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Hyflex Course Design: Exploring Student Experiences of an Equity-Centered Technology Enhanced Curriculum: A Qualitative Case Study

A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Education

in

Educational Leadership

by

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The dissertation of Paul A. Hadjipieris is approved, and it is acceptable in quality and form for publication on microfilm and electronically.

University of California San Diego

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DEDICATION

To Jaclyn,
Your unwavering care, love, and support have been the cornerstone of this journey. This accomplishment would not have been possible without you by my side. You are the heart of our family, and I am endlessly grateful for your presence in my life. You are truly loved.

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EPIGRAPH

Technology will not replace great teachers, but technology in the hands of great teachers can be transformational.

George Couros

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VITA

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ABSTRACT OF THE DISSERTATION

Hyflex Course Design: Exploring Student Experiences of an Equity-Centered Technology Enhanced Curriculum: A Qualitative Case Study

by

Paul A. Hadjipieris

Doctor of Education in Educational Leadership

California State University, San Marcos, 2024
University of California San Diego, 2024

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Professors in higher education are responsible for teaching diverse student populations complex material. Further, many instructors have yet to have specific pedagogical training on how to build and deliver equity-minded courses using a technology-enhanced curriculum. Consequently, the COVID-19 global pandemic has caused disruptions to educational systems worldwide, and instructors whose courses were built intentionally using established evidence-based design principles could pivot from face-to-face to remote instruction with less disruption

to student learning. As universities return to more in-person classes, instructors offer flexibility for students to attend classes via multiple modalities, such as in-person via video conferencing software or fully asynchronous learning management systems. This hybrid-flexible (hyflex; Beatty, 2019) approach to teaching offers great opportunities for students to continue learning during and beyond the pandemic; however, it is a complex operation for the professor and instructional teams supporting the class. Moreover, teaching equitably in this modality increases the complexities. This study introduces hyflex learning as a modality instructors use to offer equitable education to their students, followed by a review of the literature and methods used in this study. Next, Adams et al.'s *social justice education faculty development* and Beatty's *four pillars of hyflex course design frameworks* are leveraged to provide a theoretical framework for this study's design, delivery, and measurement of equity-centered hyflex courses (Adams et al., 2016, 2022; Beatty, 2019). Finally, the study aimed to qualitatively explore students' experiences taking a hyflex course with equity-centered design. The potential impact of this study sheds light on what aspects of the hyflex environment helped or hindered students in meeting their learning outcomes, potentially offering key findings for practitioners to design and deliver equitable hyflex courses.

CHAPTER 1: INTRODUCTION

If we teach today as we taught yesterday,

we rob our students of their tomorrow

– John Dewey

Introduction to the Context and Nature of the Study

The quotation by Dewey (1923) is prophetic in light of the adaptations that many faculty have made in response to the COVID-19 global pandemic. As universities closed, instructors changed their instructional model from face-to-face delivery to remote instruction (Parker et al., 2021; Watermeyer et al., 2021). Instructors made this pivot often within 1 week and continued to offer classes to their students until the end of the teaching semester via online teaching platforms and video conferencing. Although this allowed instruction to continue, students and faculty reported disruption to the learning experience (Hughes et al., 2020; J. Miller et al., 2013). In the first months of remote instruction, issues of equity such as low bandwidth, affordable internet, availability of affordable devices, and a lack of familiarity with technology hindered both delivery and receipt of learning. Current literature has suggested the faculty who received advanced pedagogical training and were already using flipped and blended models of instruction were able to make a smoother transition to this remote environment (Bennett & Barry, 2020; Verde & Valero, 2021). As universities allow a return to campus for face-to-face learning, some students cannot attend in-person classes due to health and travel restrictions, highlighting the need for hyflex instruction (Burns et al., 2020).

Further, students watching a live lecture remotely via Zoom could experience problems with lecture delivery and engagement (J. Miller et al., 2013). How students are assessed may prove complex, as they may not be able to attend exams in person, raising questions about

academic integrity and equity (Burgos et al., 2021; Burns et al., 2020). Issues such as technological infrastructure and a lack of pedagogical support may continue to hinder the delivery and acquisition of the curriculum, leading to deepening inequities in the college classroom (Watermeyer et al., 2021). It is important to acknowledge the inherent limitations of the hyflex design model. Implementing this approach is complex, requiring dependable technology for seamless execution. Teaching effectively across three modalities simultaneously while upholding instructional quality presents a notable challenge. Numerous studies have highlighted the difficulties in providing an equitable experience across all three learning modalities (Adedoyin & Soykan, 2020; Beatty, 2019; Binnewies & Wang, 2019; Detyna et al., 2022). Considering these challenges, adopting a dual-modality or hybrid course might be beneficial in supporting students. Context is crucial, and thoroughly exploring these alternatives before beginning the design process is advisable.

Equity is a broad term that encompasses many facets of students' educational experiences. For the purpose of this study, I offer an operationalized definition of equity and how it can be measured in a hyflex classroom. Equity in higher education classrooms means all students can achieve equal learning outcomes as they are supported by faculty and their institution to engage in the learning process (Beatty, 2019). Specifically, the work of equity is how a course is designed and developed to give all students full access to learning opportunities—instructional resources, activities, interactions, evaluative assessment, and a psychology-safe learning environment—which are designed to meet the specific needs of a diverse set of learners (Andreasson et al., 2015; Barrow & Grant, 2019; Beatty, 2019). Moreover, hyflex learning is an instructional design choice that allows students to choose between face-to-face, synchronous, and fully online (i.e., asynchronous) learning environments. Students can

choose how they attend class each week that best suits their learning needs (Beatty, 2014; Naffi, 2020). A hyflex course that centers on equity has defined equity-minded learning outcomes, deep consideration paid to the situational factors surrounding the course, authentic assessments, and active learning experiences as part of the design (Beatty, 2019; Bensimon, 2005; Fink, 2013; Wiggins & McTighe, 2005). Through intentional course design, introspection, and institutional support, faculty can build and deliver flexible, high-quality, and equitable instructions for 21st-century college classrooms (Alvarez, 2012; Fink, 2013; Wiggins & McTighe, 2005).

Statement of the Problem

Teaching and designing courses to meet the needs of a diverse body of learners is a complex endeavor (Bain, 2004; Wiggins & McTighe, 2005). When educational environments are designed without considering the needs of diverse learners, it disproportionately impacts students from underrepresented groups (Museus & Park, 2015; Rogers-Shaw et al., 2018). As universities implement their return to in-person learning, many faculty members are in the process of adapting their courses to provide equitable access to all students. An important question for instructors to consider is whether pedagogical techniques and course design changes carried over from their new remote modalities create an environment for all students to learn equitably (Hollingshead, 2018). Instructional decisions will be rendered more complicated by teaching students face-to-face in a safe and equitable learning environment.

Therefore, the centrality of the problem was an ability to offer flexible instruction for students to attend classes in multiple learning modalities while offering an experience with equity for learning-centered in its design. These modalities were synchronous instruction via video conferencing such as Zoom, asynchronous instruction via the institutional learning management system, in-person face-to-face classroom instruction, or offering all three modalities

at the same time, which is a specific design model called hyflex instruction (Beatty, 2019; Leijon & Lundgren, 2019). The implications of these modalities for teaching and learning for equity are complex. For instructors to ensure equitable quality instruction, pedagogical training must be available to deliver these modalities. Furthermore, institutional and technological infrastructure must be in place to support students and instructors in achieving high-quality, equitable teaching and learning (Adedoyin & Soykan, 2020). The implications for students attending hyflex courses provide flexibility and access to their learning. For example, students report hyflex courses allowed them to find employment alongside their studies and save on costs by not having to commute to campus. Further implications of attending in a hyflex format include being able to attend class despite unforeseen health complications that might have created barriers to their learning (Kohnke & Moorhouse, 2021; A. N. Miller et al., 2020; Naffi, 2020). These implications raise questions about hyflex instruction and its place as an instructional model in advancing equity in the higher education classroom.

Determining how to design and deliver instruction while providing equitable learning environments is not a new problem in higher education (Fink, 2013; Wiggins & McTighe, 2005). Student data points to a continuation of these trends and suggests a lack of student sense of belonging as being a noteworthy issue (Allan et al., 2019; Binnewies & Wang, 2019). Central questions that merited further consideration investigated how students experience equity-centered hyflex learning environments and how these experiences can inform future practice on designing and delivering equity-centered hyflex courses. Questions exploring the role of the instructor, the rationale of students' choice of modality, and how connected students feel to their peers are vital in understanding how a hyflex format could enable or inhibit opportunities related to outcomes. By extending this work, the study foregrounds the experiences of students learning

in hyflex courses while backgrounding the instructors' role in designing and delivering an equity-centered curriculum.

Conceptual Framework and Methodology

A significant body of research has pointed to the efficacy of a well-designed hybrid course on student learning outcomes (Brunner, 2006; Fayne, 2009; Raes et al., 2020; Triyason et al., 2020). However, the efficacy of hyflex instruction that centers on equity in its design is much less reported. More recent studies emerging during the COVID-19 global pandemic point to the complexities and efficacy of designing and delivering courses in this flexible modality (A. N. Miller et al., 2020; Raman et al., 2021; Triyason et al., 2020). However, a specific gap identified is how students perceive their experience as it relates to equity. Further, there is a paucity of scholarship focusing on the experiences of students who take hyflex courses explicitly designed to enhance equity across the modalities. This study aimed to fill some of that void by assessing the central research question for this study:

1. How do computer science engineering undergraduate students describe their experiences related to access, choice of modality, strengths, and pitfalls of hyflex instruction as it connects to their course that has been designed with equity for learning in its design?
2. How do students perceive opportunities related to outcomes that were enabled or inhibited by the hyflex format?

Conceptual Frameworks

This study applied two theoretical frameworks to guide the review of extant literature and data analysis. First, I leveraged the social justice education faculty development framework (Adams et al., 2016) to address how instructors examine the design and delivery of curriculum

and reflect upon their role as instructors. I applied this theory to analyze instructors' curriculum design and students' experiences engaged with this curriculum in a hyflex learning environment. I was curious about how students react to a course constructed with equity for learning as a central part of its design and the impact a hyflex learning modality has on their student learning outcomes.

This social justice framework encourages instructors to reflect upon teaching and learning. The four quadrants of this framework cover the (a) assets students bring to the learning environment as active participants, (b) assets instructors bring to the learning environment, (c) curriculum, material, and resources that convey content to students, and (d) pedagogical process in which the course is delivered (Adams et al., 2016). I analyzed this framework further in the literature review (see Chapter 2) and the methodology section (see Chapter 3).

Second, I used the four pillars of hyflex course design (Beatty, 2019) to study how instructors think about four fundamental values that guide the design and development of their hyflex course: learner choice, equivalency, reusability, and accessibility. Instructors following this framework produce consistency across the modalities, which literature reports is a key feature of designing equity for learning in hyflex courses (Binnewies & Wang, 2019; Garcia & Lee, 2020). This framework centers on an analysis of equity for learning in its design, which is core to understanding how students experience equity across the modalities of their hyflex course (Beatty, 2019).

The four pillars are particularly useful for this research because they provide a framework I used to assess the extent to which equity for learning is achieved across the hyflex modalities. For example, designing using the four pillars provides students with choice, flexibility, and specific, measurable outcomes. I used these measurable outcomes to assess how

students have been learning in an equity-centered hyflex course. I discuss this further in Chapter 2 when reviewing the literature and applying it in my methods section in Chapter 3.

Methods Overview

The research consists of a qualitative methods approach chosen specifically to understand the experiences of students who engage in an equity-centered hyflex course. The gaps identified in the literature centered around student experiences, perceptions, and sensemaking in relation to hyflex learning; thus, qualitative research is the best and arguably the only way to explore this phenomenon, as it is a process of inquiry to understand complex human interactions (Maxwell, 2013; Mertler, 2015). Further, a qualitative approach allowed a focused analysis to be conducted on the hyflex courses in this study. Notably, the limitation of a qualitative approach is that data produced by this study may not be representative of the broader student population taking hyflex courses (Ahmad et al., 2019; Maxwell, 2013; Saldaña, 2012).

A case study methodology was used to analyze my findings as this approach allowed for an exploration of students' experiences across their chosen learning modality (Yin, 1989). The case study approach can offer insights into how an equity-centered hyflex curriculum impacts student learning outcomes. This approach, in turn, can refine the course design process and add to current gaps in the literature when examining the efficacy of equity-centered hyflex courses. Further, a case study methodology allowed hyflex courses to be analyzed within a bounded unit (i.e., one course) and allowed transferability for researchers to build on the findings in this study (Byrne & Ragin, 2009).

Data collection instruments within this case study included indirect measures. First, a survey was sent to students to understand their experiences taking an equity-centered hyflex course. Second, once the survey results were analyzed, 10 semistructured student interviews and

one two-instructor interview were conducted. Next, seven classroom observations were collected to offer a more complex evaluation of their experiences and how they experienced equity in the hyflex course. Together, these instruments provide a deeply textured portrait of student experiences in an equity-centered hyflex course (Driscoll & Wood, 2007; Lareau, 2021).

Significance of the Study

Hyflex as a sub-set of hybrid learning emerged in the mid-2000s and has received much less attention within the educational literature (Beatty, 2007b, 2014). Much of the scholarship that has been produced focuses on flexibility, access, and implementation of hyflex courses (Bower et al., 2014; Donovan, 2018; Kyei-Blankson & Godwyll, 2010; Lakhal et al., 2014). Less explored is the importance of hyflex courses that support equitable outcomes for students (Lakhal et al., 2014; Raes et al., 2020). Further, research on hyflex learning emerging during the pandemic reveals that modality, choice, access, and equity are key to the design process to ameliorate gaps that were already there for students but were increased by the COVID-19 global pandemic (Adedoyin & Soykan, 2020; Burgos et al., 2021; Burns et al., 2020; Parker et al., 2021; Triyason et al., 2020). Finally, educators traditionally teaching in face-face modalities have, in some cases, experienced courses in bi-modal delivery, such as face-to-face and Zoom, as well as asynchronous courses via Learning Management systems such as Canvas (Detyna et al., 2022).

This study sought to understand the experiences of students who attend their courses in a mixed-modality format designed specifically for equity. Further, this exploration accounted for student experiences across the modalities and examined how a course design for learning equity impacted their outcomes. Significantly, as institutions of higher education continue to pivot during the COVID-19 global pandemic and beyond to accommodate their students, broader

societal issues of racial and social justice that already existed have been elevated and connected directly to what is happening in the college classroom (Ali, 2020; Barrow & Grant, 2019; Rall et al., 2019; Salmi, 2020). This study offers insights into how students experience mixed modality equity-centered curriculum and offers evidence-based recommendations for educators considering designing and delivering courses using a hyflex learning modality.

Organization of Dissertation

This dissertation is organized into an introductory section, a section reviewing the extant literature, followed by a methods section. Chapter 2 synthesizes the literature on teaching for social justice in higher education, effective teaching in higher education, hybrid course design models, and hyflex course design. The purpose of this chapter is to review significant contributions to the field and shine a light on gaps in the literature, specifically as it relates to equity-centered hyflex courses. Chapter 3 offers a detailed account of the two theoretical frameworks that guide the methodological choices in this study. The first is a social justice education faculty development framework, which supports instructors in examining the design and delivery of their curriculum. The second theoretical framework is to guide a hyflex design process to create an equitable learning experience for students. The two frameworks undergird the data collection instruments and survey and interview protocol development and guided classroom observations. Finally, a case study methodology allowed for the studied hyflex course to be analyzed within a bounded unit (one course) and enabled researchers to expand on the findings in this research (Byrne & Ragin, 2009). Chapter 4 centers on the study's findings, enabling students and instructors to articulate their experiences that paint a comprehensive portrait of their interactions within a hyflex learning environment, encompassing both the teaching and learning perspectives (Lareau, 2021; Peshkin, 1988). Finally, Chapter 5 provides a

deep analysis of students who experienced an equity-centered hyflex course and the teaching and learning perspectives of the instructor. Chapter 5 offers key findings from the data analysis and connects these findings to practical implications.

Definitions of Terms

This study used the following terms to provide clarification to support the central ideas expounded in this study:

- *Hyflex Learning:* Hyflex courses enable students to choose three different learning modalities. First, a traditional in-person class; second, a synchronous class via a video conferencing platform such as Zoom; or third, an asynchronous class (Beatty, 2019).
- *Hybrid Learning*: Hybrid learning is a pedagogical approach to course delivery that blends face-face and online (asynchronous) learning. This course design approach reduces the amount of time in a traditional classroom and shifts curriculum content into an online learning space (Fayne, 2009).
- *Hyflex Pilot Study*: This references a pilot study I conducted at the same institution to test the instrumentation for this study. The pilot was run during the spring and summer quarters of 2021.
- *Instructor*: This term is used interchangeably to talk about educators teaching in a higher education classroom.
- *Equity*: Equity is a broad term encompassing many facets of students' educational experiences; for this purpose, equity in higher education classrooms means all students can achieve equal learning outcomes as they are supported by faculty and their institution to engage in the learning process. When considering how a course is designed and developed, all students are given full access to learning opportunities—

instructional resources, activities, interactions, evaluative assessment, and a psychology-safe learning environment—which are designed to meet the specific needs of a diverse set of learners (Andreasson et al., 2015; Barrow & Grant, 2019; Beatty, 2007b, 2019; Harris & Bensimon, 2007; Montenegro & Jankowski, 2016). A course centered on equity has defined equity-minded learning outcomes, deep consideration paid to the situational factors surrounding the course, authentic assessments, and active learning experiences as part of the design (Andreasson et al., 2015; Beatty, 2019; Bensimon, 2005; Fink, 2013; Wiggins & McTighe, 2005).

- *Racism*: Racism toward an individual is when a member of the majority treats a person or people of color as inferior or subordinate because of their race (Museus & Park, 2015).
- *Outcome-Based Assessment*: Outcome-based assessment (OBA) is an assessment process that centers student learning outcomes as the primary metric for success, as opposed to other traditional forms of assessment such as grades and points (Driscoll & Wood, 2007)
- *Backward Course Design*: Starting with the end in mind, this course design model encourages instructors to think about their course learning outcomes, followed by the assessments that measure if these outcomes have been met, and finally, the active classroom experiences to engage the learner (Wiggins & McTighe, 2005).
- *Case Study*: A case study is a research approach used to generate an in-depth, multifaceted understanding of a complex issue in its real-life context (Yin, 1989).

Finally, the centrality of the problem is for instructors to design mixed modality courses that have equity for learning in their design. The implications of offering hyflex instruction for

teaching and learning for equity are complex and raise central questions around access, student choice, sense of belonging, and the role of the instructor. The central questions outlined in this dissertation focused on the experiences of students involved in a hyflex course that centered equity for learning in its design. Furthermore, how do students perceive opportunities related to outcomes enabled or inhibited by the hyflex format? To explore these questions, Adams et al.'s (2016, 2022) theoretical framework and Beatty's (2019) four pillars of hyflex course design provide a foundation for this study. Next, the methodology is a qualitative case study and allows for a deep analysis of student experiences within a bounded unit (Yin, 2013). The significance of this study centered on recent studies emerging during the COVID-19 global pandemic on how hyflex courses designed to offer choice, access, and equity are key to reducing barriers that were already there for students but were increased by the pandemic (Adedoyin & Soykan, 2020; Burgos et al., 2021; Burns et al., 2020; Parker et al., 2021; Triyason et al., 2020). The internal logic of the study begins by providing contextual information to situate the reader around the current state of hyflex instruction, specifically as it relates to teaching and learning within the COVID-19 global pandemic and beyond. This section conveys the study's importance and relevance and offers recommendations for using a hyflex course design in the post-COVID-19 era.

Next, an exploration of the literature on effective, equitable teaching connects the importance of teaching and designing equitable hybrid courses. Furthermore, the synthesis of scholarship on effective teaching and design lays the groundwork for instructors to design their hyflex courses (Beatty, 2007b; Benton-Borghi, 2015; Fink, 2013; Swallow & Olofson, 2017). Recent studies during the COVID-19 global pandemic have highlighted the flexibility of hyflex courses in supporting equitable student outcomes. Finally, the data collection and analysis

provide a deep exploration of student experiences across their chosen modality. This approach explored student opportunities related to outcomes that were enabled or inhibited by the hyflex format (Moore et al., 2012; Yin, 1989).

CHAPTER 2: LITERATURE REVIEW

Numerous studies have focused on teaching for social justice in higher education and, more specifically, how instructors can examine their understanding of teaching through a social justice lens. Notably, social justice theoretical frameworks encourage instructors to reflect on the assets their students bring to class, how the assets of the instructor influence the curriculum, and what teaching and learning strategies are used to deliver equitable content (Adams et al., 2016; Alvarez, 2012; Fink, 2013). Significantly, this literature base reveals the foundations of creating equitable learning environments, which are essential when transforming a face-to-face course to a hybrid space (Churchill et al., 2013; Fink, 2013; Triyason et al., 2020).

Hyflex learning is a subset of hybrid course delivery, gaining traction within instructional design circles over the past several years, and scholars are further exploring it since the COVID-19 global pandemic took learning into a remote space (J. Miller et al., 2013; Raman et al., 2021; Verrecchia & McGlinchey, 2021). Hybrid course design provides insight into how extant frameworks support developing and delivering an equitable hyflex learning environment (Binnewies & Wang, 2019). Despite a robust body of literature centered on the utility of designing and delivering hybrid courses to support equitable outcomes for students (Conrad & Donaldson, 2011; Hollingshead, 2018; Neal, 2016; Nichols Hess & Greer, 2016; Riggs & Linder, 2016; Rogers-Shaw et al., 2018; Stetter, 2018), the efficacy of hyflex models of instruction is far less explored (Beatty, 2014; Dong, 2021). Considering the need for effective teaching practices, how these practices can be transferred to online and hybrid education, and the efficacy of these approaches in providing equitable learning environments, hyflex education is well-aligned to support student learning as universities pivot to the post COVID-19 era (Binnewies & Wang, 2019; Hollingshead, 2018; Neal, 2016). Some studies point to the

importance of flexibility for students to choose their modality of learning, but much less is known about the impact on student learning and building equity (Beatty, 2007a, 2019; Naffi, 2020). Exploration of effective, equitable teaching practices demonstrates the importance teaching and learning can have upon hybrid course design and serves as a base from which to offer a *why* for this literature review. The literature synthesis on effective teaching with technology sets up what topics scholars suggest are important to teach for equity and access using technology in higher education; the analysis of extant course design models provides a *how* for instructors designing their hybrid courses.

Bodies of research on effective teaching in higher education posit when design principles are applied to courses, students perform better against set learning outcomes and report a deeper sense of belonging in their learning environment (Alvarez, 2012; Driscoll & Wood, 2007; Fink, 2013; Krathwohl, 2002). Literature foregrounding effective teaching with technology has suggested technology-enhanced curriculum supports instructors in assessing student learning (Ambrose et al., 2010; Swallow & Olofson, 2017). Building on this body of research, robust literature on hybrid education reveals the positive relationship between well-designed flexible instruction and equitable outcomes for students (Durak & Ataizi, 2016; Hollingshead, 2018; Nichols Hess & Greer, 2016; Rogers-Shaw et al., 2018; Stetter, 2018). However, a paucity of research has explored students' experiences, reporting how equity-centered hyflex courses enable or inhibit perceived opportunities related to their outcomes.

Teaching for Social Justice in Higher Education

Faculty development frameworks focusing on teaching for social justice acknowledge professors have not received pedagogical training as part of their teaching preparation. Moreover, their training does not always include equity-minded teaching practices (Alvarez,

2012; Bensimon & Gray, 2020). In some cases, professors have had options to teach as teaching assistants; however, this experience has been mostly in undergraduate classrooms and tends to be instructor-centered by nature (Adams et al., 2016; Alvarez, 2012). Scholars note, professors must explore their positionality and socialization through reflection to decenter the traditional authority they hold in the classroom (Alvarez, 2012; Kishimoto, 2018). This socialization many faculty had as students, in some cases, replicates and reproduces their own experiences and can lead to a deficit mindset. In light of these trends, scholars recommend faculty be given support through a social justice development framework (Adams et al., 2016).

A social justice framework facilitates faculty to think more expansively about teaching and learning. The framework covers assets students and instructors bring to the learning environment, how the curriculum is developed, and what pedagogical tools are used to deliver engaging content (Adams et al., 2016; Fink, 2013). This framework posits that a salient factor in moving from a deficit to an equity-minded approach to teaching is for educators to examine their own beliefs and biases around race before they can assess the positions of their students (Alvarez, 2012; Singleton, 2014). Finally, current research on effective teaching in higher education further supports professors in developing an equity-minded teaching orientation, prioritizing safe and supportive student environments (Bensimon & Gray, 2020; Kishimoto, 2018; Rendün, 2005).

Effective Teaching in Higher Education

In the early 1980s, continuing conversations in higher education raised concerns about the quality of teaching. Accordingly, the American Association of Higher Education published a seminal report to investigate the issue and produce recommendations (Chickering & Gamson, 1987). This work is grounded in 50 years of educational research on teaching effectiveness and

provides seven guiding principles for effective teaching in undergraduate education. The construction of the principles is student-centered and leverages a metacognitive approach to encourage faculty to think about how students engage with concepts, learn new skills, stay motivated, build relationships with each other, construct new knowledge, and develop their self-efficacy (Chickering & Gamson, 1989).

Comparatively, literature on self-efficacy and motivation has pointed to the importance of allowing students to master their own experiences over time. Part of this process is to observe others' successes and failures through a mastery process. Connected to these modes of learning is the importance of students having the ability to build community and support each other (Bandura, 1989). The main focus of this work is on the four major domains of the psychological processes: the cognitive, the motivational, the effective, and the selection. By applying these domains to how people learn, scholars offer a set of guidelines to support the development of self-efficacy in learners (Bandura, 1989). Educational researchers have leveraged Bandura's (1989) work to ground their studies on how students learn in face-to-face and hybrid environments. Moreover, these works offer useful definitions for educators who are encouraging their students to become self-directed learners in these learning modalities (Ambrose et al., 2010; Bain, 2004; Brunner, 2006; Linder, 2017). Scholars have produced principles of effective teaching to encourage instructors to (a) reflect upon the teaching strategies blocking student learning, (b) refine current practice to foster learning, and (c) contemplate how new and current teaching strategies can be transferred to hybrid courses (Ambrose et al., 2010; Conrad & Donaldson, 2011). These principles of learning are drawn from the literature base of self-efficacy, motivation, assessment, and sense of belonging (Bandura, 1997; Hattie, 2012; Knowles, 1975; Lambert et al., 2013; Morrow & Ackermann, 2012; Strayhorn, 2015).

Principles of effective learning, often called design principles, are significant and have been informed by concepts across the literature and by research on psychological processes (Bandura, 1997; Fink, 2013; Wiggins & McTighe, 2005). Student-centered design for equity has also informed technology-enhanced curriculum models and their role in shaping equitable learning environments. More recent literature has examined design principles for effective teaching in hybrid environments and has illuminated the importance of student-centered design to encourage self-efficacy through intentional classroom techniques, such as questioning and metacognition (Bain, 2004; Boelens et al., 2018; Fayne, 2009; Martin et al., 2018). Furthermore, the literature has expounded on the importance of being a lifelong learner, being willing to take risks, and showing vulnerability, which is central to self-efficacy; designing classroom experiences this way centers the assets and experiences students bring to the learning environment, creating equitable learning opportunities for students (Bain, 2004; Wiggins & McTighe, 2005).

Building from Bandura's (1989) work, when students increase their agency and become more comfortable asking and responding to questions, studies have shown this helps address performance gender gaps and increases equity and access (Baghdadchi et al., 2018; Freeman et al., 2014). Further studies have supported this claim and have added the importance of creating multiple opportunities for students to share their voices, decreasing anxiety, and increasing the representation of marginalized groups (Billson, 1986; Lorenzo et al., 2006). This asset-based approach to teaching and learning has been strongly supported in the literature on effective teaching, antiracist pedagogy, and design principles of equitable teaching practices in higher education (Adams et al., 2016; Bain, 2004; Chickering & Gamson, 1989; Harris & Bensimon, 2007; Love, 2019).

Given the increasing racial diversity of U.S. college classrooms and the imperative for asset-based teaching and learning, antiracist pedagogy specifically deserves consideration. More recently, universities have reconsidered how they are supporting racial minorities, specifically Black students, with financial aid, broader campus climate initiatives, and equitable classroom teaching practices (Harper & Hurtado, 2007; Rendün, 2005; Tichavakunda, 2020).

Scholars have noted antiracist teaching practices play an integral role in disrupting traditional education centering dominant knowledge, which has commonly been exclusionary to marginalized student populations (Blakeney, 2005; Kandaswamy, 2007; Wagner, 2005). Researchers often define antiracist pedagogy as emergent from the literature of critical race theory and gained popularity along with critical pedagogy (Freire, 2007; Ladson-Billings, 1997, 2006). Further, antiracist pedagogy is a direct response to racism in educational settings and centers on the experiences of people of color (Alderman et al., 2021; Blakeney, 2005; Carr, 1996; Kishimoto, 2018).

Antiracist teaching practices often include making race and inequality explicit parts of the curriculum, teaching from an antiracist lens, and taking direct action to break down and disrupt structural racism on campus. These practices involve going beyond teaching social justice in the classroom (Blakeney, 2005; Kandaswamy, 2007; Kishimoto, 2018). Instructors can support their students by designing a curriculum acknowledging the deep emotions surrounding antiracist learning, encouraging strategic empathy, allowing students and instructors to see the world through the eyes of each other, and celebrating the assets their cultural wealth brings to the learning experience (Adams et al., 2016; Ambrose et al., 2010; Fink, 2013; Kishimoto, 2018; Tharayil et al., 2018; Yosso, 2005; Zembylas, 2012). Recent work has shown the importance of

using educational technology to support these learning experiences to leverage students' cultural assets in and out of the classroom (Garcia & Lee, 2020).

Effective Teaching With Technology

Recent shifts in higher education invite researchers to consider design principles for effective teaching in the context of technologically enriched online pedagogy (S. Allen, 2016; Riggs & Linder, 2016; Stetter, 2018). The rapid transition to remote learning during the COVID-19 global pandemic has necessitated these learning principles be used in conjunction with a technology-enhanced curriculum (Beatty, 2007a). Technology can be a powerful tool to enhance curriculum and increase equity and access to content. However, technology must be used to support the design principles, and a useful framework supporting technology integration is the technological, pedagogical, content knowledge framework (TPACK) model (Hamilton et al., 2016). Equity is embedded within each of the three components; for example, an instructor designs activities encouraging students, particularly marginalized students, to share their cultural wealth with the class using educational technology (i.e., technological). The students in the class then have to peer review the work and reflect on what they have learned (i.e., pedagogical). The activity is designed to center the cultural wealth of the students and to challenge traditional narratives within the curriculum (i.e., content). Using this model can support instructors in designing an equity-minded curriculum by leveraging educational technology (Benton-Borghi, 2015; Freeman et al., 2014; Garcia & Lee, 2020).

TPACK is a paradigm equipping educators to teach for equity by bringing together content, pedagogy, and technology knowledge. Scholars describe the complex interaction between the specific parts of this framework and offer theoretical and practical advice for practitioners teaching with technology (Koehler & Mishra, 2009). Furthermore, teaching in a

21st-century, highly dynamic classroom adds to these complexities. Notably, the literature suggested many educators earned their qualifications when educational technology was in a very different place (Bennett & Barry, 2020). Moreover, the exponential growth in technology causes barriers to technology adoption. Accordingly, TPACK can be used to help educators break down these issues and deliver an equity-based technology-enhanced curriculum (Foulger et al., 2016).

The main idea driving this research is an overview of the components of this framework and a critical analysis of their symbiotic relationship. The central tenet builds off the seminal research of scholars who examined how educators leverage their subject knowledge and find different ways to deliver and bring the content to life for their students (Shulman, 1986; Webb, 1980). The authors state the importance of each aspect of the TPACK model as an individual knowledge base; however, a noteworthy factor is an analysis of the interactions between the paradigms, which reveals how instructors use their experiences to influence how they interact between these knowledge bases (Swallow & Olofson, 2017). Further studies discuss the importance of this reflective interaction between the paradigms as significant for equity-minded teaching (Benton-Borghi, 2015; Rosenberg & Koehler, 2015). Recommendations emerging from this research are for educators to develop mastery and flexibility in each area of the TPACK framework and consider how this knowledge can inform equitable teaching practices, particularly practices supporting marginalized students (Koehler & Mishra, 2009). Correspondingly, this framework correlates to extant course design frameworks, such as backward course design and integrated course design, supporting instructors to create accessible, equitable learning environments celebrating the assets students bring to the classroom (Adams et al., 2016; Bensimon & Gray, 2020; Fink, 2013; Wiggins & McTighe, 2005).

Further, educators use universal design for learning (UDL) to design courses that specifically provide equity and access to historically marginalized groups. Instructors do this by offering (a) open educational resources (OER), (b) resources that challenge majoritarian narratives, and (c) web-based educational technology to access this material for free. The flexibility UDL offers allows students to demonstrate their learning via multiple means. Researchers have explored blending UDL and TPACK to support equitable outcomes for historically underrepresented groups (Benton-Borghi, 2015; Hollingshead, 2018; King-Sears, 2009) and have found it reduced barriers and increased equitable outcomes (Dinmore, 2014; Jackson & Lapinski, 2019).

Hybrid Course Design Models

Researchers often study effective teaching practices in the classroom in terms of students' motivation, sense of belonging, effective learning, and self-efficacy (Ambrose et al., 2010; Bandura, 1989; Chickering & Gamson, 1989; Pass, 2004; Strayhorn, 2015). However, researchers less often consider technology-enhanced curriculum and course design explicitly as a practice core to equitable outcomes in higher education classrooms (Hollingshead, 2018; Ukpokodu, 2008; Wiggins & McTighe, 2005). Next is a synthesis of the literature on extant course design models, foundational models (e.g., backward course design), and how effective equitable teaching is connected directly to intentional design. Backward and integrated course design and the analyze, design, develop, implement, and evaluate (ADDIE) model were not designed for online learning contexts; yet, each framework offers insights that apply to hyflex learning. Design principles from across these frameworks could inform instructors' teaching and learning when designing hyflex courses (Davis et al., 2021; McGee & Reis, 2012; Thomson et al., 2019).

Course design frameworks have been used by instructors in higher education to build face-to-face and hybrid courses to meet their students' specific needs. The literature has revealed several frameworks instructors can use to write equitable course learning outcomes, design authentic assessments, and create equity-minded learning experiences (Churchill et al., 2013; Durak & Ataizi, 2016; Fink, 2013; Verrecchia & McGlinchey, 2021; Wiggins & McTighe, 2005). Moreover, although instructors make course design choices following their specific institutional context, a convergence of design principles among these different models has been congruent (S. Allen, 2016; Fink, 2013; Nichols Hess & Greer, 2016; Wiggins & McTighe, 2005).

Significantly, analogous to building traditional face-to-face courses is the hybrid course design model (Brunner, 2006; Raes et al., 2020). Technology trends in higher education are growing exponentially, and research points to college campuses becoming more interconnected, which has been sped up by COVID-19. Accordingly, instructors are transitioning from traditional face-to-face courses to hybrid versions. As with the evolution of traditional course design models, hybrid and online frameworks have leveraged these traditional design principles, offering flexibility to an instructor's course design process and equity-minded teaching practices (S. Allen, 2016; Fink, 2013; Wiggins & McTighe, 2005).

Backward Course Design Model

Faculty development centers worldwide offer opportunities for instructors to design or redesign their face-to-face and hybrid courses with the support of educational specialists and instructional designers (Richardson et al., 2019). Many of these centers use Wiggins and McTighe's (2005) backward course design to deliver an equity-minded, learner-centered curriculum for hybrid courses. Starting with the end in mind, this framework has served as a

foundational model encouraging instructors to identify their course goals, write specific, measurable course learning outcomes, and consider the situational factors impacting their course design (Fink, 2013; Wiggins & McTighe, 2005). Recent work has revealed the importance of addressing situational factors (Fink, 2013) limiting access and opportunity to marginalized groups. For example, the cost of purchasing college textbooks has become prohibitively expensive and leads to students either not taking courses or not finishing courses because they are unable to access the class material. These findings point to the undesirable impact rising costs have, specifically on underrepresented groups. By identifying this pressing situational factor and offering free alternatives, instructors can increase access and equity to the curriculum (Bol et al., 2021; Clinton-Lisell et al., 2021; Nusbaum et al., 2020).

The second stage in this course design process is to design authentic course-level assessments engaging students on worthy intellectual real-world tasks and demonstrating the meaningful application of essential knowledge and skills. This type of assessment has been shown to support equitable outcomes for underrepresented students specifically (Koh, 2017; Mullen & Rowland Woods, 2018; Wiggins & McTighe, 2005). Finally, active learning experiences are created to engage students and provide the opportunity to master the content, reflect upon their learning, and meet the course outcomes (Ambrose et al., 2010; Hattie, 2012; Wiggins & McTighe, 2005). Themes in the literature discuss the efficacy of this approach to build face-to-face and hybrid courses that are student centered and flexible and allow for instructors to make on-the-spot adjustments as required to support students (Davidovitch, 2013; Fink, 2013). Significantly, for instructors transitioning from traditional classroom teaching to hybrid and online learning, backward course design offers foundational principles applicable in

multiple modalities and that have been shown to support the learning of students from underrepresented groups (Linder, 2017; McGee & Reis, 2012; Stetter, 2018).

Integrated Course Design Model

The literature has found convergent design models for face-to-face and hybrid courses have a significant impact on equitable student outcomes in part due to how such models consider situational factors surrounding a course. Instructors can reflect upon what students must learn (i.e., learning goals), how the instructor knows if students have learned (i.e., feedback and assessments), and finally, how the instructor crafts the learning experience to ensure these goals are met (Fink, 2013; Linder, 2017). This integrated design model complements backward course design and is often used by instructors in concert with each other to design hybrid courses (Boyd et al., 2021; Linder, 2017). This approach encourages instructors to reflect upon their students' needs (McGee & Reis, 2012) while recognizing competing institutional, personal, and technological commitments influencing the design and delivery of an equitable course (Davidovitch, 2013; Fink, 2013; McGee & Reis, 2012; Wiburg, 2003).

Current themes in the literature have examined design models allowing instructors to be flexible in their course construction (Hollingshead, 2018; Rogers-Shaw et al., 2018). Teaching is a complex endeavor (Bain, 2004), and the COVID-19 global pandemic has proven instructors need to be flexible in response to their changing situational factors (Fink, 2013; A. N. Miller et al., 2020). With this in mind, instructors who have adopted the ADDIE course design model were able to transition from face-to-face course delivery to remote instruction and offer a high-quality course while maintaining a reasonable workload (Dong, 2021).

ADDIE Model

Similar to other design frameworks specific for building hybrid courses, the ADDIE model has five stages for instructors to follow. These stages encourage analysis of the learning situation, which provides an opportunity for instructors to design their course objectives. Next, the model supports the development and implementation of resources to meet these specific outcomes. The final stage guides educators through an evaluation of the resources they designed to meet the course goals (Dong, 2021; Nichols Hess & Greer, 2016). Significantly, the analysis phase of the ADDIE model is aligned with equitable teaching practices as it adopts a student-centered, asset-based approach, acknowledging the students' strengths at the center of the design process (Adams et al., 2016; Durak & Ataizi, 2016).

The linear process of the ADDIE model encourages instructor reflection along the way, which is supported by the foundational literature of effective teaching and integrated course approaches (Bandura, 1989; Chickering & Gamson, 1989; Fink, 2013). Conversely, scholars have been critical of the ADDIE stages offered (Neal, 2016; Nichols Hess & Greer, 2016); research has illuminated the limitations of the linear approach, which, in their view, does not account for the complexities of learning environments. Scholars have reported feeling constrained by the model and leaning toward other course design frameworks offering flexibility to respond to the evolving needs of faculty and students (Neal, 2016).

Resources, Activity, Support, and Evaluation Model

Designed for constructing fully online and hybrid courses, the resources, activity, support, and evaluation (RASE) model is grounded in constructivism, in which students create understandings from reflections and experiences. Researchers suggested when designing courses using the RASE model, technology should be leveraged to support students' construction of their

knowledge (Churchill et al., 2013). This focus on using technology in conjunction with design principles of effective teaching is aligned with Fink's (2013) work on creating intentional learning environments and using the tools at the instructor's disposal for students to work on problems, collaborate, and coconstruct knowledge (Albanese, 1993; Churchill et al., 2013; Fink, 2013).

Two primary areas of convergence emerge across the four frameworks (i.e., RASE, backward course design, integrated course design, and ADDIE): centering students' assets and ensuring students are active participants in the learning experience (Jonassen & Rohrer-Murphy, 1999; Pass, 2004; Vygotsky, 1978). Using one or all of these frameworks can support equitable teaching practices and improve student achievement (Churchill et al., 2013; Durak & Ataizi, 2016; Nichols Hess & Greer, 2016). When an instructor transitions their course from a face-to-face to a hybrid or fully online course, the design models discussed can support educators to construct equitable learning environments in which their technology, pedagogy, and content knowledge can be used holistically to impact student outcomes (Koehler & Mishra, 2009). Finally, the hyflex course design model uses aspects of all the course design models discussed in this review to create a modality of learning whereby students can access content with choice and flexibility—a benefit researchers have found supports student success (Beatty, 2007b; Hollingshead, 2018; Verrecchia & McGlinchey, 2021).

Hyflex Course Design

As universities have returned to campus for face-to-face classes, some students cannot attend due to the disruption of the COVID-19 global pandemic. For students who can attend face-to-face classes, the learning environments they are traditionally used to inhabiting will look different. In face-to-face modalities, students will most likely be socially distanced from each

other in their lecture halls, and collaborative learning will take on different forms or will not take place at all. Accordingly, learning spaces need to be reimagined in a 21st-century postpandemic world (A. N. Miller et al., 2020). The literature on effective course design for mixed modalities has pointed to the flexibility a hyflex approach can offer (Abdelmalak & Parra, 2016; Naffi, 2020; Verrecchia & McGlinchey, 2021).

Hyflex learning is a model of instruction under the umbrella of hybrid course design. Scholars note the genesis of hyflex is to address the pressing situational factor of recruitment and retention of students (Fink, 2013; A. N. Miller et al., 2020). This flexible modality offers students the opportunity to attend their course face-to-face in a traditional classroom setting, synchronously via a video platform such as Zoom, or asynchronously via a self-paced learning management system (Beatty, 2014; A. N. Miller et al., 2020).

A four-pillar framework specifically used for building hyflex courses guides instructors in developing their hyflex courses (Beatty, 2014). Following this framework that encourages instructors to consider learner choice, equivalency, reusability, and accessibility, produces consistency across the modalities, which literature reports is a key feature of designing equity for learning in hyflex courses (Binnewies & Wang, 2019; Garcia & Lee, 2020). First, learner choice provides flexibility for students to choose the modality they wish to attend their course. Second, equivalency allows students to meet their learning outcomes through activities that are commensurate across the modalities. Third, the reusability pillar encourages instructors to use learning artifacts from across the modalities to support the learning of all students. Specifically, reusability helps instructors save time when designing hyflex courses, creates learning objects that are high quality, and supports student learning outcomes regardless of the modality the students choose to learn in. Finally, the accessibility pillar provides equitable access and

technical support for students to participate successfully in their chosen modality. This framework centers on an analysis of equity for learning in its design, which is core to understanding how students experience equity across the modalities of their hyflex course (Beatty, 2019).

Recent work reporting student experiences learning using the hyflex model finds they took full advantage of using the learning modalities per their specific needs. Authors have concluded data on participation and satisfaction demonstrate students and the instructor felt connected to each other, leading to a deeper sense of belonging in the course (Beatty, 2007a; Bratberg et al., 2021; Liu & Rodriguez, 2019; A. N. Miller et al., 2020). By the same token, the literature has highlighted the importance of students choosing the modality in which they learn. Specifically, the data suggested the flexibility hyflex offers greater comprehension of the material through differentiated instruction, increased access to the course material, greater access to the instructor, and further support for the student's life circumstances (Abdelmalak & Parra, 2016). These findings have been strongly correlated to principles of effective equitable teaching practices and course design models increasing access, equity, and achievement (Alvarez, 2012; Ambrose et al., 2010; Fink, 2013; Rogers-Shaw et al., 2018).

Although any technology-enhanced course design approach comes with challenges, a hyflex approach is flexible and effective for designing high-enrollment courses. Accordingly, recent work examining the impact of the hyflex model in large enrollment courses has revealed the hyflex model did not harm student outcomes (i.e., grades or learning) in the class (Verrecchia & McGlinchey, 2021). Moreover, data have revealed a technology-enhanced curriculum supporting attendance and comprehension of the class material (Lakhal et al., 2014; A. N. Miller et al., 2020). Qualitative findings suggest students use technology as it enhances their learning

environment regardless of the modality attended (J. Miller et al., 2013). On the other hand, teaching and learning in this modality are not without their challenges for students and professors. Tensions in the literature suggest instructional support (e.g., teaching assistants) is required to deliver hyflex instruction. Further, pedagogical training for instructors has been recommended when teaching a hyflex course, and there needs to be a developed technology infrastructure available across institutions to ensure the smooth delivery of the mixed modalities (Bratberg et al., 2021; Leijon & Lundgren, 2019; Raman et al., 2021).

Pandemic Hyflex Instruction

Current literature has suggested although teaching with hyflex modality is efficacious for student learning, doing so during a pandemic requires different considerations (Bratberg et al., 2021; J. Miller et al., 2013; Raman et al., 2021). Researchers have noted, during the COVID-19 global pandemic, students did not always have the flexibility to choose their modality of learning, which is a central tenet of the hyflex experience (Beatty, 2007a; Bratberg et al., 2021; J. Miller et al., 2013). Further, many instructors adopted the hyflex model as an emergency response to the pandemic rather than a measured pedagogical decision (Clapsaddle et al., 2021; Li et al., 2022). Finally, the training instructors have received to teach in this modality has been limited, impacting the student experience (Padilla Rodriguez, 2022; Raman et al., 2021).

Suggestions emerging from the literature have included the importance of group work for hyflex learning, more specifically, ensuring at least one of the group members is an in-person student so they can communicate with the rest of their group attending synchronously (Detyna et al., 2022; Kohnke & Moorhouse, 2021; Verrecchia & McGlinchey, 2021). Other suggestions include (a) organizing breakout rooms in advance of the class, (b) assigning deliverables to groups to keep students on task and motivated in both modalities, and (c) looking closely at

different video conferencing tools on the market (Dong, 2021; A. N. Miller et al., 2020; Raman et al., 2021; Triyason et al., 2020). Recent research has illustrated that despite the pedagogical and technical challenges of delivering high-level instruction in multiple modalities, student perceptions suggest there is statistically no difference between student engagement in fully in-person and hyflex modalities. Scholars in this study build upon this finding and noted this also holds true for student performance on course assessments (Washuta et al., 2021). Although much of the literature has pointed toward the efficacy of hyflex course design (Abdelmalak & Parra, 2016; Binnewies & Wang, 2019; Bratberg et al., 2021; Naffi, 2020; Verrecchia & McGlinchey, 2021), recent research has noted the external factors of learning during a pandemic and beyond cannot be ameliorated by a hyflex approach in isolation. The importance of the instructor in designing and delivering the course has been a prominent theme bridging across the literature of equitable teaching practices, hybrid course design, and hyflex course delivery (Alvarez, 2012; Ambrose et al., 2010; Bell et al., 2007; Binnewies & Wang, 2019; Brown & Tenbergen, 2021; Chickering & Gamson, 1987; Durak & Ataizi, 2016; Fink, 2013; Kishimoto, 2018; Wiggins & McTighe, 2005). Finally, hyflex is grounded in the established literature of hybrid education; however, scholars have pointed to the paucity of research using this modality to increase equitable student outcomes (Beatty, 2007b; Binnewies & Wang, 2019; Howell, 2022; Leijon & Lundgren, 2019).

Summary

Synthesis of the literature on effective teaching shows when design principles are applied in the college classroom, students report a deeper level of knowledge and comprehension of the material. When students can see their progression and performance against the course objectives, they have reported the learning environment feels inclusive and supported (Alvarez, 2012;

Driscoll & Wood, 2007; Fink, 2013; Krathwohl, 2002). Further, educational technology integration has helped instructors assess student learning and students identify misconceptions in their knowledge base (Ambrose et al., 2010; Swallow & Olofson, 2017).

Established literature on hybrid and online learning has pointed to the positive impact flexible instruction has on student outcomes (Durak & Ataizi, 2016; Hollingshead, 2018; Nichols Hess & Greer, 2016; Rogers-Shaw et al., 2018; Stetter, 2018). Less well reported is how hyflex instruction has created greater access and equity for students to learn during the COVID-19 global pandemic and beyond. Limited studies into hyflex instruction have suggested its efficacy in large enrollment courses (Abdelmalak & Parra, 2016; Sowell et al., 2019) and in providing students with the flexibility to attend the class in their choice of modality (Bratberg et al., 2021; Lakhal et al., 2014; Washuta et al., 2021). However, gaps exist when analyzing how design principles should be considered to build equitable courses and how students experience learning in a hyflex environment (Beatty, 2007a; Naffi, 2020). This study aimed to fill this gap by foregrounding student experiences as they relate to perceived opportunities related to outcomes enabled or inhibited by the hyflex format.

CHAPTER 3: METHODS

Research Design

The methodology of this study is designed to address gaps in the literature related to the design and implementation of equity-centered hyflex courses. Grounded in current literature on the design and delivery of hyflex courses and outcome-based assessment, the rationale for this study was to explore student experiences in relation to their perceived opportunities, which are influenced by the affordances and constraints inherent to the hyflex format. Using an outcome-based assessment (OBA) model, indirect measurements were used to explore how students experience their instructor's use of hyflex tools and their specific equity-minded course outcomes (Beatty, 2019; Boyd et al., 2021; Driscoll & Wood, 2007; Hollingshead, 2018; Sasson et al., 2022; Triyason et al., 2020).

Research Questions

The case study methodology chosen for this study was selected to answer the research questions directly.

1. How do computer science engineering undergraduate students describe their experiences related to access, choice of modality, strengths, and pitfalls of hyflex instruction as it connects to their course that has been designed with equity for learning in its design?
2. How do students perceive opportunities related to outcomes that were enabled or inhibited by the hyflex format?

The hyflex course chosen for this study was complex to design and deliver as an instructional modality, requiring a thorough analysis of its efficacy. This methodology offered an intricate exploration of how students experienced an equity-centered hyflex course, making it

ideal for deep exploration into the intricacies of this particular case (Stake, 1995; Yin, 1989). A timeline for data collection, a detailed account of participant selection, rationale, and context for choosing a case study methodology follow.

Setting and Context

Data were collected at a large public research-intensive university in Southern California in the United States. A central mission of this institution is to provide equitable instruction to its undergraduate and graduate student population. Accordingly, study participants were recruited from the computer science engineering (CSE 100/R) department. CSE100/R has been constructed using equity-centered design frameworks and taught as a hyflex course, which is a central reason why recruitment from this academic discipline was chosen. CSE 100/R has 305 students enrolled, with a mixture of sophomore and senior undergraduate students.

The rationale for the selection of the professor teaching CSE 100/R is threefold. First, the instructor is an experienced social justice educator with pedagogical training in higher education. This point is important for this study as teaching hyflex courses requires advanced pedagogical training. Second, they have experience building hybrid courses but are new to designing and delivering hyflex courses. This second point holds relevance in the study, as the existing literature has posited robust asynchronous components are essential in the success of hyflex courses, which in turn necessitates experience of instructional design principles (Beatty, 2014, 2019). Finally, they are a deeply reflective practitioner and imbue the teaching for social justice framework, which guided the design of their course and the methodological and epistemological underpinnings of this study.

Context of CSE 100/R

Recruitment for this study occurred at a large public university in Southern California. Participants were undergraduate computer science engineering (CSE 100/R) students. CSE 100/R is a course in advanced data structures focusing on high-performance data structures and supporting algorithms. In this course, students use and implement data structures, such as (un)balanced trees, graphs, priority queues, and hash tables. Further, students learn how to use sophisticated memory management, pointers, and recursion in programs and analyze them with theoretical and practical performance analysis.

Typically, the prior preparatory experiences of students taking CSE 100/R must have completed CSE 12, which equips them with a foundational understanding of introductory data structures in Java. CSE 12 requires prior completion of either CSE 11 or CSE 8A+8B, ensuring students possess a solid programming background in Java. Moreover, CSE 12 enhances their Java programming skills. Additionally, CSE 100 necessitates prior completion of CSE 21, which imparts students with a firm grasp of combinatorics and probability theory. The prerequisites for CSE 21 and CSE 20 ensure students are familiar with discrete mathematics and proof theory. Another prerequisite for CSE 100 is CSE 15L, which provides students with proficiency in the Unix command line. CSE 30 is a prerequisite for CSE 100 and familiarizes students with programming in C or C++. CSE 100 is crucial as the first upper division CSE course computer science majors typically take. Although some students may take additional courses such as CSE 101, 103, or 105 before or alongside CSE 100, these courses primarily focus on mathematics and theory, and CSE 100 emphasizes programming-intensive aspects.

Hyflex Course Structure for CSE 100/R

The hyflex course design structure for CSE 100/R uses the two theoretical frameworks in this study. CSE 100/R is a 10-week course with defined learning outcomes, authentic assessments, and active learning classroom experiences (Adams et al., 2016; McTighe & Wiggins, 2013). The course design framework used principles of learner choice, equivalency, reusability, and access (Beatty, 2019). The learning management system for CSE 100/R, EdStem, was chosen specifically for its ability to integrate a coding environment and programming tools directly within the web platform, removing specific requirements (e.g., operating system) from students' computers. In addition to EdStem, the instructor of CSE 100/R wrote an interactive online *Data Structures Stepik* textbook that incorporated adaptive auto grading, specifically designed to scale for large class sizes. This textbook resulted from the current instructor's experience as a student (i.e., taking the CSE 100 course) and seeing the issues that arose from the older resource. Specifically, a significant issue arose from using the flipped learning model with this traditional textbook that was "dry and dense," according to the instructor for CSE 100/R. The instructor wrote an interactive online textbook to facilitate the flipped learning design of CSE 100/R. This flipped learning model ensured all pre-recorded lectures were succinct, typically lasting 8–15 minutes, and produced in high-definition. This format was designed to significantly enhance accessibility, allowing students to engage with the course materials from any location, even without an internet connection.

The assessment strategies in CSE 100/R were meticulously crafted to align with the best practices in equitable assessment, as cited in the academic literature (Feldman, 2023; Jackson & Lapinski, 2019; Koh, 2017). Idris placed a strong emphasis on creating assessments that were relevant to real-world situations, engaging, and low-stakes in nature. An innovative approach

was the weekly reading quizzes, designed to allow multiple attempts until a passing grade was achieved. In preparation for the course's launch, extensive work was carried out to ensure its smooth operation, particularly considering the diverse learning environments inherent to the hyflex model. This rigorous testing phase of CSE 100/R was a pivotal element in the course design.

Moreover, CSE 100/R featured a significant active learning component designed to foster engagement across all three learning modalities. The course was designed to incorporate equitable questioning techniques to integrate students from various learning backgrounds effectively. This approach allowed Idris to be particularly attentive to classroom dynamics, striving for balanced participation and elevating the voices of traditionally marginalized groups. These aspects of the course design were integral to its commitment to fostering equity throughout CSE 100/R.

Further, CSE 100/R has a robust asynchronous infrastructure that aligns well with the principles of equitable hyflex course design (Beatty, 2007b, 2019). This infrastructure comprises flipped learning videos, extensive teaching assistant (TA) office hours, and a Discord server. These resources serve as a platform for students to connect with their peers and seek assistance from their professor and TAs in real time. Finally, the assessments for CSE 100/R are authentic and built using a mastery approach to promote autonomy and self-directed learning (Ambrose et al., 2010; Koh, 2017).

Profile of Participants

The institution of higher education from which data for this study were collected is a large public university in Southern California. The institution has a diverse student population as an emerging Hispanic-serving institution (HSI). As of 2022, the total enrollment numbers were

8,542 medical and graduate students and 33,343 undergraduate students. The demographics of all students enrolled in 2021–2022 were: 3% Black/African American, 20.9% Chicano/Latino, 37.9% Asian American, 0.2% Native Hawaiian/Pacific Islander, 0.4% American Indian/Alaska Native, and 19% White.

Student Ethnicity for CSE 100/R

Students enrolled in CSE 100/R self-reported their ethnicity as follows: American Indian, 0.7%; Armenian, 0.3%; Asian (e.g., Chinese, Filipino, Vietnamese, Korean, Japanese), 73.7%; Black, 0.7%; Hispanic or Latino, 1%; Mestizo, 0.3%; Middle Eastern or North African, 1.6%; Northern Mexican, 0.3%; White, 16.3%; and 4.6% of students preferred not to answer (see Table 1).

Table 1. Student Ethnicity for CSE 100/R

Ethnicity	Number of students	% of total $n = 305$
American Indian or Alaska Native	2	0.7%
Armenian	1	0.3%
Asian (e.g., Chinese, Filipino, Vietnamese, Korean, Japanese, Asian Indian)	225	73.7%
Black or African American	2	0.7%
Hispanic or Latino	3	1.0%
Mestizo	1	0.3%
Middle Eastern or North African	5	1.6%
Northern Mexican	1	0.3%
Prefer not to answer	14	4.6%
White (e.g., German, Irish, English, Italian, Polish, French)	50	16.3%

Participant Selection

This study identified one university course with specific features required to qualify it for this analysis. This site is ideal for data collection because the course has been designed and offered as a hyflex modality. Next, the course uses equity frameworks and established learning outcomes. Finally, the instructor agreed to have their class open for data collection along with institutional review board approval. Three hundred and five students were enrolled, and I recruited 10 student participants and the course instructor (n = 11; see Table 2). The distribution of majors among this group was as follows: Four students identified as computer science majors, two were double majoring in computer science and engineering, three specialized in biology with a focus on bioinformatics, and one student was completing a dual major in mathematics and computer science. Six of the 10 students identified as male and four as female. All 10 students volunteered to take part in the study and agreed to be interviewed for 50 minutes. Participants were invited to join the study via a survey administered in week one of the quarter. I used convenience sampling to ensure robust participation and respect participants' time commitment. This population is key for this study as their experiences were explored to prove the efficacy or pitfalls of the hyflex model of instruction.

Table 2. Student Participant Overview

Student pseudonym	What CSE 100 remote or in-person course are you enrolled in?	Do you live on or off campus?	Major
James	CSE 100/R	On	Computer Science
Mike	CSE	On	Computer Engineering
Sarah	CSE 100/R	On	Computer Science
Qui	CSE100/R	Off	Biology Specialization in Bioinformatics

Table 2. Student Participant Overview continued

Student pseudonym	What CSE 100 remote or in-person course are you enrolled in?	Do you live on or off campus?	Major
Jen	CSE 100	Off	Mathematics—Computer Science
Ben	CSE 100	On	Computer Science
Arturo	CSE 100	Off	Computer Engineering
Karmen	CSE 100	On	Computer Science
Lou	CSE 100/R	On	Biology Specialization in Bioinformatics
Kasim	CSE 100/R	Off	Biology Specialization in Bioinformatics

Instructor Participant

In addition to the 10 semistructured student interviews (i.e., one per student), three semistructured interviews were conducted with the instructor (i.e., three interviews with one instructor) of CSE 100/R. The instructor interviewed for this study is an associate teaching professor in the computer science department. Teaching professors are members of the academic senate and have an analogous promotion and tenure path to that of research faculty. Teaching professors prioritize teaching and learning, and in many cases, this is reflected in their publication history. They tend to focus on educational and disciplinary scholarship. A typical teaching load for a teaching professor at this institution is two courses per quarter.

The instructor for CSE 100/R took CSE 100 as an undergraduate student; they also worked as a TA for CSE 100 during their undergraduate and graduate degrees. The redesign of CSE100/R took place in the quarter of Spring 2020; however, due to the COVID-19 global pandemic, it was fully online rather than a hyflex offering. The first time it was offered as a fully

hyflex course was in Fall 2022, at which point it was the eighth time the professor had taught it. The instructor for CSE 100/R has deep disciplinary knowledge of data structures, advanced course design, and pedagogical training. Table 3 provides an overview of the instructor and their credentials at the university.

Table 3. Instructor Overview

Instructor name	Faculty rank	Gender	Years teaching	Number of iterations of CSE 100/R
Idris	Associate Teaching Professor	Male	5	8

Theoretical Frameworks

Two frameworks guided the methodological development of this study. Both frameworks offer a lens to assess how equity is experienced across the hyflex learning modalities. The first is the social justice education faculty development framework (see Figure 1), which supports instructors to embed equity in their curriculum. Second, the four-pillar framework offers a road map to design and deliver curriculum across hyflex modalities (Adams et al., 2016; Beatty, 2019). Both frameworks support the construction of an equity-centered course and support instructors in assessing student experiences across hyflex modalities (Driscoll & Wood, 2007; Fink, 2013).

Adams et al. (2022) created a four-quadrant framework to guide instructors in building curriculum, interacting with students, delivering content, and reflecting on their socialization as instructors. The quadrants individually help construct the research questions for this study, and as a collective, they offer an epistemological underpinning for the survey questionnaire,

interview protocol, and classroom observations. For example, all three instruments use equity-minded language and markers to probe students' learning experiences.

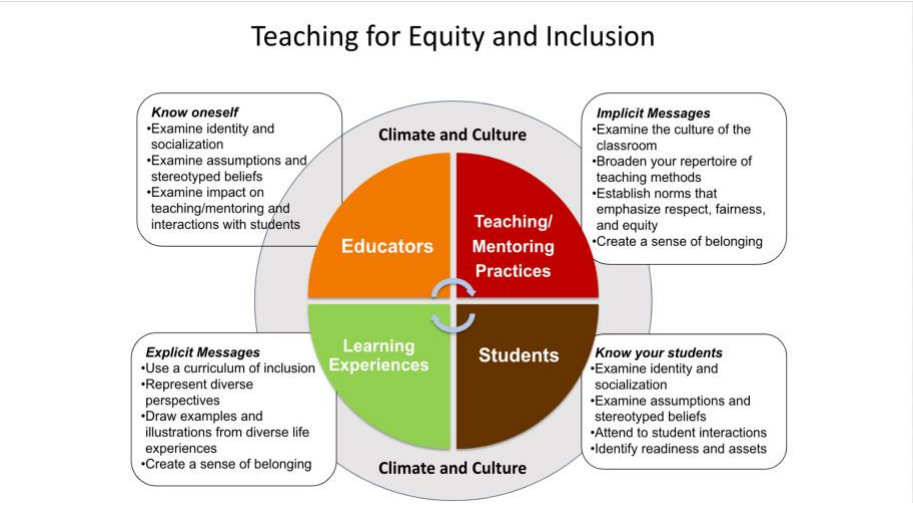

Figure 1. Social Justice Education Faculty Development Framework

Note. From M. Adams and B. J. Love (2009), A social justice education faculty development framework for a post-Grutter era. In K. Skubikowski, C. Wright, and R. Graf (Eds.), *Social Justice Education: Inviting Faculty to Transform Their Institutions*, Stylus Publishing, Figure 1.1, p. 8. Copyright 2009 by Imprint. Reproduced by permission of Taylor & Francis Group.

The interview protocol was designed to ensure participants would be at ease and ready to share their experiences authentically. Furthermore, equity markers linked to this framework played a crucial role in guiding me during classroom observations. Lastly, the core of this framework centers on interpersonal interactions in the classroom and how a safe, equitable learning environment can be created for students. This aspect of the framework was crucial in analyzing student experiences across the choice of learning modalities (see Figure 2; Adams et al., 2016).

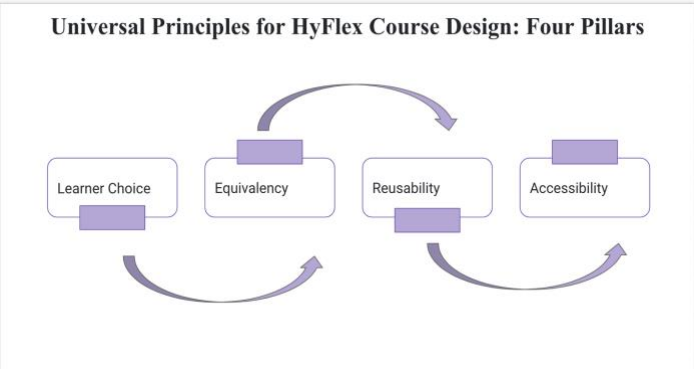

Figure 2. Four Pillars of Hyflex Course Design

Note. Adapted from *Hybrid-Flexible Course Design* by B. Beatty, 2019. EdTech Books. https://doi.org/10.59668/33

Next, the four pillars of hyflex design (Beatty, 2014) guide the methodological approaches in this study. This framework encourages instructors to consider learner choice, equivalency, reusability, and accessibility, which are grounded in equitable teaching practices (Beatty, 2007a; Kyei-Blankson & Godwyll, 2010). This approach guides the questions on the survey questionnaire, semistructured interviews, and classroom observations. For example, "learner choice" explores why students access the specific modality, while "equivalency" questions students about the specific modality's experiences. Further, asking participants about their experiences connected to accessibility sheds light on the efficacy of a hyflex approach that centers equity for learning.

The two frameworks support the iterative process of moving between the codes and themes that emerge from the data. Both frameworks offer a lens to assess how equity is experienced across hyflex learning modalities and reveal the relationship between the frameworks and insights through the coding process. As mentioned, the social justice education

faculty development framework has four distinct quadrants that support instructors in embedding equity in their curriculum. These quadrants served as a priori codes in which subthemes were developed through the inductive process. Specifically, the four a priori codes based on this framework are faculty, course content, students, and teaching methods (Adams et al., 2016). Second, the four-pillar framework (Beatty, 2019)—which guides educators in designing and delivering curriculum across hyflex modalities—was leveraged to create the set of a priori codes. These codes were accessibility, equivalency, and learner choice. At this point, the code reusability was omitted from the coding schema as it revealed no connections between the coded data and themes (Adams et al., 2016; Beatty, 2019). Figure 3 includes the two frameworks with corresponding a priori codes.

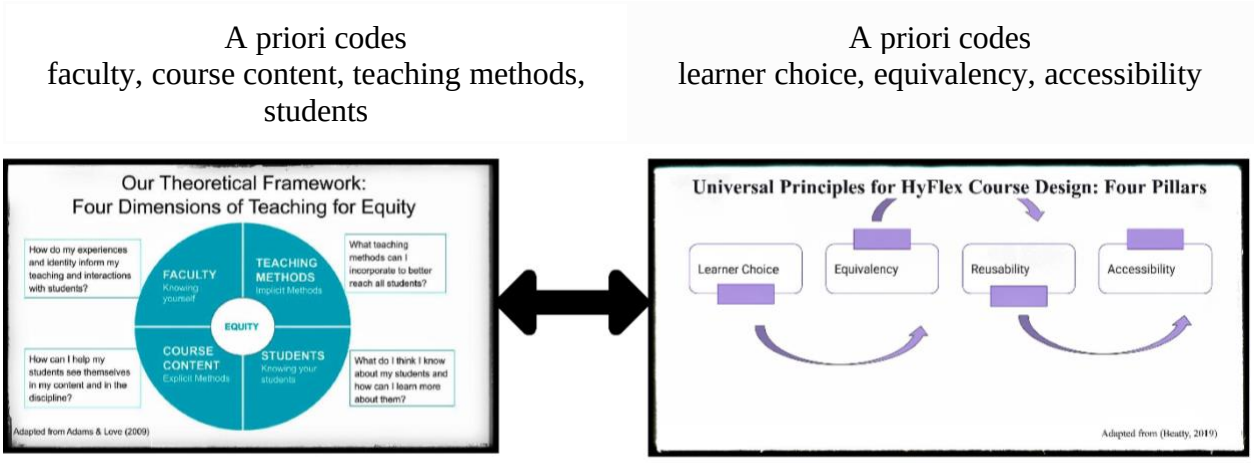

Figure 3. Theoretical Frameworks

Note. Adapted from *A Social Justice Education Faculty Development Framework for a Post-Grutter Era: Inviting Faculty to Transform Their Institutions* by M. Adams and B. J. Love, 2009. Stylus Publishing (left); and *Hybrid-Flexible Course Design* by B. Beatty, 2019. EdTech Books. https://doi.org/10.59668/33

Data Collection Timeline

CSE 100 was offered in the fall quarter of the 2022–2023 academic year. The survey was sent to participants in Week 1 of the quarter, with a reminder on Weeks 2 and 3. Seven class observations were completed on February 13, 16, 20, 22, 24, 27, and March 4, 2023. The rationale for this data collection timing is that students had completed enough curriculum to be able to share their experiences of hyflex learning against their set learning outcomes (see Figure 4). Data analysis was conducted in April and June 2023, respectively.

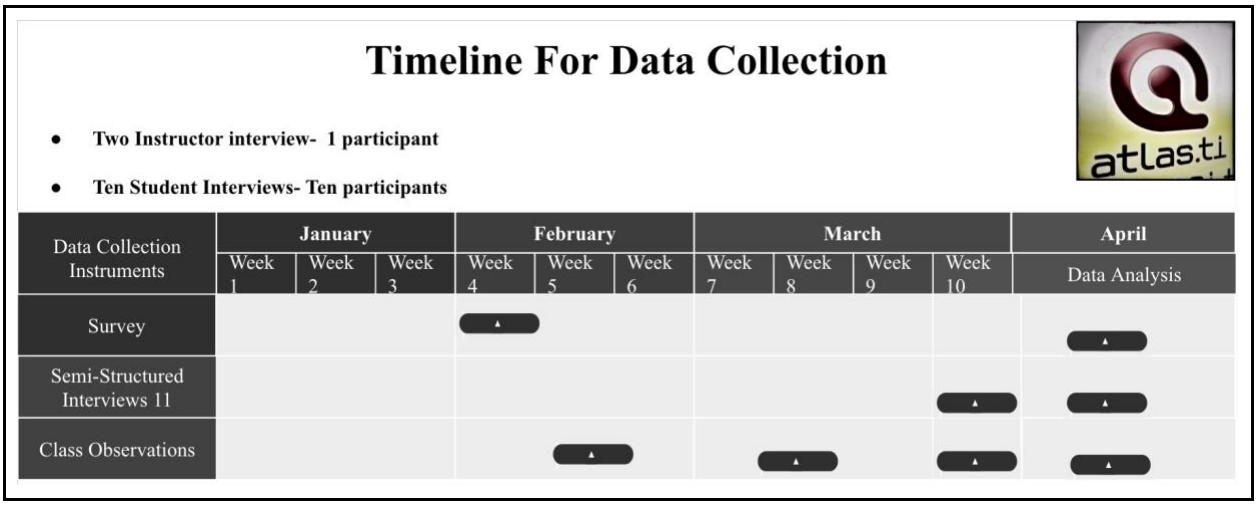

Figure 4. Data Collection Timeline

Case Study Design

Case studies allow for a highly detailed description of a specific entity and are well-suited to study the complexities of a specific case in-depth. Further, this approach concerns itself more with particularization than a generalized approach (Stake, 1995; Yin, 1989). A case study allowed for a holistic analysis of the complex phenomena surrounding student experiences of equity in a hyflex course. From an analysis of extant pilot data, themes emerged around the importance of the instructor and how they created safety and access across the modalities.

The pilot study highlighted the affordances of hyflex design, considering the need for flexibility during the COVID-19 global pandemic (Mineshima-Lowe et al., 2023). Drawbacks of this instructional approach included the difficulty students experienced communicating with each other between modalities and staying engaged in the Zoom environment. Data generated from this pilot study, in its richness and texture, explored specific student experiences across the three modalities that influenced the decision of the case study approach. Critics of case studies purport issues around generalizability; however, the in-depth case study approach can meet some of these criticisms and offer a small but representative analysis of the specific phenomenon of how equity-centered hyflex courses promote or inhibit student learning (Mertler, 2015). Finally, data collection instruments used with the case study methodology are a survey questionnaire, semistructured interviews, and classroom observations (Moore et al., 2012; Yin, 2013). The questionnaire served as a starting point for analysis, and the interviews and classroom observations allowed participants to share a profound qualitative response to specific questions.

Indirect Measurements: Survey

A survey was developed using the guiding frameworks for this study (see Appendix A). The social justice education framework and four pillars of hyflex course design offer a lens to assess how participants experience equity across the hyflex learning modalities. Both frameworks encourage reflection and specifically support the development of equity-minded language, which has been vital in this survey design (Adams et al., 2016; Beatty, 2014; Maxwell, 2013). The survey was designed and tested during a pilot study of an equity-centered hyflex course in the spring and summer quarters of 2022 (Mineshima-Lowe et al., 2023).

Interviews

The choice to conduct semistructured interviews centered on the experience and direction participants wished to explore, honoring their voices and the centrality of the research question. As mentioned, the interview protocol (see Appendix A) was guided by this study's two theoretical frameworks. Further, the interview protocol included questions to build rapport, set clear expectations, and set the interviewees at ease. Interviewing 10 participants and instructor was valuable because participants could respond when I probed deeper on specific points. For example, when one participant spoke about the pressure he felt having his family help him commute to campus, I asked in a kind and compassionate way how that impacted his decisions around his modality choice. I pushed the course instructor on his responses around positionality and intersectionality. To this end, the extant literature on qualitative methods and work exhibiting strong emotional intelligence in its interview design was leveraged successfully to retrieve deep contextual qualitative responses from participants (Goleman et al., 2013; Lareau, 2021; Pascoe, 2011; Saldaña, 2012). Specifically, methodological guidance for the interviews draws inspiration from Lareau's (2021) scholarship. This work allowed me to create a deep focus so the audience could follow and engage with the internal logic that emerged from the richness and texture of the data (Lareau, 2021; Moore et al., 2012).

Further, semistructured interviews explored student experiences. They elicited results relating to equity, access, and choice of modality, potentially yielding richer qualitative data than a survey in isolation. Ten 60-minute interviews were collected, and two semistructured interviews with the class instructor were recorded and transcribed using Rev.com. A central tenant of both frameworks guiding this study recognizes the assets students bring to the learning environment. The interview protocol's high-level outcomes were:

- Discuss the ways participants experience hyflex learning.
- Understand why participants chose the modality and how this choice supported or hindered learning.
- Explore the ways participants felt they met their course learning outcomes.
- Discuss what could be improved to support student learning (see Appendix A for the full interview protocol).

Finally, although the interview provides a thick description (Lareau, 2021) of student experiences, ethnographic observations provided information on how the instructor delivered instruction across the modalities, created a sense of belonging, and how students exhibited learning and comprehension in the different modalities. Responses to the pilot study were instrumental in the study's interview protocols (see Appendix B for the full survey)

Classroom Observations

Seven ethnographic classroom observations were conducted on February 13, 16, 20, 22, 24, 27, and March 4, 2023 (see Appendix C). The observations lasted 50 minutes, and I used a validated observation instrument (Adams et al., 2016; Chism et al., 2008; Emerson et al., 2011). This instrument is used in the institution's faculty development center, where data collection occurs. Specifically, the observations highlighted evidence of equitable hyflex teaching practices. During this period, I spent 5 hours and 50 minutes observing CSE 100/R. While observing, ethnographic field notes were written, which were then condensed into analytical memos focused on the moments of equitable hyflex teaching (Emerson et al., 2011; Peshkin, 1988). For example, the questions the instructor posed during the live in-person sessions were repeated for the students attending via Zoom and for the asynchronous classroom recording. Other equity markers observed during the seven observations were prior knowledge probes,

active learning activities, and building a sense of belonging across the modalities, to name a few (Ambrose et al., 2010; Bain, 2004; Freeman et al., 2014). This ethnographic evidence painted a textured portrait of how students experience hyflex instruction and how the instructor designed and delivered equitable instruction across modalities (Lareau, 2021).

The triangulation of this data, alongside the survey and semistructured interviews, provided a thick description (Lareau, 2021) of students' experiences attending their hyflex courses. For example, the survey probed students regarding their choice of modality, access, and the strengths and pitfalls of hyflex instruction. Next, the class survey, semistructured interviews, and classroom observations explored how students perceived opportunities related to outcomes that were enabled or inhibited by the hyflex format. Data triangulation can increase the validity and credibility of the analysis, which can lead to new improvements and refinements of the data collection instruments (Mertler, 2015).

Data Analysis

The assessment plan for this study is guided by the social justice education and four pillars of hyflex course design frameworks and is grounded in the literature on outcome-based assessment (Driscoll & Wood, 2007; Mullen & Rowland Woods, 2018). The analytical procedures generated evidence to answer the central research questions of this study:

1. How do computer science engineering undergraduate students describe their experiences related to access, choice of modality, strengths, and pitfalls of hyflex instruction as it connects to their course that has been designed with equity for learning in its design?
2. How do students perceive opportunities related to outcomes that were enabled or inhibited by the hyflex format?

This study's three data collection instruments were semistructured interviews, classroom observational field notes, and class survey data. Accordingly, interview data allowed for a deep exploration of perceptions and opportunities for students to learn in a hyflex format. For example, students taking CSE 100/R made the most of the flexibility hyflex offered and made precise decisions about how they attended the course. In turn, this flexibility allowed many to pursue other opportunities, such as paid work and internships. Next, the observational field notes of CSE 100/R explored the dimension of the research question that centers on the strengths or pitfalls of hyflex instruction. For example, in all observational data, the instructor could connect with his students across the modalities, creating an equivalent learning experience for his students. Specifically, this example is triangulated with the interview data as students described their experiences in different modalities (i.e., equivalency). Finally, the class survey helped answer both research questions as it captured rich, qualitative, free responses from students who shared their reasons and motivations for modality choice and the strengths and pitfalls of the hyflex approach. For example, a student shared that although they prefer in-person learning, their commute to the university was very challenging (i.e., they lived off campus). Accordingly, they Zoomed into class and met their learning outcomes. All three instruments were triangulated to provide a rich, validated analysis.

The instructor has taken their courses through an intensive course design process and received instructional design support to develop the course-level assessments. Assessments met the following criteria: high expectations of learners, respect for diverse talents and learning styles, coherence in learning, a synthesis of the learner's life experiences, an opportunity to master the content through practice, and authentic assessment (Mullen & Rowland Woods, 2018). The exploration of student experiences was conducted using seven a priori codes. These

predetermined codes were based on two established frameworks: one focused on social justice education faculty development and the other on a four-pillar framework (Adams et al., 2016; Beatty, 2019). The primary objective was to explore the convergence of these codes with the student's experience in the hyflex course. The codes employed included accessibility, course content, faculty, learner choice, equivalency, students, and teaching methods.

As mentioned, the seven a priori codes for this study are faculty, course content, students, teaching methods, accessibility, equivalency, and learner choice. As I analyzed the data, I started to notice specific themes emerge. For example, in all three data collection instruments, Idris was consistently mentioned as a factor that supports student learning. Accordingly, the subtheme of amazing instructor was created, and the subcode was organized under the faculty a priori code to explore how the instructor, Idris, helped or hindered students in their hyflex course.

Next, as I explored the data, I noticed patterns emerging around some barriers that students experienced during their hyflex course and how they commented on how much the organization and structure of the course helped them learn. Accordingly, the two subcodes of barriers to learning and well-structured course = equity were created. These subcodes were categorized under the a priori code of course content and used to explore how the course content was designed and enabled or inhibited student learning. As I continued to explore the data, more patterns emerged around how students leverage their hyflex course to enable self-care, make judicious choices, and report a strong sense of belonging in their course.

As a result of these patterns, the subthemes self-care, judicious choices, and sense of belonging were developed to explore how the dimensions of equity in this hyflex course supported or inhibited students' abilities to learn in their course. Next, it quickly became clear that the way Idris taught CSE 100/R and the specific pedagogical approaches he used were

salient in how students reported this dimension of equity. Accordingly, the subcode effective pedagogy was created and categorized under the a priori code teaching methods. This subcode was essential in understanding the significance that effective teaching had on student experiences.

Next, as a deeper examination of data took place, students continued to report how the accessibility of the hyflex design afforded them opportunities. Specifically, themes of equity and access emerged and accordingly were created into a subtheme categorized under the a priori code accessibility. During the pilot study, a strong theme that emerged was how students reported their experiences in the three different modalities. Connected, in this study, students reported their equivalent experiences across the hyflex modalities in a clear pattern. Developed from this analysis were subcodes of experience commensurate and experience not commensurate. These subcodes were organized under the a priori code equivalency and were vital in exploring arguably the most challenging aspect of designing and delivering an equity-centered hyflex course. Finally, flexibility for learning and time optimization were distinct subthemes grouped under the a priori code learner choice.

This iterative process allowed for the broad strokes of the data and identified a natural categorization of the subthemes under a priori codes. Of note, running all data through a co-occurrence analysis using Atlas.ti helped me consolidate a number of themes into the mentioned subcodes. For example, several themes emerged under the student a priori code. These codes were similar in nature, and the data analysis software allowed me to explore their similarities. From this point, I merged the patterns in data into the established subcodes discussed previously (Creswell & Poth, 2016; Saldaña, 2012). This analysis was run to look for relationships between the subcodes and their corresponding a priori code groups, which resulted in a refined codebook.

During the analysis, artificial intelligence (AI) coding was introduced to Atlas.ti. Although initially tested, it became evident that AI could not match the depth of human interpretation in data analysis. However, AI-generated summaries proved valuable for re-examining analytical memos, observations, and interview data. At the end of each interview and ethnographic observation, I wrote an analytical memo to reflect deeply on what was reported and how my positionality was influencing what I saw and how I was interpreting the data. For example, after a specific classroom observation, I noted in my analytical memo a wondering about why Idris made a specific pedagogical decision. I incorporated some of these questions into the second and third interviews with Idris, adding to the depth and texture of the qualitative analysis.

Significantly, AI summaries helped by providing a high-level overview useful in verifying initial assumptions and themes identified. Notably, AI assistance highlighted certain nuances in the observation data, particularly misconceptions occurring in Zoom sessions, which had previously been overlooked or misunderstood. For example, the AI-generated summaries revealed that regardless of modality students chose, they used the Discord server to get any outstanding questions that might not have been answered in class. Once I completed this process of consolidating the codes and writing up my analytical memos, I identified the resulting 14 subcodes (see Table 4). Next, subcodes were organized within the seven a priori code groups. Once I completed this organization process, the scheme was checked against the research questions and theoretical frameworks.

Table 4. Research Questions, A Priori Codes, and Subthemes

Research question	A priori code	Subtheme
How do computer science engineering undergraduate students describe their experiences related to access, choice of modality, strengths, and pitfalls of hyflex instruction as it connects to their course that has been designed with equity for learning in its design?	Accessibility	Equity & Access
	Course content	Well-structured course = equity Barriers to learning
	Faculty	Amazing Instructor Educator Introspection
How do students perceive opportunities related to outcomes that were enabled or inhibited by the hyflex format?	Learner choice	Flexibility for learning Modality choice Time optimization
	Equivalency	Commensurate experience Experience not commensurate
	Students	Judicious choices Learning outcomes met
	Teaching methods	Effective pedagogy Sense of belonging /positive hyflex experience

In the pilot study for this dissertation, three major themes emerged: student preferences, learning experiences, and the role of instructors and technology. Regarding learning experiences, students found the hyflex learning environment satisfactory, with Zoom students valuing the 360-camera view for a sense of belonging. Student preferences revealed a preference for in-person learning but an appreciation for hyflex options. The role of instructors and technology was pivotal, with adept instructors enriching the learning experience and reliable technology

reducing stress. These pilot study findings informed the data analysis in this study, emphasizing learner choice, equivalency, and the importance of an "amazing instructor" in bridging modalities and fostering community and individual connections.

The analytical question (i.e., In what ways, if at all, does an equity-centered hyflex learning modality influence student learning outcomes?) was created to speak to the data, which allowed reflective, analytical memos to be written at the end of the semistructured interviews, classroom observations, and survey responses (Lareau, 2021; Maxwell, 2013). Interviews were transcribed using Rev.com and then sent to all 11 participants for member checks. Participants provided no edits, and all gave their permission to proceed. The seven a priori codes and 14 established subcodes are organized in Table 4.

Significance of the Study

Hyflex, as a subset of hybrid learning, has gained traction in higher education since the onset of the COVID-19 global pandemic (Detyna et al., 2022; Kohnke & Moorhouse, 2021). Studies have centered on the efficacy of this design decision and have offered recommendations to educators considering its implementation (Bratberg et al., 2021; Naffi, 2020; Washuta et al., 2021). Recent work has posited key factors supporting student outcomes during the pandemic and beyond were the flexibility and access hyflex learning offered (Adedoyin & Soykan, 2020; Burgos et al., 2021; Burns et al., 2020; Parker et al., 2021; Triyason et al., 2020). Notably, there has been limited work on constructing courses centering equity in its design and on how students perceive opportunities related to outcomes the hyflex format enabled or inhibited (Binnewies & Wang, 2019; Sulecio de Alvarez & Dickson-Deane, 2018). This study used a case study methodology to provide a narrow but deep analysis of students' experiences attending hyflex courses with equity at the center of their design.

Positionality

In my role as an education specialist within a faculty development center at a research-intensive public university, my research is my daily work. Accordingly, this insider position is a benefit and a limitation of this study. For example, my position provided me access to the hyflex classroom and participants from whom I collected data. However, when I engaged with participants who shared their experiences of learning in a hyflex environment, I bracketed my subjectivity and belief that hyflex learning is an efficacious experience for students and allowed the data to tell its authentic story (Lareau, 2021). I practiced and reflected upon my biases during the pilot study (Mineshima-Lowe et al., 2023). I observed I was attracted to themes in the data that confirmed what I wanted to see about participants' experiences in hyflex courses. Accordingly, reflecting upon that experience made me search for my subjectivity; the rationale for doing this is to be aware of how my biases influence and shape my inquiry (Peshkin, 1988). Further, I was keenly aware of my positional power in this role and ensured that I did not place undue pressure on my faculty colleague who has granted me access to their classes when recruiting my participants. Finally, my identity as a middle-aged white male was considered as I interviewed the selected participant. To counter this limitation, I designed the interview protocol based on the social justice education framework and the four pillars of hyflex course design to ensure what I asked was undergirded by equitable language and practices.

Finally, I have designed and taught a hyflex course and am working on my fifth iteration. Accordingly, my proximity to this work is an asset to this study in supporting the design of the hyflex courses and what I have learned from this iterative process. For example, I noticed early on that engagement in the Zoom and asynchronous modalities was an issue if the professor was not intentional about creating learning environments that were appropriate for that modality.

Furthermore, students who choose a specific modality tend to stay in that modality for the whole course. These experiences helped me support the design of the courses under study and design the survey and interview questions.

Study Limitations

A case study methodology, although the most appropriate for this specific study, has limitations. Case studies do not always produce generalizable results and have received criticism because of the narrow focus they provide (Yin, 1989). Although this study did not produce statistically generalizable results for some larger populations, it opened up rich opportunities to understand the affordances and dilemmas of using hyflex modalities in equity-focused higher education classrooms. Another limitation of this study was that the course ran for 1 academic quarter (i.e., 10 weeks), so my data collection period was time bound and did not provide space for unforeseen events that could slow down data collection. Lastly, my primary participants were students with busy academic schedules and could have had challenges participating in the semistructured interviews. These factors represent the limitations of this study.

CHAPTER 4: RESULTS

In this study, a comprehensive analysis of a hyflex course, CSE 100/R, was conducted to understand how computer science engineering undergraduate students describe their experiences in terms of access, modality choice, strengths, and pitfalls of the hyflex instruction, particularly in relation to equity in course design. Additionally, the study explored how students perceive the hyflex format as either enabling or inhibiting opportunities and outcomes. I used deductive coding to categorize data into substantive themes. For deductive coding, I used seven a priori codes drawing on the social justice education faculty development and four-pillar frameworks (Adams et al., 2016; Beatty, 2019). The goal was to examine dimensions of student experiences in the hyflex course. The a priori codes I used were accessibility, course content, faculty, learner choice, equivalency, students, and teaching methods. The next section explicates the findings upon the categorical representation in Table 5.

Table 5. Updated Research Questions, A Priori Codes, and Subthemes

Research question	A priori code	Subtheme
How do Computer Science Engineering undergraduate students describe their experiences related to access, choice of modality, strengths, and pitfalls of hyflex instruction as it connects to their course that has been designed with equity for learning in its design?	Accessibility: Equip students with technology skills and equitable access to all participation modes.	Equity & access
	Course Content: Curriculum that allows students to connect their learning to their lived experiences.	Well structured course = equity Barriers to learning

Table 5. Updated Research Questions, A Priori Codes, and Subthemes continued

Research question	A priori code	Subtheme
	Faculty: Instructors practice deep introspection to connect with their	Amazing instructor Educator introspection
How do students perceive opportunities related to outcomes that were enabled or inhibited by the hyflex format?	Learner Choice: Provide alternative participation modes and enable student choice.	Flexibility for learning Modality choice Time optimization
	Equivalency: Provide learning activities in all participation modes, which lead to equivalent learning outcomes.	Commensurate experience Experience not commensurate
	Students: Leverage the assets students bring to the learning environment.	Judicious choices Learning outcomes met
	Teaching Methods: Use equitable, evidence-based pedagogy to drive instruction across the modalities.	Effective pedagogy Sense of belonging/positive hyflex experience

Organization of Findings

To address the primary research question of how computer science engineering undergraduate students described their experiences with hyflex instruction within the context of their equity-centered course, the findings are identified, organized, and examined through key areas (i.e., accessibility, course content, equivalence, and moving on, students). The accessibility section explores students' reports of how the hyflex model empowered them to practice self-care and maintain a healthy school-life balance. It delves into how students accessed course materials and participated in a manner they reported to align with their personal needs and well-being. Course content's focuses on how students reported that real-world skills motivate learning—that is, how students perceive the relevance of course content and its applicability to their future endeavors.

The equivalence section explores how students perceived the effectiveness of the course design in their learning experiences. It examines the design elements they perceived as fostering equity and inclusivity in their learning environment. The final area—moving on, students—explores how students reported actively making judicious choices to achieve their desired outcomes in their learning process. It delves into the decision-making processes and strategies students have adopted.

The study explored student experiences to address the secondary research question regarding how students perceive opportunities enabled or inhibited by the hyflex format by organizing and analyzing the following key areas: faculty, learner choice, and teaching methods. First, faculty examined instructors' role in shaping students' perception of learning. It highlighted students' perceptions of their instructor and how they indicated the environment he created supported their learning. Next, learner choice was a common theme reported—the focus on how students report actively making significant choices to support their learning. It encompasses students' decisions regarding their engagement with the course and preferred modalities. Moving on, teaching methods focus on the perceived effectiveness of pedagogical approaches with respect to students' sense of belonging in the course. It delves into how students reported teaching methods contributed to a positive learning community. To answer the research questions, I report on themes from the analysis of these dimensions, and the next section provides a high-level overview of the study's findings.

Overview of Findings

First, a crucial aspect of CSE 100/R as a hyflex course is its access (i.e., accessibility) for students. The findings indicate students reported the flexibility offered by the course allowed them to prioritize self-care, balance their workloads, and accommodate their schedules

effectively. Whether attending in person or remotely, the course's hyflex design ensured all students could access the material quickly, including those with long commutes who could access the course content on mobile devices.

Second, through a well-designed curriculum (i.e., content), Idris, the CSE 100/R instructor, reported he was motivated to teach practical, real-world skills to his students. One finding was that students appreciated the course's direct applicability to their learning, with a focus on real-world connections, particularly in video game development. The instructor designed the course structure of CSE 100/R to invite active problem solving, which mirrors professional experiences in engineering and mathematics. Applying real-world skills was observed as equity markers in the hyflex format. The findings highlight that Idris's commitment to improvement through student feedback and collaboration with the instructional team was reported as an important factor in creating equity across the modalities. Although most participants reported benefiting from the structured hyflex design, some reported facing challenges.

Third, students reported their positive impressions of the instructor (i.e., faculty) of CSE 100/R for creating a safe and supportive learning environment across different modalities. Idris's accessibility, empathy, compassion, and sense of humor were reported to contribute to a positive classroom experience. Further, the instructor's focus on introspection, equity, and classroom dynamics were perceived as key features of the hyflex course that students indicated fostered a sense of belonging in CSE 100/R. As mentioned, students reported they highly valued the flexibility the hyflex course provided (i.e., learner choice). Specifically, they appreciated the ability to choose a modality that suited their learning style and life circumstances.

Fourth, the instructor sought to create equitable learning experiences across different modalities (i.e., equivalency), which posed challenges for the instructor. Students' reported experiences with CSE 100/R were mostly positive across modalities. Flipped learning videos were cited as a popular resource, and support structures, like teaching assistants and online discussion boards, helped maintain equivalency. Some students felt in-person experiences were irreplaceable, but remote options were considered "good enough."

Fifth, the reported findings pointed strongly toward how hyflex learning allowed participants (i.e., students) to make judicious choices based on their life circumstances, such as prioritizing self-care or balancing work schedules. Most students indicated the course met their learning outcomes, with a focus and appreciation for the real-world application of what they learned. The course structure and support in and out of class were cited by students as instrumental in achieving these outcomes.

Sixth, effective pedagogy (i.e., teaching methods) was perceived as the key to the success of this hyflex course. As reported in the data, the instructor employed equitable questioning techniques and technological tools to engage students across modalities. Students reported a strong sense of belonging in the classroom, commenting they felt welcomed and supported. The instructor's organization, especially regarding stress testing the course for errors and around deadlines, contributed to the positive learning experience.

These findings underscore the significance of various aspects in the context of students' engagement with the course. Students reported these topics, including how they access the course, the vital role of a compassionate and introspective instructor, students' sense of agency to judiciously make choices based on their current circumstances, ensuring consistent student experiences across the three modalities, understanding the factors that impact students, and

comprehending how hyflex facilitates their learning. Additionally, the research has highlighted the crucial role of effective teaching methods in fostering equitable hyflex learning environments. These findings offer valuable insights into the student experience within hyflex course design and implementation, emphasizing the importance of flexibility, support, and equity to meet students' diverse needs and preferences. Starting with accessibility, an in-depth discussion of these findings follows in the upcoming chapter.

Accessibility: Enabling Self-Care and Supporting School-Life Balance

The accessibility principle advocates equipping students with equitable access to all participation modes. It ensures participation is not hindered by physical, economic, or accessibility barriers (Beatty, 2019). The findings from interviews, ethnographic observations, and survey data showed students in this hyflex course could practice self-care, particularly in terms of accessibility. Students reported, when they needed to prioritize specific aspects of their lives, such as more sleep or balancing a heavy workload, they could attend via Zoom or watch the recorded video over physically attending class.

Next, students reported they could work jobs around their school schedule, such as a student who worked nights to pay for her education. For example, a student reported being able to watch the videos and complete assignments while working nights. Students indicated they had long commutes to campus. They reported they could access the material on their phones and tablets because it was designed explicitly as mobile-friendly content for full equity and access.

For Sarah, a CSE major who lived on campus, the affordance of equity and access in the hyflex course enabled her to make decisions that best supported her learning, highlighting the significance of equity-centered access. The quality and accessibility of the videos were what Ben, a CSE major who lived on campus, perceived helped him while studying in a hyflex setting.

Sarah, who also needed to work and attend school, reported the importance of convenience and accessibility through the hyflex format. Sarah took advantage of completing schoolwork while working night shifts.

Equity and Access

This section examines the impact of equity and access in enhancing student learning within a hyflex course. The data highlight the positive effects of flipped learning videos, designed with accessibility in mind, on students' concentration and information absorption. The availability of varied learning modalities, like recorded videos, was reported to support diverse needs and practical challenges, thereby improving the educational experience. This data answers the research question, which explores how computer science engineering undergraduate students describe their experiences related to access, choice of modality, and the strengths and pitfalls of hyflex instruction in an equity-designed course. The findings are relevant because they illustrate the positive influence of such design on student experiences and demonstrate how each aspect of this equitable hyflex design supports student learning throughout the course.

One dimension of student experiences in the hyflex course highlighted accessibility as a crucial aspect of equity, allowing students to practice self-care through increased access to their learning through their chosen modality. However, students reported varied experiences of equity and access during the hyflex course. Nevertheless, a common connection point was that CSE100/R was frequently reported as an early 9:00 a.m. class for many participants. The time and physical location of the class proved to be a challenge for on- and off-campus students alike, as students reported in the interviews. They indicated commuting to class proved a challenge (i.e., this institution is located on a 1.976-acre site). For example, James, a CSE major who lives on campus, noted:

> Well, first and foremost, it is for me it is all about convenience and access. So, if the class is really early or if the class is really far from me because I live in Chase Hall and I have to wake up early I am more reluctant, reluctant to go. However, yeah, convenience and access is first and foremost.

Mike, a CSE student living on campus, reported being committed to attending all his classes in person. However, he expressed a greater awareness of "self-care" when the options became available to choose his method of attending CSE 100/R:

> So, personally, for the past 5 quarters, I have always tried to attend every lecture in person, just because I know that I don't watch lecture videos because I get distracted too easily; it is just easier to go to lectures, especially early in the morning, and just sit there and absorb. So, I have always tried to go to my lectures, but this quarter, I have kind of changed. I have realized this: My sleep is more valuable than waking up early to go to a lecture.

In this excerpt, Mike emphasized that lecture videos were not an effective means for learning the material, and although he prioritized in-person lectures, he felt sleep was more valuable than an early in-person lecture. For Mike, equity and access created an affordance to make the best decision that supported his learning, illustrating the importance of equity-centered access in this hyflex course. This decision around his learning and making the best choices for his circumstances was also echoed by one of Mike's classmates, Arturo. Arturo, a bioinformatics major who lived off-campus, also connected with the efficacy of the recorded flipped learning video offered as part of the CSE 100/R design. Arturo shared:

> This is kind of embarrassing, but when it comes to in-person, like, it is kind of difficult just to pay attention and speak to somebody because, I mean, for the last few years [referencing the COVID-19 pandemic], it just seems that my mind kind of wanders. However, when I watch the videos, I think that learning and just absorbing information seems like the best for me.

Arturo reported his learning was significantly impacted by the COVID-19 global pandemic, particularly due to difficulties concentrating during class, which he attributed to the mental shifts required between remote and in-person sessions. He found the flipped learning videos, designed with accessibility and equity in mind, greatly aided his concentration and

information absorption. Arturo's experience, as he described it, underscores a positive valence between his learning effectiveness and the equitable, accessible nature of the prerecorded videos.

Connected to how Arturo used the flipped videos, he reported a very long commute to class, "over an hour and 10 minutes." Because the preclass video is designed to be mobile friendly, he could watch them on his commute, work on the homework, and prepare for class. Arturo reported he appreciated the flexibility and accessibility of the prerecorded videos and the option to attend class remotely. He preferred to attend the class in person; however, on days he could not do so, the flexibility and access supported his learning. The evidence reported about the mobile readiness of prerecorded lecturers is significant because it explicates the importance of the equity-centered design of the material on his course perceptions. Further, Arturo reported the distinction between watching the recorded class session and attending synchronously via Zoom. He noted:

> If I'm going be on Zoom, I am already going to feel detached from the conversation and the lecture. Most of the time, I would rather just watch the video if I am going to be remote. I feel like there is not much difference. So, for me, seeing someone on the screen, it is really hard to see them as a person instead of a video and recording so . . . if this class had, like, for example, a day on Saturday, I would definitely watch the videos. I would not Zoom or anything, not because it is a Saturday, but because I have no other reason than to go to school. And for me, I mean that commute . . . it's just, it is just too much effort. I would just watch the video, It is just much more convenient, and I still get kind of the same, I still get the same level of understanding.

Arturo highlighted a key distinction between watching recorded videos and participating in Zoom sessions. He expressed discomfort with the Zoom option, preferring in-person learning. However, he reported his long commute significantly influenced his decision-making process regarding which learning modality to choose. This evidence, as reported, highlighted the importance of equity and access as it relates to Arturo's ability to select the modality that best suits his needs. Notably, Arturo found recorded videos were sufficiently effective, illustrating

that, in his case, they provided a viable learning alternative that eliminated the need for a lengthy commute to each class, which Arturo reported had a positive implication on his learning.

Two participants, Ben and Sarah, both CS majors who lived on campus, discussed equity and access in terms of their schedules and the support hyflex design provided them in CSE 100/R. When Ben was asked about some reasons influencing his modality choice, he reported:

> I'd, I'd probably zoom in, I think. I think it would really depend on the homework and work. Just knowing me, just knowing the schedule I have right now, I'd almost likely go to Zoom just because it's more convenient. You know, you wake up, and you go . . . and then you can still talk to the professor. I cannot always go to his class because I usually have work. I work at the IT desk, and unfortunately, they have me working the morning shift. However, you know, he has prerecorded lectures that we are supposed to watch before lectures.

Like Arturo, Ben reported the prerecorded lecturers supported his learning while taking CSE 100/R. He commented they were "high quality" and "easy to watch" and indicated they helped him stay up on his classwork while he attended to his paid work. This excerpt highlighted that Ben perceived the quality and accessibility of the videos helped him while studying in a hyflex setting.

Sarah, who also needed to work and attend school, reported the importance of convenience and accessibility through the hyflex format. Sarah took advantage of getting schoolwork completed while working night shifts. She shared:

> So I work at a hospital . . . I chose to work nights because I have a pretty busy school schedule; usually, my classes are in the morning. Monday through Friday, I have to be on campus practically every day. That being said, I don't always like being on campus, so a good thing is that classes are podcasts. So, I utilize them extensively. I have that time to stick in an AirPod and then just listen to lectures in the background. I probably would spend the majority time doing schoolwork and, you know, prepping for classes, doing homework, studying for exams. However, I work two to three times a week. So at most, 36 hours a week, which are 12-hour night shifts.

From Sarah's perspective, the recorded videos and her accessibility to them made a significant difference in her experience taking CSE 100/R. Sarah reported she could get her work done and

get paid to support her living expenses. When class material is created with equity as part of its design and accessible at all times, the combination allows students like Sarah to meet their outcomes.

In addition to her work schedule, Sarah reported being able to Zoom into her 9:00 a.m. class or watch the recording allowed her to socialize with her friends or study later, which made her college experience more enjoyable overall. She shared, “It is easier to make the classes because, you know, I do not have to get up early and rush to get to class and find a seat. I can sit at my desk log into Zoom and catch it on time.” As seen through the excerpt, the flexibility Zoom gave Sarah, specifically when she had to work night shifts, helped her enjoy classes and spend time with friends. For Sarah, the affordance of equity and access in the hyflex course enabled her to make decisions that best supported her learning, highlighting the significance of equity-centered access.

The exploration of experiences students reported connected to accessibility resulted in several significant findings. First, accessibility provided agency for students to prioritize self-care, allowing them to choose between attending class in person or virtually via Zoom or recorded videos, accommodating their varying needs, from more rest to managing heavy workloads. Additionally, students reported they integrated work commitments into their school schedules (e.g., Sarah worked night shifts to fund her education while keeping up with coursework through video lectures). Furthermore, students reported the course’s mobile-friendly design enabled students with lengthy commutes (e.g., Arturo) to access course materials conveniently on their phones and tablets, ensuring equitable access. Finally, although having access was essential for students to meet their outcomes, what they learned (i.e., content) and how it was applied to the real world (i.e., skills) was an important finding revealed by this study.

Accordingly, several participants indicated the curriculum was an important factor in the success and challenges they experienced when taking CSE 100/R.

Course Content: Real-World Skills Motivate Learning

The social justice education faculty development framework used for this study specifically highlighted how a well-designed curriculum supported equitable student outcomes (Adams et al., 2016). The model has encouraged educators to consider how the course content covers exploratory issues and perspectives that center underrepresented voices. Further, a curriculum that adheres to these principles allows students to connect and see their culture and experiences represented in the materials and ideas they study. Finally, course content and structure designed to connect lived experiences and real-world experiences have been shown to impact equitable student outcomes (Adams et al., 2016; Ambrose et al., 2010).

The findings from student and instructor interviews, ethnographic observations, and survey data showed students value a well-structured curriculum and Idris's dedication to teaching practical skills relevant to the real world (e.g., video game development). Students highlighted the hands-on, problem-solving nature of the CSE 100/R course as reflective of actual professional scenarios in engineering and mathematics. Students discussed this practical emphasis as a key aspect of promoting equity in a hyflex course structure. Further, Idris's willingness to evolve the course based on student feedback and work with the teaching team was reported as crucial in maintaining equitable learning experiences across different learning formats. However, although many students thrived under the structured hyflex approach, some reported challenges.

A central outcome Idris reported was that teaching practical, real-world skills to his students is vital. The findings suggest his students highly appreciated this focus on real-world

relevance; from their perspectives, the course content applied to their learning. For example, one student shared her opinion on how Idris's teaching motivated her by linking the concepts learned in class to tangible real-world applications, particularly in the context of video game development.

Moreover, many students emphasized the course's well-crafted structure, which was reported to actively engage them with problems connected to those encountered by professionals in engineering and mathematics. This structured approach enhanced their learning experience and played a crucial role in promoting equity within the hyflex course format. Idris's dedication to collecting and incorporating student feedback and his collaborative efforts with the instructional team to "stress test" the hyflex course infrastructure highlighted his commitment to continuous improvement—a finding students discussed during interviews. Although most students reported the well-structured hyflex design beneficial, it is essential to acknowledge some students expressed challenges and barriers in this learning format.

Well-Structured Course = Equity

Data in this section show the impact of an equity-centered hyflex course design, which (a) integrates real-world applications across fields like finance, medicine, and gaming, (b) reportedly resonates with students, (c) links curriculum to career goals, and (d) enhances learning experiences. Students reported valuing the curriculum's relevance and structured nature, which allowed them to incorporate skills and experiences from other areas, boosting motivation and engagement. They noted the chronological structure of the course aided in organization and learning while reducing stress and improving efficiency. Instructional materials like videos contributed to a low-stress environment. Stress testing in the course design is crucial, as it minimizes stress, as students and instructors reported, creating an inclusive and engaging

learning atmosphere. This evidence from students highlighted the design's effectiveness in reducing stress and enhancing learning, thereby illustrating relevance to the research question: How do students describe their experiences related to access, choice of modality, strengths, and pitfalls of hyflex instruction as it connects to their course that has been designed with equity for learning in its design? Idris referenced his desire to teach students practical, real-world skills:

> I like motivating concepts with real-world examples. So, a lot of times, students will share their unique interests. It's still, because it's a major course, but you know, are they are interested in the financial industry, in which case maybe we'll talk about examples using this data structure. We might use financial data or maybe they're interested in health, in which case we can kind of talk about examples that use health data. So, I think more so in the conversations that we have about how they can apply the concepts that they're learning in this class to whatever domains they're interested in applying it to. Those dimensions shape what types of discussions we have about the data structures.

In this extract, Idris highlighted his desire to build real-world applications for students into the curriculum. Specifically, he provided examples he said made sense for his students, topics such as finance, medical, and the video game industry. Idris shared his students latch on to these specific topics and have a deeper learning experience. This evidence provides a conceptual link to Idris's curriculum decisions and his students' reporting of an experience that supported their learning. For example, Sarah commented that the real-world aspect of the course content supported her learning; she reported how her professor motivated her learning in class: "He also tries to relate the things that we are learning to like actual real-world applications that have to do with things like video game development." For Sarah, this evidence indicated her appreciation for the course content and the intentional approach Idris took in crafting the course. Further, Sarah reported feeling motivated to learn when the topic directly applied to what she wanted to do for a job after university. Sarah's extract confirms the importance of authentic curriculum and how real-world skills motivated her to learn, connecting her learning experience with Idris's equitable approach to curriculum development.

Several students made a salient point about the way the course was crafted. For example, Arturo reported, “I think my favorite in-person classes have been ones where I am actively working on a problem like an engineer or mathematician.” Arturo went on to share that the class and content were structured to encourage him to use his lived experiences and prior knowledge from his other courses. Arturo emphasized that using the skills he developed in other courses felt good. He reported the active part of the lecture motivated him to attend class, and he was excited to learn. This evidence explicates how important and motivational applying skills and experiences was for Arturo, showing the importance of an equity-centered curriculum in his hyflex course.

Moving from real-world skills to course structure, Jen, a first-generation student and mathematics and computer science major who lived off-campus, discussed how the structure and organization of the content videos supported her learning during the course. She commented:

> I liked how the videos were organized in order to learn what I needed for the reading quiz, and then, since I was always watching the lectures after they were recorded, it always appeared last. So it was great chronologically to see what I was doing.

In this excerpt, Jen highlighted the effectiveness of the course’s chronological structure in enhancing her learning and work organization. The evidence suggests the structured hyflex course embodied equity by reducing stress and fostering efficient learning for Jen, thereby illustrating the value of an equity-centered hyflex course.

Mike reported agreement with Jen on how the course organization and structure reduced the stress. He shared, “The course structure and also the videos helped me learn, they were super clear, and you know, this actually took a lot of stress out of the course for me, because I could reference them in my own time.” For Mike, this quote shows how significant a well-designed course—specifically, the videos—was in allowing him to learn in a reduced-stress environment.

Mike also emphasized the importance of reducing stress, a key feature of a well-designed equity-centered hyflex course. This last point Mike presented tracked closely with what Idris reported about his design decisions for the course—specifically, all the work that goes on "behind the scenes" before the course starts. Idris noted spending a lot of time with his instructional team testing out the assignments and "stress testing" the systems. He commented:

> Yeah, so I use Trello to organize my course instruction; it's super helpful. I'll do this for each programming assignment; once it's ready for them to test, I'll create this test PA (programming assignment) and then. . . . I explicitly tell the instructional staff, please try to break it, try to do anything you can think of to either misuse the grader or bypass the grader or anything like that. If anything is unclear, then we'll just have very specific dialogue, you know, about, here is something that happens.

Drawing from his experiences, Idris emphasized the crucial role of stress testing the course. He relied on his instructional team's support, citing past experiences where issues in large enrollment classes caused significant stress for himself, his team, and his class. This rigorous approach to stress testing aligns with creating a well-structured hyflex course design that actively reduces student stress and anxiety.

The students interviewed reported the well-structured design of CSE 100/R enabled their opportunities related to equity in their hyflex course. Idris mentioned it was very important to him to collect student feedback data over several iterations of CSE 100/R and work with his instructional team to "stress test" the hyflex infrastructure of the course. Although most students interviewed reported the well-structured hyflex design and real-world content of CSE 100/R supported their learning, some students described challenges and experienced barriers when learning in a hyflex format.

Barriers to Learning

The data revealed several insights about student experiences and instructor decisions. Some students perceived the course as redundant, lacking the challenge necessary to stimulate

intellectual growth, indicating a barrier to providing an adequately challenging learning environment. Additionally, students faced challenges with the strict deadlines in the hyflex course, suggesting increased flexibility could have enhanced their performance. Despite these concerns, the instructor decided to enforce strict deadlines from a student-centered perspective, aiming to balance flexibility with structure.

This finding helps to provide evidence to answer the research question of how students perceive opportunities related to outcomes enabled or inhibited by the hyflex format. It reveals the complexity of teaching a high-enrollment course like this. The rigid structure, although intended to benefit students, ironically inhibited learning for some, creating barriers. This finding suggests even a well-intentioned, equity-centered hyflex course might not meet every student's needs fully. These insights highlight the nuances and challenges in implementing an equity-centered hyflex course design, especially in balancing the need for structure with flexibility expected in a hyflex course.

Lou, a bioinformatics major who lives on campus, communicated she was not challenged or engaged by the content in CSE 100/R. Lou commented, "I'm not learning; I did the textbook before classes started because we got a link. So, I did it over break, and I got through the whole thing, and like, I've already taken this exact class. I do not need to learn anything." Lou found the course redundant, having already covered the material in high school. She completed the programming assignments effortlessly during a school break, indicating a lack of challenge, a barrier to her being intellectually challenged and extended as a learner. Despite maintaining a 4.0 GPA, Lou reported the issue was not the difficulty of the work but rather the ease of completing assignments. This situation reveals even a well-intentioned, equity-centered course may not always meet every student's needs effectively.

Idris designed this hyflex course so students could take this experience as fully remote students, like Lou, who commented she never attended a class or engaged in any discussion sessions. Paradoxically, the self-paced hyflex design of CSE 100/R, although allowing Lou to complete all her work quickly and efficiently, did not build a sense of purpose and belonging for her in the classroom. Lou's experience reflects the shortcomings of the hyflex approach for students who might, as Lou reported, benefit from the human connection that could, in some cases, be more accessible in an in-person or hybrid course. The "choice" of hyflex appears to have been counterproductive for this student with respect to the affective aspect of her experience. For Jen, although she appreciated the flexibility of the hyflex format, she reported her professor's rigid deadlines were a challenge. Jen shared, "If maybe the deadlines were more flexible or like gave some slip days, you know, even if you were allowed to turn in with a penalty, for example, I still would have done much better."

This excerpt shows Jen's challenges with the strict deadlines in the hyflex course. She believed more flexibility in this area would have improved her performance. For Jen, the rigid course structure inhibited her learning and created barriers. This evidence reveals even a well-intentioned, equity-centered hyflex course may not always meet every student's needs.

Idris commented that with all the flexibility and accessibility he built into the course design, he had stringent deadlines for his students. He noted:

> I have strict deadlines that you have to complete at this time. I emphasize it in class and consistently; maybe in the first or second programming assignment, I'll get a lot of emails saying, "Hey, I missed the deadline by 10 minutes. Is there anything that you can do?" And I say, "Sorry, you have to keep up with the deadlines. Please, you know, take advantage of these lab hours, like these office hours. Start early, you know, get help when you need it." And usually, by the end of the quarter, it kind of clears up. And I've had students actually put in their responses and their evaluations that like, it was a good rude awakening for them that like, oh, there are expectations that are enforced.

As the interview continued with Idris, it became apparent that deadlines were an immutable aspect of his course design. He commented that for many courses, flexibility and multiple means pathways to complete assessment could support student learning and success; however, CSE 100/R as a hyflex course with 305 enrolled students required simplicity and consistency. Idris noted:

> I guess flexibility and structure are kind of sounding antagonistic. However, I think I try to make the course flexible in terms of everything being available at all hours of the day, but those deadlines that we set, they are fixed, and it is cyclical and kind of, you know, what to expect at any point.

These extracts show Idris's decision to enforce strict course deadlines stems from a student-centered perspective. Despite recognizing this approach might seem at odds with the flexibility expected in a hyflex course, he remained firm in his decision. This extract highlighted the complexity of teaching a high-enrollment hyflex course, as seen with Jen's experience, where not all students benefit from this aspect of Idris's course design.

Finally, the findings showed most students interviewed found the course content directly applicable, with a strong emphasis on linking concepts to real-world applications (e.g., Sarah's commentary on video game development). Findings suggest the well-structured course format encourages active problem solving, benefiting students and promoting equity in the hyflex course. Idris's dedication to student feedback and collaborative efforts for course improvement is evidenced in student and instructor interviews. However, although most students benefit from the structure, some students, such as Jen, reported challenges in this format. The next section reveals that students reported their instructor, Idris, was a key factor that supported them. All 10 participants interviewed referenced the significance of their professor in supporting their learning. This trend is supported across the literature on how important the instructor is in predictors of belongingness for students. Specifically, genuine and meaningful student–instructor

interactions make students feel valued in the college classroom (Kirby & Thomas, 2022; Pedler et al., 2022).

Faculty: Amazing Instructor Unlocks Learning

The third quadrant of the social justice education faculty development framework critically examines instructors' role in the design, development, and delivery of courses. This quadrant centers on the importance the instructor has on creating safe and generative learning environments. Further, this dimension encourages instructors to consider their positional power in the classroom and how it plays out with their students (Adams et al., 2016).

The findings from interviews, ethnographic observations, and survey data reported by students suggested Idris was central to their positive experience. Students stated Idris cultivated a safe and supportive learning environment across all modalities. Student interviews revealed an appreciation for his accessibility, the speed of his responses to their questions, and the consistent support he and his instructional team provided. Next, all 10 students indicated humor, kindness, and the ability to create an engaging environment significantly impacted their learning. Instructor interviews reported Idris's reflective teaching philosophy and understanding of power dynamics in the classroom. These insights emphasized his dedication to fostering a fair and equitable educational environment, which emerged as a significant finding. Accordingly, the subcode drawn to explore this section was amazing instructor.

Amazing Instructor

Data on the theme, amazing instructor, provide observations on the instructor, his teaching style, and his ability to connect with students. Students reported how Idris creates a fun and warm community in the class, using humor effectively to engage everyone. Observations

from February 16th further illuminate the instructor's teaching approach, marked by a blend of care and humor and underscored by genuine interactions with students.

The data revealed Idris's teaching style was not just about delivering content but about creating inclusive opportunities for students, often through references to popular culture. Students reported this equity-centered teaching made the class accessible and engaging. Data also revealed Idris's empathetic nature and introspective understanding that professors may hold misconceptions about their students' interests.

Interviews with Idris revealed his awareness of the challenges in connecting with each student in large classes. Yet, prioritizing these interactions is evident by evidence provided by his students. One student described Idris's significant impact on him by acknowledging him as an individual, which made him feel seen and encouraged him to participate more in class. The relevance of this evidence to the research question about students' perceptions of opportunities in hyflex format courses is significant, as it highlighted the crucial role of Idris as an "amazing instructor" in fostering rapport and community within hyflex environments.

All 10 students reported Idris's positive impact on their experiences taking CSE 100/R as a hyflex offering. Two students, Qui and Sarah, referenced feeling supported by the swiftness of Idris's responses. Qui noted that on the Discord server (i.e., the class's communication thread), "he responded to me in about 5 minutes. So, like, he was speedy in response; that would help a lot." He continued to express surprise that the instructor and instructional team were so "on top" of the class communication. Mike also highlighted this finding, commenting how "super active" the instructor was on the discussion boards, which made him feel connected to Idris, even though he was not meeting him in person. He noted, "It really feels like you are actually talking to this professor, and you actually know him very well." Qui, Sarah, and Mike all emphasized feeling

supported by Idris, who responded quickly to their needs. This dimension of learning reported by all three students reinforced the significance the instructor has in building relationships with students.

Connected to the care the students felt because of the speed and organization around the class structure was the humor and fun that happened during the hyflex course. Participants commented about how their professor liked to have a "good time" in class. This theme of fun and humor was reported by students across all three data collection instruments: surveys, participant interviews, and classroom observations. For example, Sarah commented on how Idris put her at ease during the class sessions. She commented, "He likes posts, memes, and everything. So, he makes the class fun for everyone. "He makes it less daunting, you know, like he also tries to relate the things that we are learning to like actual real-world applications." James also commented on how he used humor and kindness to connect with students. James shared:

> Idris is an amazing instructor; what I noticed is that he often relates to the people in the class, he uses references like meme culture or stuff like that. At the beginning of class when he was making the reading quiz for us he asked what my favorite video games are? Then in the final exam, the very last question was like, who's the professor of this course? He just keeps the class interesting and funny and sprinkles in-jokes, It is like to keep us immersed in the classes.

In the excerpt, James asserted that Idris is an amazing instructor, adept at relating to and building community with his students. James noted specific actions by Idris that contribute to a fun, warm community, including using humor to engage the class. This evidence from James's interview underscores the importance of an "amazing instructor's" role in developing rapport and community in hyflex courses.

Classroom observations of CSE 100/R were conducted on February 13, 16, 20, 22, 24, 27, and March 4. During these observed classroom sessions, humor and care were prevalent

themes coded in the data. For example, on February 16th, when coding the analytical memo, I highlighted themes of "fun and humor" strongly emerged:

> Again, Idris has a flow and style to his classes. He starts and ends on time and utilizes every moment of class time. He uses a lot of humor in this class. for example, when he was providing some tips and tricks for the examination, he said, "Nudge nudge wink-wink cough cough, this might be on the exam." [I am curious about this part of his pedagogical practices; he appears very genuine in class and looks like he is enjoying himself.]

Evidence from the February 16th observation showcased Idris's combination of care and humor in his teaching approach. It particularly highlighted his genuine and sincere interactions with students. This observation portrayed Idris as a compassionate, genuine, and thoughtful instructor who enjoys teaching in a hyflex modality, which aligns with the assertion that the instructor is a vital part of any equity-centered hyflex course.

The observation on February 20th revealed similar equity markers concerning the use of humor and care in the classroom. Idris welcomed his students into class and remarked, "How is life everyone?" The class laughs, and then he makes a joke about the midterm. The observer attending the class in dual modalities (i.e., in-person and Zoom) noted students in the physical classroom are smiling and connecting. At the same time, students who attend via Zoom react to the jokes and humor with smiling emojis and comments in the chat bar.

At the end of the February 20th observation, the observer's analytical memo commented on the "positive feeling" in the dual modality learning space, using words such as "generative," "kind," and "relaxed" to describe the affected aspects of teaching and learning observed. Finally, I interviewed Idris and probed deeper about the motivations for using humor and care in the classroom. Idris commented that this dimension of teaching and learning (i.e., social–emotional aspects of teaching) has always been very important to him as an educator. He believed this dimension is more important when teaching in a hyflex environment. For example, he made

small changes to his Zoom background to keep his Zoom students engaged. Idris also commented on how he works into his class materials' references to popular and gaming cultures. He noted:

> I try to make sure to kind of introduce the gaming stuff that I like. However, then maybe next lecture, do a little bit about movies that I have seen or TV shows that I like, or music that I like because you know that the gamers are going to really attach to the gamer side of it, but then if some students are not gamers, I do not want to alienate them. So I try to mix in pop culture references that even if I am, it is not my biggest thing, but at least hopefully try to spread as wide of a net here so something hopefully everybody can latch onto. At least, that is the goal.

In this excerpt, Idris emphasized his desire to create opportunities for his students, particularly through references to popular culture. He aimed to make the class inclusive by incorporating a wide range of content. Idris highlighted his goals and motivations to keep students engaged and excited, linking these efforts to the broader objective of instructors building welcoming, safe environments. This approach is a central tenet of equitable teaching.

When exploring this theme of care and compassion with Idris in his interviews, his body language changed, and he became animated as he explained how empathy is such a central tenet of his teaching philosophy. At one point in the interview, Idris paused and seemed reticent to share. [I could sense that Idris was trying to explain why his students resonated with his class and had a good experience but was trying to choose a way to explain that was not self-aggrandizement.] Idris shared how he understood how his students felt about taking CSE 100; namely, he took CSE 100. Further, as a teaching assistant, Idris was part of the instructional staff for CSE 100, and finally, as a professor, he redesigned CSE 100 into CSE 100/R, a hyflex course. Idris noted his ability to put himself in the position of his students as a critical motivation for designing his course as a hyflex offering:

> I think one trap that a lot of faculty fall under is that I think they are passionate about the subject matter. So they assume the students are very passionate about the class and this subject matter, whereas I recognize that the students taking my

> class, a lot of them just are taking it as a prerequisite to maybe some machine learning classes that they are more interested in. . . . I also kind of recognize that this might not be the highest priority in everyone's life. So, I think flexibility and not having draconian punishments if students choose not to come physically to class is a big philosophy of mine.

This evidence focuses on Idris's empathy and introspection. He acknowledged professors, including himself, may have inaccurate assumptions about students and the course content. For instance, Idris realized students might not share his enthusiasm for data science. This realization reflects his empathetic and emotionally intelligent approach toward students. Motivated by this understanding, Idris has integrated considerable flexibility into the course and has avoided punitive measures. This approach is essential to an equity-centered hyflex course and highlighted the pivotal role of the instructor.

Idris reported that as part of his efforts to build community in the classroom, he makes much effort to learn his students' names. He also acknowledged he cannot remember over 300 students' names in such a high enrollment class. However, he said, UCSD has a program where students can have a coffee with their professor, and the university pays for the experience. Idris noted:

> So, I have done "coffee with your prof," on average, probably like five or six of those each quarter. So, I do not get to really have a one-on-one with the entire 300-person class, but I do typically, through those coffee chats and meeting my students at the end of class, have in-person interactions with probably 5–10 students.

In this excerpt, Idris emphasized his ongoing effort to build community with his students. He acknowledged the challenge of knowing each student in a large class, but this evidence underscores the importance he places on these interactions. This commitment to student engagement explains students' positive perceptions of him, which is vital in equity-centered, hyflex learning environments. Arturo commented on this approach to building community in a hyflex environment:

> Well, I think overall, in really big classrooms, it is really hard for a professor to get to know you. I mean, after that one time that I talked to him, he did start referring to me by my name or my nickname, which was really appreciated, and it is just that he just did not forget. I think he had that, like, the idea of my question and who I was just in the back of his head. That definitely helped me keep more interest because when you know that someone has a personal interest in you, you kind of feel like it is a personal goal of yours to do better.

This portion of my interview was quite emotional to listen to, as Arturo described the profound impact Idris had on him by remembering and acknowledging him as a person. Arturo emphasized how this interaction first made him feel seen and, second, motivated him to engage and ask questions in class. This evidence correlates with Arturo's positive experience as a student and the efforts Idris made to ensure Arturo felt seen and welcomed. In essence, this extract illustrates the positive impact Idris's actions had on Arturo. Finally, to foster a connection with his students, Idris mentioned he drew upon his own experiences as a student in the same class "not that many" years prior. This educator introspection is an essential tenet of a highly impactful social justice educator (Adams et al., 2016; Kishimoto, 2018).

Educator Introspection

Data under the theme educator introspection revealed aspects of Idris's teaching approach, particularly how he leveraged his intersecting identities to enhance student learning in his class. The data report he uses his identity as a "white presenting" male to guide class discussions that could veer off course. In another situation, he lessens his authoritative role intentionally, adopting a more humanized approach to relate to his students. This information is particularly relevant to the research question, "How do students perceive opportunities related to outcomes that were enabled or inhibited by the hyflex format?" It demonstrates that, although Idris's methods may appear contradictory, in the light of a hyflex course, they are strategic uses of his positional power and identity. These tactics not only support student learning but also contribute to creating inclusive, equity-centered environments in the hyflex course.

The quadrant of the social justice education framework that centers on the experiences of educators encourages exploration of their positionality and socialization. Through this deeply introspective process, instructors can decenter their traditional authority in the classroom and connect with their students (Adams et al., 2016; Alvarez, 2012; Kishimoto, 2018). During the interview with Idris, he provided detailed responses to all the questions. However, when asked about his positional power in the classroom and how his intersecting identities impacted the student–instructor interactions, this was the only time in the interview in which Idris took extra time to formulate his response. The analytical memo of this interview highlighted this pause:

> I am curious here, every single question asked to this point, Idris fired back a full-throated response; he did not even break the momentum. I noticed his body language and demeanor change. I am not saying he could not respond, but he was thinking hard about how to formulate this answer.

The analytical memo highlighted a moment where Idris paused before addressing a challenging question about positional power and intersecting identities. This pause seemed to me to reflect deep thought and introspection. His body language shifted, visibly showing his effort to carefully formulate a well-considered response. This observation ties into the theme of this section (i.e., educator introspection), which links equity in a hyflex course to the instructor's capacity for profound reflection on issues of positionality and the interaction of their identities.

As I started to probe around questions of positionality and intersectionality during the interview, Idris commented that he felt he was straying from the central question around identity. This correction was done without any prompts from the interviewer. Idris commented:

> I'm starting to get away from the identity aspect of it. So I . . . kind of use the privilege of being a male, white-appearing faculty member. When I'm forceful, students listen. So, if I have to kind of bring down the hammer of, Hey, let's cut this out, I do encounter that students typically listen to me.

Connected to how Idris used his position as a "white presenting male" is how he decentered traditional authority in his classroom. Idris reflected, "I mean, definitely, I think trying to

humanize myself, like mixing in my hobbies, mixing in, yeah. All these dimensions of my life that hopefully a student can relate to. Absolutely, I try to do that very consciously."

Both excerpts highlight Idris's use of his intersecting identities to facilitate and enhance learning in his class. In the first instance, he used his position as a "white presenting" male instructor to steer potentially harmful class discussions back on track. In the second, he diminished his traditional authority by presenting himself in a more humanized manner. Although these approaches may seem contradictory, within the context of this theme, they serve as evidence of Idris employing his positional power and identity to support student learning and foster welcoming, equity-centered spaces in his hyflex course.

The question around his positional power and intersecting identities was challenging for Idris. However, it was a question that he had clearly given a lot of thought to. Idris shared, "That's a great question. I definitely think about it quite a bit. I try to think about, you know, power dynamics." He said this question challenged him, which was an honest response because this quadrant of Adams et al.'s framework is particularly challenging for educators to grasp fully. This work requires deep introspection and intentional planning to avoid replicating potentially harmful behaviors that have and do exist in the higher education classroom (Adams et al., 2016, 2022; Kishimoto, 2018). For Idris, he acknowledged important parts of his identity while teaching CSE 100/R and how these aspects influenced his hyflex course design, namely his decision to build lots of "human moments" into the hyflex course.

In summary, the findings overwhelmingly pointed to the students having a generative experience in CSE 100/R, which was attributed to Idris, the instructor. He created a safe and supportive learning environment, responded promptly to students' questions, and consistently provided valuable support. Further, students highlighted the importance of Idris's humor,

kindness, and ability to engage them across the modalities. Significantly, Idris reflected on his positionality, intersecting identities, teaching philosophy, and the dynamics of power in the classroom. This introspection underscored his commitment to commensurate equitable hyflex environments.

Finally, connected to how Idris wanted to create safe and supportive learning environments was his desire to ensure his students had lots of opportunities to access CSE 100/R in ways that best fit their needs. This aspect of flexibility is a central tenet of hyflex course design; accordingly, the a priori code learner choice was used to explore student experiences in the next section.

Learner Choice: Making the Big Choices to Support Learning

The learner choice principle differentiates hyflex course design from other instructional models. This principle affords students autonomy and agency in how they engage with the class material each week. Without this flexibility of "learner choice," a hyflex course reverts to a hybrid course offering. This principle also reflects the pedagogical and philosophical orientation of professors designing and teaching the course. It sends messages to students about what is valued as the "choice" they (i.e., students) make to support their learning. Student agency is a central tenet of this principle and an integral part of creating equitable hyflex experiences (Beatty, 2019; Binnewies & Wang, 2019; Ghosh & Coppola, 2023). Accordingly, this principle was used to explore the student experiences taking CSE 100/R as a hyflex offering.

Findings from student and instructor interviews, ethnographic observations, and survey data showed, when taking CSE 100/R as a hyflex course, students deeply valued flexibility for their learning. Students reported making choices that made their lives more convenient and supported their learning. Students shared having the options of the three modalities allowed them

to choose a “specific learning style” that worked for them. Next, students used the recorded videos to “augment” their learning and speed up or slow down the instructor, which helped students with knowledge and comprehension of the material regardless of their chosen modality. The findings show students reported choosing a modality was complex. Some students reported meeting their professor in person was the biggest factor in their modality choice. However, despite repeatedly saying they preferred in-person learning, they ultimately chose the modality that best suited their life and schedule at that time.

Finally, students shared the importance of using hyflex in optimizing their time, which was explained through examples such as choosing a Zoom option to save time on the commute to class, working ahead on assignments to free up time for jobs and other classes, and watching content and completing assignments on their mobile devices while commuting on the trolley to class. Findings suggest students living on and off campus overwhelmingly chose a remote learning option. The next section explores learner choice through three subcodes: flexibility for learning, modality choice, and time optimization.

Flexibility for Learning

Data under the theme of flexibility for learning provide insights into how students like Jen and Karmen used the hyflex format to enhance their learning experiences. Jen highlighted the importance of this flexibility for her well-being and sleep, noting she can still effectively learn through recorded videos. This approach allows her to progress at her own pace, deepening her understanding and comprehension of the material. Similarly, Karmen, facing a busy 16-unit course load, found attending classes via Zoom from home saved her 3 hours each week, a crucial factor in managing her schedule. This evidence ties into the research question, “How do students perceive opportunities related to outcomes that were enabled or inhibited by the hyflex format?”

It demonstrates the flexibility of the hyflex format (e.g., choosing when to attend class and using videos for learning) provides students like Jen and Karmen with significant opportunities to handle their academic responsibilities in their hyflex course effectively.

Unsurprisingly, participants attending CSE100/R widely discussed flexibility for learning. All 10 participants spoke about the affordances this hyflex course provided them. Jen discussed how hyflex helped control her schedule and time, and she commented that being allowed to choose the different modalities allowed her to pick a "specific learning style" that worked for her:

> Usually, I go to lectures for the first week . . . as soon as I hear the word this is recorded, I usually tend to like watching my lectures later. I guess I'm not much of an early riser, so I would prefer, you know, sitting down at my own pace.

Jen continued to discuss how she had time to augment her learning with other material, such as YouTube, by attending the fully asynchronous hyflex option. Jen commented:

> What I really like about recording recorded lectures is that I have the time to pause or speed up certain parts that I understand well. Or, you know, I could pause and then open a YouTube page, you know, get more references.

In these excerpts, Jen emphasized the significance of using the flexibility of the hyflex format to support her learning. She particularly valued sleep and well-being and found she could still learn effectively through recorded videos. Jen also noted the importance of progressing at her own pace for a better understanding and comprehension of the material, which was made possible with the help of the recordings. These data directly relate to the research question as they illustrate how the hyflex format's flexibility afforded Jen opportunities, especially in choosing when to attend class and using videos as support.

Moving to the question of whether students who lived on campus still chose to Zoom or watch the recorded lecture was interesting. When asked about this, Sarah shared, "Also, because I live on campus and I'm in Shafer College (resident hall), Shafer is pretty far from everything.

So, I didn't want to walk." Shafer College is a 25-minute walk from the classroom where CSE 100/R was held, and it appeared the commute time was a consideration for Sarah and others interviewed who lived on campus. For example, Karmen, a computer science major, shared that she attended class for the first 3 weeks and then switched her modality choice as her schedule changed. Karmen shared:

> So, I ended up changing as the quarter went on. So, I think the first probably 2 or 3 weeks I went in person every single day. However, part of it was just like, I live on campus, and I live in Perryville (resident hall), which is a solid 25-minute walk from where our class was. Also, as the quarter was like getting busy, things were being added to my schedule. I realized, hey, it would save me some time if I just went on Zoom. So, I still like to watch it at the regular lecture time. I like watching the live Zoom, and then at the end of the quarter, I only went on Zoom.

In this extract, Sarah and Karmen articulated choosing to attend classes via Zoom from home for time optimization. Karmen calculated a time saving of 3 hours per week. With her substantial 16-unit course load, she recognized the necessity of leveraging the flexibility the hyflex format offered to manage this busy schedule. This information is pertinent to the research question concerning how students perceive opportunities related to outcomes enabled or inhibited by the hyflex format. For Karmen, and similarly for Sarah, the time-saving aspect of this flexible format created significant opportunities, enabling them to better navigate their academic responsibilities in the hyflex environment.

Across the educational literature of hyflex instruction, flexibility and choice were essential to the hyflex experience (Beatty, 2014, 2019; Bratberg et al., 2021; Ghosh & Coppola, 2023). This finding was also reflected across the corpus of data collected for this study. Accordingly, the following sections explore student experiences regarding modality choice and how it supported their CSE 100/R learning.

Modality Choice

The modality choice theme in the data revealed how students like Ben and Arturo used the hyflex format to enhance their learning. Ben reported valuing personal connections and initially chose in-person classes to build rapport with his instructor, Idris. When his schedule became busier, he switched to Zoom classes, finding it "good enough" despite his preference for face-to-face interaction. Arturo, on the other hand, chose in-person classes and reported using mobile-ready course content to use his long commute for studying, showing how logistical factors impact modality decisions. Both experiences addressed the research question about students' perceptions of the hyflex format's impact on learning opportunities. Ben's case highlighted the importance of instructor connection balanced with the need for flexible attendance, while Arturo emphasized how logistical needs influence class format choices. Together, their experiences demonstrate the hyflex format's effectiveness in allowing students to customize their educational experience in a flexible, equity-centered environment.

For Ben, a computer science engineering student who lived on campus, attending in-person classes to speak to his professor was a priority. He shared that he appreciated the discord server (i.e., class communication system); however, he got a "richer" experience from talking directly to Idris. Ben shared, "I would definitely try to go in person . . . just being able to ask Idris questions and have a constant conversation is helpful. . . . This is like your one opportunity to kind of talk to him in person." Although this was important for Ben at the start of the course, as he became "more settled," he started to reevaluate his modality choice. Ben was attending the in-person classes at the start of the course, then, became busier and his work "ramped up," so he started to Zoom. When asked how he felt about his learning experience in his two modalities, he shared, even though he preferred in-person learning, he could learn in the Zoom environment:

> At this point, I think it's good enough because of what Idris does. He makes sure that the TAs are there, scanning the chat constantly so you get a decently quick response. He divides his attention between in-person and his tablet, and just the constant, like the ability to carry on that conversation, is the most important thing.

Ben's experiences underline the importance of personal connection in the educational setting. Initially, he prioritized attending classes in person to establish and build a rapport with Idris. This personal interaction was noted as crucial for Ben in forming a supportive relationship with Idris. As time progressed and his schedule became busier, Ben, having already formed a solid relationship with Idris, opted to switch to Zoom classes for convenience. Despite his preference for in-person sessions, he found Zoom "good enough." This aspect of Ben's experience was particularly relevant to the research question about how students perceive opportunities related to outcomes enabled or inhibited by the hyflex format. It highlighted how Ben fostered a sense of community with his instructor, which he valued greatly, while having the flexibility to attend classes via Zoom, when necessary, thus enhancing his ability to succeed in the course.

James, a computer science engineering student like Ben, was reported to be very busy; however, James's busy time was noted at the start of the course, so he opted for Zoom. He noted, "For the first half of the quarter, I was just attending like the Zoom sessions." Then, as his schedule cleared, he decided to attend in person. Again, like Ben, James reported needing to access the modality that best supported his learning, given his personal circumstances. James, like Ben, preferred in-person learning, but both reported they did not feel they were missing out on the experience because Idris could "teach well" in all the modalities. This evidence illustrated a positive valence toward both students having their opportunities enabled by the affordances of a flexible equity-centered hyflex course.

Continuing exploring students' experiences related to modality choice, Arturo, who had the longest commute to campus out of all 10 participants interviewed, reported, "The thing is, even though going remote has a lot of benefits for me, I still like going in person just because I think it gets me more in the mindset of being a student." Arturo commented that because of the flexibility of the class, he could do a lot of his work from his phone while commuting from "down south." In this extract, Arturo made a direct connection between his desire to go in person and being able to study on his long commute. He emphasized this point as significant in his ability to make that decision to attend his in-person class. This evidence connects to the research question on how the hyflex format, in the case of Arturo, enabled him to learn in this flexible format. Most participants spoke about their busy schedules as students. Many participants commented about pressures outside their studies that were part of the decision-making process. Accordingly, the next section explores time optimization as a salient subcode.

Time Optimization

The data on time optimization revealed how students perceived the hyflex course format as enabling or inhibiting certain outcomes. Arturo, for instance, chose in-person classes for the college experience, balancing this with remote work during his commute to optimize time. Faith reported a similar theme; her focus on efficiency in a hyflex environment allowed her to complete those tasks swiftly, enhancing her time management and achieving her goals. Lou's experience further illustrated this point; the hyflex design flexibility enabled her to maintain a perfect 4.0 GPA with minimal effort. Collectively, these data aligned with the research question on how students perceive opportunities related to outcomes enabled by the hyflex format, highlighting its impact on their academic choices and time.

For students, the hyflex CSE 100/R learning environment allows agency in how they attend. However, an important discussion was around the affordances this flexibility allowed them and how this impacted their experiences as it related to their learning. For example, Arturo lived 40 minutes from campus but found real value in attending his classes in person. He commented that because he made the choice to commute to his classes, he needed to "make the most" of his trolley journey to the university. He did this by watching the prerecorded videos and completing the weekly homework quizzes. He shared:

> I will take the trolley from very far south, and it'll be like an hour and 10 minutes on the trolley, so I do have some good time to work there. I would say I did get like 50 minutes of work done in that time.

Arturo reported "time efficiencies" helped him decide to take the class in person. This extract highlighted that Arturo wanted to be in class and have a college experience; however, he had to weigh this against a long commute. His ability to optimize his time by working remotely on the way to class helped him choose the modality he most desired. This evidence is relevant to this research question as it relates to the opportunities enabled for Arturo by the hyflex format.

Faith reported being extremely motivated by "time optimization." She saw the 20-minute round trip commute to her class as "suboptimal," and she noted:

> That is still 20 minutes I lose 3 times a week if I go to an in-person class, that adds up to an hour a week that I could have spent doing something else. This is also why I try to optimize my classes by putting them next to each other.

This extract highlighted a reported calculation by Faith aimed at optimizing her time for studying and other tasks. Her focus on efficiency enabled her to complete her work swiftly, aligning with her priorities. These data align with the second research question, which explored how an equity-centered hyflex course can enable opportunities. In Faith's case, the flexibility of the course significantly enhanced her time management, helping her achieve her objectives.

Lou also discussed her time optimization when it came to CSE 100/R's assignments. She reported:

> I calculated that I could get 80% on both the midterm and the final, and I would still get an A in the class and keep my 4.0. So, if I put minimal effort in and still get the grade I want, I'm fine with that.

For Lou, similar to Faith, the hyflex course design enabled her to fully optimize her time and maximize her efficiencies, all while maintaining her 4.0 GPA. Lou strongly emphasized preserving her perfect GPA was her top priority. Having previously taken this course, she focused on achieving her goal with minimal effort. The flexibility of the hyflex course format was key in facilitating this goal.

The analysis of students' learner choices emphasized the significance of flexibility in their learning experiences. The findings revealed that students prioritize convenience and choosing their learning styles when making choices and often reported using recorded videos to enhance their comprehension of course materials. The complexity of modality selection is evident, with some students placing value on in-person interactions with professors and others opting for flexibility to suit their intricate lives and schedules. Furthermore, findings highlight how hyflex courses enable students to optimize their time efficiently, allowing them to make the most of the hyflex options. Notably, remote options were popular among both on-campus and off-campus students. Although findings showed learner choice is a significant dimension influencing student experiences related to equitable outcomes, another dimension that emerged as worthy of deeper consideration was how commensurate were students' experiences across the modalities. The a priori code equivalency explored how students experience their modality choice and if they felt they had commensurate experiences across the modalities they chose.

Equivalence: The Way the Course Was Designed Helped Us Learn

The central tenet of the equivalence principle is to ensure that whichever modality the student chooses should not lead to inferior learning outcomes. This principle has been identified as a challenging part of hyflex course design and requires careful planning (Beatty, 2019). For example, just watching a recorded class video cannot replace the full experience of being there in person. Equivalency does not always mean equal experiences; however, if designed correctly, it should mean equitable experiences (Beatty, 2007a; Binnewies & Wang, 2019; Detyna et al., 2022).

Findings from interviews, ethnographic observations, and survey data indicated students' experiences exploring this dimension were overwhelmingly positive. One finding suggested flipped learning videos were particularly popular with students across all learning environments. Students reported accessing the videos in different ways to support their learning; however, they were universally found to support learning across the modalities. Accordingly, the video content for CSE 100/R served as a vital resource to create equivalency across the modalities. Next, students commented on how the structure and support systems built into the class supported equivalent experiences. For example, if students missed class or could not attend a Zoom session, the instructor and instructional team provided teaching assistance support and a class discord server (i.e., class question and answer online discussion board).

Conversely, not all students thought their experiences were commensurate. Some students who Zoomed in or watched the video said there was nothing as good as being in person, but when they had to take these other options, it was "good enough." The next section explores student equivalent experiences related to equitable outcomes through the following subthemes: commensurate experiences and experiences not commensurate.

Commensurate Experiences

The theme in the data of commensurate experiences of students revealed how an equity-centered hyflex course facilitated a balanced learning experience across different modalities. Mike's interactions with discussion boards, especially with Idris's active participation, mirrored the dynamics of an in-person dialogue, showcasing the effective substitution of physical presence with technology. This novel approach enhanced his view of other learning modalities. Similarly, Sarah's ease in using the full range of options in her CSE/100R course exemplified the importance of a consistent learning environment across modalities. The interactions between Zoom and in-person students, fostered by Idris's equitable questioning, increased participation and created a relaxed and enjoyable atmosphere, as evidenced by the evident fun and confidence among students. This finding aligned with the research question about students' perception of opportunities and outcomes influenced by the hyflex format. It reinforced the hyflex design's role in facilitating learning rather than hindering it, with technology being a crucial element in bridging modalities. This effectiveness is further highlighted by Idris's deliberate consideration of all learning modalities, showcasing effective pedagogy that enables students to engage across the modalities.

Mike, who enjoyed attending CSE100/R in person but sometimes needed the flexibility of leveraging the other modalities, reported he felt it still supported his learning when he accessed class through the other modalities. Mike shared a specific example about the prerecorded video lectures and asynchronous discussion boards and said:

> We do have problem solving sessions where you can interact with a professor, ask questions directly, and then have a discussion board where you can ask questions to the professor. He's super active there. So it feels like you're actually talking to this professor . . . also everyone watches the same lecture videos. I think it's a novel way of doing it because we have access to YouTube, so we can just watch

> these very refined videos about topics. You can learn very quickly about very dense material.

This excerpt indicated that for Mike, the use of discussion boards, and particularly Idris's prompt and active participation, created a sense of engaging in dialogue with the instructor as if he were physically present. This finding suggested the course's design, augmented by the technology used, effectively substituted for an in-person experience. Mike perceived this approach as novel, suggesting a positive valence for other modalities. This evidence supported the research question by demonstrating how an equity-centered hyflex course can provide a commensurate experience across different modalities.

Mike reported that these other ways of engaging with the material supported his learning when he could not attend the in-person classes and talk to Idris. He kept using the phrase "refined video," and when asked more about this, he reported that because the prerecorded content was so explicit and accessible, he felt it was an excellent alternative to attending the in-person lecture. Although he preferred to attend in person, it was "good enough" or commensurate for learning.

Sarah, a student who attended all the modalities offered at different points in the course, commented she did not find much difference between attending in-person or the fully remote option. Sarah shared:

> To me, they are both the same. It is nice to be able to ask a question live, but really, for me, it is pretty much the same because if I do have a question, we do have the Discord server, so I can just go in there and ask a question that I might have.

In this quote, Sarah expressed her comfort in fully using all the options available in the CSE/100R course, actively leveraging the support integrated into its design. This example indicated her ease in switching between modalities, which explicitly demonstrated the significance of experiencing a commensurate learning environment across these modalities for

her. The key point was that the hyflex design did not hinder Sarah; it facilitated her learning. This finding tied directly to the research question and supported the idea that an equity-centered hyflex design can be beneficial, as evidenced by its positive impact on Sarah's academic experience.

Observational data collected for this study further support the students' responses about their experiences engaging in the different modalities. All six analytical memos written at the end of each observation mentioned how Idris drew thoughts and ideas from the students in the classrooms and on Zoom. An example from February 15, 2023 noted:

> Also, there was a lot of Zoom engagement during this class session. The Zoom students and the in-person students were riffing off each other (this is a good example of equivalency). The instructor supported this here as he asked for any thoughts or questions in both the Zoom and in-person classes. The instructor asked nine questions, and the in-person students posed 10 questions, and there were 15 unique questions from the Zoom students. In this observation, I am noticing a trend of who is attending to which modalities and wondering about the consistency here. Finally, I am noticing how Idris does a really nice job using the whiteboard tools to engage the class. For example, he is able to screenshot some formulas and reorder them. This class had lots of equity markers here. I noted good humor and care in the room, connecting and welcoming the Zoom and in-person students. Knowing the students' names in the class and providing space to extend students' learning if needed.

This excerpt highlighted the interaction between Zoom and in-person students in the class, particularly emphasizing how Idris fostered dialogue across modalities through equitable questioning. This approach led to increased activity and engagement among students in both settings. Additionally, the class environment was characterized by fun and laughter, often initiated by Idris's playful demeanor. As an observer, it was apparent students in both modalities were enjoying themselves and appeared relaxed. The high volume of questions posed in class further indicated their confidence. Importantly, technology played a key role in engaging students across modalities and facilitating commensurate learning experiences. This finding

aligns with the research question focusing on how student opportunities related to outcomes are enabled by the hyflex design.

I was curious how students attending the class fully asynchronously received the recorded class videos. An observation from watching the classes was how Idris paused after either a Zoom or in-person student asked or answered a question. Idris then repeated the question to benefit the students attending in all three modalities (i.e., equivalency). When Idris was asked to expand on this, he commented:

> When I am teaching, I am constantly thinking about the students on Zoom, in the room, and also about the students who will be listening back later to the recording. The technique of repeating before the questions, I think, works well to include all the students, and it's easy and quick.

This quote shows Idris was thoughtfully considering all three learning modalities, demonstrating effective pedagogy that fosters commensurate learning experiences and enables students to engage across various modalities effectively. Although most participants felt they had a commensurate learning experience in their chosen modalities, some students shared that their learning experiences in their hyflex course were not commensurate.

Experience not Commensurate

The theme from the data, experiences not commensurate, provided a lens into how students perceive the hyflex course design, especially in terms of social and emotional aspects of learning. Mike, Qui, and James highlighted these aspects, underlining the potential limitations of the hyflex format in providing an equitable educational experience. For example, Arturo reported discomfort with the platform in his experience with Zoom. His previously established relationship with the instructor, Idris, became less impactful in the remote setting, where he found it difficult to connect with Idris as a person. This example was relevant to the research question about how students perceive opportunities related to outcomes influenced by the hyflex

format. It shows that although the flexibility of hyflex courses often led students to opt for remote learning for its convenience, this choice may have come at the expense of valuable social interactions, as seen in the experiences of Mike, Qui, and James. Furthermore, Arturo's case highlighted that the effectiveness of hyflex learning varies among students, with some finding it less supportive of their learning needs.

An important finding that came up as students shared their hyflex experiences was based on the dimension of emotional and dispositional elements of learning. For example, James, who preferred in-person learning and used the other modalities sparingly, commented that Zoom was "fine for learning" but not good for building friendships in class. He shared, "Zoom, I would use last because, just like, in terms of learning, it is fine, but in terms of being there with other people, seeing their faces. . . . It is like you just miss out on it when you are on Zoom."

Mike shared the same sentiment with James, commented that computer science engineering as a major is "not very social," and wanted to see more relationship-building opportunities built into the curriculum. Mike shared, "Especially with CSE, it is not great, it is not very social, which . . . I do not know, I think it is a downside. I think that class could push me to be more social." Mike continued to share that with all the choice and flexibility, students tend to choose a remote option, which did not help the social aspect of learning.

Qui, a student who also expressed an interest in in-person learning, supported James's and Mike's comments about students being given a choice not to attend in-person classes. When asked about opportunities to build community in a hyflex course, Qui shared:

> I don't think there are many opportunities to do that, mostly most people are online and then don't even show up to like the live lecture. They will just watch the recordings and answer posts. It is like they do not really build relationships with other people. They just see you as a responder to the questions.

All three students, Mike, Qui, and James, addressed the social and emotional aspects of learning, which is crucial in understanding how the hyflex design might limit certain opportunities for students. The abundance of flexibility in hyflex courses often led many students to choose remote options due to their convenience. However, as seen in the experiences of Mike, Qui, and James, this preference for flexibility often came at the cost of the social aspects of learning.

Arturo shared his dislike for Zoom, commenting that it made him feel "detached from class." He shared:

> If I am going to be on Zoom, I am already going to feel detached from the conversation and the lecture, so most of the time, I would rather just watch the video if I am going to be remote. I feel like there is not much difference. So, I mean, seeing someone on the screen is hard. It is hard to see them as people instead of as a video and recording.

This excerpt highlighted Arturo's dislike of learning via Zoom, particularly how the sense of detachment hindered his classroom learning experience. Although Arturo had established a relationship with Idris, this connection diminished on Zoom as he struggled to perceive Idris as a person in that setting. Arturo's experience demonstrated learning experiences in a hyflex course are not effective for all students, with his case showing how it can hinder learning.

Arturo ranked his preference for learning as number one, attending class in person, two, watching the recorded video, and the final resort was attending Zoom. The tensions arising from the modality choice appear to be centered on the students who value in-person learning. Mike, Qui, and James all experienced the tension of flexibility and choice set against their preference for more traditional classroom teaching and learning in which they could build community.

Ensuring equivalency in a hyflex course is a challenging endeavor (Beatty, 2019). However, in the case of CSE 100/R, students reported overwhelmingly positive experiences, with flipped learning videos being a standout favorite across various learning modalities. These

videos were found to significantly aid learning. Additionally, the course's structure and support systems (e.g., teaching assistance and a class Discord server) were instrumental in creating equivalent learning experiences. Although some students expressed that in-person interaction was superior, the alternative options were considered "good enough" for their needs. The next section explores how students make judicious choices around their learning, experience a sense of belonging, and comment on their perceived opportunities related to outcomes enabled or inhibited by the hyflex format.

Students – Making The Judicious Choices Helped Us Meet Our Outcomes

The students quadrant of Adams et al.'s teaching for social justice framework focuses on the assets students bring to the classroom, how instructors support student-to-student interactions, and how welcomed students feel in the classroom space (Adams et al., 2016, 202). This section explores the findings from students' experiences in their hyflex courses reported through interviews, ethnographic observations, and survey data. Three subthemes emerged from the data: the judicious choices students make when learning in a hyflex environment, how hyflex learning helped or hindered their learning, and if they met the course learning outcomes. First, judicious choices were made based on the unique life circumstances reported by students; for example, students reported they could use hyflex to ensure "self-care" was prioritized. Further, students shared they used hyflex to fit paid work around their school schedule to support their financial obligations. Some students reported they made judicious choices to attend CSE 100/R as fully asynchronous students. In contrast, others shared they chose to participate in every class in person even though Zooming or watching the recorded video was more convenient for their life. In these circumstances, students wanted to have the "college experience."

All 10 students indicated, to various degrees, their course learning outcomes were met. Students shared how the "real-world application of the material" was beneficial in meeting their goals. However, some students shared, even though they felt they had met their outcome, they were unsure if they were ready to apply to a work setting. Alongside the judicious choices students made, other students noted the structure and support of the class helped them achieve their learning outcomes.

Judicious Choices

The theme in the data, judicious choices, provided insights into how students made strategic choices within the hyflex format, balancing their educational needs with personal circumstances. Jen's decision to forego in-person classes in favor of night shifts enabled her to work and study simultaneously, demonstrating how the hyflex format supported her in earning a living, paying for education, and excelling academically. Similarly, Lou's choice to be fully remote from the outset of her class, a course she had previously taken, allowed her to allocate more time to other pursuits, streamlining her educational process with her priorities. Arturo's situation, however, highlighted the paradoxical nature of hyflex courses. His desire for a traditional college experience was tempered by the need to manage life commitments, including the burden his attendance placed on his family. This example reflected a careful balancing of personal wants against the practical implications for his family.

Collectively, these examples were relevant to the research question about how students perceive opportunities related to outcomes enabled or inhibited by the hyflex format. They showed the dual nature of hyflex courses: Despite offering flexibility and choice that can empower students like Jen and Lou, they also pose unique challenges, as seen in Arturo's case. This evidence added a nuanced layer to the conversation, showing the hyflex model can

simultaneously enable and constrain student opportunities, depending on individual circumstances.

Students learning in a hyflex environment made decisions each day based on a multitude of factors. These judicious choices were based on students' unique life circumstances. For example, Ben reported he made the most of all modalities; he "loved going in-person" but also knew there were a lot of options to seek out TA office hours if he missed class and needed help. As Ben got increasingly busy, he commented he would prioritize sleep and rest and watch the recorded videos that he said were "good enough" for his learning needs. Because TAs supported the Zoom sessions and Idris was quick to respond on the Zoom chat, Ben shared he felt, on balance, his learning via Zoom worked. He added, if there had not been as much TA support for CSE 100/R, he might have chosen to attend the in-person classes more often; however, because of the course structure, he felt supported.

Jen, a first-generation college student, reported she did not know much about college and how it worked; she was just getting used to classes, and due to her financial obligations, she had to work nights to cover the cost of living. Jen was judicious in her choice of work, so she could use the night shifts when things were quiet to study and get homework done. Jen shared:

> So, I have that time to stick in an AirPod and then just listen to lectures in the background. So that is kind of how my life looks like. I, I probably would spend the majority time doing schoolwork and, you know, prepping for classes, doing homework, studying for exams. I work two to three times a week. So, at most, 36 hours a week, which are 12-hour night shifts.

This excerpt focused on Jen's decision not to attend classes in person, opting to work night shifts instead so she could simultaneously work and study. Jen's ability to earn a living while paying for her education and still perform well academically was made possible by deliberate choices regarding learning modality. These decisions highlighted how the hyflex format facilitated her learning and enabled her to succeed in her course.

Jen continued to discuss how she "looked out" for podcasting options because she did not always like being on campus. With having to work nights, Jen shared that she was "not much of an early riser." Also, she found she learned a lot better when she took her time and rewatched the recorded videos. Jen finished by adding she would choose her studies (i.e., judicious choice) based on what would work best for her schedule. She found the hyflex format worked well because she felt she was getting a similar "educational experience" regardless of the modality attended. She reflected, "If I am allowed to study at a time that's convenient for me, I feel like I do better academically."

Lou was the only student who chose to attend CSE 100/R as a fully remote student. When asked about her decision, Lou shared she attended the first class to "see if there was anything she needed to know on the syllabus." Then, after that, she made the judicious choice "never to attend any classes." Lou had already taken a similar course at another institution. So, she completed all the work for the course during the first week of the quarter. By doing this, Lou could "spend time running, working, knitting and spending time with friends."

These extracts suggest Lou decided to be fully remote from the first day of class, a choice that allowed her more time for other pursuits. Given that she had previously taken this course, Lou was less invested in the learning process this time and preferred not to spend time attending in-person classes. Her judicious decision making facilitated her desired outcomes of completing the course efficiently and redirecting her focus to other aspects of her education.

Conversely, Arturo commented that being a hyflex student and taking a remote option worked well because he had a very long commute to class; however, he reported he really wanted to have the "college experience" that, for him, was more than just attending classes. Arturo shared:

> I want to go to school because there is a culture there, because there are clubs there because I can learn with everybody there. It's not always just about going in person for the classes. Oh yeah. And getting to know my professors. Right. So, it's not always about going to the classes for the learning experience, for the in-person learning experience. Because of that, most days I would go to school, but if this class were just one class on a day I would have no other reason to go to school, I would not make that effort. I just wouldn't go in at all. It just doesn't seem reasonable.

In this extract, Arturo reflected on the balance he must strike between desiring a traditional college experience and managing his life commitments. He mentioned his family had assisted him in getting to class on some mornings but recognized this as a burden on them. His choices reflect a consideration of his needs as a student and the impact on his family. This evidence illustrated the paradoxical nature of hyflex courses: Although the increased choice and flexibility can greatly benefit students, it can also present challenges. For Arturo, attending classes in person offered a desired college experience, but it also meant a longer commute and reliance on his family's help, issues he avoided by attending remotely. This evidence added complexity to the discussion on how hyflex courses enable or inhibit opportunities, suggesting that in some cases, like Arturo's, it can do both.

During the student interviews, an important question was posed about how students felt they met their CSE 100/R course learning outcomes. Idris shared his course learning outcomes in his syllabus and throughout the course as an ongoing narrative as opposed to a more traditional bulleted list. He shared:

> This is a course in advanced data structure design, analysis, and implementation. You will apply and implement data structures like (un)balanced trees, graphs, priority queues, and hash tables. You will also practice how to make sophisticated use of memory management, pointers, and recursion in programs, and analyze them with theoretical and practical performance analysis.

During the interview process, this paragraph was read out verbatim to the students to gauge how they thought they had met these outcomes by the end of the course. All 10 students indicated that, to various degrees, their course learning outcomes were met.

Learning Outcomes Met

Data on the theme, learning outcomes met, provide varied perspectives on how students interacted with and perceived the hyflex course format. Jen and Karman, for instance, were confident in achieving their educational goals, with Karman particularly benefiting from the real-world application of course materials. However, this experience was not consistent across the board, as highlighted by Qui's uncertainty in applying his learning to real-world situations. Kasim's case offered a different view, where he expressed confidence in meeting his learning objectives, albeit acknowledging challenges in practical application. His positive outlook and acceptance of "trial and error" as a part of the learning process interestingly reflect the instructor's (i.e., Idris's) pedagogical intentions.

Karman expressed appreciation for engaging with the real-world skills of an engineer. She felt more engaged, knowing her learning would apply to her profession. Jen shared a similar experience but emphasized doing the work of an engineer was enjoyable and confirmed her career aspirations. Conversely, Qui felt lost with many programming assignments. He was comfortable with theory but uncertain about applying it in the workplace. Kasim reported similar challenges regarding the real-world application of their learning. These experiences highlighted the varied impacts on students' learning outcomes, enabling and inhibiting their learning.

Ben's experience in the data science course added another dimension. Despite the course's inherent challenges and occasionally missing details in lecture recordings, he managed to keep up, thanks to TA support. This finding underlined the effectiveness of CSE 100/R's

hyflex design, which included built-in "safety nets" to help students who might struggle. Such evidence was crucial to understanding the impact of hyflex formats on student learning. It illustrated that though some, like Jen, Karman, and Kasim, find success and deeper learning within this framework, others face challenges. However, through effective teaching and structured course support, students like Ben can overcome these challenges. This complexity suggests an equity-centered hyflex design, despite its advantages, may not be universally effective in addressing the diverse needs of a large college classroom.

Jen was emphatic that she had met her learning outcomes; she shared, "Well, absolutely, we have covered everything. That's exactly what I feel was emphasized in every single data structure design we learned." Karman added she thought she met a lot of the outcomes; she shared, "I feel like that would be true definitely. I feel like I took away pretty much all of them." Karmen spoke about how she felt confident about the real-world application of what she learned, which was an important goal for Idris, the CSE 100/R instructor. Qui felt he covered all the learning outcomes but commented he was unsure if he could recreate it in a job setting. He shared his concerns:

> I am not really confident about my skills to actually apply this to a real-life task or anything. Maybe I just have not learned enough because like, it is still pretty like an introductory CS class so that is probably why.

This excerpt revealed that although Jen and Karman were confident in meeting their educational outcomes, with Karman attributing her success to the real-world applications of the material aiding her mastery, the situation was not uniform for all students. For instance, Qui expressed uncertainty about applying what he learned in real-world scenarios. This finding indicated an equity-centered hyflex design, despite its benefits for some students like Jen and Karman, was not a one-size-fits-all solution for the complexities faced in a large, diverse college classroom. Kasim shared his confidence that he met the learning outcomes for CSE 100/R; he

shared, “For the theory, I think that is perfect on my end, then for the practical aspect, I think it is kind of trial and error and seeing how you do in these projects. And I think that has been going well so far.”

In this excerpt, Kasim demonstrated overall confidence in achieving his learning objectives, though he acknowledged some challenges in the practical application of assignments. Despite these hurdles, he reported a positive experience and viewed “trial and error” as an integral part of the learning process. This perspective aligned interestingly with the instructor’s intentions. During the interview, Idris expressed his desire for trial and error to be a key outcome of the course, indicating it was an intentional element of the hyflex design that would lead students like Kasim to meet outcomes and enable deeper learning.

Kasim cited the assessments as a good example of how the learning outcomes were met for the course. He shared that with the “weekly reading quiz” and the “bigger projects,” he was able to apply the data structure skills he learned in class. Connecting with the research question about his outcomes being enabled through intentional design. Ben commented he thought he met his learning outcomes but wanted to slow down and take his time a bit more so he could “be a little nitty gritty about it and like to enjoy it.” The analytical memo, aside from Ben’s interview, was [I sense that Ben knows the subject but there is something holding him back, he mentioned wanting to be more “nitty gritty” I want to explore this further.] When asked to share more, Ben said that he often missed important information from the “recording” or “zoom recordings,” and that is holding him back from going deeper into the topic. Ben and others commented on the way Idris taught the course and the techniques he used to engage his students and teach them “challenging concepts” For example, Ben shared, “Idris does a pretty good job of balancing in-person and remote; he is just checking chat and then there is a bunch of TAs checking the chat.”

For Ben, the difficulties presented by the Data Science course were clear, yet despite occasionally missing information in the recordings, he had opportunities to catch up through TA support. This aspect is notable because CSE 100/R's hyflex design intentionally included "safety nets" to assist struggling students. This suggests although Ben and others faced challenges, they could access support through effective teaching and the structured assistance provided by the course.

The findings reported center on student experiences in a hyflex course, focusing on two main aspects: (a) the judicious choices students make in a hyflex learning environment based on their unique life circumstances, such as prioritizing self-care and managing work commitments, and (b) the impact of hyflex learning on their academic progress and the attainment of course learning outcomes. Some students opted for fully asynchronous learning; others attended classes in person for a more traditional college experience. All 10 students reported varying degrees of success in meeting their learning outcomes, with many emphasizing the real-world application of course material as beneficial. However, some expressed uncertainty about their readiness for real-world application, and others credited the class structure and support for their achievement of learning outcomes. Connected to how the student met their outcomes was how they reported experiencing the teaching methods Idris used while delivering content in the hyflex environment. This finding around his pedagogy stood out across the corpus of data. Accordingly, the a priori code teaching methods with the subtheme identified as effective pedagogy and sense of belonging in the hyflex environment was used to explore student experiences.

Teaching Methods: Effective Pedagogy Leads to a Sense of Belonging

An essential part of the social justice education faculty development framework is the teaching methods educators use to teach equitably (Adams et al., 2016). This quadrant

encourages educators to reflect upon their curriculum, “an overarching principle of social justice education practice is how we teach conveys powerful messages about what we teach” (Adams et al., 2016, p. 12). The findings, drawn from interviews, ethnographic observations, and survey data, showed students in this hyflex course reported providing active learning opportunities in the college classroom supported equitable outcomes for students. Firstly, students reported it fostered a sense of belonging, making them feel more connected to the class, the professor, and each other. Additionally, students shared active engagement boosts learning, motivation, and achievement and offers formative and summative feedback on their progress, which has been shown to benefit both students and educators. Further, this approach proved to be especially advantageous for historically marginalized groups of students, ultimately leading to improved outcomes for all (Freeman et al., 2014; Hattie & Timperley, 2007; Theobald et al., 2020).

Findings reported by students point to the efficacy of the teaching methods used in CSE 100/R. Specifically, the instructor was able to “teach effectively” across the modalities by using equitable questioning techniques, which probed for comprehension and encouraged engagement and participation. Next, the instructor uses technology tools, such as the Zoom whiteboard and the course learning management system, to engage students across the modalities. Part of the effective, equitable teaching observed during data collection reports how a sense of belonging was fostered in a large hyflex classroom. Students shared that they felt welcomed and safe when attending all the modalities. Next, students reported feeling supported through the structure of the course and how the instructor built safe learning spaces. Finally, the instructor went to great lengths to ensure the course was well organized and fully stress-tested before students arrived to learn. Part of this organization was around the deadlines for student work. The instructor shared that he built the course to allow maximum flexibility; however, when it came to deadlines, those

were “set in stone.” The findings point toward some students appreciating the structure around their course and its connection to the care they felt their instructor showed for them and their learning. Accordingly, an important subcode that emerged from the data is effective pedagogy.

Effective Pedagogy

Under the theme, effective pedagogy, the data offered insights into how instructional approaches within a hyflex environment impact student learning. Jen’s experience in Idris’s class is a good example. She reported feeling noticed and welcomed, a result of Idris using equitable language to engage and support her learning actively. This approach was not just about content delivery but also about creating an inclusive and supportive learning environment.

Karman’s reflections further highlight Idris’s adeptness in a mixed-modality setting. She reported how she particularly valued how Idris would repeat questions from both in-person and Zoom participants, ensuring inclusivity and engagement across all modalities. This technique, simple yet effective, significantly enhanced Karman’s learning experience. These instances are directly relevant to the research question exploring how students perceive opportunities related to outcomes enabled or inhibited by the hyflex format.

What emerged from this evidence was a clear indication that the success of the hyflex model was not solely dependent on its design but significantly influenced by the instructor’s ability to connect actively with and engage students. This demonstrated effective pedagogy in a hyflex setting involves more than just delivering content; it requires a conscious effort to create an environment where all students felt seen, heard, and supported, thereby emphasizing the critical role of the instructor in the overall effectiveness of the hyflex course.

The seven classes observed on February 13, 16, 20, 22, 24, 27, and March 4 all referenced evidence-based equitable teaching practices. For example, on February 13, Idris

effectively addressed student misconceptions about "Huffman coding" during a prior knowledge probe. He then pivoted to another student on Zoom who had a clarification question (Ambrose et al., 2010; McTighe & Wiggins, 2013).

In total, Idris asked four unique students in the 50-minute session. Thirty-nine students attended the Zoom session, and 43 students attended in person. In total, there were eight student-unique questions, four in-person and four on Zoom. All the Zoom questions were fielded in the chat feature and answered by Idris. The four in-person students who asked questions were all male, and the four questions on Zoom were three female and one male. A major strength of Idris's pedagogical practice was his ability to pose questions that probed for knowledge and comprehension and extended students (McTighe & Wiggins, 2013). For example, on February 17th, Idris asked 10 unique questions during the 50-minute class session. In this session, the Zoom chat was particularly active, with 15 questions being posed, to which Idris responded 12 times. The three he did not address in class he asked students to post on the Discord server; he noted, "That's a great question; please post that on Discord after class, and we will dig into that then."

During the same class on February 17, there was an excellent example of active equitable hyflex teaching:

> At 9:22 a.m., something very interesting happened; Idris posed a question from the readings and a student on Zoom answered via the chat feature. Idris celebrated the student's questions and asked the rest of the class if anyone had any thoughts. A student in the middle of the class offered a response to the question, which then prompted more questions in Zoom. Sensing this moment, Idris let the conversations run and then moved the discussion to the next point when the time was right. This was a really nice example of how learning across the modalities can occur.

During the March 1st observation at 9:32 a.m., Idris posed a question to the class, which generated an excellent mixed modality (Zoom and in-person students) discussion:

> A student asked about a tentative path in Dijkstra's algorithm, seeking clarification. Another student on Zoom clarified that while a tentative path was necessary for finding a path, it was not required to determine the path's existence or the cost of the path, similar to BFS/DFS. Both in-person and Zoom students participated in answering questions.

These excerpts highlight Idris's use of his experience in teaching hyflex courses to deliberately foster conversations across different modalities. This is significant to the research question as it demonstrates how student learning is enhanced within the hyflex setting. Specifically, it underscores the vital role of Idris's teaching techniques in facilitating these cross-modality teaching moments.

Jen noticed and commented on how Idris took student questions very seriously and made her feel that their opinions were welcome and valid. Jen shared:

> Every question was valid, always, I think for every question. Idris used to say this phrase: "That is a very good question; thanks for asking that." I mean, I do not think there were any stupid questions ever, but just the way he addressed them. I do not think I have had many professors like that. I feel like even my sister, who has no computer science knowledge, would have gotten the gist of, you know, how certain things flow.

This excerpt illustrated how Jen felt noticed and welcomed in the class by Idris, who used equitable language to engage and support her learning. This aspect was particularly significant as it showed how Jen's learning was enabled in the hyflex setting, specifically through Idris's receptive approach to her questions and his efforts to make her feel acknowledged.

In addition to good questioning techniques and equitable language to draw in students across the modalities, Idris made full use of a number of technology tools to engage students in all three modalities. In all seven observations, Idris used the Zoom whiteboard tool extensively. This was useful for mixed modality teaching as students in all three modalities could follow his board work seamlessly. Jen commented, "He said it slowly, clearly with plenty of examples. He

always used the screen for both, I guess for the high flex, so that we could see certain examples drawn out and took every student seriously."

Karmen, a student who used Zoom, commented on how she appreciated the techniques Idris used to engage all the hyflex modalities:

> I think Idris did a really good job because it can be hard doing both live and Zoom; it was very clear he was intentionally honoring the Zoom chat. He would repeat questions that were asked in person, so it felt very intentional, which I really appreciated.

In her quote, Karman acknowledged the effectiveness of Idris's teaching in a mixed-modality environment, highlighting a specific technique that greatly supported her learning. She appreciated how Idris repeated questions from both in-person and Zoom sessions, ensuring students across all modalities could hear and engage with the discussion. This simple yet impactful approach was particularly significant for Karman, enhancing her educational experience. This example underlined the broader research question about how students' experiences are enabled in a hyflex environment. Specifically, it illustrated that although the hyflex design facilitated learning across multiple modalities, the success of this approach heavily relied on the instructor's ability to engage and connect with students actively. This finding suggests the effectiveness of hyflex courses extends beyond design alone, emphasizing the crucial role of the instructor. A recurring theme across the data corpus was the intentional environment and sense of belonging students felt while in their hyflex course. The next section explores students' experiences through the subcode sense of belonging/positive hyflex experience.

Sense of Belonging of Positive Hyflex Experience

The theme of sense of belonging in the data provides a comprehensive view of the student experience in a hyflex course setting. Idris's technique of fostering community in a large-

enrollment class is notable; he stayed after class and remained on Zoom to engage in personal dialogue with his students. While acknowledging the impossibility of knowing all 300 students individually, these efforts are instrumental in creating a sense of belonging. Students like Qui, Arturo, Ben, and Kasim have formed personal connections with Idris, significantly enhancing their learning experiences. They particularly appreciate Idris's approachable and down-to-earth manner, with Qui finding this aspect crucial to his connection. Furthermore, Kasim's eagerness to have Idris as a professor, influenced by positive referrals from friends, reflects the impact of interpersonal relationships in learning.

Another key aspect is the highly structured nature of Idris's course, which effectively reduces stress for him and his students. The course's design features consistent support to ensure students do not fall behind when choosing different modalities. This structured approach, combined with an emphasis on human connections, empowers students to achieve their goals in the hyflex setting.

This evidence directly addressed the research question regarding students' perceptions of opportunities in a hyflex format, demonstrating how Idris's efforts to forge connections, whether in-person, online, or via Zoom, facilitate student learning. It highlighted the critical role of a sense of belonging and personal connection in enhancing the learning experience. The hyflex design's flexibility, coupled with the sense of community fostered by Idris and the course's well-thought-out structure, was essential to the success of students, underscoring the importance of these elements in a hyflex learning environment.

Feeling a sense of belonging is an essential core element of humanity; belonging in the college classroom is positively linked with academic success. Furthermore, it is closely tied to academic self-efficacy and positive student-teacher relationships (K. A. Allen et al., 2021; Kirby

& Thomas, 2022; Pedler et al., 2022). Mixed modality hyflex courses designed specifically to provide students with safety, flexibility, and choice demonstrate student and instructor connections, leading to a sense of belonging in the course (Bratberg et al., 2021; Buckley et al., 2023; Liu & Rodriguez, 2019; J. Miller et al., 2013).

Idris shared an essential outcome of the course was for students to feel "safe and welcome." He said this was beyond just what happened in the classroom; it also extended to what happened "behind the scenes of the course." For example, Idris asked his instructional team to "stress test" the course to ensure any issues were flushed out fully before the class started. He shared:

> I explicitly tell the instructional staff, please try to break it, try to do anything you can think of to either misuse the grader or bypass the grader or anything like that. Anything unclear. Then we will just have a very specific dialogue you know, about like, you know, here is something that happens, maybe we can add this and have them test it through ChatGPT to make sure it gives an answer, either it is wrong or something at least I am aware of.

This excerpt highlighted the dedication and effort Idris put into ensuring the smooth operation of his course, which is significant as it demonstrated his care and commitment toward his students and the instructional team. Idris reported a lack of structure in a course can lead to considerable stress for students. Therefore, the time and attention he invested in creating a well-structured hyflex course aims to provide a good learning experience and conveys a strong message of his dedication to his students. This evidence emphasized such meticulous course design was crucial for creating a stress-free learning environment. This aligned closely with the research question exploring how hyflex courses enable students to thrive. It suggests student success hinged significantly on the efforts in course design and the significance of dedicated and caring instructors like Idris.

For CSE 100/R, Idris took advantage of a program at the university called "Coffee with the Prof," which allows students to take their professor out for a coffee or to lunch to get to know them better and build a relationship. Idris explained why this was important to building a rapport with his students. He shared:

> So I've done; usually, I think on average, I do probably like five or six of those each quarter. . . . It's usually like, how do I get an internship? How do I pursue research? Can you tell me about your research? Like how did you get to where you are? So, I don't get to have a one-on-one with the entire 500-person class, but I typically have in-person one-on-one interactions with probably 5–10 students every day after class. I usually have a group of students that either in-person come up to me to ask follow-up questions, and it's usually the same few people, so I recognize their faces.

In this quote, Idris discussed his technique for fostering community in a large enrollment class. His approach involved staying after class and remaining on Zoom to chat with students, enabling him to engage in one-to-one dialogues with a significant portion of his class. Although he admitted he cannot get to know all 300 students personally, these efforts contributed to creating a sense of belonging. This evidence demonstrated how Idris facilitated his students' learning by establishing deliberate connections with them, whether in person, online, or through Zoom.

For Ben, getting a coffee with Idris stood out when asked about positive experiences taking the course. Further, Qui and Arturo appreciated the relationship they built with Idris during the course. Qui shared, "Idris being like a younger professor . . . but I feel like Idris is more down to earth . . . I guess like the way he talks to us." Arturo appreciated connecting with Idris personally over shared experiences where they lived and went to school. Kasim expressed that the main reason for taking CSE 100/R was that his friends were "raving about Idris." They told him the class was fun and flexible. Kasim shared, "So, many friends who are CS majors,

even some other ones who are bioinformatics majors, such as myself, all have positive things to say about Idris, which is great. They said his format is really flexible."

These excerpts reveal Qui, Arturo, Ben, and Kasim formed a personal connection with Idris, significantly influencing their learning experiences. They noted Idris's approachable, down-to-earth demeanor, which Qui, in particular, found to be a key aspect of their connection. Additionally, Kasim shared his enthusiasm for having Idris as a professor, a choice influenced by positive feedback from friends. This information collectively emphasizes the importance of connection and a sense of belonging for students in a hyflex course, highlighting how these elements can greatly enhance and enable the learning experience for students in a hyflex setting.

Finally, Idris commented that because of the situational factors surrounding his hyflex course, such as it being a high enrollment offering, the content being challenging, and students having lots of flexibility in how they attend, creating a welcoming environment within a "highly structured" course was essential for student success. Idris shared:

> So, I think the consistency and I do not like to wing it in my courses. It stresses me out, and it stresses the students out. So, I think the courses are fairly kind of foolproof. So, there is a lot of kind of thought in how the user is going to interact with the course.

This excerpt highlighted how the highly structured nature of the course alleviated stress for Idris and his students. Key to this structure was the consistency and extensive support integrated into the course design, ensuring students could navigate various modalities successfully without "falling through the net." This approach, combined with a focus on fostering "human connections," enabled students to achieve their outcomes in a hyflex setting. It is important to emphasize that although the hyflex design offered flexibility, the sense of belonging Idris cultivated was a crucial binding element for the course. This approach, and the deliberate and well-constructed hyflex framework, were fundamental to student success.

Conclusion

The seven priori codes were used to explore themes in the data of this hyflex case study. The seven categories and their subthemes were used to explore student experiences related to equity in their hyflex course. The analysis had a specific focus on several key aspects. It examined student access to the hyflex environment. Additionally, it delved into their interactions with course content and how their instructors influenced their learning. The study also explored student decision-making processes regarding course attendance and the various factors that influenced these decisions. Furthermore, it investigated the perceived equivalence of experiences across different modalities. The analysis also considered the daily choices made by students to achieve their learning goals. Lastly, it addressed the role of teaching methods in creating a safe and inclusive educational environment.

These codes and subcodes were instrumental in addressing the two central research questions:

1. How do computer science engineering undergraduate students articulate their experiences regarding access, modality choice, strengths, and challenges within the equity-centered design of their hyflex course?
2. How do students perceive the opportunities for outcomes, both enabled and hindered, by the hyflex format?

In addressing these research questions, CSE 100/R as a hyflex course overwhelmingly supported students as it related to equity and accessibility. Students' experiences suggested the flexibility hyflex afforded helped them plan and engage with the material meaningfully and ultimately was a crucial part of the larger support ecosystem. Next, the course content was well structured and designed to offer hyflex at scale while maintaining quality and support. Data

Structures, a challenging course within the CSE curriculum, drew from real-world examples of engaging content that was "relevant and meaningful," according to the students taking the course. Arguably, Idris was the most salient factor impacting equity in the hyflex setting and was a consistent point of reference across the data corpus. Although students shared deeply and with enthusiasm about their instructor, another fascinating finding emerged: how and why students specifically made their decision to attend a modality. In most cases, learner choice was impacted by the need to maximize flexibility to optimize their time. Arguably, the most challenging aspect of creating an equitable hyflex course for a high-enrollment class is making the modalities commensurate. Although not perfect, CSE100/R overwhelmingly supported equitable instruction across the modalities. A significant factor in this success was organization "stress testing." The instructor and instructional staff put CSE 100/R through prior to the first day of class. Furthermore, students in this study reported making "judicious choices" as to how they would attend. For example, a majority of students stated a preference for in-person learning; however, the alternative "commensurate" modalities were "good enough" learning experiences. All students in this study shared they met their learning outcomes and spoke favorably about the pedagogical techniques. Significantly, the pedagogy observed was a crucial component of high-impact equitable teaching and a crucial marker of equity in the hyflex course. Finally, students still experienced barriers and pitfalls to learning in this format; for some, too much flexibility led to "procrastination," and it was evident having developed self-directed learning skills was essential for success in using hyflex learning to its full potential.

CHAPTER 5: DISCUSSION

This dissertation explored student experiences attending an equity-centered hyflex course. The data collection was at one specific site, a large public university in Southern California. Specifically for this study, equity has been operationalized as students achieving commensurate perceptions about their learning. Equity was central to the design of CSE 100/R to provide full access to learning opportunities: instructional resources, classroom activities, interactions, and assessments. Idris, the instructor of CSE 100/R, centered equity in this course and created learning environments across the hyflex modalities that encouraged student agency and belonging to meet the specific needs of a diverse set of learners. The experiences of students attending CSE100/R as a hyflex course offering highlighted how hyflex allowed them to judiciously make choices about engaging in class that fit their unique needs. This flexibility enabled students to optimize their time, which in turn positively impacted their learning outcomes.

Idris, the instructor of CSE 100/R, and his role in designing and delivering hyflex instruction and creating equitable, safe, and generative learning environments across the three modalities were connected to student experiences. Expanding this research, the study foregrounded the experiences of students learning in hyflex courses while backgrounding the instructor's role in designing and delivering an equity-centered curriculum. This chapter revisits a summary of the purpose of the study, briefly highlights findings from data analysis that provide evidence to answer the research questions, and discusses three findings with recommendations for future research.

Purpose of the Study and Research Questions

This study explored students' experiences attending a data structure course (CSE 100/R) as part of their computer science engineering requirement. CSE 100/R has been designed and delivered as a hyflex course offering. The CSE 100/R instructor designed the course with equity frameworks; accordingly, equitable instruction was central to the design principles used. Hyflex courses are challenging to design. Although they have been proven to increase student access, this study aimed to explore how students experienced an equity-centered hyflex course (Beatty, 2014; Verrecchia & McGlinchey, 2021). A key challenge in the literature is designing and delivering hyflex learning that scales for large enrollment courses while preserving equitable, safe environments for students to thrive (Abdelmalak & Parra, 2016; Binnewies & Wang, 2019). This study aimed to understand how an equity-centered hyflex course supported or inhibited student outcomes. The two guiding research questions for this study were:

1. How do computer science engineering undergraduate students describe their experiences related to access, choice of modality, strengths, and pitfalls of hyflex instruction as it connects to their course that has been designed with equity for learning in its design?
2. How do students perceive opportunities related to outcomes that were enabled or inhibited by the hyflex format?

High-Level Overview of Case Study Findings

Students in the study made deliberate choices in their hyflex course, focusing on self-care and well-being. They tailored their learning modalities to balance stress, financial commitments, and schedules. The flexible course design facilitated this adaptability, supporting their diverse needs and helping them achieve their learning goals.

The instructor, Idris, played a pivotal role in students' positive experiences in CSE 100/R. Students highlighted his effective course structure, accessibility, and supportive nature, contributing to their academic success. His use of humor in teaching created a welcoming classroom environment. Idris's reflection on his teaching philosophy and awareness of his influence as an instructor were crucial in building a safe, equitable learning space.

Idris used effective, evidence-based teaching practices, addressed student misconceptions and engaged students across all three modalities. His methods included active, equitable learning techniques, validating questions from all students, and leveraging technology like Zoom whiteboards. These approaches facilitated a welcoming and inclusive environment, in-person and online (e.g., on the Discord server). Flipped learning and other strategies ensured students had a consistent and equitable learning experience across all modalities in CSE 100/R, addressing the core research question on the efficacy of hyflex in delivering commensurate learning experiences.

Theoretical Framework

Two theoretical frameworks guided the development of the data collection instruments and overall study design. First, the social justice education faculty development framework (Adams et al., 2016, 2022) supports instructors embedding equity in their curriculum and encourages introspection around their teaching. Next, the four-pillar framework (Beatty, 2019) provides support for educators to design and deliver equitable hyflex modalities curriculum. The four quadrants of the Adams et al. framework and Beatty's four-pillar hyflex design framework served as a priori codes. These predetermined codes were chosen to keep the focus on the research questions and ground the analysis in the extant literature on equitable teaching and course design in higher education (Adams et al., 2016, 2022; Beatty, 2014; Cassell et al., 2017;

Wiggins & McTighe, 2005). The two frameworks were essential in designing and implementing all three data collection instruments. For example, interview protocols were developed to center assets of the students and instructor interviewed. The observation protocol was designed to use the quadrants of both frameworks to highlight equity markers revealed through the ethnographic process. Next, the survey used the frameworks to ask questions exploring student experiences related to equity and access in a hyflex setting. Finally, both frameworks support educators in designing and delivering equity through their curriculum and encourage deep introspection about what it means to teach for social justice. As mentioned, the reusability pillar of Beatty's work was omitted from this study because it did not address the research questions this study sought to answer (Adams et al., 2016; Beatty, 2019; Kishimoto, 2018).

Major Findings: Recommendations for Practice

The primary findings of this research are discussed with specific recommendations for designing and delivering equitable hyflex courses. The following section centers on three major themes from Chapter 4 and connects the themes to findings and recommendations for practice. Table 6 offers a visual representation outlining the research questions, major themes, and connected findings.

High-Level Overview of Findings and Connected Recommendations for Practice: Students Making Judicious Choices Helped Meet Outcomes

The findings and recommendations for practice are broken down into two distinct sections: (a) self-care and equity-centered design and (b) financial and scheduling choices. A high-level overview of these findings and recommendations for practice are presented to set up a deeper discussion in the following section. First, students in the study demonstrated a deliberate and thoughtful approach to leveraging their hyflex course. The course was designed with an

equity-centered approach, promoting self-care among students. Students adapted their modality choices to reduce stress and prioritize their well-being, highlighting the flexibility and adaptability of the course's design and also students' openness to practicing self-care.

Table 6. Research Question, Major Themes, and Findings

Research question	Major theme	Finding
How do Computer Science Engineering undergraduate students describe their experiences related to access, choice of modality, strengths, and pitfalls of hyflex instruction as it connects to their course that has been designed with equity for learning in its design?	Students: Making the judicious choices helped us meet our outcomes	Students make judicious choices about their learning; equity-centered hyflex design can enable these choices and support learning in 21st-century classrooms.
	Faculty: Amazing instructor unlocks learning	The instructor is essential in designing a hyflex course for advancing equity; educator introspection is vital to ensure this happens.
How do students perceive opportunities related to outcomes enabled or inhibited by the hyflex format?	Teaching methods: Effective pedagogy leads to a sense of belonging	Effective Pedagogy creates commensurate experiences across the hyflex learning modalities

Second, students made judicious choices regarding their financial commitments and school schedules. They aimed to maximize opportunities available (e.g., selecting their preferred modality to accommodate paid work and pursuing internship opportunities aligned with their circumstances). The decisions students made were linked to their individual needs and learning outcomes. All students interviewed believed the hyflex course effectively helped them achieve their learning goals. The course's robust structure and support system played a significant role in enabling students to meet these outcomes.

The findings highlighted how the equity-centered hyflex course supported students' ability to learn, addressing the central research question of the strengths of hyflex instruction as it connects to their course that has been constructed with equity for learning in its design. The hyflex course allowed students to make thoughtful choices to balance self-care, financial commitments, and individual preferences, ultimately achieving their learning outcomes with the support of the course's design, instructional support, and good course structure. Beyond these findings, implications and recommendations for practice are discussed in the next section.

Finding 1: Students Make Judicious Choices About Their Learning; Equity-Centered Hyflex Design Can Enable These Choices and Support Learning in 21st-Century Classrooms

This case study revealed the unique advantages that a hyflex model, when intentionally combined with an equity-centered design, reported to support student educational outcomes. Specifically, it highlighted how the design empowered students with choices that were otherwise not available in the same way as a conventional hyflex course. This empowerment was pivotal. Hyflex inherently has provided options, but the equity-centered approach amplified its value, enabling students to make decisions that align closely with their personal circumstances. Recent studies have suggested students who participated in hyflex courses leveraged various learning modalities to suit their individual needs. In a traditional hyflex course, this ability to judiciously choose their own learner experience led to increased engagement satisfaction and agency, fostering a strong sense of connection between students and their instructors, ultimately enhancing the feeling of belonging within the course (Beatty, 2007a; Bratberg et al., 2021; Liu & Rodriguez, 2019; A. N. Miller et al., 2020).

Moving beyond these studies—in this context, this unique case study revealed, although hyflex offered flexibility, the equity-centered design was instrumental in providing students agency to choose a manner that best met their circumstances. This nuance is critical: Without an equity-focused framework, choices might be available, but the capacity to make those choices effectively could be compromised.

Furthermore, this hyflex case helps to highlight that the agency afforded by an equity-centered hyflex design is central to the student experience. This feature significantly impacts aspects of student life, such as financing their education. It means, in an equity-centered hyflex course, student experiences are recognized as varied, distinct, and unique. Therefore, no matter the personal scenario (e.g., financial constraints, mental and emotional well-being, or juggling various commitments), the equity-centered design offers a bespoke fit for students. It grants an affordance that caters to each individual's unique situation. This point is significant for understanding the efficacy of equity-centered hyflex design in the broader discourse on achieving equitable outcomes in higher education.

Participants in this study leveraged their hyflex course to make specific, calculated, thoughtful, and judicious choices around how they engaged with CSE 100/R. The findings revealed CSE 100/R to be an equity-centered hyflex course that encouraged students to practice self-care. All students in the study presented this self-care finding differently; however, a prevalent connection between all participants who spoke about self-care was the way the hyflex course was designed and taught, encouraging them as learners to make crucial decisions and prioritize their well-being.

Hyflex Supported Students Practice Self-Care

In CSE 100 at the institution of this study, there is a prevailing culture of unhealthy competition, elitism, and burnout among students. This issue is deeply rooted in higher education writ large, and a microcosm of this is in the field of computer science engineering, where competitive practices are not only normalized but often encouraged by the institutions and, in many cases, the instructors teaching the courses. The perpetuation of the idea that computer science is inherently more challenging than "soft sciences" creates a harmful hierarchy and further entrenches and divides students.

James, a CSE major, observed, "It's a well-known fact in CSE that we're not social. We come to class, get it done, get our A, and leave." This mindset reflected a broader issue: Students often socialize into a culture where overworking and neglecting self-care are glorified. Bragging about pulling all-nighters or overloading courses to graduate early has been seen as a badge of honor, fostering a Darwinian view of academic excellence. CSE 100/R, a challenging course in the CSE curriculum, has been emblematic of this issue. Students enrolling in it often expect hardship, an expectation that further entrenches the unhealthy association between learning and suffering. Moreover, the COVID-19 global pandemic has exacerbated existing inequities in higher education. As found in this study, many students have struggled to engage in traditional lecture formats postpandemic. The rush to return to prepandemic norms has overlooked the enduring emotional and mental toll on students.

Addressing these issues, the instructor of this hyflex case has developed an equity-centered, hyflex course that has emphasized self-care, love, and compassion. In a world craving change, this course offered a refreshing alternative to traditional education, challenging the detrimental educational, social, and hierarchical norms prevalent in the current U.S. system. This

case study illustrated the power of an equity-centered course that supported students in making decisions that positively impact their physical and emotional well-being.

Equity-centered hyflex design can facilitate students to take a deliberate and thoughtful approach to leverage their hyflex courses. It is crucial to acknowledge getting an intimate understanding of every student's unique and diverse needs can be daunting, perhaps unrealistic; however, equity-centered hyflex courses can achieve parity across the different learning modalities and offer students the ability to practice self-care. Although individual self-care practices may vary, a unifying element from this case was the positive experiences reported by all participants when they made judicious efforts to prioritize their well-being as learners. This point is where equity-centered design specifically diverges from more traditional hyflex models.

Traditional hyflex courses are purposefully designed to enhance student learning, and studies have confirmed the positive reception of flexibility, accessibility, and learner choice among students (Beatty, 2019). These studies also have indicated students can continue to attend classes despite challenges like illnesses or logistical issues in reaching physical locations (Binnewies & Wang, 2019; Bratberg et al., 2021; Detyna et al., 2022; Furse & Ziegenfuss, 2021). However, what is often missing from hyflex literature, and what this case uniquely illustrates, is the critical, judicious choice students make to care for themselves. A critical takeaway is students make informed choices that favorably impact their lives and, correspondingly, their learning outcomes. This case underscores that hyflex—without integrating equity-centered design—is insufficient in promoting culture and creating spaces that enable students to thrive.

Students Made Judicious Use of Hyflex to Pay Their Bills and Take Opportunities

The study took place at an institution situated in Southern California, recently ranked as the most expensive place to live in the United States as of 2023 (Robledo, 2023). Students at this institution face significant financial challenges. The average rent in August 2023 was approximately $3,131 per month, based on data from various rental listings (Rent.com, n.d.). Additionally, for students like Arturo living in more affordable areas, the cost of gasoline was $5.332 per gallon in November 2023 and necessitated a commute of over an hour.

Food insecurity and homelessness are prevalent issues among the student body. The financial burden also extends to academic requirements, particularly for computer science majors who need powerful computers for coursework. With increasing competition for jobs and internships, students often prioritize work and opportunity over their education. This dilemma can adversely affect their mental and financial well-being. This case study revealed the hardships students faced, in many cases necessitating them to make difficult choices around work and school.

CSE 100/R, designed as an equity-centered course, addresses many of these inequities. For instance, Sarah, who worked night shifts to afford her education, housing, and food, benefited from the course's flexible modality. Similarly, Kasim could pursue an internship opportunity without compromising his education, which would not have been possible in a traditional setting with rigid assessments and attendance policies.

The COVID-19 global pandemic demonstrated the feasibility of hybrid and dual-modality instruction. This finding led to a critical question: By returning to traditional education methods, are educators overlooking the needs of students like Sarah and Kasim? The pandemic revealed pitfalls and potentials of remote learning and limitations of conventional face-to-face or

fully online courses. Bad design is bad design, regardless of the modality. Idris's hyflex course, grounded in equity frameworks, presented a noteworthy alternative. It accommodated students who might be disadvantaged in a traditional brick-and-mortar classroom, thereby opening up new opportunities for a broader range of students.

Students used the hyflex model—not just to further their education—but also to pay for school and access new opportunities. Traditional hyflex courses, which embrace frameworks like universal design for learning, have been recognized for bolstering student satisfaction, accessibility, and successful course completion (Benton-Borghi, 2015; Jackson & Lapinski, 2019). This case explicitly illustrates students opted out of in-person sessions in favor of alternative modalities, which were thoughtfully crafted and delivered a good learning experience.

From the standpoint of hyflex course design, the effectiveness of these alternative learning modalities is a crucial element of the hyflex experience, especially as illustrated by this case study. Although standard hyflex courses enable students to choose their mode of attendance, ensuring the quality of these alternative modalities often presents a persistent challenge in design and delivery (Beatty, 2014, 2019). However, in this case, with an equity-centered approach, Idris made concerted efforts to guarantee the high quality and accessibility of learning materials. This aspect is particularly noteworthy as it forms a continuous thread: Students chose to engage with these materials and pursue other opportunities precisely because the quality was still high and learning was still possible. The critical message here is that when course materials are designed through an equity-focused lens, with care and thoughtfulness invested in their creation and presentation, students are in a better position to pursue additional activities outside of their learning, whether financial, professional, or personal—that ultimately support their learning outcomes.

Implications and Recommendations for Practice

Based on recommendations emerging from this research, the messaging surrounding self-care and mental health could be communicated clearly from the first day of the class, including in the syllabus. Lou was a student who struggled with the hyflex format, not due to academic difficulties but because she did not engage in the community aspects of the class. It could be argued that engaging with a community would have benefitted her. To address situations like Lou's, recommendations from this work include integrating group or project-based learning, which research has shown to be an effective strategy to ensure the inclusion of social and emotional elements in the learning process (Ambrose et al., 2010; McTighe & Wiggins, 2013). Hyflex, as a newer concept for many students, and with some students having been conditioned in a more traditional and— I would argue—problematic educational paradigm, it is imperative to rethink and reconceptualize how this could be implemented to help students make judicious choices that best suit their needs.

From a design perspective, the hyflex approach for students in CSE 100/R allowed them to balance their education with work and seize opportunities like internships. In this study, students who made these judicious choices found it supported them in meeting their learning outcomes. However, I offer a word of caution—with great flexibility comes great responsibility. I believe it is the responsibility of instructors of hyflex courses to guide students on how to use this approach in a "healthy and generative" manner. I observed that some students used hyflex to optimize their time to the extent that it led to unhealthy practices. So, How can educators provide training, advice, and support to help students use hyflex responsibly and healthily? One recommendation is to explicitly name and provide examples of healthy and unhealthy hyflex

practices. Ultimately, the choice rests with the students, but the course should include support on how to make informed decisions.

Although different students experienced convenience in CSE 100/R differently, this research highlighted the importance of establishing norms for how students select their learning path. Many students in this study preferred in-person learning but found the hyflex approach convenient for various reasons. Recommendations include training students to make the most of the available support systems. For example, in CSE 100/R, students often needed to use all the support systems provided fully. An exciting aspect of CSE 100/R is that all assessments are auto graded. This choice was deliberate, allowing instructional staff to focus on supporting the dispositional and emotional aspects of learning instead of grading 305 programming assignments. These design and assessment strategies can support students in meeting their course learning outcomes.

A recommendation emerging from this work includes taking the hyflex course through an intentional course design process. Many universities offer this process through their teaching and learning centers, and valuable, free online resources are available to support instructors through this process. Furthermore, designing for equity and access is a crucial aspect of any course, particularly in large enrollment hyflex courses. Being deliberate in the design and development of a robust asynchronous component is crucial to scaling a large enrollment hyflex course and ensuring a similar educational experience for students across different modalities.

Finally, for students to achieve their learning outcomes, the findings from this study posit support, care, and compassion can be intentionally woven into the very fabric of the hyflex course. This emotional and dispositional dimension of learning is the responsibility of each instructor, in alignment with their educational philosophies. To help reimagine this,

recommendations from the educational literature and insights from this study point to reflective prompts that encourage deep instructor introspection (Adams et al., 2016).

Faculty: Amazing Instructor Unlocks Learning

Finding 2: The Instructor Is Essential in Designing a Hyflex Course for Advancing Equity; Educator Introspection Is Vital to Ensure This Happens

The findings are divided into two distinct sections: (a) the significance of the instructor in building and delivering equitable hyflex offerings and (b) deep introspection and compassion helped build community and a sense of belonging in a hyflex course. The following section presents a high-level overview of these findings to set up a deeper discussion.

The university where this case study occurred is a research-intensive public institution. As an education specialist, my role involves collaborating with instructors in the design and delivery of their courses. This institution primarily evaluates teaching effectiveness through a student evaluation system. Historically, the focus in promotion and tenure processes for instructors has been predominantly on research, with teaching often considered secondary. To provide context, in 2023, this institution secured $1.64 billion in research grants (Bass, 2022).

It is important to clarify that I am not suggesting all instructors at this university prioritize research over teaching or view teaching as an unwanted aspect of their roles. That would be an oversimplification. However, historically—and this is beginning to change, as I discuss later—teaching excellence has not always received the recognition and reward it deserves. This trend leads to a core issue: Instructors are vital to advancing equity in education. An integral part of being a social justice educator involves self-reflection on one's socialization and a deep commitment to student well-being. Although change is occurring in higher education, it is not always recognized as a crucial educational and social imperative. Idris was hired as a teaching

professor. Teaching professors, who are members of the academic senate, follow a promotion and tenure path similar to research faculty. Their primary focus is teaching and learning, often evident in their publication history. These professors typically concentrate on scholarship related to education and their specific discipline. Higher education needs more instructors like Idris to teach, write, and research equity-centered hyflex curricula. Idris and I presented this research at the POD conference in Pittsburgh, PA, in November 2023 (Pod Network, 2023).

Interviews and survey data revealed students consistently mentioned Idris as a significant influence, which contributed to positive experiences while taking CSE 100/R. They commented on the course structure and how it specifically supported their learning. Further, students noted Idris and his instructional team were readily accessible and provided strong support, which they considered a pivotal factor in their academic success. They said they felt "safe and supported," and, if they needed it, they knew they could access support anytime. Idris and his team's level of engagement and assistance significantly contributed to their positive learning experience.

Furthermore, all 10 students mentioned Idris made the class enjoyable by incorporating humor into his teaching. This use of humor facilitated a safe and welcoming classroom environment and was an effective pedagogical tool to engage students in the subject matter. In interviews with Idris, he discussed what it meant to build a safe and equitable learning environment. Significantly, Idris noted reflecting on his teaching philosophy and the influence of his positional power as an instructor in shaping classroom dynamics and interactions with students was essential. This emphasis on creating a supportive and fair classroom environment was a central part of Idris's approach to teaching CSE 100/R as a hyflex course and connected to the research questions—it enabled opportunities for students and led to positive experiences for students learning their hyflex course. The next section moves beyond these findings and explores

what this unique case study highlighted about the instructor's significant role in an equity-centered hyflex course.

The Significance of the Instructor in Building and Delivering Equitable Hyflex Offerings

Educators beginning their careers in research and teaching at large public institutions, like the one in this case study, often possess various interdisciplinary skills beneficial for teaching; however, many lack formal training in pedagogy, particularly in designing courses focusing on equity. This gap can lead to instructors being unaware of the power dynamics and privileges in the classroom, which are crucial in their interactions with students. Instructors need to understand and appreciate how their students might perceive them.

In my experience with faculty development, I have observed even the kindest and most well-intentioned instructors can hold deficit views about their students. Common misconceptions (e.g., students being too lazy to read or not being as capable as previous generations) are often reinforced by colleagues and the broader university community. Resistance to incorporating active learning and student-centered assessments is also prevalent, stemming from the belief that the onus of learning lies solely with students rather than acknowledging the instructor's role in considering various aspects of teaching and learning.

Maybe not surprisingly, many well-intentioned instructors are unaware of certain student perceptions, such as the belief that office hours are reserved for faculty work and not student interaction. Confusion around the hidden curriculum and the diverse skills and lived experiences students bring to the classroom often results in unwelcoming, hostile learning environments. These spaces disproportionately affect students whose social identities differ from their instructors. Therefore, instructor introspection and pedagogical training are not just beneficial but morally, socially, and spiritually imperative to humanely teach in college classrooms in 2023.

Accordingly, the role of the instructor in shaping and delivering the course emerged as a prominent theme bridging the literature on equitable teaching practices, hybrid course design, and hyflex course delivery (Alvarez, 2012; Ambrose et al., 2010; Bell et al., 2007; Binnewies & Wang, 2019; Brown & Tenbergen, 2021; Chickering & Gamson, 1987; Durak & Ataizi, 2016; Fink, 2013; Kishimoto, 2018; Wiggins & McTighe, 2005). The crucial role that instructors play in fostering community and equity in classes has been well-documented; however, this aspect of teaching and learning has been less frequently discussed within the context of hyflex courses (Lakhal et al., 2014). This case study offered a nuanced view of the instructor's role, reasoning, and motivations within an equity-centered hyflex course. It particularly highlighted the necessity for instructors to engage in deep introspection regarding their positionality and intersecting identities. Moreover, a well-constructed hyflex course could fall short without the instructor's thorough reflection on shifting from a deficit to an asset-based approach when considering students, aligning with the essence of hyflex's intended design—a hyper-flexible learning experience.

Arguably, an instructor's initial decision to design and teach a hyflex course could stem from a social justice teaching orientation; this case suggests deep, ongoing introspection is crucial for achieving true equity within the hyflex model (Adams et al., 2016; Kishimoto, 2018). Here, I assert the instructor's approach is pivotal in crafting a hyflex course that authentically embodies equitable teaching. Although equity-centered hyflex courses are not a panacea for the complex challenges in higher education, they offer a promising avenue to support equitable student outcomes in the future.

Moreover, innovation and iteration stand out as distinctive characteristics of equity-centered design. Teaching a large enrollment hyflex course demands both. The unique feature of

this case demonstrated the successful scaling of an equity-centered hyflex course to over 300 students. For this case, maintaining equity in a scalable hyflex course hinged on robust course infrastructure. This finding was also reflected in hyflex literature that centers on the challenge of expanding hyflex offerings while preserving quality, particularly in large enrollment contexts (Beatty, 2019; Detyna et al., 2022b; Verrecchia & McGlinchey, 2021).

Such a task required experienced instructional design support and an instructor willing to engage, iterate, and respond to student feedback. Lastly, this case underscored that "stress testing" was critical for ensuring a course runs smoothly. Within online and hybrid course design literature, this method of testing a course is considered a best practice and is arguably even more critical in the context of hyflex courses (Beatty, 2019; Fink, 2013; Wiggins & McTighe, 2005). The design and delivery of equity-centered hyflex courses will impact the future of large-class instruction in higher education. As class sizes grow annually and universities construct large lecture halls to accommodate this expansion, there is a growing expectation for faculty to educate an increasing number of students equitably.

Fostering Belonging Through Instructor Introspection

Change is happening at the institution featured in this case study, sped by the COVID-19 pandemic, global social and geopolitical events, and growing discussions about race, justice, and compassion in college classrooms. Although these topics were not entirely absent from higher education previously, this statement would oversimplify and misrepresent the situation. Historically, in-depth conversations about the social identities of instructors and the impact of their socialization on the classroom have been less common.

Often, instructors unconsciously replicate harmful practices they experienced during their professional training and doctoral studies in their teaching. These tendencies can lead to

unconscious biases and microaggressions, usually occurring at a subconscious level. Many instructors are surprised to find discussions about course design often start with self-examining their positionality, the intersection of their identities, and how these identities manifest in the classroom setting.

As evidenced by the example of Idris, deep introspection is crucial in designing any course, whether hyflex or otherwise, that is grounded in love and compassion. Such a design centers on the student experience and acknowledges inherent biases. Being trained to recognize these biases is a fundamental step in creating more socially just educational environments.

Extensive research has consistently demonstrated the outcomes are twofold when courses are shaped deliberately around equity-centered design principles and instructors are engaged deeply in this process: Students not only achieve their learning objectives more effectively but also cultivate a sense of belonging in their classes (Alvarez, 2012; Driscoll & Wood, 2007; Fink, 2013; Krathwohl, 2002). The salient feature of this case study was its focus on a high enrollment equity-centered hyflex course. The unique case and its broader discussions on fostering equitable student experiences in a large-scale hyflex course highlighted the pivotal role of the instructor, underscored by the significant impact of their introspection on enhancing the hyflex experience for students.

Although existing literature has explored the effectiveness of hyflex modalities in student outcomes (Beatty, 2007b; Bratberg et al., 2021; Ghosh & Coppola, 2023), it has seldom delved into the reflective practices of instructors concerning issues of social justice in a hyflex setting. This case provided a portrait of the influence of instructor introspection on the student experience. For educators ready to design and deliver hyflex courses to large cohorts, the cornerstone of fostering equitable experiences across various modalities is engaging with

metacognitive prompts before the design phase. These prompts encourage educators to reflect on their interactions with students and value students' diverse contributions to the learning environment (Adams et al., 2016). Once this social justice framework is in place, relationships between students and instructors become authentic and generative.

In traditional hyflex courses, maintaining consistent and clear communication with students across all modalities is difficult to achieve, presenting a known barrier to learning (Binnewies & Wang, 2019; Detyna et al., 2022). However, in an equity-centered hyflex course, equitable communication across all modalities can be effectively maintained using tools for backchannel communication, such as a Discord server. Instructor introspection becomes particularly critical in this context, where the potential for miscommunication, or even harm, increases with the volume of interactions. The instructor's responsiveness to these challenges communicates a commitment to social justice and fosters an environment of safety and inclusion bridging modalities.

Further, this case centers on the importance of the instructor's approach and their focus on students' assets in creating a welcoming learning environment. Literature has suggested although students in traditional in-person or Zoom components of hyflex courses report positive experiences, those in asynchronous settings often encounter disparities (Beatty, 2007a, 2019). Insights from this case indicate that students across all modalities reacted positively to the supportive and safe environment the instructor fosters, irrespective of their chosen modality. This finding reaffirmed the essential synergy of instructor introspection, the adaptability of hyflex teaching, and the implementation of equity-centered design principles as vital to promoting inclusive, engaging spaces in high-enrollment hyflex courses.

Implications and Recommendations for Practice: Significance of the Instructor in Building and Delivering Equitable Hyflex Offerings

Based on the findings of this study, maintaining quality by stress-testing a course is crucial, especially for hyflex courses (Beatty, 2019; Fink, 2013; Wiggins & McTighe, 2005). This case illustrates when designing and delivering an equity-centered hyflex course in a large enrollment course, ensuring a working course infrastructure was vital. If available, it is recommended to use the unique skills of the instructional team (e.g., teaching assistant) to assist with the stress testing of the course. Accordingly, they will be in an excellent position to comment on issues and broken parts of the course structure.

Further, findings from this study point toward the efficacy of the instructional team to try to "hack" the system and run the assessments through ChatGTP. This approach can allow deep discussions with the instructional team to discuss what they found and how to fix it. Another recommendation emerging from this research is for educators designing an equity-centered hyflex course to contact instructional designers and education specialists who teach course design at the institution where the hyflex course is being taught and ask them to check the course for alignment. Checking alignment between the learning outcomes, assessments, and classroom activities is an excellent way to ensure a course has consistency and structure. Another consideration emerging from this study is, when designing hyflex courses, it is important to streamline and simplify the number of tasks students must do. For example, ensure consistency in what assignments are due each week.

Moreover, depending on the unique situational factors of the hyflex course, recommendations include making all class materials live on the 1st day of class so students could work ahead if needed. Students in this study named explicitly the availability of all materials as

helpful in organizing their time and working ahead if needed. A significant design consideration for teaching a large enrollment class was how the course assessments were designed. A recommendation from this research is to consider how instructional support (e.g., teaching assistants and graders) are used to support students when teaching a large enrollment hyflex class; adopting auto-graded assignments freed up instructional staff to provide customized student support. Further recommendations include using extensive TA support, allowing instructors to scale the hyflex course without losing quality, and enabling equitable outcomes.

This research advocates for a streamlined approach to course design. It emphasizes the development of online content within a centralized system to create a cohesive course ecosystem. Key recommendations include prerecording lectures and optimizing them for mobile access, enhancing their accessibility. Additionally, incorporating web-based platforms is advised when technology usage is a course requirement. This strategy improves accessibility for students with less powerful computers or limited device access. For educators committed to crafting equity-centered hyflex courses, this method necessitates considerable initial effort to organize the course framework meticulously and test it rigorously. Despite the initial workload, such an investment pays dividends in the long term, significantly enriching the experiences of students and instructors.

Most importantly, this method ensures students receive a rich learning experience regardless of their chosen modality. Finally, a strong recommendation from this study is that having a very well-designed, robust asynchronous element of any equity-centered hyflex offering is essential to keep the course equitable and at scale. For students, this system acts as a multilayered safety net. This research illustrated if attending an in-person lecture is not feasible, they can join via Zoom. Should that not be possible, a recorded lecture is available. Moreover, if

all three options prove inaccessible, students can engage with the asynchronous course, progressing at their own pace and leveraging TA office hours for support when needed.

Implications and Recommendations for Practice: Fostering Belonging Through Instructor Introspection

A salient aspect of this research is how the instructor built a strong support network for students. Recommendations for practices include instructors first reflecting on their positionalities and intersecting identities as instructors. Through this introspection, it is possible to decenter traditional authority in the classroom and help connect with students (Adams et al., 2016; Alvarez, 2012; Kishimoto, 2018). A recommendation would be for instructors to use a number of reflective prompts before the start of the hyflex design process.

A recommendation and implication for practice emerging from this study would be considering the teaching intricacies. Namely, the power and privilege associated with the instructor's social group memberships can profoundly influence student learning and interactions. It is crucial for instructors to grasp the longstanding consequences of social domination and subordination that many students have endured. Histories of students are deeply impacted by limited access to education, segregation, and diminished opportunities in employment, health care, and legal protection. To teach equitably in a hyflex environment, educators must first develop their knowledge and skills to respond effectively, devising intervention strategies that preempt and address issues like racist jokes, heterosexist influences, and microaggressions (Adams et al., 2016; Kishimoto, 2018). The implications of this reflective work can build a sense of belonging in hyflex courses.

Further, strategies evident in this study, such as quick communication, create a sense of personalized learning, which adds to feeling safe and supported in class. Although it can be

challenging for instructors to respond quickly to over 300 students, backchannel communications, such as Slack, Discord, or Teams, can help the instructional team support the questions and answers that arise.

Finally, this research suggests instructors must also pay specific attention to Zoom participants and the students who will watch the recorded videos after live class sessions. Pedagogical techniques such as repeating student questions and turning on captions can be an easy and equitable way to ensure the hyflex learning environments are commensurate. These techniques, like in CSE 100/R, message students that whichever modality they choose, they will still learn in a rich environment.

Finding 3: Effective Pedagogy Creates Commensurate Equitable Experiences Across the Hyflex Learning Modalities

The findings are broken down into two distinct sections. Section 1 explains the significance of the pedagogical techniques Idris used to drive learning while teaching in a hyflex environment. Section 2 explains how pedagogy created a commensurate experience for students across the hyflex learning modalities. The following sections present a high-level overview of these findings to set up a deeper discussion.

A critical initial discussion in the higher education landscape of 2023 revolves around the fact that many instructors lack formal training in pedagogy, particularly in equitable teaching practices. It is common for educators to have gained some teaching experience during their graduate studies, perhaps as teaching assistants or tutors. This context is essential for understanding the challenges in designing and delivering equitable, sustainable hyflex courses that cater to a diverse student body.

Structural issues in higher education often involve how teaching is acknowledged and evaluated in promotion and tenure processes. Historically, at the university in this case study, teaching was considered secondary to research. This value led to hiring top researchers capable of securing substantial grant funding, which, over time, has had a detrimental effect on teaching quality and student educational outcomes.

However, positive changes are emerging. The development of teaching and learning centers to support faculty has been a significant step forward. Additionally, the appointment of teaching professors like Idris indicates an institutional commitment to valuing and prioritizing teaching. Effective teaching in mixed-modality settings requires pedagogical training, instructional design support, and deep introspection from instructors. This case study aimed to provide evidence-based recommendations and specialized workshops to train and support instructors interested in designing and teaching equity-centered hyflex courses.

Idris demonstrated evidence-based, equitable teaching practices in all classroom observations. Specifically, he mastered addressing student misconceptions and effectively engaged in-person and online students during his sessions. Using effective pedagogy, Idris engaged with his students in all three modalities. For example, he facilitated active and inclusive learning experiences between in-person and Zoom attendees. Students appreciated Idris's approach, highlighting his habit of validating every question and effectively using technology, such as the Zoom whiteboard, to cater to all modalities. Feedback from the students and ethnographic observations were overwhelmingly positive. Some examples of effective pedagogy included his commitment to asking equitable questions, repeating questions for students in Zoom and asynchronous modalities, and using technology while teaching to engage his class. Idris's focus on creating a welcoming and inclusive environment was evident in class and on platforms

like the Discord server. Accordingly, the use of effective pedagogy, such as flipped learning, allowed most students to have a commensurate experience across the modalities. These videos for CSE 100/R proved essential in providing consistent learning experiences irrespective of the learning environment. The overarching theme directly addressing the second research question is that Idris's use of evidence-based practices allowed for a commensurate, equitable experience enabled by the hyflex format. The next section explores the implications of this unique case study for instructors focused on creating and designing equity-centered hyflex courses. This exploration includes a detailed discussion of the relevant findings, implications, and practical recommendations.

Significance of Pedagogical Techniques the Instructor Used to Drive Learning While Teaching in a Hyflex Environment

This story of a first-year college student proudly showing his grandmother around his university campus captures the essence of the complexities in higher education teaching and learning in 2023. His grandmother was amazed by the campus' technology innovation maker spaces and impressed by the student center, dining facilities, and the high-speed rails connecting the campus. However, her reaction to his biochemistry classroom—a small, windowless room with fixed desks and a chalkboard—was telling. "This looks like my school classroom when I was a child," she commented.

This anecdote highlights the contrast between modern university amenities and some traditional classrooms, which have remained unchanged, with limited technology support and a rigid layout. As university enrollments rise, so do class sizes, adding to the complexity of fostering a sense of belonging and actively engaging students in large classes. These challenges

are compounded by a lack of pedagogical training, TA support, and technological infrastructure (Mulryan-Kyne, 2010).

Without introspective awareness, instructors can inadvertently create environments that are not conducive to student well-being. Consider how Idris used technology in mixed modality spaces to allow his students multiple ways of responding. In his classes, female students frequently used Zoom chat to participate. Many voices could be left unheard in a conventional classroom without such inclusive and equitable questioning techniques. However, change is happening. Designing an equity-centered hyflex course is challenging but achievable, especially for instructors who already employ equitable teaching techniques. With minimal effort, these teaching and learning aspects can effectively be adapted to an equity-centered, hyflex environment.

Effective hyflex pedagogy is strongly correlated to principles of effective equitable teaching practices and course design models increasing access, equity, and achievement (Alvarez, 2012; Ambrose et al., 2010; Fink, 2013; Rogers-Shaw et al., 2018). However, researchers often miss a crucial piece: students' equitable experiences within a hyflex environment (Binnewies & Wang, 2019). This case centers on the combination of equity-driven teaching and the hyflex model. For students, this translates into a commensurate experience across their chosen modalities. This dynamic is particularly relevant as students have returned to in-person learning post-pandemic. Students are divided between a want for pre-COVID-19 normalcy and a newfound comfort in online and synchronous learning (Burns et al., 2020; J. Miller et al., 2013). The pandemic's lasting impact on their financial and mental health is a situational factor that must be considered during the design process of any hyflex course (Clapsaddle et al., 2021; J. Miller et al., 2013).

Choice in learning modality, a central tenet of the equity-centered hyflex approach, assumes new meaning within this postpandemic context. Literature has shown that although hyflex offers choice, having a commensurate experience has arguably been the most challenging part of hyflex design (Beatty, 2014, 2019). The uniqueness of this case indicated equitable pedagogy as a natural fit within equity-centered hyflex courses, where it played a pivotal role in binding together different learning modalities and significantly influencing student outcomes. Further, this case revealed a pattern: women's participation on Zoom chat increased compared to in-person sessions or discussion boards, a finding with considerable implications for those designing and delivering equity-focused hyflex courses.

Leveraging educational technology and teaching for equity is a well-established practice that has shown excellent results in supporting students' learning (Benton-Borghi, 2015; Davies, 2011; Rosenberg & Koehler, 2015). In equity-centered hyflex courses, technology facilitates and is essential for student engagement across all learning modalities. Ostensibly, it acts as the connective tissue, enabling students to learn and think collaboratively, irrespective of how they attend class. Ultimately, employing evidence-based pedagogical strategies within equity-centered hyflex courses is essential to (a) foster community, (b) ensure equitable experiences regardless of modality choice, and (c) create a cohesive learning environment where students can interact in real-time or asynchronously.

Implications and Recommendations for Practice: Effective Pedagogy Creates Commensurate Experiences Across Hyflex Learning Modalities

The implications of these findings for instructors designing and delivering hyflex courses is to remember that principles of effective, equitable teaching and learning hold and are arguably even more pressing in hyflex environments. A recommendation from this research is for

instructors to reflect upon their current pedagogy, such as adapting existing active learning strategies and enhancing them for hyflex learning environments. Taking Idris as an example, good questioning is good questioning irrespective of the learning modality. In the case of hyflex learning, questioning techniques have been efficacious in binding the learning modalities together and creating commensurate experiences. Next, when planning hyflex learning spaces, a recommendation from this study would be to think carefully about the class learning activities and how they can be designed for students to meet their course learning outcomes. For example, because CSE 100/R was a large enrollment class, active learning in a traditional sense was more challenging to execute in a hyflex setting. However, active equitable practices were still evident and effective in CSE 100/R. The takeaway for instructors is to decide how they want their live and Zoom sessions to look. A recommendation from this study for practice is to work with an education specialist or instructional designer for specific hyflex course design support (Fink, 2013).

As reported in this study, the challenging but pressing aspect of any hyflex course is ensuring students have equitable, commensurate experiences in their chosen modality. An implication arising from this unique case study was an opportunity to leverage the Zoom environment to encourage students to ask questions and respond to content via the chat feature. Female students in this study were more likely to express themselves via the Zoom chat than in the in-person session. Accordingly, a recommendation for instructors is to center the voices of underrepresented groups sharing in the Zoom chat and encourage continued participation. Further, a specific recommendation is to ask all students in the in-person class to log into the Zoom call and use the Zoom chat feature to ask and answer questions, connecting all three hyflex modalities.

This study asserted educational technology (e.g., the Zoom whiteboard and the learning management system) was a crucial factor that engaged students in all three modalities simultaneously. Recommendations include considering using educational technology that supports the session learning goals. For example, if instructors want their students to expound on an idea or concept in class, a Padlet wall would be a great choice as it can be accessed by all students in all three modalities at any moment. As illustrated in this study, Padlet is an excellent tool to "bind together" modalities and create equitable, commensurate learning experiences. A Discord server or backchannel course communication is a place for students to ask and answer questions in real time. This technology allows all students to pose questions and have their peers or the institutional team answer them. The technology choice will need to serve the specific purpose in the unique hyflex setting.

Connected to this conversation around educational technology is making the best use of the asynchronous component of any hyflex course. As mentioned, Idris used Edstem in his live classes to illustrate points and review concepts from the homework. A recommendation for teaching any hyflex course, regardless of the size, is to have a very well-structured asynchronous component. Again, education specialists and instructional designers have specialized training in adult learning theory, and course design would greatly assist in ensuring alignment between course learning goals, assessments, and classroom learning experiences.

Finally, the implication for capacity building for instructors when designing and delivering an equity-centered hyflex course is to reflect deeply on their positional power within the classroom. This critical reflection is not straightforward and often requires a structured, supportive environment or community. The challenge is that many well-meaning educators have been shaped by lifetimes within educational systems that have only sometimes fostered healthy,

generative learning environments. Unfortunately, these more problematic environments are often inadvertently replicated in their classrooms, perpetuating harmful dynamics that disproportionately affect students from underrepresented backgrounds (Adams et al., 2016).

Furthermore, replicating a successful equity-centered hyflex course necessitates a robust technological infrastructure. This infrastructure must accommodate a large student body learning across three different modalities. Features like Zoom-enabled cameras and plug-and-play room setups can help instructors overcome logistical barriers, ensuring the course is taught with fidelity to the hyflex model.

Before embarking on designing and delivering such a course, instructors need to understand their students' diverse needs keenly. This insight is crucial for making informed course design decisions, fully leveraging the versatility and adaptability of the hyflex model. These recommendations, emerging from this study, are vital for instructors considering designing and delivering a hyflex course to meet their students' diverse and complex needs effectively.

Limitations

The goals of this study were to explore the complexities of student experiences related to access, choice of modality, strengths, and pitfalls of hyflex instruction as connected to their course designed with equity for learning. Furthermore, a central interest of this study was how students perceived the efficacy of the hyflex approach as it connected to their learning outcomes for CSE 100/R. The case study methodology chosen for this study was limited because it focused on one specific site and one class within the institution. As a result, the findings from this study are not generalizable to larger populations. Further, for educators who are comfortable with quantitative analysis and intend to use this study to inform their choices about designing hyflex

courses, the in-depth analysis of student experiences could be challenging to fully translate into specific actionable course design goals (Yin, 2013). Although participants were drawn from the larger course population of 305 students enrolled in CSE 100/R, most of the 10 participants had overwhelmingly positive experiences. Therefore, important information on the barriers and pitfalls of the hyflex course design could be missing. Finally, the instructor took CSE 100 as an undergraduate student, was a teaching assistant for CSE 100 as a graduate student, and redesigned CSE 100 to CSE 100/R as the course instructor. Although many unique positives come from such a familiarity with the course, equally a limitation could be how close and intimately involved he was in the process. The instructor interviews questioned this point of bias; however, it is worthy of mention as a potential limitation.

Future Research

Hyflex teaching and learning emerged within the educational literature in the early 2000s as a subset of hybrid learning (Beatty, 2007b, 2014). The scholarship has centered on the efficacy of flexibility and access for students learning in hyflex courses. Literature focused on challenges and success with recommendations for implementing hyflex courses (Bower et al., 2014; Donovan, 2018; Kyei-Blankson & Godwyll, 2010; Lakhal et al., 2014). However, the significance of hyflex courses in ensuring equitable outcomes for students has not been as extensively examined by qualitatively exploring their experiences in high-enrollment courses (Abdelmalak & Parra, 2016; Sowell et al., 2019).

With the sudden switch to online learning during the COVID-19 global pandemic, hyflex as an instructional approach gained more traction as a possible solution to remote learning (J. Miller et al., 2013; Mineshima-Lowe et al., 2023). These studies were focused on hyflex as an emergency response and, in some respects, a temporary fix while colleges and universities were

closed (Detyna et al., 2022; J. Miller et al., 2013). Once colleges and universities started to return to in-person learning, some institutions, departments, and individual instructors wanted to include options for students still impacted by the COVID-19 global pandemic. Emerging research has suggested modality, choice, access, and equity are essential elements in the design process to mitigate disparities that already existed for students but were exacerbated by the pandemic (Adedoyin & Soykan, 2020; Burgos et al., 2021; Burns et al., 2020; Howell, 2022; Parker et al., 2021; Triyason et al., 2020). However, though this work is an excellent starting point, the emphasis on how hyflex instruction enhances access and equity for student learning in the COVID-19 aftermath needs to be more extensively covered. Although some research has highlighted the effectiveness of hyflex instruction in large enrollment courses (Abdelmalak & Parra, 2016; Sowell et al., 2019) and its capacity to offer students modality choices (Bratberg et al., 2021; Lakhal et al., 2014; Washuta et al., 2021), there are gaps in the research concerning the design principles for equitable courses and students' learning experiences in a hyflex setting (Beatty, 2007b; Naffi, 2020).

This study bridged those gaps by providing qualitative insights, prioritizing student experiences, and contextualizing the instructors' experiences concerning their equity-focused hyflex course design. This research was a case study and bounded to a specific class (Stake, 1995; Yin, 2013); future research could examine multiple courses across universities worldwide for a deeper textured analysis of how students experience equity-centered hyflex courses. Furthermore, a natural area of future research would be a systematic analysis of the benefits or pitfalls of hyflex in large enrollment courses with active learning as a central component of the course design. Recent scholarship points to the success in student learning and the challenges in the setup and design (Mentzer et al., 2023). Finally, the preparatory work for this study included

a pilot study presented at the European Conference on Teaching & Learning Politics, International Relations & European Studies in 2022 and published soon after. The piece delved into the transformative nature of hyflex and hybrid learning in the current higher education landscape, especially amid the postpandemic period. My colleagues and I offer prompts to educators to contemplate the repercussions of pedagogical choices being made for instructors and students in this evolving context. I hope this research will support educators in building and delivering equitable hyflex courses for their students to thrive (Mineshima-Lowe et al., 2023).

Conclusion

The COVID-19 global pandemic caused great hardship for students and professors teaching and learning in higher education. Hyflex instruction has offered flexible, accessible education since the early 2000s; however, the COVID-19 global pandemic has brought attention to this model of instruction that is usually reserved for educators who want to push the boundaries of traditional teaching. Within the educational literature, hyflex instruction has been shown to offer flexibility, choice, and access to students, particularly benefiting students from underrepresented groups (Binnewies & Wang, 2019, 2019; Garcia & Lee, 2020; Jackson & Lapinski, 2019). Moreover, hyflex instruction is complex and requires careful course design to offer equitable, commensurate experiences across the three learning modalities (Beatty, 2019; Benton-Borghi, 2015; Fink, 2013; Wiggins & McTighe, 2005).

The research questions for this study explored how computer science engineering undergraduate students described their experiences related to access, choice of modality, strengths, and pitfalls of hyflex instruction as they connected to their course created with equity for learning in its design and how students perceived opportunities related to outcomes that were enabled or inhibited by the hyflex format. Overwhelmingly, students in this study described

hyflex as a mode of instruction that supported them in meeting their outcomes and enabling opportunities.

Results of this study revealed three significant findings. First, students made judicious choices about their learning; equity-centered hyflex design can support these choices and enhance learning in the 21st-century classroom. Next, the instructor was essential in designing a hyflex course for advancing equity; educator introspection was vital to ensure this happened. Finally, effective pedagogy created commensurate experiences across the hyflex learning modalities.

Further, findings underscored the significance of several factors to consider when designing and executing hyflex teaching and learning. First, equity-centered hyflex design allowed students to make judicious choices that positively impacted their learning and emotional well-being. Next, the instructor played a vital role in building community, and introspection is vital to this and designing for equity. Finally, if instructors use evidence-based equitable teaching practices in a hyflex course, this can lead to equitable commensurate student experiences. The combined efforts result in an inclusive and effective equity-centered hyflex learning environment. This approach, crafted and infused with compassion, models an educational paradigm deeply needed today. In times when such compassion often seems scarce, this method stands as a welcome and essential imperative for driving equity in higher education.

Appendix A: Semistructured Interview Protocol With Students

Thank you for being willing to participate in my study. I am looking into how an equity-centered hyflex learning environment supports or hinders student learning. Specifically, I am interested in your experiences in this modality, why you attended the modality you did, which you prefer, and the strengths and pitfalls of this pedagogical approach for your learning. Some additional goals include:

- Discussing the ways, you experience hyflex learning.
- Understanding the reasons why you chose the modality you did and how this choice supported or hindered your learning.
- Exploring the ways you feel you met your course learning outcomes.
- Discuss what could be improved to support your learning.

Assets students as active participants bring to the classroom:

1. How has your week been? I am curious about how you balance your life as a student.
2. Tell us what motivated or prompted you to enroll in the XXXX course?
3. Did you feel like a valued member of the class? If so, could you explain more?
4. What factors impacted your choice to participate primarily remotely in the class, or what factors did you consider?
5. (for fully remote students): So, I noticed that you attended the majority of your classes remotely, could you tell me a bit more if you feel comfortable about why you made that specific choice?
    a. (If applicable) How would you describe the learning environment being remoted into a class full of in-person students?
6. Please take a moment to look at the following course learning outcomes (insert outcomes). Do you feel these outcomes were met by the end of your course?

Assets instructors bring to the classroom:

1. In what ways, if at all, did the instructor make you feel like part of the class?
2. Did you feel like you were part of a class community? If so, who did you connect most with? If not, why not? (OR) Did you feel like you were part of the class? If so or if not, what contributed to that?

The curriculum, materials, resources, and modalities:

1. How do you feel you performed on the course assessments?
2. From attending Zoom, in-person, and fully online classes, what might your preference be and why?
    a. If you had the opportunity going forward, would you take another class that offered a Hyflex option?
3. Do you feel that the Hyflex style of learning helps or hinders equitable learning environments? Could you explain your choice?
    a. What suggestions, if any, might you have to enhance the experience of students who are being remoted into an in-person learning environment?

4. Looking back, do you think choosing the remote/online learning environment option for (insert course) was the best option for you? If not/or so, can you elaborate?
5. Prior to enrolling in this course, had you ever participated in a hyflex course? If so or if not, what expectations did you have coming into this course about remote participation in a hybrid learning environment?
    a. Did you have any expectations? Thoughts? Feelings?
6. What advice/recommendations do you have for us as we continue to make changes and improve the hyflex (insert course) course for next year?
    a. Probe: What is one thing that we need to keep and one thing that needs significant improvement or can do without?

The pedagogical process through which the course is delivered:

1. Thinking about engaging with the course as a student in the remote hybrid learning environment…
    a. What aspects did you enjoy the most?
    b. What was the most challenging? Did you experience any obstacles engaging/participating in a hyflex learning environment?
2. Do you feel like you had equivalent opportunities to actively engage or be part of a fulfilling learning experience in the remote modality?

Appendix B: Sample Questionnaire

Hyflex Survey

General Instructions

In this survey there are a number of scales and questions designed to measure your opinions, beliefs, and behavior around attending class in a Hyflex modality.

Please answer the questions as honestly as possible, in a way that shows how you really are feeling, not how you would like to be or how you think you should be. You may feel that some questions are very similar to others in the questionnaire. Each of the different sets of questions is measuring different aspects so it is important that you answer each of the questions. *Don't spend too much time thinking about your answers. The first answer that pops into your head is what is needed.*

Instructions are given for each of the different sets of questions. Please read these carefully as they vary from section to section. Some sets of questions ask you to give an answer by ticking a box. Others ask you to rate how much you agree or disagree using a 4 point scale, others use a 5, 6 or 7 point scale. It is important that you use the correct scale for each question.

1. Thank you very much for agreeing to participate in this study.
2. What is the name of the class for which you are completing this survey?
3. How have you engaged with class so far?
    a. A mixture of the two modalities
    b. Entirely in person
    c. Entirely remote
4. Please indicate how much you either agree or disagree with each statement. Choose a number from 1 to 5 on the line next to each statement.
    a. Joining the remote (Zoom) environment has helped my learning in this class.
    b. The remote environment has allowed me to attend classes where I might not have been able to attend if this option was not available.
    c. Out of the two modalities (Zooming/in-person) I prefer to learn as an in-person student.
    d. I feel supported as a remote learner in this class and feel like I belong as a member of the class.
    e. Having the option of the flexible modality (remote environment) has helped me balance outside factors such as work, family relationships with my obligations as a student.
    f. I found learning as a remote student difficult, and it was detrimental to my learning in this class.
    g. As a student attending class remotely, I felt disconnected from my classmates when I decided to remote into the class session.
    h. As a student attending class in person, I felt disconnected from my classmates when they remote into the class session.
    i. As a student attending class in person I appreciate my classmates being able to Zoom into class and contribute to the learning.

j. As a student attending class in person I find it distracting to have my classmates Zoom into the learning environment.

5. This scale consists of a number of words that describe different feelings and emotions. For each item indicate to what extent you have felt this while attending in the remote environment:
    a. Engaged
    b. Overwhelmed
    c. Supported
    d. Cared for
    e. Anxiety
    f. Attentive
    g. Surprised
    h. Stressed
    i. Calm
    j. Happy
    k. Ready
    l. Competent
    m. Belonging
    n. Happy
    o. Comprehension
    p. Listen to

6. Thinking about your in-person experience: Please indicate how much you either agree or disagree with each statement. Choose a number from 1 to 5 on the line next to each statement.
    a. Joining the in-person environment has helped my learning in this class.
    b. I feel supported as an in-person learner in this class and feel like I belong as a member of the class.
    c. Having the option of the flexible modality (remote environment) has helped me balance outside factors such as work, family relationships with my obligations as a student.
    d. When I am attending class in person, I feel disconnected from my classmates when they remote into the class session.
    e. As a student attending class in person, I appreciate my classmates being able to Zoom into class and contribute to the learning.
    f. As a student attending class in person, I find it distracting to have my classmates Zoom into the learning environment.

7. There are many reasons why students choose to engage remotely (zoom) in an in-person class. Which reasons have most directly played a role in needing to attend remotely?

8. If you have joined entirely in person, which reason(s) do you feel would be most important to you in having a remote engagement option in future classes? (check one or more)

a. The commute to campus
b. Work considerations
c. Health considerations
d. Financial reasons
e. Having the freedom to choose
f. Mental Health
g. Other not listed

9. If you are comfortable sharing, what is your gender identity? Please select all that apply:
    a. Transgender
    b. Male
    c. Gender queer
    d. Female
    e. Agender
    f. Nonbinary
    g. Prefer not to say

10. If you are comfortable sharing, what is your racial or ethnic identity? Please type your response below:

    If you are comfortable sharing, what is your age: _____ (in years)

Appendix C: Sample Observation Forms

Classroom Observations/PRT Observation Notes

Instructor: Dr….	**Course Name:**
Date of Observation: 10.26.21	**Location:** **Number of students:**
PRT Observer: Dr…..	**Session Topic:**

Topics to note may include:

- What the instructor is speaking about
- What specific comments are being made by the instructor and students
- What types of questions are being asked by the instructor and students
- How classroom activities are organized and what dynamics you notice (a chart may be useful)
- What you notice about student engagement and interaction
- What teaching strategies are being used
- Your impressions of what is being observed

Time	Observer Notes
Instructor Questions **Student Questions**	Was this a typical class session? How was it the same? Different? What instructional strengths did you demonstrate in this class session? What changes (if any) would you make in the way you conducted this class session if it was repeated?

Time	Observer Notes

Observation Feedback Form

Instructor: Dr xxx	**Course Name:**
Date of Observation:	**Location:** **Number of students:**
Observer: Drs. Carolyn Sandoval and Erilynn Heinrichsen	**Session Topic:**

Instructor Expertise	Yes	No	N/A	Comments
Demonstrated disciplinary knowledge and skills Examples may include but are not limited to: ● Comfortable with subject and questions ● Minimal reliance on notes or slides when talking about content ● Recognizes aspects of the content that are challenging for learners	X			
Incorporated relevant and current research to support the content of the class when appropriate Examples may include but are not limited to:	X			

• Shares current related research to engage students • Shares current new items or events to engage students				
Instructional Delivery	**Yes**	**No**	**N/ A**	**Comments**
Planned class time effectively to explain content and allow student engagement Examples may include but are not limited to: • Started session on time • Summarized previous session(s) material • Previewed class session • Current event or new item used to illustrate relevance of course content • Clear transitions • Review of session at conclusion • Previewed next session • Ended session on time	X			
Listened carefully to student comments and questions and responded effectively Examples may include but are not limited to: • Restates students questions to check for understanding • Responds to questions addressing what, why, how, etc.	X			
Used effective questioning techniques Examples may include but are not limited to: • Use appropriate wait time following questions • Repeated student responses so everyone could hear • Acknowledged and encouraged students responses by saying things like, “tell me more about that,” or, “yes, and can anyone add to that response?”	X (Sometimes)			
Used a variety of appropriate instructional strategies Examples may include but are not limited to: • Small group work • Individual processing/work time	X			

• Class discussion • Paired discussion/problem solving				
Used appropriate technology (any tool for delivering content) effectively to support student learning. List specific tools used here: Chalkboard PowerPoint				
Classroom Management	**Yes**	**No**	**N/A**	**Comments**
Provided students class materials for this session (notes, slides, objectives, reference papers, assignments) Examples of course materials may include but are not limited to: • Syllabus • TritonEd, Library/reserve	X			
Practiced effective teaching strategies that acknowledged and valued differences among students, including differences in opinion during class discussions Examples may include but are not limited to: • Created an inclusive learning environment where all or most students participated during class • Approached classroom communication and management with balance and sensitivity	X (Sometimes)			

Summary Comments

Things that went well for the instructor/session:

Challenges in this particular session:

Specific suggestions for enhancing learning and the learning environment:

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