faculty can provide a culturally relevant experience by customizing curricula with a variety of individualistic and collectivistic assignments to meet the varying cultural comfort level of students (Ralabate & Nelson, 2017; see guideline 7.2 in Table 3).

**Fostering Student Engagement and Community.** In 2014, Rao et al. conducted a descriptive review of UD implementation across all educational levels, including higher education. The researchers found that students reported increased levels of engagement, including fostering communication and interactions throughout college courses. Students also perceived an improvement in instruction for courses implementing UD in their curriculum.

**Criticisms of UDL**

While there are many benefits of UDL, there are also crucial criticisms. First, educators frequently criticize the breadth and depth of the UDL framework and find it overwhelming and prohibitive. Second, the neurological research that buttresses UDL checkpoints has been absent for the last fourteen years. Third, there is insufficient higher education data to support a student outcome-based justification for UDL. Fourth, research lacks data on students with disabilities in higher education. Finally, UDL has been criticized for being culturally unresponsive.

**Overwhelming Implementation.** More than two decades following the creation of the UDL framework (Griful-Freixenet et al., 2020), UDL struggles to transition from the
advocacy phase to the accommodation phase (Edyburn, 2010). Educators are hesitant to use the UDL framework while frequently criticizing the depth of the UDL heuristic (Hromalik et al., 2020; Meyer et al., 2014). Instructional faculty struggle to progress from the initial stage of UDL awareness to actual implementation (Scott & McGuire, 2017; Tobin, 2013). Faculty are overwhelmed in the design phase with the number of possibilities in course design execution (Meyer et al., 2014) and are confused about what it means to incorporate UDL in their teaching (Rao et al., 2014; Tobin, 2013). Subsequently, Edyburn (2010) argued that UD interventions need specificity in what constitutes an actual intervention. This phenomenon of ‘over choice,’ or when there are too many choices available, complicates instructional design decisions, particularly for content-expert faculty ill-equipped with pedagogical training (Hromalik et al., 2020). Many criticize that the UDL reflection process is labor-intensive and lacks sufficient evidence of faculty and students' benefits (Rao et al., 2015; Tobin, 2013; Tobin & Behling, 2018).

Outdated Checkpoint Research. While CAST has mapped over eight-hundred research studies behind the UDL checkpoints (Novak & Bracken, 2019), the evidence is significantly dated and needs to be updated. For example, checkpoint 7.1, optimize individual choice and autonomy, cites research from 1916 to 2008 (CAST, 2021d). It is important to note that no research has been cited since 2008, and CAST is missing fourteen years of updated neurological research. Figure 2 illustrates the lack of research for UDL checkpoint 7.1 from 2008 to 2021. One of the most significant changes since 2008 has been the adoption of educational technology and its impact on learners.
Figure 2

*Number of Cited Research Evidence per Year for UDL Checkpoint 7.1*

Note. The chart excludes one cited source from 1916.

**Insufficient Student Outcomes Data.** There are also significant shortcomings in UDL student outcome research. First, the UDL guidelines research does not investigate implementation or outcomes (Rao et al., 2020). Second, since student outcome data is in short supply from extant literature, it requires empirical validation of the UDL framework (Rao et al., 2014). However, Kember (2003) argues that there are practical difficulties in using experimental designs to evaluate higher education teaching innovations, such as UDL. Instead, researchers should utilize triangulation of data through a mixed-methods evaluation study (Kember, 2003). Third, most UDL research in higher education does not disaggregate by specific student characteristics (Rao et al., 2020), such as race, ethnicity, linguistic
background, or disability status. Without this information, educators will not know which UDL interventions are most effective and consequential for their student population (Rao et al., 2020).

**Lacking Data on Students with Disabilities.** Existing literature sparsely includes data on students with disabilities in higher education. Several factors constrain the collection and reporting of this data, such as the requirement for students in higher education to opt-in to disclosing their disability status with professors, as well as limiting factors on how many students with disabilities have been verified through the local Disability Service Office (DSO) to authenticate their disability accommodations in class.

**Culturally Unresponsive.** Initially, CAST and other UDL-proponents claimed that cultural responsiveness was inherently embedded within the UDL guidelines. However, the fact that cultural responsiveness was not explicitly mentioned in the guidelines drew criticism. In a recent whitepaper titled *Cracks in the Foundation*, David Rose, the co-founder of CAST, reflected on the UDL guidelines, explicitly addressing systemic barriers to equitable learning and outcomes in education (Rose, 2021). While CAST proponents have finally admitted to their unconscious bias regarding culturally responsive materials in the UDL framework, they are still planning to update the framework to include culturally responsive pedagogy, lagging behind other social justice and inclusion movements.

**UDL in Community Colleges**

In general, there is significantly less research on pedagogy performed at community colleges than on their higher education counterparts (Alicea et al., 2016; Hromalik et al.,
As a result, several gaps exist in the extant UDL literature concerning the community college environment. However, there are some organizations and researchers worth noting.

In 2010, the Academic Senate for California Community Colleges (ASCCC) recognized UDL as a practice to promote equity in basic skills courses in California Community Colleges. The report claimed UDL increased success for all students and supported the learning of all students if given the proper access, support, and opportunity. The ASCCC viewed UDL through a cultural competency lens, and they encouraged faculty to be aware of their own cultural biases to consider students’ cultural and ethnic values. The ASCCC issued a formal recommendation that statewide faculty development efforts should focus on equity-based practices, including incorporating UDL for equitable outcomes in the classroom (Academic Senate for California Community Colleges, 2010). A decade later, however, ASCCC’s promotion of UDL still resides in a black hole outside the reach of many community college faculty.

In 2016, Gawronski, Kuk, and Lombardi examined community college faculty and students' perceptions of inclusive teaching practices. However, it must be noted that their research focused on UD, not specifically UDL. The researchers recognized that few empirical studies had measured perceptions of college students towards inclusive instruction, specifically “very little, if any, research on inclusive instruction has been conducted at community colleges” (Gawronski et al., 2016, p. 333). The researchers designed two online qualitative instruments: (a) the Inclusive Teaching Strategies Inventory (ITSI) self-report survey for faculty; and (b) the student survey equivalent, the Inclusive Teaching Strategies-Student (ITSI-S) survey instrument. Survey responses included 179 faculty ITSI submissions
and 449 student ITSI-S submissions, which were analyzed using a Multivariate Analysis of Variance (MANOVA). They discovered that the age and ethnicity of a faculty member impacted their self-reported action on inclusive teaching. Gawronski et al. (2016) described European participants between 35-44 years old as having higher action scores than faculty members of color. While faculty reported favorable attitudes toward inclusive design, the authors hypothesize that a lack of knowledge and practical skills in implementing inclusive teaching may be prohibiting changes in their classrooms. Faculty and students agreed that inclusive education was necessary. However, they rarely saw it implemented in a classroom. Strong criticism was the absence of psychometric properties in the design of a quantitative instrument. In addition, the study did not focus on online education. Furthermore, since scales had different units of measurement, the scales had to be recoded, which ultimately altered the final report. Finally, the findings indicated that the analysis was not significant.

In 2020, Hromalik et al. studied UDL training for community college faculty. This UDL Academy was organized as a two-phase professional development session. Their research uncovered that many faculty members found UDL challenging to put into practice and that faculty did not find one congruent path for implementing UDL in their classrooms. The authors asserted that UDL training would provide community college instructors the competence and confidence to succeed in course design. Through their literature review, the researchers uncovered evidence that one-time workshops did not have as many positive outcomes for faculty and continued to reference Linda Darling-Hammond’s (2017) research into effective professional development practices. Darling-Hammond’s research supported
active learning, modeling, coaching, feedback, and reflection in professional development workshops.

Research has also indicated that faculty needed more post-workshop support during UDL implementation. Hromalik et al. (2020) summarized the design, development, and implementation of the UDL Academy at the Onondaga Community College (OCC) over a two-year timeframe. The study included detailed tables of sample agendas, events, learning objectives, and content presented. It also included a detailed top-level summary of the schedule for both years of the UDL Academy. While multi-day training sessions could harm faculty attendance, the authors concluded that offering a primer workshop sparked faculty interest in the UDL Academy. It was clear that funding to support faculty summer work helped incentivize faculty participation; however, the authors realized that funding was unpredictable. Lastly, the authors aligned with Darling-Hammond’s recommendation that professional development must model and reflect best classroom practices, similar to the UDL Academy at OCC. Research findings provided thematic faculty responses on how to improve the first year of the training in preparation for the second year of training and documented the perceived improvement in the quality of the second year of the UDL Academy. However, it must be noted that a $4.5 million United States Department of Labor grant funded this study. Many community colleges lack access to such substantial resources.

Additionally, smaller community college campuses may not have the bandwidth or enough faculty to support a comprehensive two-year UDL Academy training. In addition, the community college resided in upstate New York, where over half of the population was White, starkly different from the rich diversity in the California community college system.
Furthermore, the researchers found that early studies on UDL in higher education focused on training future K-12 educators in UDL and not higher education faculty.

Universal Design models in education offer an abundance of options to tailor the design of community college courses online to students' diverse needs and learner variability. Faculty must focus on the relevance, flexibility, instructor presence, timeliness of feedback, and early alert strategies to help motivate adult online learners (Kelly, 2013). These strategies are essential to virtual modalities in higher education today.

**UDL in Distance Learning**

It is undeniable that faculty today are spending significantly more time teaching through virtual modalities. In 2011, Rao and Tanners published a case study on UDL and Universal Instructional Design (UID) implementation in an online graduate course. The study was conducted in three phases: course design, implementation, and evaluation. The authors created a valuable table for practitioners that mapped UDL and UID principles to specific course elements, such as course materials, instructional strategies, synchronous, and asynchronous activities. Student surveys and interviews identified valuable UD components in the course. Students reported an appreciation for multiple modalities in both the presentation of information and the representation of their work in the class. Additionally, Rao and Tanners found that students appreciated brief weekly assignments as less stressful than high-stakes ones. A primary limitation of this case study was the small sample size of twenty-five students, which may not be generalizable to other environments.

Later in 2014, Rao et al. conducted a systematic review of empirically-based intervention studies using three UD education models, including UDL. Research locations included pre-
kindergarten through post-secondary environments. The authors organized research findings into two elaborate tables, one for K-12 articles and one for higher education articles. The authors recommended creating reporting standards that would serve as a precursor to creating the UDL reporting criteria (Rao et al., 2020).

In 2014, Tobin documented tactical ways to increase student retention online by applying UDL principles. He advocated for learners who are increasingly using mobile devices to access information, stating that online students can experience variability and uncertainty in Internet service and an increase in the dependence on mobile devices over laptops or computers. Tobin (2014) outlined five strategies for incorporating UDL into online college courses:

- First, start with text by building course learning pathways strategically on textual information. Some of this text can be used to script content for video or audio formats succinctly.
- Next, create two pathway versions: text-only and video versions. Tobin recommends focusing on content that traditionally confused students.
- Third, let students define the method and medium for the instructor's course objectives. For example, students write an essay, record a podcast, or make a video for special assignments. However, Tobin cautions that specific assignments, such as creating a business memo, should only allow one medium since it is unsuitable for other mediums.
- Fourth, break topics into smaller chunks by creating short text-based or video content to accompany the most important topics in the course. Tobin recommends scaffolding
course content into brief segments of five minutes or less for manageable consumption by the student and manageable creation and updating by the faculty member.

- Fifth, be selective and intentional in the type and amount of software required in a course. Overall, Tobin’s (2014) article curated several tangible and accessible recommendations for integrating UDL practices into a college classroom online.

The author included several visual examples throughout the article. This article was a predecessor to Tobin and Behling’s (2018) seminal book, *Reach Everyone, Teach Everyone: Universal Design for Learning in Higher Education*.

In 2015, Rao et al. studied the implementation of Universal Instructional Design (UID), a UD model like UDL, in three online courses in a post-baccalaureate teacher certification program in special education. The purpose of this study was to document instructional practices that supported an inclusive environment for all learners while incorporating learner variability and adult learning theories into the research. The article incorporated findings from Rao’s (2014) earlier research with Ok and Bryant referenced previously. For instance, the researchers detailed the instructor’s teaching experience and acknowledged that the instructor was not an instructional design or technology professional (Rao et al., 2015).

The research provided a detailed description of how the instructor designed an inclusive online course (Rao et al., 2015). The authors included a table with course components mapped to UID and UDL principles. However, when mapping content areas to UDL principles, the authors did not specify which checkpoints were used under each variable or why. It is critical to note that Rao et al.’s (2015) research was not designed to measure
student outcomes. Additionally, while the research promoted interaction between faculty and students, it did not emphasize regular and effective contact between students, a primary focus of today's online education regulation for community colleges (California Education Code, 2007/2019).

In 2017, Scott and Temple published a study that converted a face-to-face graduate-level special education course into an online course. The study detailed technology use and content delivery methods while including a comprehensive table outlining the UDL design (Scott & Temple, 2017). While the article walks the reader through the authors' steps to convert the course to an online format, it primarily focuses on descriptive accounts of UDL instructional design without quantitative data on student outcome findings or student or faculty perspectives. Additionally, this study replicates the thoughts of many educators that discussion boards are effective for communication in an online course (Scott & Temple, 2017). However, it can be argued that discussion boards are insufficient tools for effective student-to-student or student-to-instructor engagement, depending on how instructors design their discussion board protocols (Lieberman, 2019).

Rogers-Shaw et al. (2017) published a study on UDL for adult learners in online instruction summarizing the history of UDL and describing redesigning an online course. Implementation decisions included diversifying the ways students could access text-based content in the course, simplifying the syllabus, creating visuals for assessment values, modifying previous instructor-created exams to student-created exams, and increasing communication frequency within the course and directly to students (Rogers-Shaw et al., 2017). The authors advocated for UDL as an epistemological shift supporting social justice.
However, the research could have improved its contributions to the field by adhering to the UDL reporting criteria. Additionally, this study did not include student outcome data or student perceptions.

Lastly, when considering pedagogical practices, especially in online modalities, faculty should ensure that marginal costs do not exceed marginal benefits (Tila & Levy, 2019). Faculty must take care not to invest an absorbent amount of time into course redesign if the return on investment is not proportionate to the time invested.

**Student Engagement**

Frequently described as a meta-construct that is difficult to define and decode, many scholars under-theorize student engagement research and fail to explicitly define the term within their research (Christenson et al., 2012; Leslie, 2019; Redmond et al., 2018). Challenges in agreeing on a predominant definition of student engagement are compounded by differences in student engagement research within K-12 and higher education. For example, K-12 student engagement research resides primarily within the classroom, whereas student engagement research in higher education is studied both inside and outside the classroom. One example of measuring campus-level student engagement is the National Survey of Student Engagement (NSSE). However, postsecondary engagement research tends to focus more on engagement at the campus level than the classroom level (Gunuc & Kuzu, 2014). Insufficient research is focused on classroom-level engagement in higher education (Alicea et al., 2016).

With the exponential growth in online learning accelerated by the COVID-19 pandemic, researchers and practitioners alike must focus on providing equitable experiences and
resources to online students to avoid educational segregation since online students have fewer options for institutional engagement (Redmond et al., 2018). Additionally, student engagement is key to online student retention and graduation persistence (Bolliger & Halupa, 2018).

**Online Student Engagement Framework**

Redmond et al. (2018) published an engagement framework tailored to the virtual classroom in response to a lack of recognition of online learning in student engagement research. The researchers analyzed extant student engagement literature to develop a multidimensional student engagement construct for online education. The online engagement model consists of the following elements: behavioral engagement, cognitive engagement, collaborative engagement, emotional engagement, and social engagement. The five elements are interrelated in how they impact student engagement.

**Behavioral Engagement.** There are three aspects to behavioral engagement: (a) following rules and norms, (b) active academic participation, and (c) active participation in non-academic activities through the academic institution (Redmond et al., 2018). When behaviorally engaged, students seek help and aid other students as needed. Additionally, students will display an interest in learning, find content relevant to their personal lives, and develop academic skills such as reading, writing, time management, and goal setting (Redmond et al., 2018). Illustrative indicators of behavioral engagement include, but are not limited to, adhering to online learning norms, developing agency and academic skills, and supporting peers (Redmond et al., 2018).
Cognitive Engagement. While cognitive engagement is the most fundamental form of engagement, it is not definitively defined in the literature (Redmond et al., 2018). Generally, there are two levels of cognition. Deep cognitive engagement is when a student justifies or compares his or her ideas to others’ ideas or when a student incorporates new supporting information. On the other hand, surface cognitive engagement is when an online student states ideas without justification or agrees with other students without explaining. Course design impacts the level of cognitive engagement (Redmond et al., 2018). Illustrative indicators of cognitive engagement in an online classroom include, but are not limited to, activating metacognition, critical thinking, integrating ideas, and justifying decisions (Redmond et al., 2018). Engaging self-regulation and metacognition directly align with UDL’s focus on executive functioning and creating expert learners.

Collaborative Engagement. Students benefit academically, socially, and emotionally from connecting with others. Collaborative engagement develops relationships that support academic learning (Redmond et al., 2018). Students can form relationships with other students, faculty, and professionals in the industry. Collaborative engagement with students includes group work, study groups, and tutoring. Faculty can create collaborative engagement with students by providing a supportive learning environment, including the use of peer or small group activities and assessments (Redmond et al., 2018). Externally, students can collaboratively engage with industry professionals by establishing professional networks. Students can proactively develop their networks, but faculty who create informational interview assignments and campus career centers that hold networking events can aid in establishing students’ networks. Illustrative indicators of collaborative engagement include,
but are not limited to, developing professional networks, learning with peers, and relating to faculty members (Redmond et al., 2018).

**Emotional Engagement.** Emotional engagement is a student’s feeling or attitude toward learning (Redmond et al., 2018). Emotional engagement is commonly referred to as the affective component of engagement. A student’s attitude, such as anxiety or enthusiasm, indicates emotional engagement. Academic discipline plays a unique role in emotional engagement since some courses, such as mathematics, suffer from inherent student anxiety that can directly impact student emotional engagement. Illustrative indicators of emotional engagement include but are not limited to articulating assumptions, commitment to learning, managing expectations, and student motivation (Redmond et al., 2018).

**Social Engagement.** Social engagement refers to student participation in academic activities within the virtual classroom and extracurricular activities outside of class (Redmond et al., 2018). Illustrative examples of indicators of social engagement include, but are not limited to, building community, relationships, and trust. Additionally, a social engagement subconstruct creates a sense of belonging or the feeling of acceptance and inclusion within a group of people. A sense of belonging is conceptually distinct from social engagement and, thus, should be defined and measured separately in academic research (Anh & Davis, 2020). It supports diversity and inclusion while impacting performance and retention (Cornell University, 2021).

The online engagement framework for higher education (Redmond et al., 2018) was adopted for this study to explore the variety and quality of engagement in a virtual classroom.
Theory of Transactional Distance

The theory of transactional distance dates to 1972, when the first definition of distance education was recorded in the English language (Moore, 1997). Decades later, Michael G. Moore (1997) wrote a seminal essay on the theory of transactional distance in which he described three clusters of transactional variables: (a) dialogue, (b) structure, and (c) learner autonomy.

First, the concept of instructional dialogue is differentiated from mere interactions and refined as meaningful and valuable interactions between two or more people (Moore, 1997). Moore’s writings have relevance even in our current technological environment. For instance, Moore explains that the speed of the interaction is moderated by the type of technology utilized in the course. Furthermore, he clarifies that other environmental factors influence instructional dialogue, such as the number of students in a course, the frequency of communication, and the emotional environment of both teachers and students, respectively (Moore, 1997). Multiple influencers exist for dialogue, such as content, learner personality, and teacher personality (Moore, 1997).

Second, program structure relates to instructional design components (Moore, 1997). Moore argues that overstructured interactive online programs produce a learning environment more synonymous with one-way communication modalities, such as video. Thus, specific online education components with less structure are a welcoming environment to create meaningful dialogue. The skills and attitudes of the learners are also imperative to the program structure. Students must have the confidence to participate in course activities and must have the skills to monitor autonomous learning (Moore, 1997).
Third, learner autonomy is when the learner focuses on the teaching-learning relationship, such as when a student is emotionally independent of the instructor and is self-directed (Moore, 1997). The greater the student's autonomy, the more comfortable they are with less dialogue and structure in a course. The opposite is true for students with less autonomy (Moore, 1997). Adult learning theories naturally support an autonomous environment for learners; however, it must be recognized that children and young adults experience a more dependent relationship with their teachers in elementary and secondary school (Moore, 1997).

One stark criticism of Moore’s paper on transactional distance is his reliance on university institutions that provide robust instructional design resources for faculty. He cites that online learning is a team endeavor, with multiple staff contributing to the faculty’s efforts, such as instructional designers, media specialists, and tutors (Moore, 1997). California community college faculty do not have access to that level of instructional design support; hence they must rely only on their own efforts to design and deliver their courses.

**Revised Scale of Transactional Distance (RSTD)**

As decades progressed, as did distance education, the theory of transactional distance research continued to make strides. Later, Moore’s theory of transactional design identified three types of interaction: student-to-student, student-to-teacher, and student-to-content (Zhang, 2003). In 2003, Zhang extended the theory to include more complex components related to online learning environments and developed an instrument to measure four dimensions of transactional distance that encourage active student engagement and learning:

1. Transactional distance between student and student (TDSS)
2. Transactional distance between student and teacher (TDST)
3. Transactional distance between student and content (TDSC)
4. Transactional distance between student and interface (TDSI).

Zhang’s scale of transactional distance was later updated to become the revised scale of transactional distance (RSTD) (Paul et al., 2015), which eliminated the TDSI construct in response to the changing needs of online students as technology has developed. The researchers recognized that unique obstacles to students’ engagement in class are continuously adapting to changes in social, economic, and technological advances in society (Paul et al., 2015).

**Trifecta of Student Engagement Framework**

In 2019, Heather Leslie, at the National University in California, designed the Trifecta of Student Engagement framework based on Moore’s theory of transactional distance. The framework posits that for students to be engaged in a class, they must regularly interact with course content, student peers, and their course instructor (Leslie, 2019, p. 151). The framework orients the student-centered theory into a pragmatic visual for application in faculty professional development programs.

**Challenges with the Extant UDL Literature**

While, at first, the breadth of UDL academic research seems vast and expansive, K-12 research is the overwhelming focus of research settings (Rao, 2019; Scott & McGuire, 2017; Tobin & Behling, 2018). Extant research points to a lack of UD and UDL implementation studies in college classrooms (Gawronski et al., 2016; Rao et al., 2014; Samuels-Peretz & Powers, 2014; Silver et al., 1998; Stes et al., 2010). Furthermore, research data has
insufficiently described which implementations distinctly benefited students with unique characteristics, such as disability or language ability status (Rao et al., 2014). Lastly, it is not surprising that since UDL originated in the United States, research has primarily been conducted within the United States.

This study aims to further the research of UDL within the community college setting and document implementation techniques and student outcomes. This research investigates whether UDL impacts student retention in an online business survey course at a suburban community college and whether it promotes student engagement in an online course.

Summary

While extant literature thoroughly discusses UDL as an excellent pedagogical practice, several studies identified a lack of UDL implementation examples in educational research, particularly in the community college segment. In addition, recent studies suggest the importance of measuring improvements in student outcomes facilitated by UDL, including for students with specific characteristics. The meta construct of student engagement was described to support student outcomes and persistence. This study investigates the possible influence of UDL on student success outcomes at the course level. Furthermore, this study explores student perceptions of course engagement and a sense of belonging with UDL.

Research Questions

The following research questions (RQs) will guide this study:

1. **Mixed-Method RQ:** What are the main factors that influence the effective implementation of UDL?
2. **Quantitative RQ:** How does UDL influence student success in general and student learning in particular?

3. **Mixed-Method RQ:** How does UDL affect student experience, including student engagement and sense of belonging?
Chapter 3. Methodology

As previously discussed, while current Universal Design for Learning (UDL) literature documents implementation in K-12 and higher education, the literature lacks sufficient UDL research in the community college segment. The purpose of this study is to disseminate UDL implementation procedures for college faculty while documenting if UDL makes a perceived difference in student learning, engagement, and sense of belonging. The following chapter describes the research design, field site and participants, UDL intervention, instrumentation, sources of information, data collection procedures, and data analysis procedures. The Institution Review Board (IRB) notice of approval from San José State University can be found in Appendix B: IRB Notice of Approval – San José State University. Additionally, the organizational letter of support can be found in Appendix C: Organizational Letter of Support – Cañada College.

Research Design

This research was designed as a convergent mixed-methods study. Convergent mixed methods research is conducted when a scholar collects both qualitative and quantitative data to merge datasets to draw integrated mixed methods findings (Creswell, 2015). The rationale for a convergent mixed-method study is to combine qualitative and quantitative data to develop a complete understanding of the impact of implementing UDL. This study utilizes mixed methods to leverage the advantages of qualitative and quantitative research, such as rich descriptions and investigating relationships within data respectively, against the disadvantages of each individual method, such as limiting the generalizability of qualitative data and impersonal data from quantitative data (Creswell, 2015). Additionally, this study
was designed as a multistage evaluation with three phases of UDL implementation in multiple sections of the same course type within a seven-month period. A multistage evaluation design promotes continuous levels of inquiry between research phases (Creswell, 2015). Since the location of this study is at one college and in one type of course, the research serves as a case study for UDL implementation in online community college courses. The results may or may not be generalizable to other disciplines, colleges, or universities. Figure 3 illustrates the convergent mixed methods procedural diagram for this study. Each component will be described in subsequent sections.

**UDL Reporting Criteria**

This study has been designed utilizing the Universal Design for Learning Reporting Criteria (UDL RC) developed by the UDL Implementation and Research Network (UDL-IRN) Research Committee (Rao et al., 2020). The UDL RC were validated in existing K-12 research studies (Rao et al., 2020). The UDL RC consists of three categories: (a) learner variability and environment, (b) proactive and intentional design, and (c) implementation and outcomes. Each category is discussed throughout this research study to align with the reporting criteria.

**Field Site and Participants**

The following section describes the research location, student participants, course content and modality, and the course instructor.
Figure 3

Procedural Diagram: A Convergent Mixed-Methods Study of UDL

Research Questions:
1. What are the main factors which influence the effective implementation of UDL?
2. How does UDL influence student success in general and student learning in particular?
3. How does UDL affect student experience, including student engagement and sense of belonging?

Qual Data Collection Procedures:
- Researcher logbook & field note memos
- Researcher post-reflections
- Construction response questions in the student questionnaire, student reflections, and student survey

Procedures:
- Comparison of qualitative and quantitative databases for congruencies and discrepancies
- Assessment of viability of data integration

Qual Data Analysis Procedures:
- Coding and thematic analysis of text (MaxQDA)

Quant Data Analysis Procedures:
- Descriptive & inferential statistics
- Independent sample t-tests (SPSS)
- Multiple regression analysis (SPSS)

Spring 2021
- IRB Approval
- Phase I: BUS 100 Pilot (1 section)

Summer 2021
- Phase II: BUS 100 (4 sections)

Fall 2021
- Phase III: BUS 100 (3 sections)

Spring 2022
- Interpretation Procedures:
  - Data integration leading to weaving approach for integrated MM findings
  - Joint display (MaxQDA)
  - Interactive quote matrix (MaxQDA)
The Community College

This study took place at Cañada College, a 2-year public community college located in northern California in the United States of America. In 1968, the college was founded as the second of three colleges in a three-college district. The college is accredited by the Accrediting Commission for Community and Junior Colleges (ACCJC) of the Western Association of Schools and Colleges (WASC). The college served approximately 10,300 students in the 2019-2020 academic year and offers Associate in Arts (AA)/Associate in Science (AS) degrees, Associate Degrees for Transfer (AD-T), certificates of achievement, and skills certificates (Cañada College, 2021). The college is federally designated as a Hispanic Serving Institution (HSI) and Asian American and Native American Pacific Islander-Serving Institution (AANAPISI) Minority Serving Institution (MSI).

It is essential to note the regional demographics. Nestled on the mid-peninsula of the San Francisco Bay Area, the college is geographically located within the heart of Silicon Valley. Silicon Valley is composed of 35% Asian, 33% White, 25% Hispanic/Latinx, 5% multiple and other, and 2% Black or African American (Massaro, 2021). The region is home to a significantly larger portion of foreign-born residents, with 39.1% born outside of the United States, compared to 13.7% foreign-born in the nation (Massaro, 2021; U.S. Census, 2019). It is significant to note that more than half of Silicon Valley residents speak a language other than English at home (Massaro, 2021). While adult educational attainment in the region is higher than the national average, with 11% less than high school, 14% high school graduate, 22% some college, 28% bachelor’s degree, and 25% graduate or professional degree, the
majority of the Hispanic and Black population do not hold an undergraduate degree (Massaro, 2021).

**The Business Students**

The notable demand for business education justifies the study of the discipline. According to NCES (2019a), business was the largest major declared for bachelor’s degrees earned in 2016-2017. Over 90,000 students are served in the business and marketing education program statewide (California Department of Education, 2020a). Business is also the most popular master’s degree, ahead of education and health professions. Students are interested in the major for its versatility and broad job prospects. The interest in the business major is also reflected in student enrollment at the community college level.

In the 2019-2020 academic year, the host institution’s business department served 1,241 students (Cañada College, 2021). Of those students, 50.6% identify as female, 47.9% as male, and 1.5% as unreported. Table 4 and Table 5 describe business student age and race/ethnicities, respectively. The largest age segment was students between the ages of 18-22 (45.3%), followed by 22-28 years old (22.3%) and 29-39 years old (16.4%). The largest race/ethnicity groups identified in the business student population were Hispanic/Latinx (41.9%), White (21.7%), and Asian (14.8%).

It is important to note that over half (54.4%) of business students identify as first-generation students, defined as a student where neither parent/guardian has an education level above an associate degree (Cañada College, 2021). While the number of first-generation students is significant, only 5.8% of business students identified as international students. In alignment with community colleges throughout the state, in the spring of 2021,
Table 4

Age Demographics for Cañada College Business Students

<table>
<thead>
<tr>
<th>Age</th>
<th>% of the population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 18</td>
<td>7.7%</td>
</tr>
<tr>
<td>18-22</td>
<td>45.3%</td>
</tr>
<tr>
<td>23-28</td>
<td>22.3%</td>
</tr>
<tr>
<td>29-39</td>
<td>16.4%</td>
</tr>
<tr>
<td>40-49</td>
<td>4.6%</td>
</tr>
<tr>
<td>50-59</td>
<td>2.7%</td>
</tr>
<tr>
<td>60+</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

*Note.* Data is from the 2019-2020 academic year.

Table 5

Race/ethnicity Demographics for Cañada College Business Students

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>% of the population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic/Latinx</td>
<td>41.9%</td>
</tr>
<tr>
<td>White</td>
<td>21.7%</td>
</tr>
<tr>
<td>Asian</td>
<td>14.8%</td>
</tr>
<tr>
<td>Unknown</td>
<td>6.1%</td>
</tr>
<tr>
<td>Filipino</td>
<td>5.4%</td>
</tr>
<tr>
<td>Multiraces</td>
<td>4.0%</td>
</tr>
<tr>
<td>Black/African American</td>
<td>3.9%</td>
</tr>
<tr>
<td>Pacific Islander</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

*Note.* Data is from the 2019-2020 academic year.

students at the host institution were primarily part-time, with 55.05% enrolling in 3.0 – 5.9 units, 20.28% enrolling in 6.0 – 8.9 units, and 10.59% enrolling in 9.0 – 11.9 units (California Community Colleges Chancellor’s Office, 2022). In the fall of 2020, 313 students were verified as having a disability through the college Disability Resource Center (DRC) (B. Lee, personal communication, March 19, 2021). Table 6 details the types of disabilities reported.
Table 6

Disability Demographics for Cañada College Students

<table>
<thead>
<tr>
<th>Disability Type</th>
<th># of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning disability</td>
<td>95</td>
</tr>
<tr>
<td>Mental health</td>
<td>78</td>
</tr>
<tr>
<td>Other</td>
<td>49</td>
</tr>
<tr>
<td>Attention deficit hyperactivity disorder (ADHD)</td>
<td>42</td>
</tr>
<tr>
<td>Physical disability</td>
<td>16</td>
</tr>
<tr>
<td>Autism</td>
<td>12</td>
</tr>
<tr>
<td>Acquired brain injury</td>
<td>8</td>
</tr>
<tr>
<td>Deaf and Hard of Hearing (DHH)</td>
<td>7</td>
</tr>
<tr>
<td>Blind/low vision</td>
<td>4</td>
</tr>
<tr>
<td>Intellectually delayed</td>
<td>2</td>
</tr>
<tr>
<td>Total Disabilities</td>
<td>313</td>
</tr>
</tbody>
</table>

Note. Data is from the fall semester of 2020.

Learner Variability Factors. It is well documented that diversity found in student populations leads to classrooms with varying degrees of learner variability (Meyer et al., 2014; Rao et al., 2015; Tobin & Behling, 2018). Drawing upon this researcher’s eleven years of teaching the Introduction to Business survey course, including nine years at the current institution, underserved students in the community college have a wide variety of learner variabilities. Without any required course prerequisites, a few students may come to the classroom with limited English skills. As referenced earlier, over half of the business student population were first-generation students, where family members cannot mentor students’ journeys through academic institutions. Additionally, low-income students are distracted by seeking financial resources to cover their college expenses, such as tuition fees and textbooks. Most students are non-traditional students; they may have taken some time off from college and typically have outside demands from work, family, or athletics. Some
students have to care for children or other family members. Students’ responsibilities outside of the classroom constantly compete against their responsibilities in the classroom. Many students struggle with understanding how to study and read a college-level textbook. Most students increasingly utilize mobile devices, such as smartphones and tablets, to access coursework on demand. However, most students do not have necessary tech skills beyond simple online internet search capabilities, such as online communication etiquette, video conferencing management, and online source evaluation skills.

While in the researcher’s personal experience, there have been few students with physical disabilities in her in-person courses, it is unknown whether the same is true with respect to her online courses. It is difficult to know whether students in online classes have physical disabilities that might impact their learning since letters of accommodation (or “accommodation memos”) do not indicate the actual disability but only the approved accommodations, such as additional test time or use of a screen reader. For a section of the Introduction to Business course, with an average of 35 students, typically only 1 to 3 students are likely to submit a letter of accommodation.

It is essential to highlight that most students self-select into the business major and come to the course out of personal interest. While the course is a rigorous transfer-level course, students are not as intimidated by the course content as they may be in science, technology, engineering, and mathematics courses or courses that require substantial amounts of reading, such as literature and language courses.

**Student Population and Sample.** The target student population for this study was students enrolled in the author’s online Introduction to Business courses from June to
December of 2021 (n = 245). A pilot was conducted in the preceding spring semester to test the UDL implementation and student survey resulting in significant revisions to the study. Therefore, the pilot data was not included in the final analysis.

**Student Recruitment.** All enrolled students were invited to participate in the study approximately three weeks prior to the end of the semester. Initially, the instructor posted a course announcement in the learning management system, Canvas, alerting students to the opportunity to participate in the research study and to look for an email from a specific college researcher. Examples of recruitment materials are included in Appendix D: Recruitment Materials. Then, students were contacted by one of the college staff researchers inviting students to opt into the research study through an Adobe Sign invitation for the consent form. Students were sent one of two consent forms depending on if they were an adult or a minor (see Appendix E: Consent Form - Adult and Appendix F: Consent Form - Minor). Students were given a week to sign the consent form. After the consent deadline passed, the college staff researcher emailed personalized Qualtrics survey links to all students who signed the consent form. Students were directed to contact the college staff researcher for any follow-up questions regarding the consent form or survey process.

Students were offered extra credit for their participation in the research study. Students who did not want to participate in the research study but who were interested in earning extra credit were instructed to complete an alternative assignment of equal extra credit value and time requirements as the survey. The alternative assignment involved researching current news articles of the student’s choice from the Wall Street Journal and summarizing the content while relating it to current course topics. Students submitted their work to a faculty
colleague who collected and graded it to provide anonymity to students. The faculty colleague provided a list of students who completed the extra credit assignment to the college staff researcher. A consolidated list of all students who completed either the research survey or the alternative assignment was provided to the faculty-researcher to record extra credit in the course grade book immediately before submitting final course grades to admissions and records. The instructor did not know which students completed the survey versus the alternative assignment to protect student anonymity. The researcher was not granted access to the survey data until after submitting final course grades.

**The Business Course**

**Course Content and Articulation.** Students were enrolled in an Introduction to Business three-unit credit course. The course is a survey course introducing students to the various fields of business, such as accounting, economics, ethics, finance, information systems, management, marketing, and operations. This course was designated as a C-ID articulated course: C-ID courses are California Community College courses that are approved for articulation with any other equivalent community college course for content credit (California Community Colleges Chancellor's Office, 2021b). The course is also articulated for University of California (UC) and California State University (CSU) transfer credit. The course is considered a major preparation course for business students. Additionally, the course meets General Education (GE) Area D Social Sciences requirements for CSU GE and local associate degree requirements. It is important to note that there are no prerequisites or corequisites for the course (see Appendix G: BUS 100 Course Outline of Record).
**Course Delivery Method and Schedule.** The course was scheduled for online asynchronous delivery through the district’s learning management system (LMS), Canvas. While select synchronous video sessions were offered online through Zoom, they were not a required component of the course and thus were not included in the public scheduling system as a requirement. Sessions of the course were offered in 6-week (spring and summer), 8-week (fall), and 16-week terms (fall). See Table 7 for course scheduling and enrollment details.

**Table 7**

*Course Scheduling*

<table>
<thead>
<tr>
<th>Academic Term</th>
<th>Length in Weeks</th>
<th># of Sections</th>
<th>Student Enrollment b</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring 2021a</td>
<td>6</td>
<td>1</td>
<td>28</td>
<td>Last 6 weeks of the 18-week semester</td>
</tr>
<tr>
<td>Summer 2021</td>
<td>6</td>
<td>4</td>
<td>84</td>
<td>Full 6-week summer session</td>
</tr>
<tr>
<td>Fall 2021</td>
<td>8</td>
<td>1</td>
<td>100</td>
<td>First 8 weeks of the 18-week semester</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>1</td>
<td></td>
<td>Last 8 weeks of the 18-week semester</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>1</td>
<td></td>
<td>Late-start course beginning on week 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>of 18-week semester</td>
</tr>
</tbody>
</table>

*Note.* a Spring 2021 was the research study pilot and was not included in the final analysis.

b Enrollment was calculated at the start of the semester.
The Faculty Member

The faculty-researcher taught all courses in this study. The researcher is a mid-career tenured faculty member at the host institution, with eleven years of teaching experience in the community colleges, including teaching online. She met minimum qualifications to teach in the business discipline with a master’s in business administration from the American International College and a bachelor’s in marketing from San José State University. The researcher did not hold a teaching credential since it is not required to teach in the business discipline in California community colleges. Before this study, she was unaware of UDL and learned about UDL through self-study and conference participation. As a first-generation college graduate in her family, she is also a fourth-generation Mexican American who attended community college for lower-division education and understood many community college students' struggles within and outside the classroom. She was a native English speaker and received no formal training in teaching English Language Learners (ELLs). As the spouse of someone who suffered from a traumatic brain injury (TBI) at a young age, she witnessed how the right support can help students with disabilities persist, graduate from college, and lead a fulfilling life. As a doctoral student during the abrupt transition to remote teaching during the COVID-19 pandemic, she developed learner empathy as an online student.

UDL Intervention

Drawing upon previous teaching experience for this course, the instructor aligned UDL interventions with the anticipated business student learner variabilities. Learner variability is the concept that each person learns through different methods according to their neurological
composition (CAST, 2020b). For instance, some learners may prefer to watch a video explaining new content, while other learners prefer to read new content. Learner variability impacts how students learn, how they express their learning, and what motivates them to continue learning. According to UDL, course curriculum and pedagogical techniques need to be customized to the unique students in the classroom. For this study, the instructor prioritized specific UDL checkpoints for implementation. First, the instructor used her experience teaching community college students to predict which supports would benefit her students the most. Through a reflective process, she then mapped specific UDL checkpoints against interventions in her course. Table 8 delineates the prioritized UDL checkpoints implemented in the course for this study.

**Instrumentation**

This convergent mixed methods study consisted of three implementation phases, including an initial pilot phase in the spring of 2021. Each phase collected participant data through a student questionnaire, student reflections, a student survey, and a faculty reflection protocol. Refer to Appendix H: Items Blueprint and Appendix I: Item Stems Design for details.

**Student Questionnaire**

**Format and Content.** In the first week of class, students were required to complete a student questionnaire. The questionnaire was administered in Qualtrics with personalized link invitations sent to students’ school Gmail accounts. The instructor notified students to look for the link in their school email accounts. If a student could not locate the Qualtrics email, they contacted the faculty-researcher directly for the survey invitation link. A copy of
<table>
<thead>
<tr>
<th>UDL Principle</th>
<th>Checkpoint</th>
<th>Checkpoint Description</th>
<th>Prioritized for Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide multiple means of representation</td>
<td>1</td>
<td>Provide options for perception</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1</td>
<td>Offer ways of customizing the display of information</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>1.2</td>
<td>Offer alternatives for auditory information</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.3</td>
<td>Offer alternatives for visual information</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Provide options for language and symbols</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.1</td>
<td>Clarify vocabulary and symbols</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.2</td>
<td>Clarify syntax and structure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.3</td>
<td>Support decoding of text, mathematical notation, and symbols</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.4</td>
<td>Promote understanding across languages (native or academic language)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.5</td>
<td>Illustrate through multiple media</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Provide options for comprehension</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.1</td>
<td>Activate or supply background knowledge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.2</td>
<td>Highlight patterns, critical features, big ideas, and relationships</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.3</td>
<td>Guide information processing and visualization</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.4</td>
<td>Maximize transfer and generalization</td>
<td></td>
</tr>
<tr>
<td>Provide multiple means of action and expression</td>
<td>4</td>
<td>Provide options for physical action</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.1</td>
<td>Vary the methods for response and navigation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.2</td>
<td>Optimize access to tools and assistive technologies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Provide options for expression and communication</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.1</td>
<td>Use multiple media for communication</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.2</td>
<td>Use multiple tools for construction and composition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.3</td>
<td>Build fluencies with graduated levels of support for practice and performance</td>
<td></td>
</tr>
<tr>
<td>Provide multiple means of engagement</td>
<td>6</td>
<td>Provide options for executive functions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.1</td>
<td>Guide appropriate goal setting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.2</td>
<td>Support planning and strategy development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.3</td>
<td>Facilitate managing information and resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.4</td>
<td>Enhance capacity for monitoring progress</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Provide options for recruiting interest</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.1</td>
<td>Optimize individual choice and autonomy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.2</td>
<td>Optimize relevance, value, and authenticity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.3</td>
<td>Minimize threats and distractions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Provide options for sustaining effort and persistence</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.1</td>
<td>Heighten salience of goals and objectives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.2</td>
<td>Vary demands and resources to optimize challenge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.3</td>
<td>Foster collaboration and community</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.4</td>
<td>Increase mastery-oriented feedback</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Provide options for self-regulation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9.1</td>
<td>Promote expectations and beliefs that optimize motivation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9.2</td>
<td>Facilitate personal coping skills and strategies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9.3</td>
<td>Develop self-assessment and reflection</td>
<td></td>
</tr>
</tbody>
</table>
the student questionnaire and answer selections is included in Appendix J: Instrument – Student Questionnaire.

**Pilot-Test Procedures.** The student questionnaire was in use prior to this study as a tool to get to know students and tailor a particular course to their interests. It was refined to increase relevancy for this study during the spring 2021 semester pilot. Additional revisions were made based on the spring 2021 pilot data analysis.

**Student Reflections**

**Format and Content.** Students were required to submit seven reflection assignments per course consisting of 4 to 7 questions per assignment. All reflection assignments were submitted through Google Forms. Students earned credit for completion but were not graded on writing abilities or length of open-ended answers. Appendix K: Instrument – Student Reflections includes student reflection questions and formats for the study.

**Pilot-Test Procedures.** Students piloted student journal reflections during the spring semester. Student and instructor feedback were incorporated into revised reflection question prompts. Once student reflections were officially administered in the summer session, one minor adjustment was made to add a question on assignment relevancy to one of the reflection assignments.

**Student Survey**

**Format and Content.** The final student survey was emailed to participants approximately three weeks prior to the end of the course through Qualtrics. The survey collected student perceptions of UDL interventions and student engagement. Appendix L:
Instrument – Student Survey includes the prompts, question stems, question sources, answer selections, and Qualtrics logic for the student survey.

**Pilot-Test Procedures.** Two faculty colleagues piloted the student survey prior to the spring 2021 pilot with students. Multiple revisions of the survey incorporated feedback from faculty and student pilot participants.

**Faculty Reflection Protocol**

**Format and Content.** After each course, the author completed and recorded a faculty reflection protocol consisting of 8 constructed-response questions in a Google Doc. Appendix M: Instrument – Faculty Reflection Protocol includes a copy of the faculty protocol used in this study.

**Pilot-Test Procedures.** The faculty reflection protocol was tested during the spring semester pilot. Slight adjustments were made based on the author’s reflection on the utility and usefulness of the protocol question set.

**Sources of Information**

This study required four forms of archival data. First, the author manually collected historical student success rate data for all previous BUS 100 courses she taught at the institution through the registration system. These included initial course enrollment, final course enrollment, and student grade distribution in each course. Second, the researcher submitted a records request to the host institution’s research office to data mine district-wide course success rate data for equivalent online BUS 100 courses. Third, the researcher also requested participant demographic data from the college research office. Fourth, the author harvested historical and current Canvas eXtensible Markup Language (XML) data packets
documenting student engagement behavior in the course learning management system, Canvas. This was completed using a publicly available script embedded within the instructor’s version of Canvas. The college district information technology (IT) office did not have additional Canvas XML data available through its Canvas access.

**Data Collection Procedures**

The author obtained data in co-construction through a constructivist lens with student participants. The research methodology is outlined in Table 9 and will be discussed in subsequent sections.
## Table 9

**Research Methodology**

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Participants / Producers</th>
<th>Data Source</th>
<th>Collection Procedure</th>
<th>Analysis Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1: What are the main factors which influence the effective implementation of UDL?</td>
<td>Faculty researcher</td>
<td>Faculty post-reflections protocols</td>
<td>Direct observation</td>
<td>Content analysis for thematic coding</td>
</tr>
<tr>
<td></td>
<td>Students</td>
<td>Student questionnaire fixed-choice items</td>
<td>Online survey at the start of the course</td>
<td>Descriptive statistics</td>
</tr>
<tr>
<td></td>
<td>Students</td>
<td>Reflection journal fixed-choice and constructed-response items</td>
<td>Google Forms administered throughout the semester</td>
<td>Descriptive and inferential statistical analysis &amp; content analysis for thematic coding</td>
</tr>
<tr>
<td></td>
<td>Students</td>
<td>Exam exit slip fixed-choice items</td>
<td>Google Forms administered throughout the semester</td>
<td>Descriptive and inferential statistical analysis</td>
</tr>
<tr>
<td></td>
<td>Students</td>
<td>Post-survey fixed-choice items</td>
<td>Online survey at the end of the course</td>
<td>Descriptive and inferential statistical analysis</td>
</tr>
<tr>
<td></td>
<td>Students</td>
<td>Post-survey constructed-response items</td>
<td>Online survey at the end of the course</td>
<td>Content analysis for thematic coding</td>
</tr>
<tr>
<td></td>
<td>Faculty researcher</td>
<td>Canvas LMS XML data</td>
<td>Records</td>
<td>Data visualization in R Project for Statistical Computing</td>
</tr>
<tr>
<td></td>
<td>Faculty researcher</td>
<td>Researcher logbook</td>
<td>Direct observation</td>
<td>Content analysis for thematic coding</td>
</tr>
<tr>
<td>Research Question</td>
<td>Participants / Producers</td>
<td>Data Source</td>
<td>Collection Procedure</td>
<td>Analysis Procedure</td>
</tr>
<tr>
<td>-------------------</td>
<td>--------------------------</td>
<td>-------------</td>
<td>----------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>RQ2: How does UDL influence student success in general and student learning in particular?</td>
<td>Students</td>
<td>Student questionnaire fixed-choice survey questions</td>
<td>Online survey at the start of the course</td>
<td>Descriptive and inferential statistical analysis</td>
</tr>
<tr>
<td></td>
<td>Faculty researcher</td>
<td>Course success rate and student outcomes data</td>
<td>Records</td>
<td>Descriptive and inferential statistical analysis</td>
</tr>
<tr>
<td></td>
<td>College research office</td>
<td>Student demographics and district-wide outcomes data</td>
<td>Records request</td>
<td>Descriptive and inferential statistical analysis</td>
</tr>
<tr>
<td>RQ3: How does UDL affect student experience, including student engagement and sense of belonging?</td>
<td>Students</td>
<td>Student survey fixed-choice survey questions</td>
<td>Online survey at the end of the course</td>
<td>Descriptive and inferential statistical analysis</td>
</tr>
<tr>
<td></td>
<td>Students</td>
<td>Student survey constructed response questions</td>
<td>Online survey at the end of the course</td>
<td>Content analysis for thematic coding</td>
</tr>
<tr>
<td></td>
<td>Students</td>
<td>Student reflection assignments</td>
<td>Participant observation</td>
<td>Content analysis for thematic coding</td>
</tr>
</tbody>
</table>
**Quantitative Procedures**

Quantitative data was used to analyze all three research questions in this study. Quantitative data was constructed from multiple sources, such as student questionnaire and post-survey fixed-choice question responses, individual student assignment and course scores from the learning management (LMS) system Canvas, success rate data, and Canvas eXtensible Markup Language (XML) data. Educational data mining (EDM) is a method for using mass data collected in educational systems, such as learning management systems, to improve teaching and learning through learning analytics (Brown et al., 2020). While learning analytics has been utilized at the enterprise level to monitor student engagement, little research supports its use at the course level (Brown et al., 2020). These collection methods ensure that student perceptions are included in the data, as well as existing quantitative data automatically collected through the institution. These data sources are itemized in Table 9.

**Qualitative Procedures**

To uncover the main factors which influence the effective implementation of UDL (RQ1) and to understand UDL implementation’s influence on student engagement and sense of belonging (RQ3), multiple qualitative data sources were triangulated (see Table 9). The author and students coproduced most of the data collected. Participants were asked to provide constructed-response submissions through a student questionnaire, reflection journals, exam exit slips, and a post-survey. Reflection journal and exam exit slip data were collected through Google Forms. The student questionnaire and post-survey data were collected through the survey software Qualtrics. To protect sensitive data in the post-survey and to
assure student privacy prior to final grade submissions, college research office staff administered the post-survey in Qualtrics on behalf of the researcher. All data was secured behind user login and password credentials.

Due to the amount of student constructed-response data, the researcher winnowed the data to focus on the most meaningful data while filtering out less meaningful data (Creswell, 2018). The faculty member produced the researcher logbook and faculty protocol reflections collected through direct observation and stored in MaxQDA. The goal of these observations was to build the perspective of the faculty researcher into the study (Hatch, 2002). The researcher logbook, also known as a researcher journal, kept a record of experiences and ideas throughout the study and allowed for the systematic collection of rich descriptive text of activities from the faculty member’s perspective.

**Mixed-Methods Procedures**

Integrating qualitative and quantitative data provided robust evidentiary support for how UDL affects the student experience (RQ3) through a constructivist lens promoting students’ contributions to the process. Students produced a significant portion of the data collected under mixed-methods procedures, through fixed-choice and constructed-response submissions in the student questionnaire, reflection journals, exam exit slips, and post-survey instruments. The author extracted XML data from Canvas for each course section at the conclusion of each academic term. XML data provided quantified user interaction data, such as student pathways and course online content interaction. To guarantee that each construct was measured proportionately, the researcher created an items blueprint to map instrument questions to constructs being measured (see Appendix H: Items Blueprint).
**Data Analysis Procedures**

Data analysis occurred in multiple phases as a convergent mixed-methods design. As each class concluded, the stages of analysis began independently. After the final courses in the fall, additional analysis was conducted across all 7 course sections. However, all 4 summer courses were treated as one for analysis since all 4 sections began and ended on the same dates. The 3 fall courses had different start and end dates, requiring different analysis timelines.

**Quantitative Analysis**

The quantitative analysis began immediately after the commencement of each course and was required for all three research questions in this study. Using Google Sheets, each set of responses were monitored and organized into constructs for analysis. At the conclusion of all courses in the end of the fall semester, data was combined for a thorough analysis. The researcher pulled course success data, student final grade percentages, exam scores, and group project scores during the fall semester. The quantitative data were analyzed using descriptive and inferential statistical analysis in SPSS. Analyses included independent sample *t*-tests and multiple linear regressions. Levene’s test for equality of variances was run for all *t*-tests. Additionally, since linear regression analysis requires numeric variables, multiple variables were coded with dummy variables to fit the requirements of the analysis. Canvas XML data was analyzed using the R Project for Statistical Computing software.

**Qualitative Analysis**

Qualitative data answered the question of which main factors influence the effective implementation of UDL (RQ1, refer to Table 8). Using a typological analysis, the qualitative
data were coded and grouped into broad emerging themes in MaxQDA. In this type of analysis, data were divided into categories based on predetermined typologies before looking for relationships or patterns among the data (Hatch, 2002). The first round of coding used the five student engagement constructs of the online engagement framework (Redmond et al., 2018). Each code is described in Table 10.

Table 10

*Student Engagement Constructs Used for Initial Coding of Qualitative Data*

<table>
<thead>
<tr>
<th>Student Engagement Construct</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral</td>
<td>Includes (a) following rules and norms, (b) active academic participation, and (c) active participation in non-academic activities through an academic institution</td>
</tr>
<tr>
<td>Cognitive</td>
<td>Includes two levels of cognitive engagement: Deep cognitive engagement and surface cognitive engagement</td>
</tr>
<tr>
<td>Collaborative</td>
<td>Developing relationships that support academic learning</td>
</tr>
<tr>
<td>Emotional</td>
<td>A student’s feeling or attitude toward learning</td>
</tr>
<tr>
<td>Social</td>
<td>Student participation in both academic activities within the virtual classroom and extracurricular activities outside of class</td>
</tr>
</tbody>
</table>


*Integrated Mixed-Methods Analysis*

In the third and final phases of analysis, both the qualitative and quantitative findings were integrated to create integrated mixed methods findings to discover how UDL affects student experience, including student engagement and a sense of belonging. To alleviate
some of the common challenges of integrating mixed methods data, qualitative and quantitative data collection aligned with similar constructs and variables.

**Summary**

Chapter 3 described the methodology for this study. The mixed-methods research design was discussed in detail. Next, the field site and participants were reported. Then, the UDL intervention implementation process was chronicled. Afterwards, the research study instrumentation and sources of information were recounted. The chapter concluded with a comprehensive account of the data collection and data analysis procedures. Next, Chapter 4 will consider the research study findings and discussion.
Chapter 4. Findings and Discussion

This chapter presents and discusses the results of this convergent, mixed methods study, which investigates the impact of UDL on faculty teaching effectiveness and student experience. More specifically, the study focused on the impact of UDL on student engagement and sense of belonging and addressed three questions. The primary questions focus on the main factors that influence the effective implementation of UDL, whether UDL influences student success in general and student learning in particular, and whether UDL affects the student experience, including student engagement and sense of belonging.

This chapter begins with a review of each of the three research questions, followed by an analysis of the findings related to each question, before discussing the mixed methods convergence of findings. A brief statement of the limitations of the study is included, followed by recommendations for practice and further research.

Research Question 1

The first research question (RQ#1) focused on the main factors that influence the effective implementation of UDL. Specifically, this question investigated whether students utilized UDL implementations and incorporated the researcher’s reflection of the ongoing implementation process. This section will discuss the measures used in the mixed methods analysis, present the analysis results, and conclude with a discussion of the research results.

Measures

Student Post-Survey. The post-survey was administered at the end of each semester. A series of questions were included in the student post-survey to measure student-reported adoption of UDL implementations made by the course instructor. The questions covered all
UDL principles through a variety of checkpoint-specific questions. Questions were primarily fixed-choice items; however, two questions were constructed-response items. The implementations for the first UDL principle (multiple means of representation) were measured through 4 fixed-choice items. The second UDL principle's implementation (multiple means of action and expression) was measured through 18 fixed-choice questions. The third UDL principle (multiple means of engagement) was measured through 9 fixed-choice questions in the post-survey instrument.

Reflection Journals and Exam Exit Slips. Additional questions to measure UDL principle three were included in 5 reflection journal assignments and 2 ‘exam exit slip’ assignments. Two questions in the reflection journal assignments were constructed-response questions. However, all the remaining questions were fixed-choice items. Data was collected in Google Forms and protected by the researcher’s username and login credentials.

Faculty Post Reflection Protocol. At the end of each term, the researcher completed a faculty post reflection protocol (see Appendix M: Instrument – Faculty Reflection Protocol). One protocol was collected at the end of the summer term for the four summer courses. A second protocol was collected at the mid-point of the fall term when one accelerated 8-week course concluded in mid-October. Finally, the third and final protocol was collected at the end of the fall semester at the conclusion of two courses. Each faculty post reflection protocol consisted of the same 8 questions.

Results

First, this section will present the results from measuring student self-reported data about their adoption of the UDL implementations initiated in this research. Then, this section will
review the qualitative analysis of the faculty post-reflection protocol documents.

**Student Utilization of UDL Implementations.** The following section presents the results for each of the three UDL principles.

**Multiple Means of Representation.** During the instructional design phase, the researcher chose two UDL checkpoints to implement under UDL principle one: checkpoint 1.2 and checkpoint 2.5. To measure students’ adoption of UDL checkpoint 1.2, offer alternatives for auditory information, participants were asked how often they used the closed captions while watching the chapter content video recordings. Students responded \((n = 46)\) that they always \((n = 10; 21.74\%)\), most of the time \((n = 12; 26.09\%)\), sometimes \((n = 8; 17.39\%)\), rarely \((n = 13; 28.26\%)\), and never \((n = 3; 6.52\%)\). When asked how often they read the transcription while watching Zoom video recordings, students responded \((n = 46)\) that they always \((n = 5; 10.87\%)\), most of the time \((n = 11; 23.91\%)\), sometimes \((n = 11; 23.91\%)\), rarely \((n = 7; 15.22\%)\), and never \((n = 12; 26.09\%)\).

Two questions were included in the post-survey to measure students’ adoption of UDL checkpoint 2.5, illustrated through multiple media. When asked how often students utilized a variety of types of course materials for learning, such as videos, lecture slides, or text-based reading, students reported \((n = 46)\) that they always \((n = 14; 30.43\%)\), most of the time \((n = 22; 47.83\%)\), and sometimes \((n = 10; 21.74\%)\) used a variety of course materials for learning. Students reported \((n = 45)\) watching the optional chapter content video tutorials always \((n = 9; 19.57\%)\), most of the time \((n = 11; 23.91\%)\), sometimes \((n = 18; 39.13\%)\), rarely \((n = 5; 10.87\%)\), and never \((n = 2; 4.35\%)\).
**Multiple Means of Action and Expression.** After predicting student variability for her courses, the researcher did not include implementations for UDL guideline four to provide options for physical activity due to the nature of the course content and modality. However, the researcher did include question stems for UDL checkpoint 5 to provide options for expression and communication and UDL checkpoint 6 to provide options for executive functions. Table 11 delineates student responses for the fixed-choice post-survey questions.

**Multiple Means of Engagement.** To capture students’ utilization of UDL checkpoints under UDL principle 3, multiple means of engagement, the researcher designed 4 reflection journal prompts, 2 ‘exam exit slip’ prompts, and 9 post-survey prompts. The 9 fixed-choice anchor responses are delineated in Table 12.

To measure relevancy for students, 4 fixed-choice questions were spread across 2 reflection journal assignments and 2 exam exit slips. The question for the first ‘exam exit slip’ was not added until after the summer session; therefore, the sample size is substantially smaller (n = 28). The relevancy results are included in Table 13.

Two constructed-response questions were included within two student reflection journal assignments. The first question asked, “what skills have you learned in this class that you want to transfer to the workplace?” Forty-four students submitted responses. The second question asked, “how will you use what you have learned in this class in the future?” Forty-two students submitted responses. A preliminary review of student submissions revealed that students included workplace responses for both questions; therefore, the two constructed response questions were merged into a word cloud analysis in MaxQDA and filtered by relevance.
Table 11

Student Utilization of UDL Checkpoints for Action and Expression

<table>
<thead>
<tr>
<th>UDL Checkpoint</th>
<th>Question Stem</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Most of the time</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 (n = 46)</td>
<td>When reading assignment instructions, I watched the embedded support videos related to the assignment.</td>
<td>0</td>
<td>4</td>
<td>17</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>5.1 (n = 46)</td>
<td>I referred to previous announcements in Canvas as needed.</td>
<td>0</td>
<td>3</td>
<td>18</td>
<td>16</td>
<td>9</td>
</tr>
<tr>
<td>5.1 (n = 46)</td>
<td>I communicated with my instructor through a variety of ways, such as the Canvas Inbox, during office hours, or during Zoom sessions.</td>
<td>6</td>
<td>9</td>
<td>15</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>5.1 (n = 43)</td>
<td>How often did you use the Canvas app to view course announcements?</td>
<td>0</td>
<td>3</td>
<td>8</td>
<td>7</td>
<td>25</td>
</tr>
<tr>
<td>5.1 (n = 43)</td>
<td>How often did you use the Canvas app to email other students?</td>
<td>16</td>
<td>11</td>
<td>6</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>5.2 (n = 46)</td>
<td>How often did you use Canvas for designing graphics?</td>
<td>23</td>
<td>8</td>
<td>9</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>5.2 (n = 46)</td>
<td>How often did you use Slides Carnival for designing presentations?</td>
<td>28</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>5.2 (n = 43)</td>
<td>How often did you use Grammarly for editing your writing?</td>
<td>15</td>
<td>3</td>
<td>10</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>5.2 (n = 43)</td>
<td>How often did you use the Canvas app to submit assignments?</td>
<td>12</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td>6.1 (n = 46)</td>
<td>I used the course reading schedule to set appropriate goals for my work.</td>
<td>0</td>
<td>4</td>
<td>11</td>
<td>14</td>
<td>17</td>
</tr>
<tr>
<td>6.1 (n = 46)</td>
<td>I used the weekly checklist announcement to set appropriate goals for my work.</td>
<td>2</td>
<td>4</td>
<td>9</td>
<td>10</td>
<td>21</td>
</tr>
<tr>
<td>6.4 (n = 46)</td>
<td>I used the Canvas calendar feature to visualize course due dates.</td>
<td>2</td>
<td>10</td>
<td>6</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>6.4 (n = 46)</td>
<td>I reviewed grading rubrics before submitting my assignments.</td>
<td>1</td>
<td>1</td>
<td>10</td>
<td>13</td>
<td>21</td>
</tr>
<tr>
<td>6.4 (n = 43)</td>
<td>How often did you use the Canvas app to view your grades?</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>31</td>
</tr>
<tr>
<td>6.4 (n = 43)</td>
<td>How often did you use the Canvas app to view instructor feedback?</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>9</td>
<td>23</td>
</tr>
</tbody>
</table>
Table 12

Student Utilization of UDL Checkpoints for Engagement

<table>
<thead>
<tr>
<th>UDL Checkpoint</th>
<th>Question Stem</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Most of the time</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1 (n = 45)</td>
<td>I used choices available for assignments, such as choice in topic, group selection, or submission type (such as a paper versus a video submission).</td>
<td>1</td>
<td>2</td>
<td>13</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.22%)</td>
<td>(4.44%)</td>
<td>(28.89%)</td>
<td>(35.56%)</td>
<td>(28.89%)</td>
</tr>
<tr>
<td>7.2 (n = 45)</td>
<td>Assignments were relevant and valuable to my interest and goals.</td>
<td>0</td>
<td>2</td>
<td>9</td>
<td>10</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0%)</td>
<td>(4.44%)</td>
<td>(20%)</td>
<td>(26.67%)</td>
<td>(48.89%)</td>
</tr>
<tr>
<td>7.2 (n = 44)</td>
<td>Assignments allowed me to be my authentic self, such as my racial, cultural, ethnic, and gender identity.</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0%)</td>
<td>(6.82%)</td>
<td>(4.55%)</td>
<td>(22.73%)</td>
<td>(65.91%)</td>
</tr>
<tr>
<td>8.3 (n = 46)</td>
<td>I completed assignments where I worked on my own.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>14</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0%)</td>
<td>(0%)</td>
<td>(0%)</td>
<td>(30.43%)</td>
<td>(69.57%)</td>
</tr>
<tr>
<td>8.3 (n = 46)</td>
<td>I completed assignments where I collaborated with other students in the course.</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0%)</td>
<td>(6.52%)</td>
<td>(10.87%)</td>
<td>(17.39%)</td>
<td>(67.98%)</td>
</tr>
<tr>
<td>8.3 (n = 46)</td>
<td>I completed assignments where I peer-reviewed the work of others.</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>8</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0%)</td>
<td>(4.35%)</td>
<td>(10.87%)</td>
<td>(17.39%)</td>
<td>(67.39%)</td>
</tr>
<tr>
<td>8.4 (n = 46)</td>
<td>Instructor feedback was informative and constructive, rather than comparative or competitive.</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>10</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0%)</td>
<td>(2.17%)</td>
<td>(8.7%)</td>
<td>(21.74%)</td>
<td>(67.39%)</td>
</tr>
<tr>
<td>9.1 (n = 46)</td>
<td>My instructor provided words of encouragement for students to succeed in the course.</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>11</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.17%)</td>
<td>(6.52%)</td>
<td>(13.04%)</td>
<td>(23.91%)</td>
<td>(54.35%)</td>
</tr>
<tr>
<td>9.3 (n = 46)</td>
<td>I reflected on my progress and goals in class, such as through exam exit tickets or weekly reflection assignments.</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>22</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0%)</td>
<td>(2.17%)</td>
<td>(8.7%)</td>
<td>(47.83%)</td>
<td>(41.3%)</td>
</tr>
</tbody>
</table>

Table 13

Assignment Relevance

<table>
<thead>
<tr>
<th>UDL Checkpoint</th>
<th>Question Stem</th>
<th>Not relevant at all</th>
<th>Little relevance</th>
<th>Average relevance</th>
<th>Very relevant</th>
<th>Absolutely relevant</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2 (n = 45)</td>
<td>How relevant was the Shark Tank group assignment for you?</td>
<td>2</td>
<td>5</td>
<td>15</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.44%)</td>
<td>(11.11%)</td>
<td>(33.33%)</td>
<td>(33.33%)</td>
<td>(17.78%)</td>
</tr>
<tr>
<td>7.2 (n = 28)</td>
<td>How relevant was [exam 1] for you?</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0%)</td>
<td>(7.14%)</td>
<td>(28.57%)</td>
<td>(35.71%)</td>
<td>(28.57%)</td>
</tr>
<tr>
<td>7.2 (n = 43)</td>
<td>How relevant was [exam 2] for you?</td>
<td>0</td>
<td>3</td>
<td>13</td>
<td>19</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0%)</td>
<td>(6.98%)</td>
<td>(30.23%)</td>
<td>(44.19%)</td>
<td>(18.6%)</td>
</tr>
<tr>
<td>7.2 (n = 42)</td>
<td>How relevant was the Assignment #3 group project for you?</td>
<td>0</td>
<td>4</td>
<td>11</td>
<td>16</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0%)</td>
<td>(9.52%)</td>
<td>(26.19%)</td>
<td>(38.1%)</td>
<td>(26.19%)</td>
</tr>
</tbody>
</table>
One emergent theme from the qualitative analysis included students’ desires to work across generational differences (n= 31). Participant 4 shared, “Some of what I have learned that I could transfer to a workplace is how people from different generations tend to have different needs when managing them, so learning this would help me when working with people from various ages.” Participant 8 also submitted a comment regarding generational differences when stating “dealing with younger generations.”

A second theme was students’ improvement in communication skills with their peers (n = 29). Participant 24 stated, “I've learned how to communicate and talk to my peers/groupmates better, something that I couldn't do easily before at my old job.” Participant 1 also wrote:

I hope to continue many skills taken from this class, especially the ability to build relationships. This business class has taught me to take some personal agency and realize the importance of teamwork and communication, and to do this effectively strong relationships are needed between coworkers and classmates.

Thus, participants expressed interest in refining their communication skills both in the course and in the workplace.

A third theme was students’ discovery of leadership, both as a hands-on skill they could practice in class and a theoretical skill taught within the course curriculum (n = 24). Participant 22 reflected, “I found that there is a lot of group works in this class. So I learned some about leadership skills. I learned how to call on team members, take the lead in doing things, assign tasks, and discuss decisions together.” Participant 25 shared, “I learned a lot about leadership from the textbook and also from the group projects.”

**Faculty Perception of UDL Implementation.** At the end of each course, the researcher completed a series of 8 questions to reflect on the UDL implementation process in each
Once all protocols were recorded, the series of protocols were reviewed through multiple cycles of analysis based on the cycles of coding (Saldaña, 2011). The first cycle focused on what emerged from the data at a textual level, such as first impressions. The second cycle concentrated on collapsing and expanding codes to understand patterns, such as frequency, sequence, similarities, or differences. The third cycle considered substantive memo writing while repeating cycles one and two as needed.

Three critical themes emerged from the prompt, “What did you learn about how UDL can be implemented in an online course?” First, the researcher continued to witness how the choice in assignment topics and formats encouraged student interest in the course. It allowed students to personalize assignments to their abilities and interests. Second, while students have traditionally disliked group work, many commented on how they benefited from working with virtual teams and how those skills would transfer to the post-pandemic workplace. Several students created great friendships through these courses, even while others struggled to engage with their groups for various reasons, typically around group members not responding in time to facilitate group collaboration and planning. Third, the researcher felt more engaged in the course as the instructor. Since UDL required a focus on reducing barriers for students, it also reduced instructor barriers to interacting with them online. For example, students were guided to contact the instructor through the Canvas Inbox for any questions about the class. Since both applications were installed on the researcher-instructor’s smartphone, urgent messages were responded to during the evenings and weekends when most students worked on assignments.
The researcher also experienced some challenges with implementing UDL. The breadth framework caused confusion during the instructional design process. Several of the guidelines were vague, and descriptions of specific guidelines on CAST’s website were difficult to find. The horizontal and vertical complexity within the UDL guidelines graphical organizer can be numbing for first-time implementers. The intense instructional preparation proved to be a further challenge when compared to previous semesters. Since multiple assignments required peer reviews or topic selection in group projects, there was an increased instructional load to prepare for each term.

In reflecting on the future of implementing UDL, the researcher continued to question how to link UDL with the trifecta of student engagement. Most implementation strategies focused on peer-to-peer engagement for the researcher’s online courses. However, the trifecta of student engagement model focuses not just on peer-to-peer interactions, but also on student-to-instructor and student-to-content interactions. Initially students seemed to prefer to have optional synchronous sessions with the ability to watch on-demand recordings at their leisure. However, multiple students commented that required synchronous Zoom sessions would create a greater sense of belonging. Lastly, there were concerns about how another professor could observe the asynchronous online course and subjectively score the course for UDL implementation. This aligns with Edyburn’s (2010) criticism that UDL may be an elusive construct.

**Discussion**

The first research question (RQ#1) focused on the main factors that influence the effective implementation of UDL. Student responses indicated which universally designed
components were utilized throughout the course. Students confirmed that they used a variety of course materials to learn the content. They also indicated that they were likely to watch the optional chapter content video tutorials embedded within each module in Canvas. Students reported using the one-page course reading schedule document and the weekly checklists distributed through the Canvas announcement feature to set goals for their work each week. Most students reported previewing grading rubrics prior to submitting assignments. Additionally, most students reported that assignments allowed them to be their authentic selves, such as their racial, cultural, ethnic, and gender identities. They also reported that many students frequently utilized the choices built into assignments, such as picking their topic, teammates, or how they would deliver their project.

Students reported on their Canvas application user behavior. Nearly all students used the free app. Some of them submitted all their assignments on their mobile device, while some students never used their smartphones to submit assignments. However, nearly all students used the Canvas app to view their grades and instructor feedback. Students also heavily used the Grades page within the desktop version of Canvas to monitor their progress, but only some used the “what if” grade feature to mockup their final grade in the course. This could mean that students need more education and awareness about the “what if” grade feature. It is important to measure students’ user behavior in Canvas, both in the desktop and mobile device applications, since Canvas does not report traditional user behavior data, such as student interaction with the platform.

However, not all UDL implementations were as eagerly adopted by students. Student responses were split using closed captions or transcripts while watching videos. Students did
not use recommended free software tools to create content for the course, such as Canva for graphics and Slides Carnival for presentation slide deck designs. Students were split in their reporting of using Grammarly for improving their writing.

Notably, students reported that they found the course assignments very relevant. Additionally, students expressed an appreciation for learning how to work across generational differences, improve their peers' communication skills, and discover theoretical and practical leadership.

**Research Question 2**

The second research question (RQ#2) questions whether UDL influences student success in general and student learning in particular. This section will discuss the datasets used for the quantitative analysis before describing the findings and summarizing the results.

**Measures**

Three datasets of increasing granularity were created and analyzed to answer this research question: a local course success rate dataset, a district-wide course success rate dataset, and a local student final scores dataset.

**Dataset #1: Course Success Rates – Local.** This first dataset included information that the researcher pulled manually from the registration system, such as course year, term, modality (online or in-person), course record number, duration (in weeks), enrollment at census, final enrollment, course success rate percentage, and grade distribution data. The student success dataset included nine years of course success data from 2013 to 2021. The dataset included 49 sections of student success data from BUS 100 sections taught by the
researcher at one California community college. Table 14 details the course modality options included in the dataset.

**Table 14**

*Course Modality for Dataset #1*

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>In person</td>
<td>12</td>
<td>24.5</td>
</tr>
<tr>
<td>Online</td>
<td>37</td>
<td>75.5</td>
</tr>
<tr>
<td>Total</td>
<td>49</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The dataset excluded special cohort sections, such as College for Working Adult (CWA) sections and Honors Transfer Program (HTP) sections. Course sections consisted of fall \((n = 16)\), spring \((n = 15)\), and summer \((n = 18)\) terms. Courses included a variety of instructional timeframes, such as 6-week, 8-week, 10-week, 15.5-week, and 17.5-week timeframes, as described in Table 15.

**Table 15**

*Course Duration*

<table>
<thead>
<tr>
<th>Duration (In weeks)</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>18</td>
<td>36.7</td>
</tr>
<tr>
<td>6(^a)</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>8a</td>
<td>3</td>
<td>6.1</td>
</tr>
<tr>
<td>8b</td>
<td>4</td>
<td>8.2</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>15.5</td>
<td>8</td>
<td>16.3</td>
</tr>
<tr>
<td>17.5</td>
<td>14</td>
<td>28.6</td>
</tr>
<tr>
<td>Total</td>
<td>49</td>
<td>100.0</td>
</tr>
</tbody>
</table>

\(^a\)Six-week course not taught during the summer six-week term
Initial course enrollment, defined by the semester census deadline, varied from a minimum of 14 students enrolled at census to a maximum of 50 students enrolled at census ($M = 32.84$, $SD = 7.625$). According to the California Community College Chancellor’s Office (CCCCO), census week is defined as the Monday in the week closest to 20% of the number of weeks in the term (California Community Colleges Chancellor’s Office, 2021a).

The California Community College’s Chancellor’s Office (2022) defines success rate as the rate at which students completed courses with a final grade of A, B, C, or P. The denominator of the calculation includes student withdrawals. Due to the COVID-19 pandemic, colleges across the state implemented excused withdrawal (EW) options for students with hardships from the pandemic. The two central State databases, Cal-PASS Plus and Datamart decided to exclude EW grades from the denominator in their calculations (Cal-PASS Plus, 2021), thus inflating their success rates during the pandemic. This research, however, took place in a district that included all withdrawal (W) grades in the course success rate calculation (T. Huang, personal communication, January 19, 2022). During the pandemic, the district also decided to remove the failing (F) grade and replace it with a no pass (NP) grade. In the dataset, there were 49 course sections analyzed ($M = 67.84\%, SD = 14.73\%$).

**Dataset #2: Course Success Rates – District-wide.** The college research office pulled data for the second dataset, which included anonymous BUS 100 course success rate data across all three colleges across the district, one of which includes the local institution where the UDL implementation took place. This dataset was combined with parts of the local
course success rates dataset to create a new dataset with the following variables: course year, course term, modality, intervention status, data source (researcher data or district-wide data), pandemic status, and course success rate percentage. The dataset included course success rates from 2013 to 2021, including 276 BUS 100 courses.

Table 16 itemizes the various course modality options. Covid synchronous courses began during the COVID-19 pandemic and required students to attend live synchronous course sessions each week via online video conferencing software. Course sections consisted of fall ($n = 118$), spring ($n = 102$), and summer ($n = 56$) terms. There were 49 courses in the researcher data subset and 227 in the district data subset. Courses before or during 2019 were coded as pre-pandemic data ($n = 176$), while courses during or after the spring of 2020 were coded as post-pandemic data ($n = 100$).

**Table 16**

*Course Modality for Dataset #2*

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>In person</td>
<td>117</td>
<td>42.4</td>
</tr>
<tr>
<td>Online</td>
<td>147</td>
<td>53.3</td>
</tr>
<tr>
<td>Hybrid</td>
<td>4</td>
<td>1.4</td>
</tr>
<tr>
<td>Covid Synchronous</td>
<td>8</td>
<td>2.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>276</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

**Dataset #3: Student Final Scores.** The final dataset was built to include more granular student learning data. Again, data was pulled manually by the researcher. However, these data were pulled from the college’s learning management system (LMS). The college piloted Canvas as their LMS in the summer of 2016. As a result, Canvas grade book data was only available starting in the fall of 2016. The researcher pulled 757 student records in Canvas.
Variables included the Canvas student case number, year, semester, section description, duration in weeks, intervention status, final exam score percentage, three exam score percentages, and group project score percentages. It is important to note that there were 125 student records missing exam score data due to significant changes in how exams were administered prior to the spring of 2018. Additionally, there were 447 missing data instances from the group project score variable due to instructional changes in 2019. All missing data were prior to the UDL intervention. The means (with standard deviations in parenthesis) for exams 1-3 and the group project were 79.97% (18.03%), 73.88% (22.98%), 73.29% (27.69%), and 82.74% (28.68%) respectively. All student records ($n = 757$) included final grade percentage data ($M = 81.50$, $SD = 19.96$).

**Results**

Multiple measures were used to analyze the data for this research question. First, the analysis began at the course level with course success rates which expanded into an analysis of district-wide course success rates. Then, the analysis dug deeper into the data to investigate the impact of the UDL intervention on individual course final grades and various assignment grades.

**Course-Level Findings.** Independent sample $t$-tests and multiple regression analyses investigated if the UDL intervention made a significant difference at the course level. Specifically, these tests explored the effect of the UDL intervention on the course success rate, the impact of the pandemic on the course success rate, and the effect of independent variables on the course success rate.
**Impact on Course Success Rate.** The investigation for RQ#2 began with the local course success rate dataset (dataset #1). It was hypothesized that the UDL intervention would positively impact the course success rate. The mean value of course success rate in the pre-intervention group was 66.58% which increased to 75.38% after the UDL intervention (see Table 17). Course success rates increased by 8.8 percentage points.

**Table 17**

**Course Success Rate Percentages by Intervention Status**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>n</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Success Rate</td>
<td>Yes</td>
<td>7</td>
<td>75.38</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>42</td>
<td>66.58</td>
</tr>
</tbody>
</table>

To further examine whether a statistically significant difference occurred in the course success data between the pre- and post-intervention groups, an independent sample $t$-test was conducted. Levene’s test for equality of variances indicated that the variances were assumed to be equal for the course success rate data, $t(47) = -1.48, p = .145$ (see Table 18). These results suggest that the overall course success rate did not significantly differ before and after the UDL intervention.
Table 18

*Independent Samples *t*-Test for Course Success Rate Percentages*

<table>
<thead>
<tr>
<th>Course Success Rates</th>
<th>Levene’s Test for Equality of Variances</th>
<th><em>t</em>-test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>F</em></td>
<td>Sig.</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>.511</td>
<td>.478</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-1.59</td>
<td>8.62</td>
</tr>
</tbody>
</table>
Pandemic Impact on Course Success Rate. It was hypothesized that the COVID-19 pandemic that emerged during the Spring 2020 semester would have a negative impact on course student success rates. To determine if the UDL intervention improved course success rates during the pandemic, researcher course success rate data was compared to district-wide course success rate data for the same course (BUS 100) and course modality (online). An independent sample \( t \)-test was performed by splitting the district-wide course success rate dataset (dataset #2) by data source (researcher data, \( n = 37 \), district data, \( n = 110 \)) and including only online modality (\( n = 147 \)) before analyzing the course success rate variable when grouping by pandemic status. The researcher data improved by 14.64 percentage points from the pre-pandemic to post-pandemic time frame. In contrast, the district-wide data was reduced by 0.93 percentage points during the same time frame (see Table 19).

Table 19

COVID-19 Pandemic Influence on Course Success Rate Percentages

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Pre-Pandemic</th>
<th>Post-Pandemic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Researcher data</td>
<td>25 62.41</td>
<td>12 77.05</td>
</tr>
<tr>
<td>District-wide data</td>
<td>50 70.53</td>
<td>60 71.46</td>
</tr>
</tbody>
</table>

Levene's test for equality of variances was performed to determine if the changes in course success rate means were statistically significant. As seen in Table 20, for the researcher data group, the variances were assumed to be equal (\( p = .571 \)) which indicated that the results were statistically significant, \( t(35) = -3.083, p = .004 \) (see Table 20). For the district-wide data group, the variances were also assumed to be equal (\( p = .186 \)), however, the pre-and post-pandemic mean differences were not statistically significant, \( t(108) = -.329, \)
### Table 20

**Independent Samples t-Test for Course Success Rate Percentages (District)**

<table>
<thead>
<tr>
<th></th>
<th>Levene’s Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$F$</td>
<td>Sig.</td>
</tr>
<tr>
<td>Researcher Data</td>
<td>Equal variances assumed</td>
<td>.327</td>
</tr>
<tr>
<td></td>
<td>Equal variances not assumed</td>
<td></td>
</tr>
<tr>
<td>District-wide Data</td>
<td>Equal variances assumed</td>
<td>1.774</td>
</tr>
<tr>
<td></td>
<td>Equal variances not assumed</td>
<td></td>
</tr>
</tbody>
</table>

* Relevant $p$-values
While the researcher data pre-pandemic course success rate mean was initially lower than the district-wide data pre-pandemic mean, the results suggest that the percentage points increase for the researcher data was statistically significant. The post-pandemic researcher data ($M = 77.05, SD = 12.69$) was also 5.59 percentage points higher than the post-pandemic district-wide data mean ($M = 71.46, SD = 15.10$). These results suggest that the UDL implementation increased the course success rate during the post-pandemic era compared to the fixed trajectory of the course success rate across the district data during the pandemic.

**Impact of Independent Variables on Course Success Rate.** It was hypothesized that the course duration in weeks ($x_1$), modality ($x_2$), intervention status ($x_3$), and initial enrollment at census ($x_4$) would positively predict the course success rate ($y$) as listed in Table 21. A series of regression analyses were conducted using the local course success rate dataset (dataset #1, $n = 49$) to test this hypothesis.

**Table 21**

<table>
<thead>
<tr>
<th>Variable Type</th>
<th>Variable Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV ($y$)</td>
<td>Course success rate</td>
</tr>
<tr>
<td>IV ($x_1$)</td>
<td>Duration in weeks</td>
</tr>
<tr>
<td>IV ($x_2$)</td>
<td>Modality</td>
</tr>
<tr>
<td>IV ($x_3$)</td>
<td>Intervention</td>
</tr>
<tr>
<td>IV ($x_4$)</td>
<td>Initial enrollment</td>
</tr>
</tbody>
</table>

Results showed that 41.3% ($R^2$) of the variance in course success rates could be accounted for by the four predictors collectively, $F(4, 44) = 7.727, p < .001$ (see Model 4 in Table 22 and Table 23). In further investigating the unique individual contributions of the
Table 22

Model Summary $^b$

<table>
<thead>
<tr>
<th>Model</th>
<th>$R$</th>
<th>$R^2$</th>
<th>Adjusted $R^2$</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>.642$^a$</td>
<td>.413</td>
<td>.359</td>
<td>11.79500%</td>
</tr>
</tbody>
</table>

$^a$ = Predictors: (Constant), Duration in weeks, Modality, Intervention, Initial enrollment  
$^b$ = Dependent Variable: Course Success

Table 23

ANOVA $^a$

<table>
<thead>
<tr>
<th>Model</th>
<th>$SS$</th>
<th>$df$</th>
<th>$MS$</th>
<th>$F$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>4299.998</td>
<td>4</td>
<td>1075.000</td>
<td>7.727</td>
<td>&lt;.001$^b$</td>
</tr>
<tr>
<td>Residual</td>
<td>6121.369</td>
<td>44</td>
<td>139.122</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10421.367</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^a$ = Dependent Variable: Course Success  
$^b$ = Predictors (Constant), Duration in weeks, Modality, Intervention, Initial enrollment

independent variables, the results showed that the course duration ($\beta = -.840$, $t = -5.110$, $p < .001$, see Model 4 in Table 24) negatively predicted course success rate. Furthermore, the results also revealed that courses with an in-person modality were more likely to report lower course success rates ($\beta = -.714$, $t = -4.364$, $p < .001$, see Model 4 in Table 24). The other two variables, intervention and initial enrollment at census, did not significantly predict the course success rate. These findings suggest that students were less likely to earn a passing grade in courses with longer durations and face-to-face modalities.

Summary of Course-Level Findings. While the limited intervention sample size at the course level led to insignificant findings on the effect of UDL, the larger district-wide dataset suggested that UDL did make a positive impact on course success rates during the pandemic. Additionally, the data indicates that students are doing better online than in-person courses, possibly due to students and faculty adopting online technologies due to the
Table 24

Coefficients$^a$

<table>
<thead>
<tr>
<th>Model</th>
<th>$B$</th>
<th>$SE$</th>
<th>$\beta$</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>128.041</td>
<td>15.255</td>
<td>8.393</td>
<td>&lt; .001</td>
<td></td>
</tr>
<tr>
<td>Duration in weeks</td>
<td>-2.388</td>
<td>.467</td>
<td>-.840</td>
<td>-5.110</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Modality</td>
<td>-24.204</td>
<td>5.547</td>
<td>-.714</td>
<td>-4.364</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Intervention</td>
<td>8.719</td>
<td>5.473</td>
<td>.209</td>
<td>1.593</td>
<td>.118</td>
</tr>
<tr>
<td>Initial enrollment</td>
<td>.237</td>
<td>.248</td>
<td>.123</td>
<td>.956</td>
<td>.344</td>
</tr>
</tbody>
</table>

$^a = \text{Dependent Variable: Course Success}$

pandemic. More research is needed in this area. Finally, results also suggest that the course success rate decreases in courses with longer durations. Enrollment management decisions must consider the negative effect of lengthy course durations. This research study took place at a higher education institution with one of the most extended semesters available of 17.5 weeks.

Student-Level Findings. To investigate if the UDL intervention made a significant difference at the individual student level, independent sample $t$-tests were conducted on student final grade percentages, three different exam scores, and group project scores.

Impact on Student Final Grades. The descriptive statistics in Table 25 show a noticeable increase in final grades after the pedagogical intervention. On average, students scored 80.86% and 84.02% in the pre-and-post-UDL intervention courses, respectively, representing an increase of 3.16 percentage points.

Table 25

Student Final Grade Percentages by Intervention Status

<table>
<thead>
<tr>
<th>Intervention</th>
<th>$n$</th>
<th>$M$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Grade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>604</td>
<td>80.86</td>
<td>20.81</td>
</tr>
<tr>
<td>Yes</td>
<td>153</td>
<td>84.02</td>
<td>16.00</td>
</tr>
</tbody>
</table>
An independent samples $t$-test was conducted to investigate if a statistically significant difference existed between pre-and post-intervention groups. Levene’s test for equality of variances showed that the variances were assumed to be unequal, as depicted in Table 26, $t(296.49) = 2.04, p = 0.42$. This deeper analysis concluded that students’ final grades were statistically significantly higher in the post-intervention group compared to the pre-intervention group.

**Impact on Exam Scores.** To measure the impact of the UDL intervention on individual exam scores, 1,896 exam scores from three exams (exam 1, exam 2, and exam 3) were collected from 632 students. Of those students, 153 students received the UDL intervention, while 479 did not. Table 27 shows the means and standard deviations for each exam split by intervention status.
### Table 26

**Independent Samples t-Test for Student Final Grades in Percentages**

<table>
<thead>
<tr>
<th>Final Grade</th>
<th>Levene’s Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$F$</td>
<td>Sig.</td>
</tr>
<tr>
<td>Equal variances</td>
<td></td>
<td>9.28</td>
</tr>
<tr>
<td>assumed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal variances</td>
<td></td>
<td>2.04</td>
</tr>
<tr>
<td>not assumed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Relevant $p$-value

### Table 27

**Means and Standard Deviations of Exam Score Percentages**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Exam #1</th>
<th>Exam #2</th>
<th>Exam #3</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
</tr>
<tr>
<td>No$^b$</td>
<td>79.17</td>
<td>18.56</td>
<td>72.68</td>
<td>23.01</td>
<td>72.99</td>
</tr>
<tr>
<td>Yes$^a$</td>
<td>82.48</td>
<td>16.05</td>
<td>77.62</td>
<td>22.54</td>
<td>74.22</td>
</tr>
</tbody>
</table>

$^a n = 479$ for each exam

$^b n = 153$ for each exam
Exam 2. Pre-intervention groups earned on average 72.68% on exam two, while post-intervention groups earned 77.62%, increasing 4.94 percentage points for post-intervention exam scores (see Table 27). An independent sample $t$-test was conducted to see if there was a significant difference between the two groups. Levene’s test for equality of variances indicated that variances were assumed to be equal, $t(630) = 2.32, p = .02$ (see Table 28). The test confirms that students in the post-intervention group scored higher on exam two than students in the pre-intervention group.
Table 28

Independent Samples t-Test for Individual Student Exam Scores

<table>
<thead>
<tr>
<th>Exam #1</th>
<th>Equal variances assumed</th>
<th>Equal variances not assumed</th>
<th>Exam #2</th>
<th>Equal variances assumed</th>
<th>Equal variances not assumed</th>
<th>Exam #3</th>
<th>Equal variances assumed</th>
<th>Equal variances not assumed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Levene’s Test for Equality of Variances</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$F$</td>
<td>Sig.</td>
<td>$t$</td>
<td>$df$</td>
<td>Sig. (2-tailed)</td>
<td>Mean Difference</td>
<td>$SE$</td>
<td>95% CI</td>
</tr>
<tr>
<td>Exam #1</td>
<td>2.38</td>
<td>.124</td>
<td>1.98</td>
<td>630</td>
<td>.048*</td>
<td>3.31</td>
<td>1.67</td>
<td>[.03, 6.59]</td>
</tr>
<tr>
<td></td>
<td>2.14</td>
<td>2.61</td>
<td>2.32</td>
<td>630</td>
<td>.034</td>
<td>3.31</td>
<td>1.55</td>
<td>[.26, 6.36]</td>
</tr>
<tr>
<td>Exam #2</td>
<td>.689</td>
<td>.407</td>
<td>2.35</td>
<td>260.88</td>
<td>.02</td>
<td>4.94</td>
<td>2.13</td>
<td>[.77, 9.11]</td>
</tr>
<tr>
<td></td>
<td>.516</td>
<td>.607*</td>
<td>.477</td>
<td>630</td>
<td>.634</td>
<td>1.23</td>
<td>2.38</td>
<td>[-3.45, 5.91]</td>
</tr>
</tbody>
</table>

* Relevant $p$-values
Exam 3. An independent sample t-test was conducted to determine a statistically significant difference between the pre-and post-intervention groups for exam three. Students in the pre-intervention group scored 72.99% on average in the third and final exams, while the post-intervention group scored 74.22% (see Table 23). The post-intervention group scored 1.23 percentage points higher on exam three than the pre-intervention group. Levene’s test for equality of variances indicated that the variances were assumed to be unequal, \( t(294.93) = .516, p = .607 \) (see Table 28). The results for an unequal variance show that there was no statistically significant difference in students’ performance on the final exam between the pre-and post-intervention groups.

Group Project Scores. To discover if the UDL intervention supported greater student collaboration and peer-to-peer engagement, an independent sample t-test was conducted on student group project grade percentages (\( n = 310 \)). Students in the pre-intervention group scored 77.93% on average on the group project, whereas the post-intervention group scored 87.43%, indicating a 9.5 percentage increase (see Table 29).

| Table 29 |
|-----------------|--------|---|---|
| **Means and Standard Deviations of Group Project Scores** |
| Intervention |
| No         | 153   | 77.93% | 26.71% |
| Yes        | 157   | 87.43% | 29.82% |

According to Levene’s test for equality of variances, the variances were not significant (\( p = .605 \); therefore, equal variances were assumed (see Table 30). The equal variances show a statistically significant difference in students’ group project scores between the pre-and post-intervention groups, \( t(308) = -2.952, p = .003 \).
Table 30

*Independent Samples t-Test for Individual Student Group Project Scores*

<table>
<thead>
<tr>
<th>Group Project Scores</th>
<th>Levene’s Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig.</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>.267</td>
<td>.605</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-2.957</td>
<td>305.83</td>
</tr>
</tbody>
</table>

* Relevant p-value
Summary of Student-Level Findings. In summary, this more granular analysis suggests that the UDL intervention positively impacted student scores on exams one and two. However, there was no statistically significant difference for the third exam. The pedagogical intervention also improved students’ final grade percentages. It is interesting to note that these findings imply that UDL can increase student collaboration and peer-to-peer engagement, even in an online class, as seen through the improvement in students’ group project scores.

Discussion

The second research question (RQ#2) focused on UDL influence student success in general and student learning in particular. The course-level and student-level data synthesis confirm that UDL is a beneficial pedagogical intervention in higher education. Evidence of an increase in student learning was apparent when comparing pre-and post-pandemic course success rate data across the larger district dataset. While initial analysis indicates that students may perform better in online modalities than in-person modalities, additional research is warranted to confirm this finding. This could be a reaction to the shift to online education because of the pandemic, where students and faculty have had to adopt their behaviors significantly in a new virtual classroom. However, faculty and administrators should dig deeper than top-level course success rate data to measure the return on investment. Evidence supports increased learning at the more granular student-level data, such as improved exam 1, exam 2, and group project scores. The UDL implementation also improved student final course grade percentage scores.
Research Question 3

The third research question (RQ#3) focused on whether UDL affects student experience, including student engagement and sense of belonging. This section includes a description of the measures used in the mixed methods analysis, a profile of the student participants, a presentation of the analysis results, and a discussion of the implications.

Measures

The analysis included one dataset combined from multiple instruments and another dataset from the learning management system as described next.

Dataset #4: Student Demographics and Responses. The fourth dataset in this study included a combination of student questionnaire responses at the start of the course, student reflection assignments, exam exit slips, student post-survey responses administered at the end of each course, and student demographic data. First, students completed a questionnaire at the start of the course. Traditionally, the survey collected relevant student information and interests to plan and adapt instruction strategies for each class. For this study, the questionnaire was modified to include items to collect data as a means to identify student personas, such as working students, students with caregiving responsibilities, and student-athletes. A list of all question stems, responses, and survey logic are included in Appendix J: Instrument – Student Questionnaire.

Second, students completed 7 reflection assignments through Google Form submissions throughout each term; see Appendix K: Instrument – Student Reflections for a list of student reflection question stems, purpose, and answer types. The researcher manually pulled relevant participant responses in the dataset, including two ‘exam exit slip’ assignments.
Third, the institutional research office administered the student survey on behalf of the researcher to maintain privacy for students as they finished the semester. The survey was designed to measure UDL implementations, student engagement, transactional distance, and optional student disability disclosure, as seen in Appendix I: Item Stems Design. An items blueprint assured that each construct was efficiently measured, as seen in Appendix H: Items Blueprint.

**Dataset #5: Canvas XML.** A dataset was created by pulling Extensible Markup Language (XML) data directly from the learning management system, Canvas. Data was pulled using a publicly available script embedded within the Canvas interface on a desktop browser.

Finally, the institutional research office supplied the student demographic data, which included administrative data from students’ applications to the college, such as gender, ethnicity, age, education level, enrollment goal, enrollment status, first-generation status, and the part time-full-time index data. All demographic data was not available until after final grades were submitted. However, primary language data was pulled from student survey responses since student responses included greater detail of non-English language data.

**Profile of the Student Participants**

In 2021, 78 community college students were enrolled in the researcher’s summer courses, with another 75 students enrolled during the fall term. Thirty percent of students (n = 46) participated in the research study and completed the post-survey instrument. Nearly two-thirds (65.2%) of participants identified as female, one-third as male (32.6%), and one as non-binary (2.2%). Participants were primarily Hispanic (43.5%), White Non-Hispanic
(23.9%), or Asian (21.7%) with a minimum age of 15 years old and a maximum age of 56 years old. At least half of the respondents (50%) identified as first-generation students. Table 31 further presents the demographic information for study participants.

**Results**

Following Redmond et al.’s (2018) online student engagement model, this section presents the results of this analysis based upon the model’s constructs of online student engagement.

**Student Engagement.** As mentioned previously, the online student engagement model (Redmond et al., 2018) includes five constructs: behavioral engagement, cognitive engagement, collaborative engagement, emotional engagement, and social engagement. In addition, this research focused on the social engagement subconstruct of a sense of belonging. The results for each construct are discussed next.

**Behavioral Engagement.** First, three selected-response questions adapted from the Online Student Engagement (OSE) scale were used to measure students’ behavioral engagement in the post-survey. In general, participants reported that they studied on a regular basis most of the time \((n = 22; 47.83\%)\), half of the time \((n = 11; 23.91\%)\), or all of the time \((n = 8; 17.39\%)\). Students primarily claimed that they put forth effort into the course most of the time \((n = 23; 50\%)\) or all the time \((n = 18; 39.13\%)\). Additionally, students reported staying current with course readings most of the time \((n = 15; 32.61\%)\), half of the time \((n = 16; 34.78\%)\), or all the time \((n = 11; 23.91\%)\). Table 32 lists the three question stems with their associated Likert scale response frequencies and percentages.
Table 31

**Participant Demographics**

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Category</th>
<th>Summer</th>
<th>Fall</th>
<th>Total</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td></td>
<td>15</td>
<td>31</td>
<td>46</td>
<td>100.0</td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>8</td>
<td>22</td>
<td>30</td>
<td>65.2</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>7</td>
<td>8</td>
<td>15</td>
<td>32.6</td>
</tr>
<tr>
<td></td>
<td>Non-binary</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Asian</td>
<td>5</td>
<td>5</td>
<td>10</td>
<td>21.7</td>
</tr>
<tr>
<td></td>
<td>Filipino</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>Hispanic</td>
<td>7</td>
<td>13</td>
<td>20</td>
<td>43.5</td>
</tr>
<tr>
<td></td>
<td>Pacific Islander</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td>White Non-Hispanic</td>
<td>2</td>
<td>9</td>
<td>11</td>
<td>23.9</td>
</tr>
<tr>
<td>Age</td>
<td>Minimum</td>
<td>15</td>
<td>16</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>23</td>
<td>28</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
<td>43</td>
<td>56</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Education Level</td>
<td>Associate Degree</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td>Concurrently enrolled in K-12</td>
<td>4</td>
<td>3</td>
<td>7</td>
<td>15.2</td>
</tr>
<tr>
<td></td>
<td>Foreign Secd Diploma/Cert</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td>GED, HS Certif of Equiv/Compl</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>10.9</td>
</tr>
<tr>
<td></td>
<td>Not HS grad &amp; no longer in HS</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>Received High School Diploma</td>
<td>9</td>
<td>16</td>
<td>25</td>
<td>54.3</td>
</tr>
<tr>
<td></td>
<td>Unknown/Unreported</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>6.5</td>
</tr>
<tr>
<td>Enrollment Goal</td>
<td>Complete Credits for HS</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td>Diploma</td>
<td>5</td>
<td>18</td>
<td>23</td>
<td>50.0</td>
</tr>
<tr>
<td></td>
<td>Earn AA AS &amp; Transfer to 4 yr</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>Earn AA AS without Transfer</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>10.9</td>
</tr>
<tr>
<td></td>
<td>Educational Development</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td>Improve Basic Skills</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td>Transfer to 4 yr without AA AS</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>Undecided on goal</td>
<td>7</td>
<td>0</td>
<td>7</td>
<td>15.2</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enrollment Status</td>
<td>Continuing Student</td>
<td>5</td>
<td>21</td>
<td>26</td>
<td>56.5</td>
</tr>
<tr>
<td></td>
<td>First-Time Student</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>8.7</td>
</tr>
<tr>
<td></td>
<td>First-Time Transfer Student</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td>Not Applicable, Currently K-12</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>10.9</td>
</tr>
<tr>
<td></td>
<td>Returning Student</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2.2</td>
</tr>
</tbody>
</table>
Next, students were presented with two additional selected-response Likert-style questions in the post-survey instrument. When asked about their frequency of logging into the course each week through a computer, students reported that they logged in several times.
per day \((n = 19; 41.30\%)\), several times per week \((n = 17; 36.96\%)\), once per day \((n = 9; 19.57\%)\), and once per week \((n = 1; 2.17\%)\) with no students reporting less than once per week or never. Student responses, however, were more distributed across the six scale responses when asked how often they used a mobile device to log into the course each week. While the two highest response rates mirrored that of the previous question \(\text{several times per day, 34.78\%; several times per week, 26.09\%}\), students also responded less than once per week \((n = 5; 10.87\%)\) and never \((n = 2; 4.35\%)\). Table 33 includes the question stems with their accompanying Likert scale response frequencies and percentages.

**Table 33**

**Behavioral Engagement Responses: Access through Technology**

<table>
<thead>
<tr>
<th>Question Stem</th>
<th>Never</th>
<th>Less than once per week</th>
<th>Once per week</th>
<th>Several times per week</th>
<th>Once per day</th>
<th>Several times per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log into the course each week via a computer?</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>17</td>
<td>9</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>(0%)</td>
<td>(0%)</td>
<td>(2.17%)</td>
<td>(36.96%)</td>
<td>(19.57%)</td>
<td>(41.30%)</td>
</tr>
<tr>
<td>Log into the course each week via a mobile device, such as a smartphone or tablet?</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>12</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>(4.35%)</td>
<td>(10.87%)</td>
<td>(10.87%)</td>
<td>(26.09%)</td>
<td>(13.04%)</td>
<td>(34.78%)</td>
</tr>
</tbody>
</table>

Near the beginning of the semester, students were asked to describe how they interacted with the course during the week in one reflection assignment. Student responses \((n = 44)\) were imported into MaxQDA to analyze using the visual word cloud tool and linked document. The three major themes that emerged from student responses were group work, course assignments, and reading. Thirty-one students referred to working on group work,
such as communicating with their group to complete a group plan assignment. Nineteen students referred to the course assignments, such as previewing what assignments were due, working on assignments, and submitting assignments in Canvas. Twelve students responded with comments about the course reading, such as reading assignment instructions thoroughly and reading the textbook. Some students commented on how difficult reading was with family and other distractions at home. A sample of student quotations for each of the three themes can be found in Table 34.

**Cognitive Engagement.** In the post-survey instrument, participants were presented with four cognitive engagement stems adapted from the Student Course Cognitive Engagement Instrument (SCCEI). When asked if they thought critically about the concepts presented in class, most students responded that they *often* \( (n = 26; 56.52\%) \), *always* \( (n = 9; 19.57\%) \), or *sometimes* \( (n = 9; 19.57\%) \) did. Students less frequently thought about previous concepts presented in the course, with most students reporting that they *often* \( (n = 23; 50\%) \) or *sometimes* \( (n = 19; 41.3\%) \) did. Students reported connecting current course content with previous course content *often* \( (n = 19; 41.3\%) \), *sometimes* \( (n = 17; 39.96\%) \), or *always* \( (n = 8; 17.39\%) \). Lastly, participants divulged that they considered how multiple ideas or concepts related in class *always* \( (n = 10; 21.74\%) \), *sometimes* \( (n = 15; 32.61\%) \), or *often* \( (n = 21; 45.65\%) \). The distribution of cognitive engagement anchor responses is illustrated in Table 35.
<table>
<thead>
<tr>
<th>Theme</th>
<th>Supporting Quote</th>
<th>Supporting Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group work</td>
<td>“I've also began to do some research for our Shark tank group project. Our group has been trying to establish what time works best, so that we know when we can work on this project together and when we can record the presentation.” Participant 27</td>
<td>“In the Shark Tank planning assignment, it required me to contact my group members and discuss about a plan. It was a bit challenging online as some people didn't respond in the canvas inbox; however, others in my group were very responsible and set up group chats for us to talk.” Participant 6</td>
</tr>
<tr>
<td>Course assignments</td>
<td>“I interacted with the course this week by looking through all the modules and assignments to see what I needed to complete and read the announcement reminding me to complete the necessary assignments.” Participant 14</td>
<td>“I attended [sic] the course orientation on Monday and reviewed all of the assignments on Canvas. I planned my schedule accordingly to get my work accomplished on time.” Participant 15</td>
</tr>
<tr>
<td>Reading</td>
<td>“The reading was a little tough. I tried reading while my family was up and around and found that it was too distracting. I now read when they are either away from the house or in bed. It’s a lot of content to take in and requires my undivided attention.” Participant 39</td>
<td>“The tips you gave about reading the summary first, scanning the chapter and then going back and reading the whole chapter are very helpful. When I tried it that way, I did feel like I retained more of the information.” Participant 19</td>
</tr>
</tbody>
</table>
Table 35

*Cognitive Engagement Responses: Student Course Cognitive Engagement Instrument*

<table>
<thead>
<tr>
<th>Question Stem</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>I thought critically about the concepts covered in class.</td>
<td>1</td>
<td>1</td>
<td>9</td>
<td>26</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>(2.17%)</td>
<td>(2.17%)</td>
<td>(19.57%)</td>
<td>(56.52%)</td>
<td>(19.57%)</td>
</tr>
<tr>
<td>I thought about previous concepts covered in the course.</td>
<td>0</td>
<td>1</td>
<td>19</td>
<td>23</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>(0%)</td>
<td>(2.17%)</td>
<td>(41.3%)</td>
<td>(50%)</td>
<td>(6.52%)</td>
</tr>
<tr>
<td>I connected current concepts with previous course content.</td>
<td>0</td>
<td>2</td>
<td>17</td>
<td>19</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>(0%)</td>
<td>(4.35%)</td>
<td>(36.96%)</td>
<td>(41.3%)</td>
<td>(17.39%)</td>
</tr>
<tr>
<td>I considered how multiple ideas or concepts relate.</td>
<td>0</td>
<td>0</td>
<td>15</td>
<td>21</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>(0%)</td>
<td>(0%)</td>
<td>(32.61%)</td>
<td>(45.65%)</td>
<td>(21.74%)</td>
</tr>
</tbody>
</table>

**Collaborative Engagement.** Students were presented with questions to gauge their collaborative engagement in the course in the post-survey. The first question asked students how often, on average, did they contact their professor. Most students reported that they contact their professor less than once per week \((n = 30; \text{65.22%})\), once per week \((n = 7; \text{15.22%})\), or never \((n = 6; \text{13.04%})\). Few students reported contacting their professor more frequently, with 2 students reporting several times per week \((4.35\%)\) and just one student reporting once per day \((2.17\%)\). The second question asked students how often, on average, did they contact other students in the course. Students were bimodal in their response, with most students reporting less than once per week \((n = 16; \text{34.78%})\) or several times per week \((n = 21; \text{45.65%})\). The response anchor frequencies and percentages are included in Table 36.
Table 36

Collaborative Engagement Responses: Frequency of Contact

<table>
<thead>
<tr>
<th>Question Stem</th>
<th>Never (%)</th>
<th>Less than once per week (%)</th>
<th>Once per week (%)</th>
<th>Several times per week (%)</th>
<th>Once per day (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>On average, how often did you contact your professor?</td>
<td>6 (13.04%)</td>
<td>30 (65.22%)</td>
<td>7 (15.22%)</td>
<td>2 (4.35%)</td>
<td>1 (2.17%)</td>
</tr>
<tr>
<td>On average, how often did you contact other students in the course?</td>
<td>1 (2.17%)</td>
<td>16 (34.78%)</td>
<td>8 (17.39%)</td>
<td>21 (45.65%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

In addition, participants were asked how often they met online with other students in the course, such as during group work in Zoom breakout rooms or study groups. The question was adopted from a previous pedagogical study in higher education (Mourtos, 2010).

Students reported their frequency of online meetings with peers as 5 or more times ($n = 5$; 10.97%), 3 to 4 times ($n = 21$; 45.65%), 1 or 2 times ($n = 18$; 39.13%), and never ($n = 2$; 4.35%).

**Emotional Engagement.** Students were asked four questions from the Utrecht Work Engagement Scale for Students (UWES) to better understand their emotional engagement in the course. The UWES has been used in prior students to analyze the impact of UDL in college courses (Smith, 2012). Students reported that they *often* ($n = 17$; 36.96%), *always* ($n = 15$; 32.61%), or *sometimes* ($n = 13$; 28.26%) felt that class assignments were full of meaning and purpose. Students would *sometimes* ($n = 25$; 54.35%) or *often* ($n = 11$; 23.91%) get carried away when working on class assignments. They felt enthusiastic about the course *often* ($n = 17$; 36.96%), *always* ($n = 13$; 28.26%), or *sometimes* ($n = 12$; 26.09%). Lastly,
students responded that they felt inspired by the course always \( (n = 17; 36.96\%) \), sometimes \( (n = 15; 32.61\%) \), often \( (n = 12; 26.09\%) \), or rarely \( (n = 2; 4.35\%) \). Table 37 features student responses for the emotional engagement item stems.

Table 37

Emotional Engagement Responses

<table>
<thead>
<tr>
<th>Question Stem</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>I found that class assignments were full of meaning and purpose.</td>
<td>0</td>
<td>1</td>
<td>13</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>(0%)</td>
<td>(2.17%)</td>
<td>(28.26%)</td>
<td>(36.96%)</td>
<td>(32.61%)</td>
</tr>
<tr>
<td>I got carried away when I was working on class tasks and assignments.</td>
<td>0</td>
<td>6</td>
<td>25</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>(0%)</td>
<td>(13.04%)</td>
<td>(54.35%)</td>
<td>(23.91%)</td>
<td>(8.7%)</td>
</tr>
<tr>
<td>I am enthusiastic about this class.</td>
<td>1</td>
<td>3</td>
<td>12</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>(2.17%)</td>
<td>(6.52%)</td>
<td>(26.09%)</td>
<td>(36.96%)</td>
<td>(28.26%)</td>
</tr>
<tr>
<td>This class inspired me.</td>
<td>0</td>
<td>2</td>
<td>15</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>(0%)</td>
<td>(4.35%)</td>
<td>(32.61%)</td>
<td>(26.09%)</td>
<td>(36.96%)</td>
</tr>
</tbody>
</table>

Social Engagement and Sense of Belonging. Students were asked various questions to measure social engagement and sense of belonging in reflection assignments and the post-survey. Throughout the semester, students were required to submit reflection journal assignments. In three reflections assignments, students were asked how connected they felt to others in the course through a fixed-choice question. The first fixed-choice question was administered the first week of the course, the second fixed-choice question was approximately one-third of the way through the course, and the final fixed-choice question was during the last week of the course. The first question asked students how connected they felt to others in the course after they finished the first week. More than half of students
reported that they felt *very connected* \((n = 2; 4.44\%)\), *connected* \((n = 13; 28.89\%)\), or *somewhat connected* \((n = 18; 40\%)\). The second question was asked after students completed their first group project. At that time, students reported that they felt *somewhat connected* \((n=17; 37.78\%)\), *connected* \((n = 11; 24.44\%)\), and *very connected* \((n = 7; 15.56\%)\). The third reiteration of the fixed-choice question was asked at the end of the course after completing the larger group project in the course. Students reported that they felt *connected* \((n = 15; 34.09\%)\), *somewhat connected* \((n = 14; 31.82\%)\), and *very connected* \((n = 11; 25\%)\). Table 38 delineates student responses for connectedness.

**Table 38**

*Social Engagement Responses: Connectedness*

<table>
<thead>
<tr>
<th>Question Stem</th>
<th>Very disconnected</th>
<th>Disconnected</th>
<th>Somewhat disconnected</th>
<th>Somewhat connected</th>
<th>Connected</th>
<th>Very connected</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>How connected do you feel to others in the course...</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...now that you have completed your first week in the course? ((n = 45))</td>
<td>2 ((4.44%))</td>
<td>5 ((11.11%))</td>
<td>5 ((11.11%))</td>
<td>18 ((40%))</td>
<td>13 ((28.89%))</td>
<td>2 ((4.44%))</td>
</tr>
<tr>
<td>...now that you have completed the Shark Tank group assignment. ((n = 45))</td>
<td>0 ((0%))</td>
<td>5 ((11.11%))</td>
<td>5 ((11.11%))</td>
<td>17 ((37.78%))</td>
<td>11 ((24.44%))</td>
<td>7 ((15.56%))</td>
</tr>
<tr>
<td>...now that you have completed the assignment #3 group project? ((n = 44))</td>
<td>1 ((2.27%))</td>
<td>2 ((4.55%))</td>
<td>1 ((2.27%))</td>
<td>14 ((31.82%))</td>
<td>15 ((34.09%))</td>
<td>11 ((25%))</td>
</tr>
</tbody>
</table>

In one reflection assignment, students were presented with a constructed-response question that first defined a sense of belonging as when they feel connected to their
community. The question then went on to ask that as a student in an online course, what would make them feel a strong sense of belonging in the class. Student responses were analyzed using MaxQDA software visual tools, such as word cloud visualizations and sorting. All responses \((n = 30)\) were reviewed for related themes with select quotes included in Table 39.

The post-survey instrument also presented students with questions measuring their sense of belonging in the course. Participants were asked to report which course assignments contributed to their sense of belonging through a multiple-response question in which all students responded \((n = 46)\) as seen in Table 40. The top three rated assignments that created a sense of belonging were the Student Mixer: Introduction discussion question \((n = 39)\), Assignment #1: Resume and peer review \((n = 35)\), and Assignment #0: Shark Tank presentations and peer review. The lowest rated items included office hours \((n = 10)\), reading textbook chapter content \((n = 9)\), and exams #1 – 3 \((n = 9)\).

Students were asked if they felt that the course provided a sense of community \((n = 46)\). Eighty percent of students reported that they felt the course did provide a sense of community among students \((n = 37)\), while twenty percent reported that it did not \((n = 9)\). Students who felt the course provided a sense of community among students were then presented with a follow-up constructed-response question asking which aspects of the course create this sense of community among students.
Table 39

Sense of Belonging Constructed Responses

<table>
<thead>
<tr>
<th>Theme</th>
<th>Supporting Quote</th>
<th>Supporting Quote</th>
<th>Participant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group projects (n = 28)</td>
<td>“I honestly feel pretty connected to the course community. I think that the group projects do help me feel closer to the classmates when we can't be in person.”</td>
<td>“I believe a sense of belonging comes from being able to actively engage with classmates either via zoon or by chat. My current group is very responsive and I feel connected to all of them. We chat via text to communicate where we are in our project and to discuss ideas. We also have had a very productive zoom meeting that helped us connect. I think being more connected throughout the course it would be helpful to have a &quot;study&quot; group that you are assigned to so that you can connect and discuss the chapters we are covering.”</td>
<td>Participant 3</td>
</tr>
<tr>
<td>Synchronous virtual sessions (n = 20)</td>
<td>“Something that would make me feel a strong sense of belonging in this class would be participating in zoom meetings, as well as being in breakout rooms. In those breakout rooms that was in the zoom held earlier this week, I really enjoyed getting to know and talking to some of my peers.”</td>
<td>“Having classes on Zoom would make me feel a strong sense of belonging in the class. Even though people's cameras are not on, it is comforting to know that there are other people in the class who are as investing in learning as I am.”</td>
<td>Participant 14</td>
</tr>
<tr>
<td>Caring professor (n = 11)</td>
<td>“I feel when a professor reaches out and checks in on their students progress really makes me feel a sense of belonging during online courses. I don't mind online courses as it really forces me to focus, but having professors check in makes me want to do that much better of a job in my education.”</td>
<td>“Personally, a strong sense of belonging in the class is if the professor really puts care in their work because there has been some professor who really don't put their love into their work which can be discouraging from time to time.”</td>
<td>Participant 29</td>
</tr>
</tbody>
</table>
Table 40

Course Assignments Contributing to Students’ Sense of Belonging

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Mixer: Introduction</td>
<td>39</td>
</tr>
<tr>
<td>Assignment #1: Resume and peer review</td>
<td>35</td>
</tr>
<tr>
<td>Assignment #0: Shark Tank presentations and peer review</td>
<td>33</td>
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<tr>
<td>Assignment #3: Group project videos and peer review</td>
<td>32</td>
</tr>
<tr>
<td>Assignment #2: Informational interview and peer review</td>
<td>31</td>
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<tr>
<td>Student questionnaire</td>
<td>29</td>
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<tr>
<td>Reflection assignments</td>
<td>23</td>
</tr>
<tr>
<td>Attending a live Zoom session</td>
<td>15</td>
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<tr>
<td>Watching a recording of a live Zoom session</td>
<td>15</td>
</tr>
<tr>
<td>Participating in a breakout room during a live Zoom session</td>
<td>13</td>
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<tr>
<td>Exam exit tickets</td>
<td>13</td>
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<tr>
<td>Watching the video tutorials for each chapter</td>
<td>11</td>
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<td>Technology backup plan</td>
<td>11</td>
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<tr>
<td>Reading lecture slides online</td>
<td>11</td>
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<tr>
<td>Course navigation tutorial</td>
<td>11</td>
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<tr>
<td>Office hours</td>
<td>10</td>
</tr>
<tr>
<td>Reading textbook chapter content</td>
<td>9</td>
</tr>
<tr>
<td>Exams #1 - 3</td>
<td>9</td>
</tr>
</tbody>
</table>

Students ($n=19$) indicated that group assignments required them to connect with their peers, contributing to a sense of belonging. Participant 36, for example, shared that “…the group work was the strongest time I felt I was in a community. I loved meeting and working with my classmates, so it felt nice, especially when we were behind screens all the time.”

Participant 6 commented on the following contributors for a sense of community in the course:

I think different aspects such as the collaboration activities with random people brought a closer sense of communities. At the beginning of the course, during the discussions, I didn't recognize many people; however, towards the end, I recognized most of the people, as I had either worked with them, reviewed their past paper, or watched one of their
presentation videos. Overall, these collaboration activities enhanced the social aspect of online learning and also taught us to be more independent (communicating with group, setting a zoom time, and setting realistic goals to meet the due date).

Thus, participants reported that group work and collaboration assignments helped them connect with others in the course and positively contribute to the sense of community within the course.

Students who felt the course did not provide a sense of community were also presented with a follow-up constructed-response question to ask how the course could be changed to create a greater sense of community. Of the 9 students who initially replied no to the first question, 8 completed the follow-up constructed-response question. Across the responses, students reiterated the negative impact of low-performing peers or uneven work distribution in group project assignments. However, respondents also advocated for more group projects, weekly live Zoom sessions, and student mixer discussion questions so students could get to know each other better. Participant 37 shared, “It's hard to create a sense of community in online classes, and I haven't taken one yet that truly does this. Synchronous classes certainly help. The group projects did help to a degree, as well.”

**Transactional Distance.** Five questions were adopted from Zhang’s (2003) revised scale of transactional distance (RSTD) to measure the four dimensions of transactional distance that encourage active student engagement and learning. All five fixed-choice questions were presented to participants in the post-survey instrument at the end of each course. Most students responded strongly agree (n = 21; 45.65%) or agree (n =21; 45.65%) when asked if they felt connected to the instructor and could reach the instructor promptly. When asked if they made connections with several of the students in the course, 63.04% of students (n = 29)
responded agree, and 21.74% (n = 10) responded strongly agree. Students were also asked if they could easily access the content for the course to measure the transactional distance between students and the content (TDSC). The majority of students strongly agreed (n = 29; 63.04%) or agreed (n = 14; 30.43%) that they could easily access the course content. Lastly, to measure the transactional distance between the student and the interface (TDSI), students were asked if they could easily navigate the online system for the course. Participants responded that they strongly agreed (n = 28; 60.87%), agree (n = 17; 36.96%), and disagree (n = 1; 2.17%). Table 41 illustrates student responses to the adopted RTSD questions.

Table 41

Revised Scale of Transactional Distance (RSTD) Responses

<table>
<thead>
<tr>
<th>RSTD Construct</th>
<th>Question Stem</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transactional distance between student and teacher (TDST)</td>
<td>I feel connected to the instructor and can reach him or her in a timely manner.</td>
<td>1 (2.17%)</td>
<td>3</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Transactional distance between student and student (TDSS)</td>
<td>I made connections with several of the students in this course.</td>
<td>1 (2.17%)</td>
<td>6</td>
<td>29</td>
<td>10</td>
</tr>
<tr>
<td>Transactional distance between student and content (TDSC)</td>
<td>I could easily access the content for this course.</td>
<td>0 (0%)</td>
<td>3</td>
<td>14</td>
<td>29</td>
</tr>
<tr>
<td>Transactional distance between student and interface (TDSI)</td>
<td>I could easily navigate the online system for this course.</td>
<td>0 (0%)</td>
<td>1</td>
<td>17</td>
<td>28</td>
</tr>
</tbody>
</table>
A second question was included to measure the transactional distance between the students and the course interface (TDSI). When asked if they used the Canvas application for the course, 93.48% of students confirmed that they used it \((n = 43)\), while just 6.52% of students indicated that they did not use it \((n = 3)\).

**Discussion**

The third research question (RQ#3) focused on whether UDL affects student experience, including student engagement and sense of belonging. This study measured student engagement constructs following Redmond et al.’s (2018) online student engagement model to investigate this research question.

For the behavioral engagement construct, students generally reported that they regularly studied, put effort into the course, and stayed current with course readings most of the time. They reported logging into the course through a computer slightly more frequently than a mobile device. However, students reported that they mostly logged in to either device *several times per day or several times per week* to access the course. Three themes emerged when writing in responses about how they interacted with the course in the first week. Students responded that they were engaging in group work, starting course assignments, and reading the course textbook.

For the cognitive engagement construct, students generally reported that they *often* thought critically about the course concepts, thought about previous concepts covered in the course, connected current concepts with previous concepts, and considered how multiple ideas relate in class. Additional UDL scaffolds should be implemented in the course to encourage greater cognitive engagement.
Students were more likely to report great contact with their peers than their professor during an average week for the collaborative engagement construct. This may suggest that some UDL interventions successfully encouraged peer-to-peer interaction in this online course. This is an encouraging finding since peer-to-peer interaction has historically been scarce in online courses, especially asynchronous courses. Students also reported meeting with their peers over Zoom multiple times throughout the semester.

For the emotional engagement construct, most students found that class assignments were at least sometimes full of meaning and purpose. Results were less encouraging, in that students were less likely to report getting carried away and engrossed in their coursework. However, students reported feeling enthusiastic about the course and inspired by the class.

For the social engagement construct, students reported feeling *somewhat connected* or *connected* to others throughout three different periods in the course. The transition to remote virtual learning during the pandemic reiterated the importance of creating a sense of belonging for students. Students described the group projects, synchronous virtual sessions, and a caring professor as ingredients to create a sense of belonging. When asked to indicate which assignments contributed to students’ sense of belonging in the course, students chose the student mixer discussion question and the major assignments that required peer components, such as group work or peer reviews. Students' assignments that were least likely to be selected included the course navigation tutorial assignment, office hours, reading the textbook, and taking the exams. Community college students want peer interaction in online courses to create a sense of belonging and build a community in the class.
The researcher also measured transactional distance in this study. While most students favorably reported that they could easily access the course content and navigate the learning management system, improvements could be made in promoting more opportunities for making connections with other students and with the instructor.

**Limitations**

There are a few limitations with this study. First, it is essential to note that the COVID-19 pandemic emerged during the spring 2020 semester which impacted students’ abilities to withdraw from courses at any time. In the summer of 2020, the district approved an Excused Withdrawal (EW) petition for students facing hardships from the pandemic, such as the illness of a student or family member, loss of childcare, or economic hardship. Second, students experienced the first pandemic lockdown during the summer of 2020, which boosted enrollment among local high school students who could not travel or participate in many typical in-person activities. This could have differentiated the summer student cohort for this study compared to previous summer terms. Third, a primary limitation of this study is the small sample size at one institution, which may or may not generalize to other institutions or disciplines.

**Recommendations**

In this section, recommendations for practice and future research will be discussed.

**Recommendations for Practice**

This study leads to the following recommendations for the practice of UDL:

1. UDL should be used as a pedagogical investment in community colleges.
2. UDL should also be seen as an investment in teacher variability.
3. Community college faculty and administrators must be strategic in evaluating this pedagogical investment.

4. Learning management systems must release student user behavior data to improve instructional design.

5. A UDL rubric is warranted for higher education.

6. To encourage more faculty to use UDL, barriers must be removed for accessing detailed UDL checkpoint descriptions online.

7. A closer look is warranted for rethinking student engagement with textbooks.

8. Changes to course durations are suggested.

**UDL as a Pedagogical Investment in Community Colleges.** It is evident that UDL is a promising pedagogical investment for community college students. UDL implementation in this study has shown to increase student course level grades, assignment scores, student engagement, and sense of belonging. This at a time when many students have struggled with the transition to online learning during the Covid-19 pandemic. To fully harness the benefits of UDL, however, community colleges need to reevaluate their professional development programs and incentives to support systemic change.

**UDL is an Investment in Teacher Variability.** While the primary focus of UDL has been on learner variability, teacher variability is a necessary skill in community colleges today. Instructors need to adapt their pedagogical techniques to a variety of means to meet the learner variability of students. Many community college faculty in Career Technical Education fields rely heavily on textbook publishers to supply reading schedules, homework assignments online in a homework manager, and disengaging publisher PowerPoint files.
Community colleges must invest in high-quality pedagogical training to encourage instructors to vary how they teach. As referenced previously, community colleges admit all students who apply, creating a wide variance of student ability and preparedness for college. Community college students will directly benefit from a more diverse and flexible instructional staff. Additionally, faculty would benefit from dedicated time for peer observations to model UDL practices in the classroom to improve the system.

**Evaluating the Pedagogical Return on Investment.** As discovered in the analysis for RQ#2, the impact of UDL is not always evident at the course success rate level. Faculty and administrators must not use course success rate data as their only measure to determine if a novel pedagogical practice is effective. They must investigate further into student course grade percentages and individual assignment grade distributions.

**Canvas User Behavior Data.** As a learning management system, Canvas does not report standard user behavior data for the system. Instructors do not have access to patterns in student behavior when accessing courses through either the desktop or mobile device applications. With such limitations, instructors are not aware of how students typically enter their courses online and typically design courses with their own user behavior biases in mind. Student behavior is substantially different compared to the instructor and compared to other students. More user behavior analytical data is needed to help instructors understand how their students interact with the course in an online environment, so that they can provide better support.

**UDL Rubric for Higher Education.** In alignment with Edyburn’s (2010) criticisms of UDL, it is not easy to know if practitioners could identify UDL practices observed in the
classroom, either in-person or virtually. Higher education practitioners need to develop a rubric to evaluate courses for UDL implementation. Ultimately, the rubrics and many of the item stems used throughout the instrumentation in this research should be used to update faculty evaluation procedures typically controlled by faculty unions. Faculty unions should update their tenure-track and adjunct review processes to include question stems measuring transactional distance and a sense of belonging. This is especially relevant after the cataclysmic pandemic shifted most higher education online. The National Center on Universal Design for Learning (2010) has produced videos sharing panels of experts evaluating UDL practices in K-12 classrooms. This could be used as a model for faculty peer-evaluation of UDL implementations in higher education. However, it must be noted that this observation method would need to be altered if faculty were peer-reviewing online asynchronous courses.

**Reducing Barriers to Checkpoint Descriptions.** While CAST’s UDL graphic organizer is readily available online, the organization would benefit from reducing the barriers to accessing details of each checkpoint description. Currently, to find descriptions of each checkpoint, users must click deep within each checkpoint on CAST’s website to find the corresponding description. Creating a short document that expands upon the one-page graphic organizer would assist faculty in learning, printing, and implementing UDL checkpoints. The expanded document could include descriptions and examples of UDL implementation relevant to higher education.

**Student Engagement and Support in Textbooks.** Applying the trifecta of student engagement model to this research, the relationship of engagement between the student and
the course content must be examined further. While many aspects of this research measured students’ engagement with the course learning management system (LMS) Canvas, it did not measure students’ engagement with the course textbook. Printed textbooks are limited in engagement opportunities with the content, peers, and the instructor. Even as the textbook publishing industry has adapted to digital publication, the industry has yet to fully harness digital capabilities for student engagement with the text, particularly peer-to-peer engagement. Digital textbook readers could imbed reflection prompts to encourage student executive functioning. Additionally, student reflection submissions could be publicly viewed by students in the same course section to model answers and encourage student participation.

Furthermore, digital textbooks could provide more vocabulary support for non-native language students. This would align with UDL checkpoint 2.1 to clarify vocabulary and symbols for students. Digital textbooks could differentiate modules to support students currently mastering the native language. While some digital textbook publishers provide embedded support for vocabulary and symbols within the text, more could be done with current technology to allow embedded videos or realistic audio reading the text for students.

**Shorter Semester Time Frames.** The analysis for RQ#2 suggested that longer course durations resulted in a lower course success rate. Additionally, student responses in the student questionnaire indicated that some students believed that 16-to 18-week semesters were too long in duration. At 17.5 weeks, the host institution has one of the longest academic terms for the fall and spring semesters. While this is understandably a complicated issue with union governance and a multiple college district to navigate, to be a student-centered institution the difficult work to change the system must be ignited.
**Recommendations for Research**

There are multiple opportunities for future UDL research, including additional research on UDL in community colleges, continuing research on UDL and students with disabilities, commencing research on reiterative UDL implementation, and updating the outdated research evidence supporting the current UDL guidelines.

**Research on UDL in Community Colleges.** Additional research needs to be conducted on UDL implementation in community colleges for various instructional modalities, including in-person, hybrid, asynchronous online, and synchronous online courses. The pandemic has accelerated the adoption of a newer instruction modality called HyFlex, where students are given the option to attend a class either in-person, synchronous online, or asynchronous online. Instructors are simulcasting their live in-person lectures to a subgroup of students attending live online remotely from another location. Asynchronous students have the ability to watch recordings on demand. This new modality has great potential but also many challenges for student engagement.

**Research on UDL and Students with Disabilities.** To better understand how UDL can meet the needs of community college students with disabilities, additional research is needed. Future studies will need to expand their sample size to capture a statistically significant number of student participants who self-disclose their disability for research purposes.

**Research on Reiterative Implementation.** Further research is needed to investigate the instructional design process of multiple revisions of UDL implementation within a course. While examples of single instance implementations are available in the literature, little is known about how long each implementation cycle can last for faculty, or how many cycles
are conducted. Research is needed to document implementation time frames and how frequently faculty use the “plus one” method for implementation. The current literature supports a snapshot of UDL implementation instead of a longer view on implementation.

**Updating Research Evidence for UDL Guidelines.** First, as shared in the literature review, the claim that UDL is based upon research cannot continue to be promoted unless CAST updates all UDL checkpoint research. Due to circumstantial reasons, UDL’s researched-based evidence stops after 2008. CAST must reevaluate research since 2008 to update the guidelines based on new neuroscience discoveries. In tandem with this recommendation, the UDL framework must be substantively updated for cultural responsiveness. While culturally relevant pedagogy has been in the literature for some time, it has only been in recent years that public awareness has increased and demanded more culturally relevant content in today’s classrooms. More needs to be done to make significant strides in this area, including diversifying those working with UDL.

**Summary**

In conclusion, this chapter has summarized the findings and results of this mixed methods study that explored the implications of UDL interventions on faculty and the student experience, specifically on student engagement and sense of belonging in an online community college course. The findings revealed that most UDL interventions were utilized by students, improved student learning, and increased student engagement while creating a sense of belonging and community in the course. Chapter Five presents a systems design framework for implementing pedagogical innovations, such as UDL, in community colleges.
Chapter 5. A Systems Model for Student Learning at Community Colleges

A system is a set of elements, interconnections, and stocks, that are interdependent and construct their own behavioral patterns, which serve a particular function or purpose (Meadows, 2008). Systems thinking is a critical tool for every educational leader. A systems model can help illuminate the dynamic relationships within the systems as well as the various challenges that need to be overcome. This chapter presents a systems model for student learning at a community college, with a view towards facilitating student learning through adaptation of new pedagogies, such as UDL. The analysis will begin with a review of the system structure and behavior and conclude with a vision of a more optimal system design.

System Structure

The purpose of a student learning system, such as a community college, is to provide high-quality student learning in the classroom by ensuring faculty teaching efficacy, student engagement and lifelong learning skills, and state-of-the-art curriculum. Figure 4 delineates the system elements, stocks, feedback loops, and interconnections.

System Elements

In Figure 4, elements are depicted as plain text without a box around the text, while stocks are depicted as boxes. Starting from the top of the model, elements of the presented system include professional development, technology training, tutoring, curriculum, and external influencers such as Career Technical Education (CTE) advisory boards, private companies, the State of California, and regional recommendation groups such as the Bay Area Community College Consortium (BACCC). Intangible elements, such as school culture, are always present and may have a significant effect on the operation of a system.
Figure 4

Systems Diagram for Student Learning

System Stocks

Stocks are elements that form the foundation of the system. They can be measured, change over time through flows, and act as shock absorbers for the system (Meadows, 2008). Stocks tend to change slowly over time, as the process of absorbing flows into a stock or draining a stock is by nature slow. Stocks can have one or more inflows or outflows and are illustrated in Figure 4 as text within boxes. There are four main stocks in our system: (a) funding, (b) faculty teaching efficacy, (c) student learning, and (d) student lifelong learning.
skills. Time lags or delays are most likely to influence the funding stock, which would then impact its outflows to the faculty teaching efficacy stock and the tutoring element. This could cause the system to oscillate, particularly for the lifelong learning skills stock. For instance, a delay in the funding outflow to the tutoring element could lead to a temporary tutoring shortage. This would negatively influence students’ study skills.

**Feedback Loops**

Interconnections are the relationships within the system, such as flows and other interactions between elements (Meadows, 2008). A feedback loop is a mechanism that changes the inflow or outflow from a stock (Meadows, 2008). There are multiple interconnections in Figure 4. At the top of the model, the funding stock flows into the professional development element. If this flow is weak, professional development activities for pedagogical training may not be adequately funded. While the faculty union contract mandates that a certain percentage of salaries go into a professional development fund, the use of that fund is limited to narrow activities, which must be preapproved for individual faculty use. In the lifelong learning skills subsystem at the lower-right corner of Figure 4, the stock is regulated through the trio of positive balancing feedback loops: reading skills, technology skills, and writing skills. At the center of the diagram is the student learning stock, which may be viewed as the outcome stock of the entire system. Clearly, the purpose of the entire system is to maximize this stock, so graduates can succeed in the workplace or transfer to a four-year university. The student lifelong learning skills stock, as well as the faculty teaching efficacy stock, must each provide a healthy flow into the student learning stock, whose level is also regulated by the student engagement feedback loop. Without
student engagement, good pedagogy and student skills alone will not result in student learning.

The curriculum element also has an input into the student learning stock. For example, curriculum that is not current or engaging will not result in student learning. The curriculum element in turn is shaped by two balancing feedback loops, one each from external influencers and internal influencers, as shown in Figure 4.

The student learning system operates within the larger institutional system, which includes planning and budgeting for the entire campus. In particular, the funding stock of the student learning system relies solely on the larger campus system for a sufficient inflow of funds. To add complexity, many of the external influencers driving the curriculum are entire systems of their own, such as the State of California and the Bay Area Community College Consortium (BACCC).

The pedagogical practice subsystem can frequently be out-of-sync with the student learning system due to financial restrictions, which may limit professional development and technology training for faculty. In addition, low faculty morale, which could be the result of a number of factors, including low pay and benefits, could also affect faculty teaching efficacy.

**Misalignments and Malfunctions**

Ideally, each subsystem should work to ensure that main system outcome (student learning) remains well stocked, and for the most part, subsystems do. However, as mentioned earlier, subsystem performance depends on the inflow from the funding stock, as the level of this stock heavily influences the faculty teaching efficacy stock through professional development and the student lifelong learning stock through tutoring.
Malfunctions in the system can arise from competing demands between school culture, funding, and college goals. For instance, if the school culture does not value faculty teaching efficacy, the funding stock will be diverted from activities such as professional development and technology training, and this will have a negative effect on the student learning stock. The possibility of malfunctions is greater in this system due to the hierarchical nature of academic institutions. In addition, the student learning system lacks an ability to recover from perturbations and suffers from low resilience if funding is significantly reduced for a period of time and the system would become suboptimized.

**Systems Analysis**

A resilient system functions like the shocks on a sports car. The shocks flex to absorb external disturbances, while allowing the car to maintain its shape and trajectory. However, there are limits to system resiliency, just like there are limits to the ability of the shocks of a sports car to absorb impact from external bumps. A resilient system is dynamic and adjusts to change. As with most institutions, faculty, staff, students, and administrators have had to adapt to full distance learning and remote work in response to the COVID-19 pandemic. Instructional faculty members who were not teaching online at the onset of the pandemic had to shift and retrain in online technology within a very short period of time. Students also had to adapt to the new learning environment and methods of communication, while administrators had to adapt to new rules, different funding models, and remote work. Two years after the pandemic emerged, all parties involved are continually adapting to uncertain times in higher education.
**System Surprises**

Historically, pedagogical professional development was funded and appreciated on the college campus. Previously the college had funded a Center for Innovation and Excellence in Teaching and Learning (CIETL) space with three faculty coordinators under the oversight of the vice president of instruction. However, politics and disagreements over the space occupied by CIETL led to the closure of the center in 2014. While the website still exists and promotes the opportunity for professional development and the sharing of the scholarship of teaching and learning, no professional development opportunities related to pedagogy exist on campus. Professional development is now a term used for mandatory faculty flex training days and individual projects or conference approval forms for individual faculty members.

**System Delays.** Four types of delays within the student learning system have a major impact on student learning outcomes: (a) funding delays, (b) scheduling delays, (c) administrative delays, and (d) staffing delays, as shown in Figure 5.

First, there are funding delays from the larger college system, which impact the funding stock. Delays in funding may be caused by administrative delays in requesting the funds, delays in the approval process or delays in transferring the funds. Second, there are scheduling delays for professional development. Most professional development activities occur only during union-designated flex days. For instance, at the start of the fall semester there are two days of flex activities followed by one flex day in the middle of the semester. The same pattern exists during the spring semester, but there are no professional development days during the summer. Third, there are long administrative delays associated with the curriculum approval process. There are strict rules with curriculum procedures and
Figure 5

*Systems Surprises*

Bounded Rationality. Surrounding the faculty teaching efficacy stock, a bounded rationality case persists. Professional development activities are bounded by the existing knowledge of faculty members who are willing to volunteer their time to lead a professional development workshop. This could be improved by strategically researching external professional development activities and sending small teams of faculty to train in order to
bring the training back to the campus. Alternatively, the college could invest in additional funding to pay for high-quality pedagogical workshops on campus administered by external providers.

**System Traps**

There are numerous traps inherent within the system, such as addiction, drift to low performance, tragedy of the commons, success to the successful, and seeking the wrong goal, as illustrated in Figure 6.

**Figure 6**

**System Traps**
**Addiction.** The prominent example of addiction in this organization is the dependence on property tax funding. The college is a part of a multiple college district which is funded through local property taxes instead of through state apportionment funds from the State of California. This results in additional funding compared to traditionally state-funded community colleges. The district receives all funding and then decides how to split it up among the three campuses. The opaqueness of the complex funding distribution formulas makes it difficult to follow the allocation process. Additionally, there are no mandates on how that money is spent at either the district or campus level. Since there is no district-wide focus from leadership as a student learning centered institution, funding allocations are at the discretion of district and campus administrators. Without administrator commitment to excellence in teaching, funds will not be directed toward improving the system performance. Funds will continue to be dedicated to vanity projects.

**Drift to Low Performance.** The elimination of the Center for Innovation and Excellence in Teaching and Training (CIETL) space on campus is an example of a drift to low performance. Without a cultural focus on continual and substantive renewal of pedagogical skills, the lack of teaching preparation continues to diminish, thus lowering the possibilities for student learning. While the union contract does stipulate a certain percentage of the district budget be used for individual professional development funds, the application process is political and opaque. To increase the faculty teaching efficacy stock, there needs to be a systemic drive for high-quality pedagogical training for faculty.

Additional evidence of the drift to low performance is the lack of Higher Education Emergency Relief Funding (HEERF) invested in instructional training for online education.
and securing additional equipment and software to enable distance learning during the pandemic. Sadly, many faculty have accepted this lower standard across the campus and there is no groundswell of motivation to change the current situation. However, if deans were provided more administrative support, they could earmark time during monthly division meetings to include pedagogical workshops and discussions for discipline specific faculty.

**Tragedy of the Commons.** Prior to the COVID-19 pandemic, the lack of classroom facility space was an example of tragedy of the commons. For years, the availability of classroom space during the peak times on campus has been limited. Classroom scheduling rules were vague and illusive. Each semester the rules change depending on which administrator had responsibility over the space or courses being scheduled. The missing feedback, in this case the revelation by the administrative team, is the need to acknowledge there is a finite amount of classroom space and for the leadership team to take a step back and reimagine the block scheduling system on campus. Even during virtual learning, little thought is given to when courses are offered synchronously, with a view towards helping students schedule their classes efficiently each day and throughout the week. Additionally, there are no equitable policies on how much space each division or department receives. This leads to inefficiencies in the system. Regulating the commons for efficiency and equity would help avoid this trap and maximize facility space to create better opportunities for student learning.

**Success to the Successful.** In this system, students who graduate will become a part of the archetype of exponential success. As students transfer and graduate, they will find jobs faster than people who do not have a degree. Their experience at that first job will help them
reach their next job, and the next job, and the job after that. This perpetuates the feedback loop as they will see more success in their future compared to their peers who did not graduate.

**Seeking the Wrong Goal.** In this system, an example of seeking the wrong goal is when employees put their vanity projects ahead of the needs of the students. Administrators, faculty, and staff must be student centered in their goal setting instead of focused on personal goals or resume building tasks. For example, an administrator recently agreed to a partnership with a local technology company without discussion nor commitment from the impacted faculty department. Another example includes when administration repeatedly failed to collaborate with athletic faculty and students on the redesign of a new athletics facility on campus.

**Intervening with Leverage Points**

There are twelve leverage points, or points of power, within systems (Meadows, 2008). While correctly using leverage points can be counterintuitive, when used properly they can promote significant change within the system. For the student learning system studied here, if the college were to increase the number of faculty teaching at the college, it would change the parameters of the system. For example, if the college president agreed to hire ten new full-time faculty, the systems parameters would change.

A great leverage point in our system would be additional funding to make the funding stock large enough to act as a buffer and be able to absorb perturbations in the funding inflow. This would allow sufficient funding to provide for consistent professional development training throughout the year, every year. One way to achieve this buffer for the
funding stock would be to create a separate budget for professional development. Consistent and accessible funding would lead to an increase in professional development and ultimately into the faculty teaching efficacy stock. For instance, adding external professional development workshops to the professional development element can support new pedagogical ideas entering the faculty teaching efficacy stock. In response to the tragedy of the commons surrounding classrooms, a public task force can be created to review scheduling placement practices and establish transparent policies around facilities allocations. Faculty representing each division as well as division assistants would serve on the task force.

The funding delay at the top of the model is mostly appropriate: however, delays caused by political stalling over the approval of funding requests should be shorter and transparent. For instance, if an administrator does not approve of the funding request due to suspected covert political reasons, faculty should be able to appeal the denial in a public forum, such as through the Planning and Budget Committee. The scheduling delay is too long and should be reduced by offering more frequent opportunities for pedagogical professional development. This would be by offering professional development opportunities outside of the mandated faculty flex days to bring high-quality pedagogical workshops on campus.

The positively balancing feedback loop between external influencers and the curriculum is too critical to be so weak. This feedback loop needs to be strengthened by the structural changes mentioned above. The same can be said about the mirrored balancing feedback loop between the internal influencers and the curriculum.
There are several points within this system where the information flow could be improved. For instance, the information flow on how much funding is available for professional development could be more transparent within the campus community. Increasing information flow about what professional development activities are being planned could also benefit the system.

Numerous rules deserve alteration and strengthening within this system. First, a rule should be added that all board report submissions from individual colleges must go through a seven-day period of open review by the campus. Any questionable items could be removed from the board report for local discussion. Another rule could be that the college does not push faculty with low loads into release time positions, such as professional development coordinator, solely because that faculty member cannot meet their teaching load. Perhaps, if that faculty member had more pedagogical training and increased student engagement in their courses, they would have a full load of courses and would not be in need of release time. Their lack of pedagogical efficacy, as indicated by the fact that students do not want to take their courses, certainly should disqualify them from taking on leadership roles related to professional development.

If faculty self-organized to demand frequent high-quality pedagogical training, it would improve the performance of the student learning system. This would be achieved through coordinated presentations and discussions through the local Academic Senate committee followed through with Academic Senate led discussions with administrative leadership.

In summary, the purpose of this system is to provide high quality student learning in the classroom through pedagogical practice, curriculum development, and development of
student lifelong learning skills. If the purpose of this system was restated as “providing the best quality instruction to maximize student learning” then the resulting performance could improve, but only if the system structure was reevaluated to provide an environment maximizing student learning.

The most substantial paradigm shift needed in this system is to embed a student-centered focus within every element, interconnection, and subsystem. If each decision had to be challenged with proving how it was student-focused, in relation to student learning, then the various subsystems and their main actors would be forced to align their behavior to be in line with the main function of the system.

**Lead the Change**

While there are multiple areas within the system that could benefit from change, the purpose of this model resides within the construct of student learning as it relates to faculty professional development. Hence, leverage points are sought that will cause changes within the professional development subsystem. The goal is to improve the frequency and quality of faculty professional development opportunities in the college, specifically focusing on pedagogical training.

In *Leadership: Key Competencies for Whole-System Change*, Kirtman and Fullan (2016) describe seven competencies for educational leaders: (a) challenges the status quo, (b) builds trust through clear communication and expectations, (c) creates a commonly owned plan for success, (d) focuses on team over self, (e) has a high sense of urgency for change and sustainable results in improving student achievement, (f) has a commitment to continuous improvement for self and organization, and (g) builds external networks and partnerships (p.
12). To facilitate change in the system, each of these leadership competencies must be addressed.

First, to take the risk to challenge the status quo, one must first identify and challenge common practices that may be blocking necessary improvements. In the student learning system above, one must challenge the existing system of compliance-orientated professional development on campus. Existing professional development programs focus on meeting flex day attendance requirements for faculty as well as top-down messaging from the current administration. Highlighting this suboptimal system to individual faculty on campus would create a ground swirl of advocacy to demand pedagogical training for faculty members. Risks must be calculated carefully to not burn bridges or act counterintuitively to the end goal. Risks may include speaking up publicly at committee meetings, during small meetings with administrators, or in smaller group conversations within departments.

Second, trust needs to be built within relationships in the organization. It is important to provide honest feedback with colleagues as well as follow through on promises made. This is a situation where one must become more comfortable leaning into conflict to solve the goal of initiating high-quality pedagogical training on campus. Dealing with conflict involves creating a safe space to have a conversation, to make the effort to actively listen, and to share ideas without threatening the other parties in the conversation. It is best to have an open dialogue, if possible, for all sides under conflict. One solution would be to hire an external contractor to provide high-quality conflict resolution training and mediation.

Third, one must create a commonly owned plan for success, such as a written plan submitted and vetted by the Academic Senate. This could include a listening session to hear
faculty insight as well as a formal resolution to demand pedagogical training opportunities for faculty to include the input of stakeholders. Both competencies relate to the need to effectively communicate with others and to set realistic expectations going forward. Monitoring will be an ongoing process of keeping track of the number and types of professional development activities available to faculty. Once faculty have at least two workshops per year focused on pedagogy and have more opportunities for professional development throughout the academic year outside of the standard flex days, then the goal would have been met. The college could sponsor cohort opportunities through external contractors who specialize in pedagogical training for online instruction. Furthermore, the college could remove administrative barriers to enrolling in such classes and cover the costs without requiring financial reimbursement processes for faculty members.

Fourth, a competent leader in education focuses on the team over the self. While any given faculty member has limited power in the hiring process, they are able to have some influence on hiring committees, especially within their own department. Focusing on one’s department first as the immediate team for setting high-performance goals is one of the first areas to start to craft one’s influence. Next would be to increase promotional efforts to restart our Faculty Learning Program (FLP), which ran out of funding just as the COVID-19 pandemic began. The researcher will have to proactively work on building allies in other divisions to carry the message across campus that pedagogical training is relevant and urgent in our profession.

Fifth, leaders must create a sense of urgency around change. It is important to make decisions in a timely manner and not procrastinate in making tough decisions for the team.
Additionally, instructional data, such as student success data over time, should be used to track our instructional improvements. Faculty will need to be able to adapt to change as they pursue it.

Sixth, an effective leader has a commitment to continuous improvement. As life-long learners, faculty should demonstrate their passion for continuous learning. It is important for an academic team to constantly adapt to change and listen to each other to get to the results they are working towards. While this is more easily achieved within small team units, it will be more difficult to spread a culture of continuous learning among my more distant colleagues. That is where conflict may come up or differences in cultural values. Listening is always important in any form of conflict or disagreement.

Lastly, leaders must develop and nourish external partnerships. In the context of this systems model, this would mean building my network outside of my college to find other likeminded individuals at other institutions. One way to achieve this is to sign up for external conferences, such as Academic Senate for California Community Colleges (ASCCC) conferences or conferences that focus on pedagogical training in higher education.

**Conclusion**

Systems are inherently dynamic over time. This system is no different. Opportunities to optimize the system are abound after thorough analysis of the system’s components and subsystems. Through the lens of systems design we can better understand the many directions systems operate in simultaneously. This research provided a detailed look at the impact of UDL as a pedagogical intervention at one community college. It examined how UDL made a positive impact on student learning, engagement, and sense of belonging.
Throughout this process, the researcher has encountered reflective changes as both a researcher and practitioner. The process of administering this study has shown the great value of providing space for student voice throughout a course, whether it be through student choice in assignment deliverables or through collecting data that allows students to report what works for them in the course. Additionally, there is immense value in learning new pedagogical practices not just for the student benefit, but also for the revitalization of a teaching career. When educators focus on improving practices for students, it also benefits the educator’s career in tandem.
References


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Polanska, K. (2013). Reading tips for online learners. Online Cl@ssroom, 13(12), 7-8.


## Appendices

### Appendix A: UDL Chronology

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1944</td>
<td>World War II veterans returned home with disabilities and wanted to use the GI Bill to attend higher education, although few higher education institutions were designed for people with disabilities (Silver et al., 1998).</td>
</tr>
<tr>
<td>1962</td>
<td>Ed Roberts advocated attending UC Berkeley as a student with a disability, eventually leading UC Berkeley to become one of a few universities in the United States accommodating students with disabilities (U.C. Berkeley, 2021).</td>
</tr>
<tr>
<td>1968</td>
<td>The U.S. Architectural Barriers Act of 1968 mandated access for “physically handicapped persons” to buildings created or modified with federal funds (Tobin &amp; Behling, 2018; U.S. Department of Justice, 2020).</td>
</tr>
<tr>
<td>1973</td>
<td>The Rehabilitation Act of 1973 federally mandated that educational institutions, including post-secondary institutions, that received federal funding must provide physical access to people with disabilities (Silver et al., 1998; U.S. Department of Justice, 2020).</td>
</tr>
<tr>
<td>1975</td>
<td>President Gerald Ford enacted the Education for All Handicapped Children, later known as the Individuals with Disabilities Education Act (IDEA) (U.S. Department of Education, n.d.).</td>
</tr>
<tr>
<td>1984</td>
<td>Anne Meyer and David Rose founded CAST (2020a, 2021e) near Boston, Massachusetts.</td>
</tr>
<tr>
<td>1990</td>
<td>Americans with Disabilities Act (ADA) was passed to mandate even broader access to the physical environment (Tobin &amp; Behling, 2018; U.S. Department of Justice, 2020).</td>
</tr>
<tr>
<td>1998</td>
<td>Neuroscientists at CAST created the Universal Design for Learning (UDL) framework (Griful-Freixenet et al., 2020).</td>
</tr>
<tr>
<td>Early 2000s</td>
<td>Grants from the U.S. Office of Postsecondary Education served as seed funding to incentivize colleges and universities to incorporate UDL in higher education (Tobin &amp; Behling, 2018).</td>
</tr>
<tr>
<td>2010</td>
<td>The Basic Skills Committee and Noncredit Committee of the Academic Senate for California Community Colleges (ASCCC) published a report, Practices that Promote Equity in Basic Skills in California Community Colleges, including UDL as a pedagogical technique (Academic Senate for California Community Colleges, 2010).</td>
</tr>
</tbody>
</table>
Appendix B: IRB Notice of Approval – San José State University

SAN JOSE STATE UNIVERSITY
HUMAN SUBJECTS INSTITUTIONAL REVIEW BOARD

IRB Notice of Approval

Date of Approval: 6/4/2021

Study Title: A Universal Design for Learning (UDL) Mixed Methods Case Study: Faculty Implementation & Student Engagement in an Online Community College Course

Principal Investigator (PI): Dr. Nikos Mourtos

Other SJSU Team Members: Dr. Matt Love (Consultant)

SJSU Student(s): Candice Nance

Funding Source: None

IRB Protocol Tracking Number: 21128

Type of Review:

- Exempt Registration: Category of approval §46.104(d)(1)
- Expedited Review: Category of approval §46.110(a)(1)
- Full Review
- Modifications
- Continuing Review

Special Conditions:

- Waiver of signed consent approved
- Waiver of some or all elements of informed consent approved
- Risk determination for device:
- Other:

Continuing Review:

- Is not required. Principal Investigator must file a status report with the IRB one year from the approval date on this notice to communicate whether the research activity is ongoing. Failure to file a status report will result in closure of the protocol and destruction of the protocol file after three years.
Appendix C: Organizational Letter of Support – Cañada College

Cañada College

Human Subjects Research Institutional Review Board (IRB)
San Jose State University
1 Washington Square
San Jose, CA 95192

June 9, 2021

To Whom It May Concern:

I give Candice Nance permission to contact students for her dissertation research being conducted at San Jose State University and to collect student data through surveys, reflection questions, student outcome data, and Canvas XML data. Our Office will be working with Professor Nance to support the data collection process and ensure the protection of student data privacy. I understand that Professor Nance is conducting a study about implementing Universal Design for Learning (UDL) in her courses this summer and fall. This research is for her dissertation but may help inform our campus and district on effective pedagogical practices in the online environment. Cañada College welcomes the opportunity to partner with San Jose State University and I am available to answer any questions about our campus’ involvement.

Sincerely,

Dr. Karen Engel
Dean of Planning, Research, Innovation and Effectiveness
Cañada College
engelk@smccd.edu
(650)306-3145
Appendix D: Recruitment Materials

Course Announcement in Canvas:

Dear business students,

You will be receiving an email to your SMCCD Gmail account inviting you to take the pre-survey for this course. As a reminder, the pre-course and post-course surveys are worth up to 5 points of combined extra credit for students who participate in the research study and complete both surveys.

If you cannot find the email, please check your spam folders. The survey is administered through a platform called Qualtrics. The email is sent from Qualtrics through the following email address: noreply@qemailserver.com

If you have any questions or concerns, please do not hesitate to contact me.

Sincerely,
Candice Nance

Email Invitation via Qualtrics

Dear ${m://FirstName},

As announced in class, you can find a link to the extra credit student survey assignment below. Each link is unique for each student, so please do not share your link or use someone else's link.

The survey should take approximately 12 - 15 minutes to complete.

Follow this link to the Survey:
${l://SurveyLink?d=Take the Survey}

Or copy and paste the URL below into your internet browser:
${l://SurveyURL}

Follow the link to opt-out of future emails:
${l://OptOutLink?d=Click here to unsubscribe}

Sincerely,
Candice Nance
Appendix E: Consent Form - Adult

A Request for Student Participation in Research

A Universal Design for Learning (UDL) Mixed Methods Case Study: Faculty Implementation & Student Engagement in an Online Community College Course

Candice Nance, Doctoral Candidate, and Dr. Nikos Mourtos, Faculty Advisor
San Jose State University, Doctorate in Education Program

You have the opportunity to voluntarily participate in this research study. Please take the time to decide if you want to participate.

WHY IS THIS STUDY BEING DONE?

The purpose of this study is to investigate the implementation of Universal Design for Learning (UDL) in online business courses and the impact it may have on student learning and engagement.

WHAT DOES THIS STUDY ASK STUDENTS TO DO?

All students in this introduction to business course are invited to participate in the research study through an email invitation. Participating in the post-survey is voluntary and not required as a part of your participation in this course. Participation or non-participation in this survey will not impact your grade in this course. Students who participate will complete a post-survey in Qualtrics. The survey should take between 10 – 15 minutes to complete. Research participants can complete the survey on a computer or mobile device. The purpose of this study is to advance research in the field of online learning and will not be used to evaluate your professor’s performance. Student participants are encouraged to be honest in their responses since this survey will not impact your professor.

The research study will also collect examples of student work in the class, such as the student questionnaire and student reflection assignments, as well as Canvas XML user data, student demographics, and student course grades. Students who do not opt-in to participate are still required to complete the student questionnaire and reflection assignments in the course.

CONFIDENTIALITY

The Cañada College Office of Planning, Research, and Institutional Effectiveness (PRIE) will administer the post-survey and merge all data into one de-identified database for analysis by the faculty researcher. All reported information will be confidential and no personally identifying information will be reported in the final study. When data is reported, it will be in aggregate form with no identifiable information included.

WHAT ARE THE RISKS AND BENEFITS OF PARTICIPATING?

There are no identifiable risks associated with this study. By participating in this study, you may help improve the instructional techniques used in business classes online.
COMPENSATION

Students may participate in this research study for seven points of extra credit. If a student does not want to participate in the research study, students may complete an alternative assignment for equal course extra credit by reading a current Wall Street Journal article and writing a report summarizing the article, and applying concepts from the course to the article content. Details about the alternative extra credit assignment will be posted in Canvas. Students will submit the alternative extra credit to Professor Gampi Shankar at Shankarg@smccd.edu. Students may also choose not to participate in either extra credit opportunity.

WHAT ARE MY RIGHTS AS A PARTICIPANT?

Your participation in this study is entirely voluntary, and you may refuse to participate. If you agree to participate, you have the right to stop at any time with no penalty. You also have the right to skip survey questions that you do not wish to answer.

QUESTIONS OR PROBLEMS?

You are encouraged to ask questions at any time during this study.

- For further information about the study, please contact Candice Nance at NanceC@smccd.edu or (650) 306-3497.
- If you have any concerns about the study, please contact Dr. Nikos Mourtos at Nikos.Mourtos@sjcc.edu or (408) 924-3867. At Cañada College, please contact Dr. Alexander Claxton, Planning and Research Analyst at claxtona@smccd.edu or (650) 306-3198.
- For questions about participants’ rights or if you feel you have been harmed in any way by your participation in this study, please contact Dr. Mohamed Abousalem, Vice President of Research and Innovation, San Jose State University, at (408) 924-2479.

AGREEMENT TO PARTICIPATE IN THE ONLINE SURVEY

Your signature below indicates your willingness to participate in the study. Please keep a copy of this document for your records.

I understand the study described above and have been given the opportunity to ask questions. I am 18 years or older and I agree to participate.

Participant Signature

_________________________  _______________________  ________________
Participant’s Name (First & Last)  Participant’s Signature  Date

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Appendix F: Consent Form - Minor

A Request for Your Child’s or Ward’s Participation in Research

A Universal Design for Learning (UDL) Mixed Methods Case Study: Faculty Implementation & Student Engagement in an Online Community College Course

Candice Nance, Doctoral Candidate, and Dr. Nikos Mourtos, Faculty Advisor
San Jose State University, Doctorate in Education Program

Your child or ward has the opportunity to voluntarily participate in this research study. Please take the time to decide if you want your child or ward to participate.

WHY IS THIS STUDY BEING DONE?

The purpose of this study is to investigate the implementation of Universal Design for Learning (UDL) in online business courses and the impact it may have on student learning and engagement.

WHAT DOES THIS STUDY ASK STUDENTS TO DO?

All students in this introduction to business course are invited to participate in the research study through an email invitation. Participating in the post-survey is voluntary and not required as a part of your participation in this course. Participation or non-participation in this survey will not impact your grade in this course. Students who participate will complete a post-survey in Qualtrics. The survey should take between 10 – 15 minutes to complete. Research participants can complete the survey on a computer or mobile device. The purpose of this study is to advance research in the field of online learning and will not be used to evaluate your professor’s performance. Student participants are encouraged to be honest in their responses since this survey will not impact your professor.

The research study will also collect examples of student work in the class, such as the student questionnaire and student reflection assignments, as well as Canvas XML user data, student demographics, and student course grades. Students who do not opt-in to participate are still required to complete the student questionnaire and reflection assignments in the course.

CONFIDENTIALITY

The Cañada College Office of Planning, Research, and Institutional Effectiveness (PRIE) will administer the post-survey and merge all data into one de-identified database for analysis by the faculty researcher. All reported information will be confidential and no personally identifying information will be reported in the final study. When data is reported, it will be in aggregate form with no identifiable information included.
WHAT ARE THE RISKS AND BENEFITS OF PARTICIPATING?

There are no identifiable risks associated with this study. By participating in this study, your child or ward may help improve the instructional techniques used in business classes online.

COMPENSATION

Students may participate in this research study for seven points of extra credit. If a student does not want to participate in the research study, students may complete an alternative assignment for equal course extra credit by reading a current Wall Street Journal article and writing a report summarizing the article and applying concepts from the course to the article content. Details about the alternative extra credit assignment will be posted in Canvas. Students will submit the alternative extra credit to Professor Gampi Shankar at shankarg@smccd.edu. Students may also choose not to participate in either extra credit opportunity.

WHAT ARE MY RIGHTS AS A PARTICIPANT?

Your child or ward’s participation in this study is entirely voluntary, and you may refuse to have them participate. If you agree for your child or ward to participate, you have the right to stop at any time with no penalty. Your child or ward will also have the right to skip survey questions that they do not wish to answer.

QUESTIONS OR PROBLEMS?

You are encouraged to ask questions at any time during this study.

- For further information about the study, please contact Candice Nance at NanceC@smccd.edu or (650) 306-3497.
- If you have any concerns about the study, please contact Dr. Nikos Mourtos at Nikos.Mourtos@sjcc.edu or (408) 924-3867. At Cañada College, please contact Dr. Alexander Claxton, Planning and Research Analyst at claxtona@smccd.edu or (650) 306-3198.
- For questions about participants’ rights or if you feel you have been harmed in any way by your participation in this study, please contact Dr. Mohamed Abousalem, Vice President of Research and Innovation, San Jose State University, at (408) 924-2479.

AGREEMENT TO PARTICIPATE IN THE RESEARCH STUDY

Parent/Guardian Signature

Your signature indicates that you voluntarily agree to allow your child to be part of the study, that the details of the study have been explained to you and your child, that you have been given time to read this document, and for your questions to be answered. Please keep a copy of this document for your records.

Parent or Guardian Name

<table>
<thead>
<tr>
<th>Name of Child or Minor</th>
<th>Parent or Guardian Name (Printed)</th>
</tr>
</thead>
</table>

Relationship

<table>
<thead>
<tr>
<th>Relationship to Child or Minor</th>
<th>Parent or Guardian Signature</th>
<th>Date</th>
</tr>
</thead>
</table>
Appendix G: BUS 100 Course Outline of Record

Official Course Outline

1. COURSE ID: BUS 100  TITLE: Introduction to Business  C-ID: BUS 110
   Units: 3.0 units  Hours/Semester: 48.0-54.0 Lecture hours; and 96.0-108.0 Homework hours
   Method of Grading: Letter Grade Only
   Recommended Preparation:
      Eligibility for MATH 110.
      Eligibility for READ 836 and ENGL 836, or ENGL 847 or ESL 400.

2. COURSE DESIGNATION:
   Degree Credit
   Transfer credit: CSU; UC
   AA/AS Degree Requirements:
      California GE Area D: SOCIAL SCIENCES: Social Institutions:
      CSU GE:
      CSU GE Area D: SOCIAL SCIENCES: DSI - Social Institutions

3. COURSE DESCRIPTIONS:
   Catalog Description:
      Introduction to American business in the global environment providing an overview of economics, ethics,
      management, marketing, operations, information management, accounting, and finance.
   Schedule of Classes Description
      Introduction to American business in the global environment providing an overview of economics, ethics,
      management, marketing, operations, information management, accounting, and finance.

4. STUDENT LEARNING OUTCOME(S) (SLO(S)):
   Upon successful completion of this course, a student will meet the following outcomes:
   1. Demonstrate an understanding of the major disciplines of business and its terminology.
   2. Successfully work in a diverse group setting using current business processes and technologies to solve
      everyday business problems.
   3. Appraise ethical and social responsibility issues involved in the current domestic and global business
      environment and determine the best course of action.

5. SPECIFIC INSTRUCTIONAL OBJECTIVES:
   Upon successful completion of this course, a student will be able to:
   1. Understand economic indicators and the different types of economic systems.
   2. Define business ethics and apply critical thinking skills to determine the best course of action in ethical
      dilemmas.
   3. Understand business in a global context with emphasis on trade, culture, and political and economic
      environments.
   4. Identify and choose appropriate forms of business ownership.
   5. Examine entrepreneurial opportunities and describe key elements for success.
   6. Explain the four functions of management and leadership styles.
   7. Discuss how traditional and contemporary motivational theories and industrial psychology has changed the
      work environment since the early twentieth century.
   8. Understand the purpose of human resources.
   9. Explain components of marketing and how these can affect an organization's success.
   10. Understand the operations process in a manufacturing and service environment.
   11. Understand the impact of online business technologies and information systems.
   12. Describe the role of accounting and evaluate basic financial statements.
   13. Explain how to manage financial resources in business and demonstrate how fiscal and monetary policy is
       used in the U.S.
   14. Examine personal finance including debt, equity, credit score, and interest rates.

6. COURSE CONTENT:
   Lecture Content:
   1. Business Basics
      A. The business landscape
B. Common business challenges and opportunities
C. Types of businesses

2. Economics and Banking
   A. The basics of economics
   B. Determining price: supply and demand
   C. Degrees of competition
   D. Economic indicators
   E. Government and the economy

3. Ethics in Business
   A. Ethics defined
   B. Personal ethics versus business ethics
   C. Corporate social responsibility

4. Business in a Global Economy
   A. Globalization
   B. International trade
   C. Free trade and protectionism
   D. Conducting business internationally
   E. Economic factors and challenges

5. Small Business and the Entrepreneur
   A. Small business and the economy
   B. Small business and the workforce
   C. Entrepreneurs and the American dream
   D. Buying franchises and existing businesses
   E. The risks of small business
   F. Financial considerations

6. Forms of Business Ownership
   A. Sole proprietorships
   B. Partnerships
   C. Corporations
   D. Not-for-profit and cooperatives
   E. Mergers and acquisitions

7. Business Management and Organization
   A. The foundations of management
   B. Functions of management
      a. Planning
      b. Organizing
      c. Controlling
   C. Teamwork
      a. Advantages of teams in the workplace
      b. Disadvantages of teams in the workplace
      c. Best practices for teams

8. Motivation, Leadership, and Teamwork
   A. Motivation
      a. Personal motivation
      b. Motivating employees
      c. Traditional theories of motivation
      d. Motivational theories in the modern workplace
   B. Leadership
      a. Traits of leadership
      b. Leadership and corporate culture
   C. Teamwork
      a. Advantages of teams in the workplace
      b. Disadvantages of teams in the workplace
      c. Best practices for teams

   A. Managing staffing needs
   B. Hiring
   C. Training and evaluating employees
   D. Compensating, scheduling, promoting, and terminating employees
   E. Managing workplace diversity
   F. Labor and union issues

10. Online Business and Technology
    A. Online business
    B. Technology in business
11. Production, Operations, and the Supply Chain
   A. Production of goods and services
   B. Operations management
   C. Supply chain management
   D. Production management
   E. Operations control

12. Principles of Marketing
   A. Marketing fundamentals
   B. Marketing tactics
   C. The marketing environment
   D. Marketing research and planning
   E. Consumer behavior

13. Product Development and Pricing Strategies
   A. Developing goods and services
   B. Branding
   C. New product development
   D. Pricing goods and services

14. Promotion and Distribution
   A. Promotion and the promotional mix
   B. Advertising and public relations
   C. Personal selling and sales promotion
   D. Distribution: Marketing intermediaries

15. Financing and Tracking Business Operations
   A. Financial management
   B. Financing small business activities
   C. Debt and equity
   D. Accounting functions
   E. Financial statements

16. Investment Opportunities in the Securities Market
   A. Investment fundamentals
   B. Investing in stocks
   C. Investing in bonds
   D. Investing in mutual funds and other opportunities

Honors Content:
1. This course may be offered at an honors level. While the class content remains the same and students can expect to achieve the same student learning outcomes, the students experience in an honors section may be significantly different in the following ways:
   A. Topics covered with greater breadth and depth than non-honors, lower division course work;
   B. Research expectations are beyond non-honors course assignments;
   C. Extensive reliance on primary source documents and more advance research methodology is required;
   D. Greater critical thinking and extended analysis than in non-honors course work; and,
   E. Creative projects and/or documentation beyond non-honors course requirements

   The specific details about how honors-level work is implemented in this course are included in the Honors Course Addendum.

7. REPRESENTATIVE METHODS OF INSTRUCTION:
   Typical methods of instruction may include:
   A. Lecture
   B. Critique
   C. Discussion
   D. Guest Speakers

8. REPRESENTATIVE ASSIGNMENTS
   Representative assignments in this course may include, but are not limited to the following:

   Writing Assignments:
   - One short paragraph writing assignment per term approximately 750 - 1000 words summarizing and reflecting on a topic relevant to a course topic. For example, students might be asked to summarize and reflect on the impact of e-commerce in business.
• A minimum of one analytical essay per term 3 - 5 pages in length on the topics assigned, which is related to the discussion in class during the week. For example, students might be asked to develop a business plan for a current company.

Reading Assignments:
• One chapter per week from text of approximately 20-30 pages.
• Biweekly readings of approximately 1 - 2 articles from the Wall Street Journal and other publications.

Other Outside Assignments:
• None.

To be Arranged Assignments:
• Not applicable.

9. REPRESENTATIVE METHODS OF EVALUATION
Representative methods of evaluation may include:
A. Class Participation
B. Class Work
C. Exams/Tests
D. Group Projects
E. Homework
F. Oral Presentation
G. Papers
H. Projects
I. Quizzes

10. REPRESENTATIVE TEXT(S):
Possible textbooks include:

Other:
A. Supplementary materials include business publications and periodicals, e.g., Wall Street Journal.

Origination Date: January 2019
Curriculum Committee Approval Date: February 2019
Effective Term: Fall 2019
Course Originator: Candice Nance

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# Appendix H: Items Blueprint

<table>
<thead>
<tr>
<th>Learner Variability Personas (LVPs)</th>
<th>Student Questionnaire</th>
<th>Reflection Journals</th>
<th>Exam Exit Slips</th>
<th>Post-survey</th>
<th>Demographic Data</th>
<th>Canvas XML Data</th>
<th>Total Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-generation students</td>
<td></td>
<td></td>
<td>QQ</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Students with outside demands of 20+ hours per week</td>
<td>Working: Q14A, Q14B, Q14C, Q14D Caregiving: Q15A, Q15B, Student athlete: Q16A, Q16B</td>
<td></td>
<td>QQ</td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>English Learners</td>
<td>Q17A, Q17B</td>
<td></td>
<td>QQ</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Students with disabilities</td>
<td>Q30A, Q30B, Q30C</td>
<td></td>
<td>QQ</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Concurrent Enrollment</td>
<td>Q02b</td>
<td></td>
<td>QQ</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>QQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UDL</td>
<td></td>
<td></td>
<td>QQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UDL P1 Checkpoints 1, 2, &amp; 3</td>
<td></td>
<td></td>
<td>QQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UDL P2 Checkpoints 4, 5, &amp; 6</td>
<td></td>
<td></td>
<td>QQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UDL P3 Checkpoints 7, 8, &amp; 9</td>
<td></td>
<td></td>
<td>QQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adapted from [reference](https://example.com)
<table>
<thead>
<tr>
<th>Student Engagement</th>
<th>Questions</th>
<th>Scale</th>
<th>CR Notes</th>
<th>UDL 9.3: Q21D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Engagement</td>
<td>Q07A, Q07B</td>
<td>R1.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Engagement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student Engagement</td>
<td>Q08A, Q08B</td>
<td>R1.4</td>
<td>R.ST.6, R6.5</td>
<td>Q15</td>
</tr>
<tr>
<td>Social Engagement: Sense of Belonging</td>
<td>Q27A-R, Q28, Q28Y (CR), Q28N (CR), Q29, Q29Y (CR), Q29N (CR)</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student Engagement</td>
<td>Q09, Q10, Q11, Q12</td>
<td>R1.1 (CR)</td>
<td>Q01A, Q01B, Q01C, Q02A, Q02B, Q03, Q04</td>
<td>4</td>
</tr>
<tr>
<td>Cognitive Engagement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavioral Engagement</td>
<td>R1.1 (CR)</td>
<td>Q05, Q06, Q07, Q08</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Collaborative Engagement</td>
<td>Q13, Q14, Q16, Q17</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional Engagement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revised Scale of Transactional Distance (RSTD)</td>
<td>TDST - Q19A, TDSS - Q19B, TDSC - Q19C, TDSI - Q19D, Q26A</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality Control</td>
<td>Q01, Q02</td>
<td>Q18</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

**Total** 17 12 2 67 3 1 101
## Appendix I: Item Stems Design

### Behavioral Engagement Stems

<table>
<thead>
<tr>
<th>How well do the following statements describe your work in this class?</th>
</tr>
</thead>
<tbody>
<tr>
<td>[OSE 1] I made sure to study on a regular basis.</td>
</tr>
<tr>
<td>[OSE 2] I put forth effort into the course.</td>
</tr>
<tr>
<td>[OSE 3] I stayed up on the readings.</td>
</tr>
<tr>
<td>Adapted from Online Student Engagement (OSE) Scale</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How often did you do the following?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log into the course each week via a <strong>computer</strong>?</td>
</tr>
<tr>
<td>Log into the course each week via a <strong>mobile device, such as a smartphone or tablet</strong>?</td>
</tr>
</tbody>
</table>

| How many **live** Zoom sessions did you **attend** during the course? |

| How many **recorded** Zoom sessions did you **watch** during the course? |

### Collaborative Engagement Stems

| On average, how often did you contact **your professor**? |

| On average, how often did you contact **other students in the course**? |

| How often did you **meet online with your professor during office hours**? |
| Adapted from Mourtos (2010) |

| How often did you **meet online with other students for this course**, such as breakout rooms, group work, or study groups? |
| Adapted from Mourtos (2010) |
### Cognitive Engagement Stems

<table>
<thead>
<tr>
<th>Stem</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>I thought critically about the concepts covered in class.</td>
<td>Adapted from Student Course Cognitive Engagement Instrument (SCCEI)</td>
</tr>
<tr>
<td>I thought about previous concepts covered in the course.</td>
<td>Adapted from Student Course Cognitive Engagement Instrument (SCCEI)</td>
</tr>
<tr>
<td>I connected current concepts with previous course content.</td>
<td>Adapted from Student Course Cognitive Engagement Instrument (SCCEI)</td>
</tr>
<tr>
<td>I considered how multiple ideas or concepts relate.</td>
<td>Adapted from Student Course Cognitive Engagement Instrument (SCCEI)</td>
</tr>
</tbody>
</table>

### Emotional Engagement Stems

<table>
<thead>
<tr>
<th>Stem</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>I found that class assignments were full of meaning and purpose.</td>
<td>Utrecht Work Engagement Scale for Students (Smith, 2012)</td>
</tr>
<tr>
<td>I got carried away when I was working on class tasks and assignments.</td>
<td>Utrecht Work Engagement Scale for Students (Smith, 2012)</td>
</tr>
<tr>
<td>I am enthusiastic about this class.</td>
<td>Utrecht Work Engagement Scale for Students (Smith, 2012)</td>
</tr>
<tr>
<td>This class inspires me.</td>
<td>Utrecht Work Engagement Scale for Students (Smith, 2012)</td>
</tr>
</tbody>
</table>
### Social Engagement Stems

[OSE 14] I helped other students in class.

| Adapted from Online Student Engagement (OSE) scale |

A *sense of belonging* is defined as the feeling of acceptance and inclusion within a group of people.

Which of the following assignments contributed to your *sense of belonging* in the course? Select all that apply.

- Student questionnaire
- Course navigation tutorial
- Technology backup plan
- Student mixer: Introductions
- Assignment #0: Shark Tank presentations and peer review
- Assignment #1: Resume and peer review
- Assignment #2: Informational interview and peer review
- Assignment #3: Group project videos and peer review
- Reflection assignments
- Exams #1 - 3
- Exam exit tickets
- Office hours
- Reading textbook chapter content
- Reading lecture slides online
- Watching the video tutorials for each chapter
- Attending a live Zoom session
- Participating in a breakout room during a live Zoom session
- Watching a recording of a live Zoom session

Do you feel that this class provides a sense of community among students?

*If “yes:” Which aspects of the course helped create a sense of community among students?*

*If “no:” How could this course be changed to create a greater sense of community?*

Adapted from Mourtos (2010)
Did your instructor make you feel welcome in the class?  
How did your instructor make you feel welcome in class?  
How could your instructor make you feel more welcome in class?  

<table>
<thead>
<tr>
<th>Transactional Distance Stems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please rate the following statements where 1 = strongly disagree, and 5 = strongly agree.</td>
</tr>
<tr>
<td>[RSTD TDST] I feel connected to the instructor and can reach him or her in a timely manner.</td>
</tr>
<tr>
<td>[RSTD TDSS] I made connections with several of the students in this course.</td>
</tr>
<tr>
<td>[RSTD TDSC] I could easily access the content for this course.</td>
</tr>
<tr>
<td>[RSTD TDSI] I could easily navigate the online system for this course.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adapted from Mourtos (2010)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>UDL - P1 - Representation (1 - 3) Stems</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often have you experienced each of the following items during this course?</td>
</tr>
<tr>
<td>[UDL 1.2] I read the transcription while watching Zoom video recordings.</td>
</tr>
<tr>
<td>[UDL 1.2] I used the closed captions while watching the chapter content video tutorials.</td>
</tr>
<tr>
<td>[UDL 2.5] I utilized a variety of types of course materials for my learning, such as videos, lecture slides, or text-based reading.</td>
</tr>
<tr>
<td>[UDL 2.5] When studying chapter content in Canvas, I watched the optional chapter content video tutorials.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adapted from Zhang (2003)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>UDL - P2 - Action &amp; Expression (4 - 6) Stems</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often have you experienced each of the following items during this course?</td>
</tr>
<tr>
<td>[UDL 5.1] I communicated with my instructor through a variety of ways, such as the Canvas Inbox, during office hours, or during Zoom sessions.</td>
</tr>
<tr>
<td>[UDL 5.1] I referred back to previous announcements in Canvas as needed.</td>
</tr>
<tr>
<td>[UDL 5.1] When reading assignment instructions, I watched the embedded support videos related to the assignment.</td>
</tr>
<tr>
<td>[UDL 5.2] I used Canva for designing graphics.</td>
</tr>
<tr>
<td>[UDL 5.2] I used Grammarly for editing my writing.</td>
</tr>
<tr>
<td>[UDL 5.2] I used Slides Carnival for designing presentations.</td>
</tr>
<tr>
<td>[UDL 6.1] I used the course reading schedule to set appropriate goals for my work.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adapted from Smith (2012)</th>
</tr>
</thead>
</table>
[UDL 6.1] I used the weekly checklist announcement to set appropriate goals for my work.
[UDL 6.4] I received timely feedback on graded assignments from the instructor.
[UDL 6.4] I reviewed grading rubrics before submitting my assignments.
[UDL 6.4] I used the Canvas calendar feature to visualize course due dates.
[UDL 6.4] I used the Canvas “grades” page to monitor my progress in the class.
[UDL 6.4] I used the Canvas “grades” page “what-if” feature to estimate my grade in the course.

How often did you use the Canvas app to do the following?
[UDL 5.1] To email other students.
[UDL 5.1] To view course announcements.
[UDL 5.2] To submit assignments.
[UDL 6.4] To view instructor feedback.

**UDL - P3 - Engagement (7 - 9) Stems**

<table>
<thead>
<tr>
<th>How often have you experienced each of the following items during this course?</th>
</tr>
</thead>
<tbody>
<tr>
<td>[UDL 7.1] I used choices available for assignments, such as choice in topic, group selection, or submission type (such as a paper versus a video submission).</td>
</tr>
<tr>
<td>[UDL 7.2] Assignments allowed me to be my authentic self, such as my racial, cultural, ethnic, and gender identity.</td>
</tr>
<tr>
<td>[UDL 7.2] Assignments were relevant and valuable to my interest and goals.</td>
</tr>
<tr>
<td>[UDL 8.3] I completed assignments where I collaborated with other students in the course.</td>
</tr>
<tr>
<td>[UDL 8.3] I completed assignments where I peer-reviewed the work of others.</td>
</tr>
<tr>
<td>[UDL 8.3] I completed assignments where I worked on my own.</td>
</tr>
<tr>
<td>[UDL 8.4] Instructor feedback was informative and constructive, rather than comparative or competitive.</td>
</tr>
<tr>
<td>[UDL 9.1] My instructor provided words of encouragement for students to succeed in the course.</td>
</tr>
<tr>
<td>[UDL 9.3] I reflected on my progress and goals in class, such as through exam exit tickets or weekly reflection assignments.</td>
</tr>
</tbody>
</table>

**Disability Status for Students in Higher Education Stems**

Do you have a learning challenge that impacts your learning?
No, I do not have any learning challenges that impact my learning.
I don’t know.
Yes, I have learning challenges that affect my learning (includes both physical or mental health challenges, too).
Yes, I have a diagnosed learning deficit(s) or health condition but HAVE NOT registered with the Disability Resource Center (DRC) for accommodations.
Yes, I have a diagnosed learning deficit(s) or health condition and HAVE registered with the Disability Resource Center (DRC) for accommodations.
Other
I prefer not to say.

<table>
<thead>
<tr>
<th>Which of the following impacts your learning? (Select <strong>all</strong> that apply.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
</tr>
<tr>
<td>Attention deficit or hyperactivity disorder (ADD or ADHD)</td>
</tr>
<tr>
<td>Autism spectrum</td>
</tr>
<tr>
<td>Bipolar disorder</td>
</tr>
<tr>
<td>Chronic medical condition</td>
</tr>
<tr>
<td>Deaf or hard of hearing</td>
</tr>
<tr>
<td>Depression</td>
</tr>
<tr>
<td>Intellectual disability</td>
</tr>
<tr>
<td>Learning disability</td>
</tr>
<tr>
<td>Physical/motor impairment</td>
</tr>
<tr>
<td>Post-traumatic stress disorder (PTSD)</td>
</tr>
<tr>
<td>Schizophrenia</td>
</tr>
<tr>
<td>Speech or communication disorder</td>
</tr>
<tr>
<td>Traumatic or acquired brain injury</td>
</tr>
<tr>
<td>Vision impairment/blind</td>
</tr>
<tr>
<td>Other mental health diagnosis</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>I prefer not to say.</td>
</tr>
</tbody>
</table>

Adapted from National Survey of Student Engagement (NSSE) (2013) Q39a

Please describe how your disability or condition impacts your learning in an online class. If you do not wish to answer this question, please leave it blank.

Adapted from National Survey of Student Engagement (NSSE) (2013) Q39c
Appendix J: Instrument – Student Questionnaire

BLOCK_WELCOME

Q00_WELCOME [Text prompt]

Dear business student,

The goal of this student questionnaire is to learn more about your background so I can customize the course to the individual students in this session. Please take the time to answer questions completely and honestly.

Thank you for taking the time to answer this survey.

Sincerely,

Candice Nance, MBA
Assistant Professor, Business

Phone: (650) 306-3497 | nancecc@smccd.edu
Cañada College | Redwood City, CA
BLOCK_COURSE_ENROLLMENT

Transition Statement:
Introduction to Business Course:
Please carefully read each statement below and answer each question to the best of your ability.

Q01_ENROLL_SEMESTER [QUALITY CONTROL]
Which semester are you taking this course (BUS 100 - Introduction to Business)?

- Spring
- Summer
- Fall

Q02_ENROLL_DURATION [QUALITY CONTROL]
How long is the duration of this course (BUS 100 - Introduction to Business)?

- Entire semester course (16-week course)
- Half-semester course (8-week course)
- Accelerated course (6-week course)

[DISPLAY LOGIC: If they answer “6-week course” AND “spring” in Q01 AND Q02, then SHOW Q02a.]
[DISPLAY LOGIC: If they answer “8-week course” AND “fall” in Q01 AND Q02, then SHOW Q02a.]

Q02a_ENROLL_REASON_XCEL
Why did you choose to take an accelerated course? Select all that apply. [Multiple answers]
- I’m completing the 19-unit business administration certificate in 12-months.
- Traditional 16- to 18-week semesters are just too long.
- I like being able to focus on one class at a time.
- It was the only available option that fit my schedule.
- It was the only section open.
- I didn’t realize I was signing up for an accelerated course at the time.
- None of the above. [Exclusive answer]
- Other: [Allow text entry]
- I prefer not to say. [Exclusive answer]

[DISPLAY LOGIC: If they answer “summer” in Q01, then SHOW Q02b.]

Q02b_ENROLL_REASON_SUM
Why did you enroll in the summer session? Select all that apply. [Multiple answers]
- I am a community college student earning more credits towards my certificate of achievement
- I am a community college student earning more credits towards my associate’s degree
- I am a community college student earning more credits towards transferring to a four-year university
I am a student at a four-year university taking summer courses at the community college to go towards my university degree.
I am a high school student looking to boost my application to four-year universities.
I want to graduate from college on time.
I want to graduate early from college.
I am taking prerequisite courses for graduate school.
None of the above. [Exclusive answer]
Other: [Allow text entry]
I prefer not to say. [Exclusive answer]

**Q03_Enrolled_Units**
How many units are you currently enrolled in for this term? Include units from all colleges or universities you are enrolled in this semester if you are at more than one. (Please write just the number, such as 3, 6, 10, etc.)
[TEXT BOX, SINGLE LINE, VALIDATE - CONTENT TYPE: NUMBER, MIN = 0, MAX = 25]

**BLOCK_EXPERIENCE**

**Q04_Exper_College**
Which of the following best describes your status as a student?

A "college course" is at the community college or university level.

This is my first college course.
I have recently been enrolled in college.
It has been a while since I have been enrolled in college.
Other: [Allow text entry]

**Q05_Exper_Online**
What is your experience with online courses?

Online courses have no in-person requirements but may or may not require synchronous live sessions online. Select all that apply. [Multiple answers]

I have never taken an online course before. [Exclusive answer]
I have taken online courses in high school.
I have taken online courses through a community college.
I have taken online courses through a university.
I have taken online courses but NOT through a high school, college, or university.
Other: [Allow text entry]

[SKIP LOGIC: IF Q05 is "I have never taken an online course before.", SKIP Q06]

**Q06_Exper_Online_#**
How many online courses have you previously taken?

I have taken at least 1 course online.
I have taken 2 - 3 courses online.
I have taken 4 or more courses online.
Other: [Allow text entry]

[DISPLAY LOGIC: SHOW if Q05 is “I have taken online courses through a university.”]

Q07a. UNI SENSE. ENGAG
In thinking about the last course you took online at a university, how engaged did you feel in the online course?
Likert Scale Options:
- Not engaged
- Somewhat engaged
- Engaged
- Very engaged

[DISPLAY LOGIC: IF Q07a is “not engaged”, SHOW Q07b]

Q07b. UNI SENSE. ENGAG
In thinking about the last course you took online at a university, why did you feel not engaged?
Was it from some factor outside of the classroom, the instructor, the content, or the students in the online class?
[TEXT ENTRY = Multiple lines]

[DISPLAY LOGIC: SHOW if Q05 is “I Have taken online courses through a university.”]

Q08a. UNI SENSE. BELON
In thinking about the last course you took online at a university, how connected did you feel to others in the online course?
Likert Scale Options:
- Very disconnected
-Disconnected
- Somewhat disconnected
- Somewhat connected
- Connected
- Very connected

[DISPLAY LOGIC: IF Q08a is “very disconnected,” disconnected,” OR “somewhat disconnected,” SHOW Q08b]

Q08b. UNI SENSE. BELON
In thinking about the last course you took online at a university, why did you feel some degree of being disconnected from others in the online course?
[TEXT ENTRY = Multiple lines]
BLOCK_TECHNOLOGY

Q09_TECH_DEVICES
Please select all of the devices that you could have access to during this course. [Multiple answers]
- Laptop/computer with webcam
- Laptop/computer without webcam
- Tablet with webcam
- Tablet without webcam
- Smartphone with camera
- Smartphone without camera
- Internet at home
- Wifi hotspot
- Printer
- Headphones
- None of the above [Exclusive answer]
- Other: [Allow text entry]

Q10_TECH_EXPER
Indicate your experience level with each of the following types of technology.

If you are on a mobile device, you will need to use the drop-down arrows to respond to each item. [Matrix table]
Likert scale options:
- No experience
- Minimal experience
- Some experience
- Very experienced
- Canvas
- Microsoft Word
- PowerPoint
- Excel
- Google Docs
- Google Slides
- Google Sheets
- Creating PDFs
- Zoom video conferencing
- Making a video
- Editing a video
- Uploading a video online (YouTube, Vimeo, etc.)
- Creating graphics, such as in Adobe software or via online websites such as Canva.com

Q11_TECH_METAINFO
Browser meta-information (no question, just data collection)
BLOCK_STUDENT_SUPP

Q12. SUPPORT_MTGS
Availability for Meetings Online:
Below is a list of possible times that your instructor could offer live video support sessions, such as for a course orientation, supplemental micro-lectures, or office hours. These would be optional support sessions that would not be required but would be recorded for on-demand access after the live session concludes.

Please select all of the following times that you could be available during an average week to meet online for optional live online sessions for this course.

If you are on a mobile device, you will need to use the drop-down arrows to respond to each item. [Matrix table; Likert; Multiple answers]
Likert scale options:
8 AM
9 AM
10 AM
11 AM
12 NOON
1 PM
2 PM
3 PM
4 PM
5 PM
6 PM
7 PM
8 PM
9 PM
Mondays
Tuesdays
Wednesdays
Thursdays
Fridays
Saturdays
Sundays

Q13. SUPPORT_INSTR
What can your instructor do to support your success in this course? Check all that apply. [Multiple answers]
- Live Zoom sessions for a course orientation at the start of the course
- Live Zoom sessions for lectures on a weekly basis
- Live Zoom sessions to learn about signature assignments
- Live Zoom sessions for office hours
- Offer pre-recorded videos to watch on-demand when my schedule allows
Caption videos so I can read the words as the video is playing
Find creative ways to connect me with other students in our class
Offer the ability to connect with other students and/or the professor on a texting app, such as WhatsApp, GroupMe, or Discord
Offer student choices in assignments, such as choices in the topic of an assignment or choices with how the assignment is submitted (i.e. paper, presentation, video, etc.)
Offer multiple attempts on quizzes or tests
Offer the ability to access the course on the go on my mobile device
None of the above [Exclusive answer]
Other: [Allow text entry]

BLOCK STUDENT LEARNER VARIABILITY PERSONA DATA

Transition Statement:
The following questions focus on your commitments both within and outside of college. Please read each statement carefully before answering. All information will be kept confidential.

Q14a EMPLOY STATUS
Are you currently employed?
Yes
No
I prefer not to say.

Q14b EMPLOYMENT HRS
On average, how many hours per week do you currently work?
[DISPLAY LOGIC: Q14a = Yes]
1 - 5 hours
6 - 10 hours
11 - 15 hours
16 - 20 hours
21 - 25 hours
26 - 30 hours
31 - 35 hours
36 - 40 hours
41+ hours
I prefer not to say.

Q14c EMPLOYMENT YRS
How many years of working experience do you have? Include both full-time or part-time work. Do not include volunteer work. [SKIP LOGIC = If Q14c = None, SKIP to Q15a]
None
Less than one year
1 - 2 years of experience
3 - 5 years of experience
6 - 10 years of experience
11 - 15 years of experience
16 - 20 years of experience
More than 20 years of experience
I prefer not to say.

Q14d_EMPLOYMENT_TYPE
What industries have you worked in?
[TEXT ENTRY = Multiple lines]

Q15a_CAREGIVING
Do you currently take care of family members, including children, grandchildren, or adults?
   Yes
   No

Q15b_CAREGIVING_HRS
On average, how many hours per week do you currently take care of family members?
[DISPLAY LOGIC: 15a = Yes]
   1 - 5 hours
   6 - 10 hours
   11 - 15 hours
   16 - 20 hours
   21 - 25 hours
   26 - 30 hours
   31 - 35 hours
   36 - 40 hours
   41+ hours

Q16a_STUDENT_ATHELTE
Are you a student-athlete on a team sponsored by the college athletics department?
   Yes
   No

Q16b_STUDENT_ATHELTE_HRS
On average, how many hours per week do you currently participate in student-athlete activities?
[DISPLAY LOGIC = Q16a = Yes]
   1 - 5 hours
   6 - 10 hours
   11 - 15 hours
   16 - 20 hours
   21 - 25 hours
   26 - 30 hours
   31 - 35 hours
   36 - 40 hours
41+ hours

BLOCK_DEMOGRAPHIC_DATA

Q17a_LANGUAGE_PRIME
What is your primary language (i.e., the language you are most fluent in)? [SKIP LOGIC: Q17a = English, SKIP TO Next Block]
- English
- Spanish
- Mandarin
- Cantonese
- Filipino
- Other: [Allow text entry]
  - I prefer not to say.

Q17b_LANGUAGE_PROFIC [Adopted from U.S. Census]
How proficient are you in reading and writing in English at a college level?
- Not very proficient
- Slightly proficient
- Somewhat proficient
- Moderately proficient
- Very proficient

BLOCK_INTERESTS

Q18_INTERESTS
What interests do you have outside of class? Hobbies, activities, volunteer work, etc.
[TEXT ENTRY = ESSAY TEXT BOX]

Q19_ANYTHING_ELSE
Is there anything else you would like for me to know about you?
[TEXT ENTRY = ESSAY TEXT BOX]
End of Survey Message

Thank You!
Thank you for submitting your student questionnaire submission. You do not need to submit anything within Canvas. I will manually pull a list of names with completed surveys and allocate course credit within Canvas.

Sincerely,
Professor Nance
## Appendix K: Instrument – Student Reflections

### Reflection Assignment #1

<table>
<thead>
<tr>
<th>Label</th>
<th>Question Stem</th>
<th>Question Purpose</th>
<th>Answer Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1.1</td>
<td>Describe how you interacted with the course this week.</td>
<td>Engagement - Course</td>
<td>Constructed Response</td>
</tr>
<tr>
<td>R1.2</td>
<td>What did you learn this week?</td>
<td>Instructional Planning</td>
<td>Constructed Response</td>
</tr>
<tr>
<td>R1.3</td>
<td>Did you attend a live Zoom orientation session since the start of the course?</td>
<td>Instructional Planning</td>
<td>Yes/No</td>
</tr>
<tr>
<td>R1.4</td>
<td>Now that you have completed your first week in the course, how connected do you feel to others in the course?</td>
<td>Sense of Belonging</td>
<td>Likert (6 points)</td>
</tr>
</tbody>
</table>

### Reflection Assignment #2

<table>
<thead>
<tr>
<th>Label</th>
<th>Question Stem</th>
<th>Question Purpose</th>
<th>Answer Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>R3.1</td>
<td>The term <em>sense of belonging</em> refers to when a person feels connected to their community. As a student in an online college course, what would make you feel a strong sense of belonging in the class? Please be as detailed as possible.</td>
<td>Sense of Belonging</td>
<td>Constructed Response</td>
</tr>
<tr>
<td>R3.2</td>
<td>This week you learned about management, organization, and production/operations. If you were to rank which chapter was the most interesting to you (1 = most interesting, 3 = least interesting), how would you rank them? Why?</td>
<td>Instructional Planning</td>
<td>Constructed Response</td>
</tr>
<tr>
<td>R3.3</td>
<td>Next week, we will be covering a chapter on motivating employees (chapter 10), human resource (HR) management (chapter 11), and marketing (chapter 13). In thinking ahead (and assuming you haven't read ahead yet), which chapter do you think will be the most relevant to you and why?</td>
<td>Instructional Planning</td>
<td>Constructed Response</td>
</tr>
<tr>
<td>R3.4</td>
<td>Is there anything I can help you with or change in the course to help you be more successful?</td>
<td>Open-Ended</td>
<td>Constructed Response</td>
</tr>
</tbody>
</table>
Reflection Assignment #3

<table>
<thead>
<tr>
<th>Label</th>
<th>Question Stem</th>
<th>Question Purpose</th>
<th>Answer Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>R5.1</td>
<td>Out of all the chapters that we have covered so far in the course, which</td>
<td>Instructional Planning</td>
<td>Constructed Response</td>
</tr>
<tr>
<td></td>
<td>chapter did you find the most interesting? Why?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R5.2</td>
<td>What skills have you learned in this class that you want to transfer to the</td>
<td>Relevancy</td>
<td>Constructed Response</td>
</tr>
<tr>
<td></td>
<td>workplace?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R5.3</td>
<td>In our remaining time for this course, what do you have lingering that you</td>
<td>Instructional Planning</td>
<td>Constructed Response</td>
</tr>
<tr>
<td></td>
<td>would still like to learn?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R5.4</td>
<td>Is there anything else that you'd like for me to know?</td>
<td>Open-Ended</td>
<td>Constructed Response</td>
</tr>
</tbody>
</table>

Reflection Assignment #4

<table>
<thead>
<tr>
<th>Label</th>
<th>Question Stem</th>
<th>Question Purpose</th>
<th>Answer Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>R6.1</td>
<td>What was the most challenging part of Assignment #3 for you? Why?</td>
<td>Instructional Planning</td>
<td>Constructed Response</td>
</tr>
<tr>
<td>R6.2</td>
<td>Did you or your teammates find any effective ways to work together as a</td>
<td>Instructional Planning</td>
<td>Constructed Response</td>
</tr>
<tr>
<td></td>
<td>virtual team? What tips would you have for other students working remotely in</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>virtual teams?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R6.3</td>
<td>How will you use what you have learned in this class in the future?</td>
<td>Relevancy</td>
<td>Constructed Response</td>
</tr>
<tr>
<td>R6.4</td>
<td>How relevant was the Assignment #3 group assignment for you?</td>
<td>Relevancy</td>
<td>Likert (5 points)</td>
</tr>
<tr>
<td>R6.5</td>
<td>Now that you have completed the Assignment #3 group assignment, how</td>
<td>Sense of Belonging</td>
<td>Likert (6 points)</td>
</tr>
<tr>
<td></td>
<td>connected do you feel to others in the course?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R6.6</td>
<td>Is there anything else you would like for me to know?</td>
<td>Open-Ended</td>
<td>Constructed Response</td>
</tr>
</tbody>
</table>
Reflection Assignment: Shark Tank Project

<table>
<thead>
<tr>
<th>Label</th>
<th>Question Stem</th>
<th>Question Purpose</th>
<th>Answer Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.ST.1</td>
<td>Describe how you contributed to the group project.</td>
<td>Instructional Planning</td>
<td>Constructed Response</td>
</tr>
<tr>
<td>R.ST.2</td>
<td>Describe how others contributed to the group project.</td>
<td>Instructional Planning</td>
<td>Constructed Response</td>
</tr>
<tr>
<td>R.ST.3</td>
<td>What was the most challenging part of this project for you? Why?</td>
<td>Instructional Planning</td>
<td>Constructed Response</td>
</tr>
<tr>
<td>R.ST.4</td>
<td>In thinking about your own experience working in this group, what skills would you like to approve upon so you can be a more effective group member?</td>
<td>Instructional Planning</td>
<td>Constructed Response</td>
</tr>
<tr>
<td>R.ST.5</td>
<td>How relevant was the Shark Tank group assignment for you?</td>
<td>Relevancy</td>
<td>Likert (5 points)</td>
</tr>
<tr>
<td>R.ST.6</td>
<td>Now that you have completed the Shark Tank group assignment, how connected do you feel to others in the course?</td>
<td>Sense of Belonging</td>
<td>Likert (6 points)</td>
</tr>
<tr>
<td>R.ST.7</td>
<td>Is there anything else you would like for me to know?</td>
<td>Open-Ended</td>
<td>Constructed Response</td>
</tr>
</tbody>
</table>

Reflection Assignment: Exam Exit Slip #1

<table>
<thead>
<tr>
<th>Label</th>
<th>Question Stem</th>
<th>Question Purpose</th>
<th>Answer Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEE.1.1</td>
<td>Which format of the textbook do you use? (Select all that apply)</td>
<td>Instructional Planning</td>
<td>Multiple selection</td>
</tr>
<tr>
<td>EEE.1.2</td>
<td>Which study techniques below did you use in preparation for the exam? (Select all that apply)</td>
<td>Instructional Planning</td>
<td>Multiple selection</td>
</tr>
<tr>
<td>EEE.1.3</td>
<td>What was your score on your exam? (For instance, write &quot;12&quot; if you scored 12 out of 15 on the exam.)</td>
<td>Instructional Planning</td>
<td>Numerical</td>
</tr>
<tr>
<td>EEE.1.4</td>
<td>How satisfied are you with your score on the exam? (1=Not satisfied, 6 = Very satisfied)</td>
<td>Instructional Planning</td>
<td>Likert (6 points)</td>
</tr>
<tr>
<td>EEE.1.5</td>
<td>How relevant was this exam for you?</td>
<td>Relevancy</td>
<td>Likert (5 points)</td>
</tr>
<tr>
<td>EEE.1.6</td>
<td>Is there anything else you would like for me to know?</td>
<td>Open-Ended</td>
<td>Constructed Response</td>
</tr>
</tbody>
</table>
## Reflection Assignment: Exam Exit Slip #2

<table>
<thead>
<tr>
<th>Label</th>
<th>Question Stem</th>
<th>Question Purpose</th>
<th>Answer Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEE.2.1</td>
<td>What was your score on exam #2? (Out of 30 points possible.)</td>
<td>Instructional Planning</td>
<td>Numerical</td>
</tr>
<tr>
<td>EEE.2.2</td>
<td>How satisfied are you with your performance on the exam? (1 = not satisfied, 5 = very satisfied)</td>
<td>Instructional Planning</td>
<td>Likert (5 points)</td>
</tr>
<tr>
<td>EEE.2.3</td>
<td>Select each activity you did as part of preparing for the exam. (Check all that apply.)</td>
<td>Instructional Planning</td>
<td>Multiple selection</td>
</tr>
<tr>
<td>EEE.2.4</td>
<td>How relevant was this exam for you?</td>
<td>Relevancy</td>
<td>Likert (5 points)</td>
</tr>
<tr>
<td>EEE.2.5</td>
<td>In your opinion, which study strategies worked best for you?</td>
<td>Instructional Planning</td>
<td>Constructed Response</td>
</tr>
<tr>
<td>EEE.2.6</td>
<td>Write down at least three things you will do differently next time in preparing. Be specific. For example, will you spend more time, start your preparation earlier, change a specific study habit, try a new one (if so, try to name it), sharpen some other skill (if so, name it), participate in more review opportunities or something else?</td>
<td>Instructional Planning</td>
<td>Constructed Response</td>
</tr>
<tr>
<td>EEE.2.7</td>
<td>Is there anything else you would like for me to know?</td>
<td>Open-Ended</td>
<td>Constructed Response</td>
</tr>
</tbody>
</table>
Appendix L: Instrument – Student Survey

BLOCK_ENGAGE_BEHAVIORAL_CANVAS

Transition Statement:
Please answer the following questions to the best of your ability.

Q01_OSE [Adapted from OSE scale]
How well do the following statements describe your work in this class?

If you are on a mobile device, you will need to use the drop-down arrows to respond to each item.

CODING RULES/VALUES: [Never, Sometimes, Half of the time, Most of the time, All of the time]

[OSE 1] I made sure to study on a regular basis.
[OSE 2] I put forth effort into the course.
[OSE 3] I stayed up on the readings.

Q02_LOGIN_FREQ_COMP
How often did you do the following?

If you are on a mobile device, you will need to use the drop-down arrows to respond to each item.

CODING RULES/VALUES: [Never, Less than once per week, Once per week, Several times per week, Once per day, Several times per day]

Log into the course each week via a computer?
Log into the course each week via a mobile device, such as a smartphone or tablet?

Q03_ZOOM_SYNC [UDL 2.5]
How many LIVE Zoom sessions did you ATTEND during the course?

[Text Entry: Validation = Number, Minimum = 0, Maximum = 25]

Q04_ZOOM_ASYNC [UDL 2.5]
How many RECORDED Zoom sessions did you WATCH during the course?

[Text Entry: Validation = Number, Minimum = 0, Maximum = 25]
BLOCK_ENGAGE_COLLABORATIVE

Q05_COLLAB_INBOXPROF
On average, how often did you contact your professor?

Never
Less than once per week
Once per week
Several times per week
Once per day
Several times per day

Q06_COLLAB_INBOXPEER
On average, how often did you contact other students in the course?

Never
Less than once per week
Once per week
Several times per week
Once per day
Several times per day

Q07_COLLAB_OFFICE_HR [Adopted from Mourtos, IJEE study]
How often did you meet online with your professor during office hours?

Never
1 or 2 times
3 to 4 times
5 or more times

Q08_COLLAB_GROUP_WK [Adopted from Mourtos, IJEE study]
How often did you meet online with other students for this course, such as breakout rooms, group work, or study groups?

Never
1 or 2 times
3 to 4 times
5 or more times

18
**BLOCK_ENGAGE_COGNITIVE**

**Q09_COG_CRITICAL** [Adapted from SCCEI]
I thought critically about the concepts covered in class.
- Never
- Rarely
- Sometimes
- Often
- Always

**Q10_COG_CONCEPTS_PRE** [Adapted from SCCEI]
I thought about previous concepts covered in the course.
- Never
- Rarely
- Sometimes
- Often
- Always

**Q11_COG_CONCEPTS_CON** [Adapted from SCCEI]
I connected current concepts with previous course content.
- Never
- Rarely
- Sometimes
- Often
- Always

**Q12_COG_CONCEPTS_MUL** [Adapted from SCCEI]
I considered how multiple ideas or concepts relate.
- Never
- Rarely
- Sometimes
- Often
- Always
BLOCK ENGAGE EMOTIONAL

Q13 EMO PURPOSE [Adapted from UWES]
I found that class assignments were full of meaning and purpose.
  Never
  Rarely
  Sometimes
  Often
  Always

Q14 EMO CARRIED [Adapted from UWES]
I got carried away when I was working on class tasks and assignments.
  Never
  Rarely
  Sometimes
  Often
  Always

Q15 SOCIAL HELP OTHR [Adapted from OSE Scale] [OSE 14]
I helped other students in class.
  Never
  Rarely
  Sometimes
  Often
  Always

Q16 EMO ENTHUSIASM [Adapted from UWES]
I am enthusiastic about this class.
  Never
  Rarely
  Sometimes
  Often
  Always

Q17 EMO INSPIRE [Adapted from UWES]
This class inspires me.
  Never
  Rarely
  Sometimes
  Often
  Always
Q18 QUALITY_CONTROL
This question is a little different. While most people carefully read and respond to the questions in surveys, some do not. To verify that you have read this question carefully, please select the second response from the list below.

- Extremely important
- Very important
- Somewhat important
- Not at all important
- Don’t know

---

BLOCK_RSTD

Q19_RSTD_MOD [Adapted from Zhang’s scale of transactional distance]
Please rate whether you agree or disagree with the following statements.

If you are on a mobile device, you will need to use the drop-down arrows to respond to each item.

[REPEAT HEADERS = REPEAT]
CODING RULES/VALUES: [1 = Strongly disagree, 2 = Disagree, 3 = Agree, 4 = Strongly agree]

[RSTD TDST] I feel connected to the instructor and can reach him or her in a timely manner.
[RSTD TDSS] I made connections with several of the students in this course.
[RSTD TDSC] I could easily access the content for this course.
[RSTD TDSI] I could easily navigate the online system for this course.
BLOCK UDL

Transition Statement:
Introduction to Business Course:
The following section consists of multiple parts. Please read each question and statement carefully before answering.

Q20 UDL_ACCESS CONTENT [Adapted from Smith et al., 2012]
How often have you experienced each of the following items during this course?

If you are on a mobile device, you will need to use the drop-down arrows to respond to each item.

[REPEAT HEADERS = REPEAT]
CODING RULES/VALUES: [Never, Rarely, Sometimes, Most of the time, Always]

[UDL 2.5] I utilized a variety of types of course materials for my learning, such as videos, lecture slides, or text-based reading.
[UDL 5.1] When reading assignment instructions, I watched the embedded support videos related to the assignment.
[UDL 2.5] When studying chapter content in Canvas, I watched the optional chapter content video tutorials.
[UDL 1.2] I used the closed captions while watching the chapter content video tutorials.
[UDL 1.2] I read the transcription while watching Zoom video recordings.

Q21 UDL GOALS [Adapted from Smith et al., 2012]
How often have you experienced each of the following items during this course?

If you are on a mobile device, you will need to use the drop-down arrows to respond to each item.

[REPEAT HEADERS = REPEAT]
CODING RULES/VALUES: [Never, Rarely, Sometimes, Most of the time, Always]

[UDL 6.1] I used the course reading schedule to set appropriate goals for my work.
[UDL 6.1] I used the weekly checklist announcement to set appropriate goals for my work.
[UDL 6.4] I used the Canvas calendar feature to visualize course due dates.
[UDL 9.3] I reflected on my progress and goals in class, such as through exam exit tickets or weekly reflection assignments.

[PAGE BREAK]
Q22. UDL COMMUNICATION [Adapted from Smith et al., 2012]  
How often have you experienced each of the following items during this course?

If you are on a mobile device, you will need to use the drop-down arrows to respond to each item.

[REPEAT HEADERS = REPEAT]  
CODING RULES/VALUES: [Never, Rarely, Sometimes, Most of the time, Always]

[UDL 5.1] I referred back to previous announcements in Canvas as needed.
[UDL 5.1] I communicated with my instructor through a variety of ways, such as the Canvas Inbox, during office hours, or during Zoom sessions.
[UDL 9.1] My instructor provided words of encouragement for students to succeed in the course.
[UDL 8.4] Instructor feedback was informative and constructive, rather than comparative or competitive.

Q23. UDL GRADES [Adapted from Smith et al., 2012]  
How often have you experienced each of the following items during this course?

If you are on a mobile device, you will need to use the drop-down arrows to respond to each item.

[REPEAT HEADERS = REPEAT]  
CODING RULES/VALUES: [Never, Rarely, Sometimes, Most of the time, Always]

[UDL 6.4] I reviewed grading rubrics before submitting my assignments.
[UDL 6.4] I received timely feedback on graded assignments from the instructor.
[UDL 6.4] I used the Canvas "grades" page to monitor my progress in the class.
[UDL 6.4] I used the Canvas "grades" page "what-if" feature to estimate my grade in the course.

Q24. UDL RELEVANCE AUTHEN [Adapted from Smith et al., 2012]  
How often have you experienced each of the following items during this course?

If you are on a mobile device, you will need to use the drop-down arrows to respond to each item.

[REPEAT HEADERS = REPEAT]  
CODING RULES/VALUES: [Never, Rarely, Sometimes, Most of the time, Always]

[UDL 7.1] I used choices available for assignments, such as choice in topic, group selection, or submission type (such as a paper versus a video submission).
[UDL 7.2] Assignments were relevant and valuable to my interest and goals.
[UDL 7.2] Assignments allowed me to be my authentic self, such as my racial, cultural, ethnic, and gender identity.

Q25 UDL WORK CREATION [Adapted from Smith et al., 2012]
How often have you experienced each of the following items during this course?

If you are on a mobile device, you will need to use the drop-down arrows to respond to each item.

[REPEAT HEADERS = REPEAT]
CODING RULES/VALUES: [Never, Rarely, Sometimes, Most of the time, Always]

[UDL 8.3] I completed assignments where I worked on my own.
[UDL 8.3] I completed assignments where I collaborated with other students in the course.
[UDL 8.3] I completed assignments where I peer-reviewed the work of others.
[UDL 5.2] I used Canva for designing graphics.
[UDL 5.2] I used Slides Carnival for designing presentations.
[UDL 5.2] I used Grammarly for editing my writing.

Q26a UDL_CANVAS_APP [SKIP LOGIC BELOW]
Did you use the Canvas app for this course?
Yes
No

[SKIP LOGIC: If “no,” SKIP to Q_a]

Q26b UDL_CANVAS_APP
How often did you use the Canvas app to do the following?

If you are on a mobile device, you will need to use the drop-down arrows to respond to each item.

[REPEAT HEADERS = REPEAT]
CODING RULES/VALUES: [Never, Rarely, Sometimes, Most of the time, Always]

[UDL 5.1] To view course announcements.
[UDL 6.4] To view instructor feedback.
[UDL 5.2] To submit assignments.
[UDL 5.1] To email other students.
BLOCK ENGAGE SOCIAL

Q27 BELONG ASSIGNMENTS
A sense of belonging is defined as the feeling of acceptance and inclusion within a group of people.

Which of the following assignments contributed to your sense of belonging in the course? Select all that apply. [Multiple answers]

- Student questionnaire
- Course navigation tutorial
- Technology backup plan
- Student mixer: Introductions
- Assignment #0: Shark Tank presentations and peer review
- Assignment #1: Resume and peer review
- Assignment #2: Informational interview and peer review
- Assignment #3: Group project videos and peer review
- Reflection assignments
- Exams #1 - 3
- Exam exit tickets
- Office hours
- Reading textbook chapter content
- Reading lecture slides online
- Watching the video tutorials for each chapter
- Attending a live Zoom session
- Participating in a breakout room during a live Zoom session
- Watching a recording of a live Zoom session

Q28 BELONG COMMUNITY
Do you feel that this class provides a sense of community among students?

- Yes
- No

Q28a BELONG COMMUNITY [DISPLAY LOGIC BELOW] [Optional]
Which aspects of the course helped create a sense of community among students?

[TEXT BOX = Essay Text Box]

[DISPLAY LOGIC: If Q28 = “Yes”]

Q28b BELONG COMMUNITY [DISPLAY LOGIC BELOW] [Optional]
How could this course be changed to create a greater sense of community?

[TEXT BOX = Essay Text Box]

[DISPLAY LOGIC: If Q28 = “No”]
Q29_SERVER_INSTRUCTOR
Did your instructor make you feel welcome in the class?
Yes
No

Q29y_SERVER_INSTRUCTOR [DISPLAY LOGIC BELOW] [Optional]
How did your instructor make you feel welcome in class?
[TEXT BOX = Essay Text Box]

[DISPLAY LOGIC: IF Q29 = “Yes”]

Q29n_SERVER_INSTRUCTOR [DISPLAY LOGIC BELOW] [Optional]
How could your instructor make you feel more welcome in class?
[TEXT BOX = Essay Text Box]

[DISPLAY LOGIC: IF Q29 = “No”]
**BLOCK_DISABILITY**

**Q30a_DISAB_STATUS**
Do you have a learning challenge that impacts your learning?
- No, I do not have any learning challenges that impact my learning.
- I don’t know.
- Yes, I have learning challenges that affect my learning (includes both physical or mental health challenges, too).
- Yes, I have a diagnosed learning deficit(s) or health condition but HAVE NOT registered with the Disability Resource Center (DRC) for accommodations.
- Yes, I have a diagnosed learning deficit(s) or health condition and HAVE registered with the Disability Resource Center (DRC) for accommodations.
- Other [Allow text entry]
  I prefer not to say.

**Q30b_DISAB_NSSE_39A**
[Adapted from NSSE Question #39a]
Which of the following impacts your learning? (Select all that apply.) [Multiple answers]
[See DISPLAY LOGIC below]
- Anxiety
- Attention deficit or hyperactivity disorder (ADD or ADHD)
- Autism spectrum
- Bipolar disorder
- Chronic medical condition
- Deaf or hard of hearing
- Depression
- Intellectual disability
- Learning disability
- Physical/motor impairment
- Post-traumatic stress disorder (PTSD)
- Schizophrenia
- Speech or communication disorder
- Traumatic or acquired brain injury
- Vision impairment/blind
- Other mental health diagnosis
- Other [Allow text entry]
  I prefer not to say. [Exclusive answer]

[DISPLAY LOGIC: Q30a = Any of the following (“OR” function)]
- Yes, I have learning challenges that affect my learning (includes both physical or mental health challenges too).
- Yes, I have a diagnosed learning deficit(s) or health condition but HAVE NOT registered with the Disability Resource Center (DRC) for accommodations.
- Yes, I have a diagnosed learning deficit(s) or health condition and HAVE registered with the Disability Resource Center (DRC) for accommodations.
Other [Allow text entry]

Q30c DISAB_NSSE_39C
[Adapted from NSSE Question #39c] [Optional]
Please describe how your disability or condition impacts your learning in an online class. If you do NOT wish to answer this question, please leave it blank.

[TEXT BOX = Essay Text Box]

(DISPLAY LOGIC = Q30a = Any of the following (“OR” function))
Yes, I have learning challenges that affect my learning (includes both physical or mental health challenges too).
Yes, I have a diagnosed learning deficit(s) or health condition but HAVE NOT registered with the Disability Resource Center (DRC) for accommodations.
Yes, I have a diagnosed learning deficit(s) or health condition and HAVE registered with the Disability Resource Center (DRC) for accommodations.
Other [Allow text entry]
BLOCK_EXIT_QUESTION

Q31_EXIT_QUESTION [Optional]
If you have any additional comments or feedback that you would like to share regarding the survey-taking experience, please enter them below.
[TEXT BOX = Essay Text Box]

Custom End of Survey Message

TY_PROMPT
Thank you!
The fact that you are reading this message indicates that you have completed our survey and that we owe you a debt of thanks. We appreciate the time you have taken to assist in this research and will utilize the information gained to analyze and implement worthwhile improvements in the student learning experience.

As a reminder, the information collected in this study is confidential. Survey responses have been collected through the Cañada College Office of Planning, Research, and Institutional Effectiveness (PRIE) who will hold all data until after course grades have been submitted.

Once again, we are extremely grateful for your participation.

Questions or Concerns?
If you have any questions or concerns regarding this survey, please contact Dr. Nikos Mourtos at Nikos.Mourtos@sisu.edu or (408)924-3867 or Candice Nance at NanceC@smccd.edu or (650)306-3497.

[End of the survey]
Appendix M: Instrument – Faculty Reflection Protocol

Course Information:

Course Curriculum: BUS 100 Introduction to Business
Term:
Course length:

Reflection Questions:

1. What did you learn about how UDL can be implemented in an online course?

2. What were the successes with UDL implementation?

3. What were the challenges with UDL implementation?

4. What did you learn from listening to your students about the UDL guidelines you implemented?

5. How can you make use of your students’ perspectives?

6. What questions about the implementation came up through the process?

7. Are there things you would like to try in your online classroom as a result of this implementation?

8. Has there been a change in your perception of your engagement with the students in the course as their professor?