# HOW FACULTY TEACHING UNDERGRADUATE STEM COURSES EXPERIENCE EXTENDED TEST TIME ACCOMMODATIONS

by

SARAH ALLEN

(Under the Direction of Lindy K. Parker)

## ABSTRACT

This analysis of thematic patterns in science, technology, engineering, and mathematics (STEM) faculty stories gathered using basic narrative inquiry explores how faculty teaching undergraduate STEM courses perceive and experience providing extended test time accommodations for students with disabilities (SWDs). Guided by a constructivist approach (Evans et al., 2017) and theoretical frameworks, including Sanford's (1967) challenge and support theory, disability studies (Society for Disability Studies, 2015), and universal design for learning (UDL; Meyer et al., 2013), this study aims to uncover how faculty attitudes, beliefs, and other factors affect their receiving, interpreting, and ultimately granting (or not granting) of extended test time accommodations requests for SWDs in their STEM courses. This research adds relevant insights to the existing literature on accommodations for SWDs in higher education, with particular attention given to STEM faculty perspectives and extended test time accommodations. Its outcomes have implications for academia and student support services. The findings can inform effective policies, training, and support mechanisms to ensure accessibility and success of those with disabilities in STEM disciplines, ultimately deepening understanding

of extended test time accommodations that create inclusive educational environments in these fields.

INDEX WORDS: Educational equity, Academic accommodations, STEM education, Faculty perspectives, Disabilities, Extended test time accommodations, Inclusive learning, Self-advocacy, Ableism, Intersectional identities

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# DEDICATION

To all professionals dedicated to creating inclusive and accessible environments for marginalized groups. To my fellow disability service providers and lifelong advocates.

# ACKNOWLEDGEMENT

I extend my deepest gratitude to my family and friends for their unwavering support and encouragement throughout this journey. Your belief in me has been invaluable. I would also like to acknowledge my former colleagues who have navigated the SAL programs before me—your insights and experiences have been a source of guidance and inspiration.

A special thank you to my exceptional advisor, whose mentorship and dedication have been instrumental in my success. I am truly grateful for your guidance and encouragement. Additionally, I sincerely appreciate my committee members for generously sharing their expertise, wisdom, and passion, all of which have greatly enriched this dissertation.

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# CHAPTER 1

## INTRODUCTION

While more researchers are beginning to explore the postsecondary experiences of students with disabilities (SWDs; e.g., Carroll et al., 2016; Cox et al., 2017; Fleming et al., 2017; Friedensen et al., 2021; Vaccaro et al., 2015), several gaps in the empirical literature remain (Kimball et al., 2016; Peña, 2014). As Friedensen et al. (2021) identified:

> A particularly noteworthy gap in this literature base concerns the experience of SWDs in science, technology, engineering, and mathematics (STEM) fields. Although STEM degrees provide access to lucrative professional pathways (Joint Economic Committee of the U.S. Congress, 2014), and SWDs express an interest in STEM careers (Newman et al., 2018), fewer SWDs earn STEM degrees compared to their peers without disabilities (National Science Foundation [NSF], 2017). The limited literature available suggests that environmental barriers may contribute to a "leaky pipeline" in STEM for SWDs: students often do not encounter disability-inclusive pedagogy in STEM classes (e.g., Bettencourt et al., 2018; Moriarty, 2007; Street et al., 2012), and STEM instructors are resistant to providing needed accommodations (e.g., Lee, 2010; Love et al., 2014; Rao & Gartin, 2003). (p. 77).

This study aims to explore one of those disability-inclusive accommodations—extended test time—from the perspective of those STEM instructors, specifically how faculty members teaching STEM courses perceive, respond, and act on extended test time accommodations, as well as their attitudes and beliefs about those accommodations. Understanding and examining

the perspective of STEM instructors who are resistant to providing these accommodations in previous studies (e.g., Lee, 2011; Love et al., 2014; Rao & Gartin, 2003) has the "potential to reveal common barriers to STEM success that can be addressed through modifications to environments, which are more easily scalable and replicable than individualized accommodations" (Friedensen et al., 2021, p. 77).

## Background Information

Approximately one in five students enrolled in undergraduate degree programs have at least one disability (National Center for Education Statistics, 2018). SWDs are less likely to enroll in STEM classes, finish their STEM programs, and graduate with STEM degrees (Gottfried et al., 2014). STEM instructors are less willing to readily provide necessary accommodations (Lee, 2011; Love et al., 2014; Rao & Gartin, 2003), and therefore SWDs enrolling in STEM are less likely to receive reasonable academic accommodations than non-STEM fields (Lambert & Tan, 2019). Past research suggests that SWDs at universities classified by the Carnegie Classification System as "R1: Doctoral Universities – Very high research activity"—or more frequently called "R1" institutions—often encounter unique challenges in these research-intensive environments, perhaps related to the competitive nature of these R1 universities, the emphasis on research, and the availability or lack of availability of support services (Castrodale, 2015). These barriers could be even larger at R1 institutions (Castrodale, 2015).

In examining the provision of accommodations for SWDs, it is essential to consider the differences between undergraduate and graduate student experiences since most RI institutions cater to both categories of students. The existing literature highlights that students at these levels exhibit varying degrees of maturity, experience, and commitment, which can significantly

influence faculty perceptions and the implementation of accommodations (Taraban & Logue, 2012). Undergraduate students often navigate the complexities of college life for the first time, which can include significant adjustments to independence, academic demands, and social responsibilities (Mulaudzi, 2023). Their limited experience with higher education may lead to reliance on faculty for guidance and support, even in accommodations. Research indicates that faculty attitudes towards undergraduates often reflect concerns about fostering self-advocacy and independence in their students, which may impact their approach to providing accommodations. In contrast, graduate students typically possess greater academic maturity and self-direction, as they are more likely to have experience managing the demands of advanced coursework and research (Goetz, 2009). This increased maturity may lead faculty to perceive graduate students as more responsible and capable of advocating for their needs, potentially impacting their approach to accommodations.

## Problem Statement

SWDs, including those with non-apparent disabilities, face significant challenges in obtaining reasonable academic accommodations, particularly in STEM courses. Even though (apparent and non-apparent) disabilities are becoming increasingly prevalent among college students, existing studies have primarily focused on these disabilities in non-STEM fields (Friedensen et al., 2021). Little has been explored concerning STEM courses, which are often more rigorous, making it challenging for students to succeed without appropriate accommodations (Gottfried et al., 2014). Pertinent research also supports the limited success of SWDs in STEM courses due to self-advocacy requirements within the collegiate learning environment. Students are usually responsible for their self-advocacy and securing

accommodations; previous studies have identified barriers to self-advocacy in STEM courses, including lack of support from familial habitus (Ertl et al., 2017; Pfeifer et al., 2020).

Even fewer studies have examined the experiences of STEM faculty members accommodating SWDs, including non-apparent disabilities (Aguirre et al., 2020; Love et al., 2014). Most existing research has focused solely on students' perceptions regarding extended test times, leaving a significant gap in understanding STEM faculty's broader, equally significant, experiences, including challenges (Rattan et al., 2018). Noting the "relatively small body of literature related to STEM faculty and disability," Bettencourt et al. (2018) recommended exploring how STEM faculty think about and respond to SWDs (p. 392); therefore, there is a need to investigate the perspective of STEM faculty members regarding extended test time accommodations for SWDs in STEM fields. Understanding these perspectives is crucial in informing the development of better support systems and training programs for faculty, ultimately leading to a more inclusive and equitable learning environment for all students.

## Purpose of the Study

The purpose of this study was to explore the perspective of STEM faculty on using extended test time as an accommodation for SWDs in their STEM courses to understand and examine how they perceive, interpret, and implement extended test time accommodations. By examining these narratives, the study aimed to uncover the underlying themes that characterize faculty experiences and attitudes toward accommodations in STEM education within the three-dimensional space of temporality, sociality, and place (Clandinin & Connelly, 2000; Killam, 2013). By understanding and exploring their experiences and perspectives, this study hoped to reveal common barriers or reasons for resistance to these accommodations that can be addressed through modifications to university processes or training, which are more easily scalable and

replicable than individualized accommodations and can inform the work of disability advocates in student affairs. Utilizing a constructivist theoretical approach, this basic narrative study explored faculty members' experiences teaching STEM courses with extended test time accommodations, specifically how they perceive, respond, and act on those accommodations and their attitudes and beliefs about them.

### *Research Questions*

The research questions (RQs) which were explored include:

1. What experiences have STEM faculty had with receiving and acting on a request to provide an extended test time accommodation in their STEM courses?
2. What are faculty attitudes and beliefs about extended test time accommodations and the greater flexibility this accommodation can offer to students?

## Theoretical Frameworks

Sanford's (1967) challenge and support theory, disability studies (Society for Disability Studies, 2015), and universal design for learning (UDL; Meyer et al., 2013) serve as theories and frameworks for this study.

### Challenge and Support Theory

Sanford's (1967) challenge and support theory, as applied in this research, posits that college environments present challenges and supports, which can act as obstacles when balanced incorrectly or as facilitators to fulfilling student goals (Ward et al., 2005). Too much support by a faculty member can impede student growth and learning; however, too much challenge (and insufficient support) can lead to little or no student growth and learning in the subject matter. Since the study is focused on faculty experiences and perspectives, the scope of the application of the theory is defined by the unique position of the STEM faculty in providing support to SWDs in

STEM courses to balance the unique challenges that the SWDs, which has over time led to their underrepresentation in STEM disciplines and professions. The unique challenges that SWDs face in learning environments have been adequately researched in literature from the student's perspectives, thus making Sanford's theory of challenge and support a crucial bridge to the under-researched area of support from the perspective of the faculty. While focusing on the role of faculty in the support side of the equation, the theory also has significance in exploring the challenges and support that faculty encounter to effectively cater to the needs of SWDs in STEM disciplines through accommodations such as extended test times.

**Disability Studies**

Disability studies (Society for Disability Studies, 2015) recognize that disabilities have social, political, cultural, and economic factors. It highlights how individuals with disabilities can experience oppression due to societal perceptions (Singer, 2012). In the context of this research, disability studies provided a critical framework for understanding the broader social and cultural factors that influence the experiences of STEM faculty—and their attitudes and beliefs—while providing SWDs extended test time accommodations. It allowed exploring the perceptions these faculty hold and how these perceptions may or may not need to be addressed to de-stigmatize SWDs in STEM classrooms and their warranted accommodations. This theory investigates whether the presence or absence of ableist norms can be traced to the quality and quantity of support provided to STEM faculty within research-intensive and STEM disciplines with rigorous curricula to support SWDs.

**Universal Design for Learning**

Universal Design for Learning (UDL, Meyer et al., 2013), is an educational approach that aims to increase inclusivity and accessibility through flexibility in teaching and assessment. UDL

was not explicitly designed to cater to the needs of SWDs. Instead, its goal is to have an individualized approach to learning where one's unique needs, abilities, and preferences are considered when providing instructions and learning. It achieves this by offering multiple forms of representation, expression, and engagement in teaching and learning (Navaitienė & Stasiūnaitienė, 2021). In this study, UDL was a complementary theory relevant to understanding how accommodations, such as flexible test times, can be designed and implemented to create equitable and inclusive learning environments in STEM education for SWDs. UDLserved as a framework to address the unique challenges faced by SWDs in STEM fields. When STEM faculty in research-intensive institutions have been adequately supported, through the provision of accommodations such as extended test times, SWDs who face unique challenges within STEM disciplines will lead the fulfillment of the objectives of UDL in creating inclusive and accessible learning environments.

These theories, individually and collectively, formed the foundation of this study. They provided a lens for exploring the experiences of STEM faculty with issuing extended test time accommodations. By applying these frameworks, this study aimed to understand the experiences of faculty receiving and responding to extended test time accommodations, and their impact on SWDs pursuing STEM education.

## Significance of the study

By investigating the experiences of STEM faculty members with extended test times, which is the most offered academic accommodation in STEM fields (Lindstrom et al., 2021), the study aimed to understand the role that faculty members can play in making STEM courses equitable for SWDs (Pfeifer et al., 2023). Insights from this study may increase the enrollment and persistence of SWDs in STEM courses and increase their access to STEM careers.

## Operational Definitions

In this dissertation and study, the following terms and definitions apply:

1. ***A student with a disability (SWD):*** In the context of this dissertation, a "student with a disability" or “SWD” refers to an individual enrolled in an educational program or course who has a documented physical, cognitive, sensory, or mental health condition that substantially impacts their ability to participate in educational activities fully. “SWDs” refers to multiple students with disabilities. This dissertation distinguishes between "a disabled student" and "a student with a disability." A "disabled student" can be seen as a label that may carry a stigma and focus on limitations. In contrast, a "student with a disability" emphasizes the person-first language and recognizes that their disability does not solely define the student's identity.
2. ***STEM:*** STEM stands for science, technology, engineering, and mathematics. In the context of this dissertation, STEM refers to the academic disciplines and fields of study related to these subjects. STEM courses typically include biology, chemistry, physics, mathematics, computer science, engineering, and technology-related fields.
3. ***Accommodation:*** In the context of this dissertation, an "accommodation" refers to an adjustment or modification made in educational settings to provide equitable opportunities for SWDs. These adjustments may include but are not limited to, extended test time, accessible materials, assistive technology, or changes in instructional methods to ensure that SWDs can fully participate in educational activities on an equal basis with their peers. Accommodations are intended to reduce the barriers SWDs may encounter in the learning environment.

4. ***Extended test time accommodation:*** An extended test time accommodation is an academic adjustment provided to SWDs, allowing them additional time beyond the standard duration to complete exams or quizzes. It ensures these students are evaluated on their knowledge and skills rather than their test-taking speed.

## Chapter Summary

While the postsecondary experiences of SWDs are being examined more recently, the research around SWDs in STEM fields remains limited. The limited literature available suggests that more considerable barriers, such as a lack of disability-inclusive classes and faculty who are resistant to providing warranted accommodations, may impede SWDs from being successful in STEM courses and majors (Bettencourt et al., 2018; Friedensen et al., 2021; Lee, 2011; Love et al., 2014; Moriarty, 2007; Street et al., 2012; Rao & Gartin, 2003). This study aims to uncover the perspective of those STEM instructors—specifically how faculty members teaching STEM courses perceive, respond, and act on extended test time accommodations, as well as their attitudes and beliefs about those accommodations and their impact on providing appropriate support while still challenging their students—in hopes to uncover any common barriers to STEM course success that can be addressed through modifications to the college environment or faculty training around accommodations.

# CHAPTER 2

# LITERATURE REVIEW

Students with disabilities (SWDs) pursuing undergraduate degree programs encounter many barriers and face significant physical, attitudinal, social, cultural, and political obstacles when attempting to access higher education. Their narratives point to a tendency to navigate the path of least resistance, often leading to forfeiture from other paths they might otherwise pursue (Hopkins, 2011). Those seeking science, technology, engineering, and mathematics (STEM) degrees programs face even more significant challenges (Bettencourt et al., 2018; Lee, 2011; National Science Foundation, 2017; Isaacson et al., 2016; Sithole et al., 2017), and even more so if they have another intersecting identity (Griffiths et al., 2020; Alexander & Hermann, 2016). Legislative efforts such as the Americans with Disabilities Act (ADA, 1990) and Rehabilitation Act (1973) require postsecondary institutions to make reasonable accommodations for SWDs, including for those in STEM classes and majors (Weis et al., 2016). If successful, these accommodations could help produce additional graduates and address STEM workforce shortages while leveraging the unique strengths of these SWDs in the STEM fields (Jetha et al., 2018).

One of those accommodations offered to SWDs is extended test time, and its impact has been significant. Research has consistently shown that extended test time benefits all students and leads to particularly substantial score improvements for SWDs (Sireci et al., 2005). However, training and faculty attitudes, particularly those of faculty teaching STEM courses, impact the beliefs and actions around accommodations (Sandoval et al., 2020).

This chapter explores seminal and recent literature around each of these areas mentioned above, specifically the definition of students with disability and their challenges in postsecondary STEM learning environments; the impact of applicable laws, other intersecting identities, ableist norms, self-advocacy, and COVID-19; and the history and benefits of accommodations and faculty experiences with them, specifically extended test time accommodations. This chapter also includes literature related to Sanford's (1967) challenge and support theory, the disability studies framework (Society for Disability Studies, 2015), and universal design for learning (UDL; Meyer et al., 2013) that will serve as theories and frameworks for this study that seeks to understand through a constructivist lens how faculty teaching undergraduate STEM courses who provide extended test time accommodations for SWDs perceive, respond, and act on those accommodations (Evans et al., 2017).

## Students with Disabilities in Undergraduate Degree Programs

Undergraduate SWDs encompass a diverse group of individuals who face various physical, sensory, cognitive, or mental health conditions that may impact their learning experiences and educational journeys. The National Center for Education Statistics (NCES, 2018) defined these students as those who report one or more of the following conditions: blindness or visual impairment not correctable by glasses, hearing impairment (including deaf or hard of hearing), orthopedic or mobility impairment, speech or language impairment, learning disabilities, mental health conditions (such as depression, ADD, or ADHD), or other health impairments or problems. It is essential to recognize the significance of this student population within undergraduate degree programs at postsecondary institutions. According to the NCES (2018), over 19% of students enrolled in undergraduate degree programs have at least one disability. This statistic emphasizes the substantial presence of SWDs in higher education.

The journey through higher education for these students can be marked by challenges. Studies have shown that SWDs are less likely to graduate compared to their peers without disabilities (Shandra & Hogan, 2009). SWDs lag academically and often fail to complete academic programs at a level and within the timeframe comparable to their peers without disabilities (Dong & Lucas, 2014). Furthermore, students with specific types of disabilities, such as mental disabilities, face significant barriers to completing a bachelor's degree, even when controlling for family and academic background (Carroll et al., 2020).

Moreover, the performance of SWDs may vary across different types of postsecondary institutions. Research, including studies on R1 institutions, suggests that SWDs often encounter unique challenges in these research-intensive environments (Castrodale, 2015). These challenges relate to the competitive nature of R1 schools, the emphasis on research, and the structure of support services. While R1 institutions often have greater financial resources, the size and complexity of these universities may introduce bureaucratic hurdles that affect students' access to accommodations and support (Castrodale, 2015). Understanding these variations in experiences and outcomes is crucial for developing effective strategies to support undergraduate SWDs on their academic journeys.

### Undergraduate Students with Disabilities and Other Intersectional Identities

When considering the impact of various characteristics and intersectional identities, it becomes evident that disparities exist in the prevalence of disabilities among undergraduate students. For instance, the National Center for Education Statistics (NCES, 2018; Zhang & Katsiyannis, 2002) highlights that 26% of undergraduate students who are veterans report having a disability, while 28% of students who identify as American Indian/Alaska Native also report disabilities in comparison to 19% of non-veteran and 21% of white undergraduate students who

have disabilities. These findings highlight the importance of understanding how different attributes and identities intersect with disability representation, and they provide the groundwork for a suitable subsequent exploration of the interactions between race, class, gender, and disability among undergraduate students (Reid & Knight, 2006).

## Students with Disabilities' Underrepresentation in STEM Majors and Fields

When analyzing patterns of enrollment, research has shown that SWDs face more restricted pathways to success in STEM majors and degree programs (Bettencourt et al., 2018; Lee, 2011; National Science Foundation [NSF], 2017). Prospective undergraduate STEM SWDs often encounter barriers in pursuing their academic and career aspirations. These barriers are not solely self-perceived; they are grounded in the reality of STEM education and its inherent challenges. Alston and Hampton (2000) emphasized that these students and their influential high-school teachers and parents perceive STEM majors and fields as unwelcoming or unaccommodating to persons with disabilities. These perceptions are rooted in the historical lack of accessibility, inclusive practices, and support within STEM disciplines (Holmes et al., 2017). It is crucial to recognize that these perceptions are not unfounded and reflect systemic issues that need to be addressed (Reid & Knight, 2006). Dunn et al. (2012) further shed light on the lasting consequences of these challenges. Professionals with disabilities have been chronically underrepresented in STEM fields for many years. This underrepresentation results from the cumulative effect of obstacles faced by prospective undergraduate STEM SWDs, ultimately impacting their ability to pursue STEM careers (Lee, 2020).

These challenges can encompass several dimensions, including:

**Physical Accessibility:** Many STEM facilities, laboratories, and research environments were not historically designed with physical accessibility. This design flaw can create significant barriers for mobility-impaired students (Jeannis et al., 2017).

**Attitudinal Barriers:** SWDs may encounter negative attitudes from both peers and faculty. Stereotypes and biases about the capabilities of individuals with disabilities persist, affecting the overall climate in STEM departments (Aguirre et al., 2020).

**Inadequate Support Services:** The availability of support services such as note-takers, assistive technology, or personal aides can vary widely between institutions. This inconsistency in services can impact the quality of education and research experiences for SWDs (Kendall, 2017).

**Adverse Reactions from Peers and Faculty:** SWDs may experience adverse reactions or a lack of understanding from their peers and faculty members. The stigmatization and lack of understanding can create an unwelcoming and isolating environment (Deckoff-Jones & Duell, 2018).

**Lack of Representation:** The absence of visible role models with disabilities in STEM fields can further contribute to the perception that individuals with disabilities are not meant to thrive in these disciplines (Atchison & Libarkin, 2016).

Due to the above, it could lead to a negative self-reinforcing vicious cycle, whereby low enrollment of SWDs in STEM courses leads to a shortage of professionals with disabilities in the field. This shortage then contributes to an unwelcoming environment for potential SWDs, reinforcing the cycle and making it increasingly difficult to improve representation and inclusivity in STEM. To address these challenges and ensure a more inclusive and equitable STEM education, it is essential to acknowledge and actively work to remove these barriers,

creating an environment where undergraduate STEM SWDs can confidently pursue their interests and aspirations.

Empirical studies have uncovered several noteworthy advantages associated with SWDs in STEM fields. While these students may encounter various challenges, they also bring unique perspectives and capabilities that can significantly advance research and development in these disciplines. Carballo et al. (2022) identified that despite facing obstacles like negative attitudes from faculty, inadequate support services, inaccessible facilities, and adverse reactions from peers and faculty, SWDs offer valuable perspectives and insights that can drive innovation in STEM. Uttal and Cohen (2012) further noted that individuals with disabilities often possess exceptional abilities, including keen attention to detail and spatial reasoning skills, which are highly relevant and advantageous for future careers in STEM areas.

Creating inclusive learning environments and providing the necessary accommodations at universities have demonstrated that SWDs can succeed in STEM fields and significantly contribute to important research and innovation projects. Research by Lopez-Gavira et al. (2019) highlights that when SWDs are supported with accessible facilities and accommodations, they have the potential to excel academically and play a pivotal role in advancing STEM knowledge and applications. Including diverse perspectives, including those of SWDs, can foster innovation and progress in these critical fields, ultimately benefiting society (Alston & Hampton, 2000).

Encouraging these students to pursue STEM fields is a matter of equity and a strategic approach to meeting projected employment needs and strengthening the STEM workforce. The global digital skills gap [an excellent example of the STEM field sector] will lead to a shortage of 85 million jobs by 2030, resulting in a potential $8.5 trillion in unrealized revenues (Trautman, 2023). This shortage exacerbates existing challenges in sectors that require

specialized technical knowledge, making it difficult to meet the growing demands of digital transformation. Despite this increasing demand for skilled workers, individuals with disabilities remain significantly underrepresented in STEM fields. While 19.5% of undergraduate students in the U.S. identify as having a disability, only about 8.6-10% of employed scientists, engineers, and researchers are individuals with disabilities (Gordián-Vélez, 2022). Wage gaps, fewer employment opportunities, and limited representation in leadership roles within STEM fields further compound this disparity. Therefore, STEM faculty and the collegiate environment that they present to SWDs becomes a point necessary for scrutiny to investigate whether the workforce deficit problem can be found further upstream in the STEM learning environments. With regards to the current study, the scope of the lens of scrutiny that is used covers the experiences of STEM faculty providing support services to SWDs in STEM disciplines who experience unique challenges as a result of their various disabilities to require extended test time accommodation, as well as the support that is afforded to the faculty in providing accommodations in an R1 institution within STEM disciplines with rigorous curricular.

### Discrimination and Laws Impacting Undergraduate Students with Disabilities

As background information for a meaningful literature review on STEM faculty experiences of providing extended test time accommodations to SWDs, it is critical to acknowledge the historical exclusion of SWDs in higher education. Discriminatory attitudes, practices, and policies have significantly limited the participation of people with disabilities in STEM fields, resulting in the underrepresentation and marginalization of these individuals (McGee, 2020). However, over the years, there has been some progress toward creating an inclusive and accessible learning environment for individuals with disabilities in STEM fields. Legislative efforts such as the Rehabilitation Act (1973), the Americans with Disabilities Act

(ADA, 1990), and the Individuals with Disabilities Education Act (IDEA, 2004) require postsecondary institutions to make reasonable accommodations for SWDs (Weis et al., 2016).

The Rehabilitation Act of 1973 marked a significant step in advocating for the rights and accessibility of individuals with disabilities. This legislation, specifically Section 504, prohibited discrimination based on disability in programs and activities receiving federal financial assistance. For universities, it meant establishing equal educational opportunities and accessibility for students and faculty with disabilities, ultimately fostering a more inclusive academic environment.

The Americans with Disabilities Act (ADA) of 1990 further reinforced the protection of individuals with disabilities. This law aimed to eliminate discrimination and ensure the full participation of individuals with disabilities in various aspects of society, including education. In the context of universities, the ADA transformed inclusivity by requiring institutions to provide reasonable accommodations and accessible facilities to students and faculty with disabilities. This law influenced the transformation of campuses into more accessible and equitable spaces.

The Individuals with Disabilities Education Act (IDEA) of 2004 focuses on the rights of SWDs in the K-12 educational system. While it may not directly impact universities, it indirectly influences higher education by promoting inclusive educational practices at earlier stages. By ensuring students receive appropriate support and accommodations during their formative years, IDEA contributes to a more prepared and empowered student body, ultimately benefiting universities in their efforts to accommodate and support SWDs.

Together, these laws – the Individuals with Disabilities Education Act (IDEA, 2004), the Rehabilitation Act (1973), and the Americans with Disabilities Act (ADA, 1990) – aim to ensure educational equity by mandating reasonable academic accommodations for SWDs so that all

students have equal access to opportunities and are equipped with the tools to succeed in their educational pursuits and beyond (Kramarczuk-Voulgarides et al., 2021).

## Accommodations

Accommodations encompass a range of support measures designed to address the unique needs of SWDs in the campus setting. These accommodations have a historical precedent and have evolved to provide essential support, ensuring that SWDs have an equal opportunity to access and excel in higher education (Newman et al., 2018). Many SWDs require and rely on academic accommodations to achieve goals in their academic, social, and future professional lives (Reed & Kennett, 2017). However, implementation of these laws varies across different levels of education and within the same levels (Cole et al., 1995). Faculty within institutions respond to accommodations differently (Nelson et al., 1990). Jarman et al. (2023) write:

> Crucial to institutional belonging are faculty attitudes and approaches to students with disabilities. On one side, faculty can be resistant to accommodations or rigid in ways that impede student progress; on the other side, they can be compassionate collaborators who actively support the success of their disabled students—of all their students. (p. 3)

In addition to faculty attitudes, unexpected events like COVID-19 can disrupt postsecondary institutions' accommodations for SWDs. Gin et al. (2021) found how COVID-19 affected SWDs enrolled in undergraduate STEM programs at large enrollment institutions, leading to various challenges for these individuals by highlighting the additional hurdles faced by SWDs when engaging in online learning due to an absence of accessibility features and support services. Students with visual, hearing, and learning disabilities faced difficulty accessing online course materials that were not designed to be accessible (Bhardwaj & Kumar, 2017), which led to SWDs experiencing more significant anxiety and stress during pandemic

outbreaks, resulting in poor academic performance. These findings highlight the significance of accessibility to online learning platforms and tailored support services during pandemic outbreaks. Alshawabkeh et al. (2021) highlighted how difficult accommodations, such as sign language interpreters, note-takers, and assistive technology, can be in an online learning environment; students may need access to the equipment and technology required for online learning. McMaughan et al. (2021) discovered that SWDs faced significant difficulty accessing accommodations during this pandemic period, which resulted in increased stress, anxiety, and academic challenges for these individuals in STEM programs. Therefore, further research should explore how COVID-19 affected the persistence of SWDs in STEM programs and whether it led to cascading enrollment impacts for this cohort.

**Extended Test Time Accommodations**

Extended test time is a crucial academic accommodation for SWDs. It grants eligible students additional time for completing exams tailored to their unique needs, ensuring an equitable chance to showcase their knowledge. Research consistently confirms its benefits, impacting SWDs and the wider academic community. Extended test time enhances overall performance, allowing more critical thinking and improved knowledge demonstration (Kim & Lee, 2016). Notably, it empowers SWDs, leveling the academic field and resulting in significant score gains (Sireci et al., 2005). It proves especially valuable for those with reading disabilities, allowing them time to overcome reading challenges and succeed academically (Lesaux et al., 2006).

Inadequate academic support for SWDs can have negative consequences, such as lower retention rates, delayed graduations, and reduced numbers in STEM (De Los Santos et al., 2019). However, these statistics may not be the best way to investigate STEM faculty's views and

experiences. Faculty may lack access to detailed retention or graduation data, but they can recall cases where a struggling SWD improved after receiving accommodations. The focus on faculty perspectives makes GPA, which, according to Kim and Lee (2016), has been positively correlated with access to accommodations, a more relevant and immediate measure of the impact of extended test time accommodations from the faculty's viewpoint. GPA shows students' academic progress. It indicates to faculty that students can improve with accommodations like extra test time. However, it is also important to note the existence of research that has demonstrated that extended test time accommodations may stigmatize students, and faculty may need help in providing accommodations (Karp & Yoels, 2020).

### STEM Faculty Attitudes and Beliefs of Students with Disabilities and Accommodations

Some difficulties in accessing academic accommodations within the collegiate environment depend on the nature of the disability and the program enrolled (Yssel et al., 2016). It is usually much more accessible for students with apparent disabilities, such as physical disabilities, to access academic accommodations than students with non-apparent academic accommodations, such as specific learning disabilities or attention-deficit/hyperactivity disorder (ADHD) (Friedensen et al., 2021). This disparity shows that the perception of a disability matters when accessing accommodations. According to Bettencourt et al. (2018), STEM faculty had differing views of what constitutes a disability and the types of support needed by SWDs, often favoring more visible disabilities such as mobility impairments while overlooking less obvious disabilities like learning disabilities or mental health conditions – leading to underrepresentation of SWDs in STEM fields and underscoring the need for an inclusive definition of disability.

Love et al. (2014) identified barriers STEM faculty encounter when working with such students, such as lack of knowledge/training about accommodations and limited access to

assistive technology solutions. In proposing a solution, Reinholz and Ridgway (2021) underlined the importance of centering SWDs while dismantling ableist norms in STEM. Their study demonstrated how ableist attitudes and practices in STEM could create an unwelcoming environment for those with disabilities and a lack of accommodations or support hindering their success. Therefore, adequate support must be available, such as assistive technology, accessible course materials, or flexibility with course requirements, so all individuals with disabilities have equal chances to excel in these fields.

Recognizing the necessity of supporting SWDs in STEM fields has become more widely appreciated. However, more research needs to focus on the experiences of STEM faculty when dealing with such students. Morina and Orozco (2022) sought to address this gap by exploring inclusive Spanish STEM faculty's experiences working with SWDs. Researchers found that although faculty had positive attitudes toward inclusive education, they also identified several challenges, such as insufficient training and resources for supporting SWDs and the need for more collaboration with support services. Burgstahler (2023) found similar findings in their US study: adequate resources, time, and training were significant impediments to effectively supporting SWDs. However, faculty who received training on how to assist SWDs reported feeling more capable and confident when providing accommodations and support. These findings demonstrate the significance of equipping faculty members with sufficient training and resources to assist SWDs in STEM fields effectively.

Love et al. (2014) conducted a study where STEM faculty were interviewed about their experiences supporting SWDs. Researchers noted a need for more awareness regarding accommodations and an apparent need for additional training to support such individuals effectively. However, they acknowledged the significance of including SWDs in STEM courses

and its benefits in classroom settings. The study highlighted the need for ongoing training and support of STEM faculty to ensure they can effectively assist SWDs while creating inclusive learning environments. These studies underscore the significance of providing STEM instructors with resources, training, and ongoing assistance to support those enrolled in their classes who require assistance due to disabilities. Faculty members can help foster an inclusive learning environment by receiving training on providing practical support for SWDs. According to Bettencourt et al. (2018) and Reinholz and Ridgway (2021), it is necessary for shifts in attitudes and practices regarding disability perception within postsecondary STEM learning environments to address limitations associated with current perceptions and provide equal chances for success across STEM fields.

## Philosophical World View

In this qualitative research study, I aim to explore STEM faculty's individual stories and experiences regarding providing extended test time accommodations to SWDs. Adopting a constructivist philosophy lens, I recognize that knowledge is subjective; people form their understandings through interactions and experiences (Prawat & Floden, 1994). Therefore, faculty may approach or have different attitudes when providing extended test time accommodations in STEM courses depending on past experiences and personal identities. With a constructivist approach, I aim to map out faculty experiences regarding extended test time accommodations, including how their attitudes and identities may impede or inform their views on such accommodations. By emphasizing subjective knowledge and diverse STEM faculty perspectives, this study will contribute a more nuanced understanding of extended test time accommodations in higher education. Given that much remains to be learned regarding how faculty navigate providing accommodations within STEM fields through a qualitative approach, I hope to gain

new insight into how faculty members approach providing extended test time accommodations and how their experiences and attitudes influence their perceptions of this provision. This study hopes to create a more inclusive and supportive higher education environment for SWDs.

## Theoretical Framework

In this study, three theories and frameworks will be employed to shed light on the experiences of STEM faculty in providing extended test time accommodations to SWDs. These theories help frame the challenges and approaches to creating a more inclusive educational environment.

### Challenge and Support Theory

Sanford's (1967) challenge and support theory, as applied in this research, posits that college environments present both challenges and supports, which can act as either facilitators when balanced appropriately or obstacles when there is a disproportion of one to fulfilling student goals (Ward et al., 2005). This theory emphasizes the need to balance challenges and supports to foster personal development and growth among students.

Challenge and support theory focuses on striking the perfect balance between support and challenges for students to optimize student learning and development, though multiple realities of the perfect ratio of support to challenges exist (Dinise-Halter, 2017; Sanford, 1967). Faculty can support SWDs in their challenging STEM disciplines and courses through accommodations. Sanford's (1967) challenge and support theory offered a structured approach to understanding if and how the faculty provides support through extended test time accommodations to the unique challenges experienced by SWDs in their courses and whether the faculty felt that the SWDs were still adequately challenged while receiving the accommodations (Dinise-Halter, 2017).

### Disability Studies

Disability studies explore and examine social, political, cultural, and economic factors that help a program or entity—in this study, a STEM instructor—define disability and help determine their responses to differences (Society for Disability Studies, 2015). It highlights how individuals with disabilities can experience oppression due to societal perceptions (Singer, 2012). In the context of this research, disability studies provide a critical framework for understanding the broader social and cultural factors that influence the personal beliefs of STEM faculty while interacting with SWDs and granting (or not granting) their extended test time accommodations. It allowed this researcher to delve into the perceptions these faculty have around extended test time and how these perceptions may influence their actions around being asked to provide extended test time accommodations for their SWDs.

According to the Society for Disability Studies' (2015) social model of disability, obstacles for SWDs arise primarily from institutional structures defined by factors, attitudes, and beliefs rather than individual impairments. Ultimately, Disability Studies encourages work to de-stigmatize disease, illness, impairment, and disability. For example, work can start with instructors encouraging participation by SWDs through adequate accommodations, ensuring physical and intellectual access to all learning environments and fields of study, including STEM (Society for Disability Studies, 2015). When combined with the theory above, Disabilities Studies examines the factors, attitudes, and beliefs the faculty and their institution hold around extended test time accommodations and how these might influence their ability to maintain the necessary balance described in Sanford's (1967) challenge and support theory for their SWDs receiving (or not receiving) extended test time accommodations.

**Universal Design for Learning**

UDL is an educational approach that aims “to remove access barriers at the point of instructional design” to increase inclusivity and accessibility (Jarman, 2023; Meyer et al., 2013). It deals with inclusive and accessible pedagogy, achieved by offering multiple forms of representation, expression, and engagement and stressing flexibility in teaching and learning (Jarman, 2023; Navaitienė & Stasiūnaitienė, 2021). By incorporating UDL as a framework to approach and ultimately improve their teaching and learning, educators can optimize learning experiences for all individuals (Meyer et al., 2013). Jarman (2023) identified many UDL strategies, including "having access to class notes, instructional materials ahead of time, and concept summaries or outlines" and added, "in terms of expression, UDL encourages instructors to provide diverse assignments, and even to offer choices to students in terms of how they demonstrate mastery of course material" (p. 3). Jarman further explained

> Although the literature on faculty perceptions toward UDL and inclusive design is somewhat limited (Roberts et al., 2011), recent studies indicate a generally positive attitude toward UDL among faculty (Cook et al., 2009; Dallas et al., 2014). At the same time, positive attitudes do not necessarily translate into broad implementation of UDL strategies and techniques in courses (Dallas et al., 2016; LaRocco & Wilken, 2013; Lombardi et al., 2011), and this gap between openness to and implementation of UDL emerged as an important finding in this review of research (p. 3).

In this study, UDL is a complementary theory relevant to understanding how one element of flexibility or technique, specifically an extended test time accommodation, is received and implemented (or not implemented) by the STEM instructors to create an equitable and inclusive learning environment in their STEM courses, giving SWDs the flexibility they need to demonstrate their STEM course learning and mastery through an extended test time accommodation.

## Integration of the Theoretical Frameworks

The Society for Disability Studies' (2015) frameworks would approach this study from a social lens of disability, where obstacles encountered by SWDs arise primarily from institutional structures defined by factors, attitudes, and beliefs rather than individual impairments. Through that lens, UDL would say that faculty and instructors can proactively provide accommodations to all their students to build an inclusive culture within STEM disciplines that transcends ableist norms (Meyer et al., 2013), while still maintaining the necessary balance described in Sanford's (1967) challenge and support theory.

## Chapter Summary

These theories, individually and collectively, form the foundation of this study. They provide a lens for exploring the experiences of STEM faculty issuing the academic accommodation of extended test time as the support dimension of Sanford's (1967) challenge and support theory for their SWDs while still maintaining an appropriately challenging STEM learning environment, as well as the factors, attitudes, and beliefs shaping the faculty's perceptions as explored in disability studies (Society for Disability Studies, 2015), when being asked to implement this factor of flexibility following ULD (Meyer et al., 2013). By applying these frameworks, it is aimed that an understanding of the complexities surrounding academic accommodations, such as extended test time, and their impact on the pursuit of STEM education by individuals with disabilities will be gained in all areas that this literature review has revisited and explored.

# CHAPTER 3

# METHODOLOGY

This study used a qualitative approach to explore the depth of experiences of science, technology, engineering, and mathematics (STEM) faculty receiving requests for extended test time accommodations from students with disabilities. With research showing that students with disabilities (SWDs) report that their STEM instructors are resistant to providing necessary accommodations (e.g., Lee, 2011; Love et al., 2014; Rao & Gartin, 2003), the purpose of this study was to understand the instructors' experiences and perspectives, in hopes that they may reveal common barriers or reasons for resistance to these accommodations that can be addressed through modifications to university processes or training, which are more easily scalable and replicable than individualized accommodations, and can inform the work of disability advocates in student affairs.

This chapter begins by outlining the theoretical framework and the constructivist paradigm's ontological, epistemological, and axiological dimensions. It is upon the framework and paradigms that the use of basic narrative methodology was built, as well as the rationale for employing thematic analysis. The sampling and recruitment plan, data collection methods, and data analysis procedures are also articulated later in this chapter. The sections are followed by the mention of strategies to enhance the study's trustworthiness, such as triangulation, member checking, and reflexive journaling for rigor and credibility of the research. The following research questions guided this study:

1. What experiences have STEM faculty had with receiving and acting on a request to provide an extended test time accommodation in their STEM courses?
2. What are faculty attitudes and beliefs about extended test time accommodations and the greater flexibility this accommodation can offer to students?

## Research Paradigm and Theoretical Framework

### Research Paradigm

The research paradigm selected for the study was constructivism, an approach that considers realities as subjective and that knowledge is socially constructed (Merriam, 2009). Pilarska (2021) explains, "All constructivist approaches acknowledge that there are no universal 'truths' or valid categories for the human experience; hence knowledge is the production of the social and personal process of meaning-making" (p. 64). There are observable inferences about how individuals actively construct their understanding of reality through interactions, experiences, and interpretations (Killam, 2013; Merriam, 2009). While this study aimed to find recurring themes, identification of the themes depended on the specific experiences of the STEM faculty receiving extended test time accommodation requests and acting on them, how they interpret(ed) these experiences, and how they communicate their interpretations of the experiences, leading to a diversity of perspectives from the multiple participants. Interviewing multiple participants can uncover multiple realities that are socially constructed from each STEM instructor's beliefs and attitudes. I aimed to understand how different STEM faculty members interpretively make meaning of their experiences by offering (or not offering) extended test time accommodations.

## Ontological Dimensions of the Constructivist Research Paradigm

Given that reality is subjective in that different people make meaning of the world through their interpretations (Merriam, 2009), it becomes crucial to understand the various interpretations that might exist for support services of SWDs in STEM. SWDs and their advocates would like to believe that faculty members have a very positive perception towards offering extended test time accommodations to make the STEM learning environments more equitable and accessible to SWDs; however, the reality could be that, based on an individual instructor's experiences and interpretations, they fail to have such a positive perception about offering extended test time accommodations (Killam, 2013). For example, some may view STEM fields as needing to be rigorous and that providing such flexibility through accommodations is a form of academic leniency and fails to adequately challenge and prepare students for rigorous STEM practice after graduation. A constructivist paradigm also allows one to develop hypotheses and research questions from the ontology of reality being socially constructed.

## Epistemological Dimensions of the Constructivist Research Paradigm

By exploring the perspectives of STEM faculty members, the study recognized that knowledge about extended test time accommodations is not universally objective but is constructed through the unique lenses of individual experiences (Killam, 2013; Merriam, 2009). For instance, a faculty member's past encounters with SWDs, their training, and their personal beliefs about accommodation may shape their perception of the efficacy of extended test time (Jarman et al., 2023). Knowledge is constructed through interpretation, influenced by the social context in which STEM faculty members operate. For instance, faculty responses may be shaped by departmental culture, institutional policies, and societal attitudes toward disability.

Acknowledging challenges such as negative attitudes, inadequate support services, and stereotypes within STEM fields also revealed an interpretive epistemology. These challenges are not seen as objective facts but as socially constructed barriers that influence faculty members' experiences and interactions with students who require extended test time accommodations.

**Axiological Dimensions of the Paradigm in the Study**

The study placed a significant axiological emphasis on the value of inclusivity and diversity in STEM education. By exploring the experiences of STEM faculty members in providing (or not providing) extended test time accommodations, the research recognized the importance of creating an inclusive learning environment. This recognition aligns with equity and social justice values, emphasizing that all students, including those with disabilities, should have equal opportunities to succeed in STEM fields (Killam, 2013). The research also acknowledged the ethics associated with accommodating SWDs. By focusing on extended test time accommodations, the study aimed to shed light on the ethical responsibility of faculty members in ensuring the well-being and success of SWDs in STEM courses through the flexibility of ULD. Therefore, the provision of accommodations reflects a commitment to ethical practices and a concern for students' overall academic and emotional welfare.

**Narrative Inquiry Methodology**

The narrative inquiry methodological approach included interviewing STEM faculty members who have experience receiving requests for extended test time accommodations from students enrolled in their STEM courses and collecting their *narratives* around those experiences, as well as the faculty member's beliefs and attitudes about the accommodation, to explore their stories and share their stories of their lived experiences (Creswell, 2014). Clandinin and Connelly (2000) explain that "in the construction of narratives of experience, there is a

reflexive relationship between living a story, telling a life story, retelling a life story, and reliving a life story" (p. 71). Clandinin and Connelly (2000) used a metaphor of a three-dimensional narrative inquiry space: *temporality* or past, present, and future (continuity) along one dimension; *sociality* or the personal and social (interaction) along the next dimension; and *place* (situation) along a third dimension (Clandinin, 2006). Temporality acknowledges how experiences in the past and present—in this study, perhaps faculty training around SWDs or personal experience with their own disabilities—affect the future and responses to requests for accommodation. Sociality considers the relationship between the participant and their social setting, or the faculty member and their STEM field, college colleagues, university professionals, and students. The place looks at the context in which the request for accommodation occurs, e.g., the specific STEM course, the college, and the university (Clandinin & Connelly, 2000).

Through open-ended interview questions, the methodology allowed the participants to freely express their unique and shared experiences, perceptions, and actions regarding extended test time accommodations within the three-dimensional space of temporality, sociality, and place (Clandinin & Connelly, 2000; Killam, 2013). Through thematic coding, this study identified recurring themes such as the challenges that some of the faculty members have in effectively being involved in the provision of extended test times.

**Theoretical Framework**

Sanford's (1967) challenge and support theory, disability studies (Society for Disability Studies, 2015), and Meyer et al. (2013) universal learning design (UDL) collectively formed the conceptual framework. The chosen theories and frameworks align well with the study's constructivist epistemology and narrative inquiry methodology.

Challenge and support theory, focusing on the balance between support and challenges for optimum student learning and development, shows the existence of multiple realities based on the ratio of support to challenges (Dinise-Halter, 2017; Sanford, 1967). STEM faculty are in a unique position to provide the much-needed support to SWDs in their challenging STEM disciplines and courses, who already face unique challenges in the postsecondary learning environments as SWDs. This theory enabled exploring how faculty navigated keeping their STEM courses appropriately challenging while providing the necessary balance of support within the academic environment to SWDs through extended test time accommodation. Sanford's (1967) challenge and support theory offered a structured approach to understanding how the faculty provides support to the unique challenges experienced by SWDs in STEM courses, and whether the faculty felt that the SWDs were still adequately challenged while receiving the accommodations (Dinise-Halter, 2017).

Disability studies show that individuals can perceive disabilities as medical, functional, or social, and these perceptions can be influenced by factors, attitudes and beliefs (Society for Disability Studies, 2015). This framework can help assess the accessibility of the STEM learning environment and possibly help assess whether the STEM faculty in this study hold a perception of disabilities that is defined mainly through a medical, functional, or social lens. Medical and functional lenses portray disability as being almost synonymous with inherent inability, whereas the social lens considers disability a social issue that can be addressed by promoting inclusivity and accessibility by providing academic accommodations.

Taking the Society for Disability Studies' (2015) framework's idea of a social lens of disability of even further, UDL would say that faculty and instructors can proactively provide accommodations to all their students to build an inclusive culture within STEM disciplines that

transcends ableist norms (Meyer et al., 2013), while still maintaining the necessary balance described in Sanford's (1967) challenge and support theory. More specifically, UDL contributed to the study by grounding extended test time accommodations as a reasonable and flexible way for all students with their unique and different learning styles and abilities to be able to effectively express what they have learned in the challenging STEM courses taught by a supportive STEM faculty member who holds a social lens of disability (Meyer et al., 2013; Sanford, 1967; Society for Disability Studies, 2015), especially after the other aspects of UDL (e.g. keeping every student engaged and motivated through different formats of instructions that suit them) have been implemented (Cole et al., 2024). Therefore, UDL provided a chance to enquire about the extent of inclusive learning practice in the STEM classroom by exploring STEM faculty's willingness and flexibility to provide extended test time accommodations to SWDs so that the SWDs may more effectively express what they have learned (Meyer et al., 2013).

Apart from guiding the kinds of questions asked to the participants, Sanford's (1967) challenge and support theory, the Society for Disability Studies' (2015) framework, and UDL also helped to analyze the data and consider the study's findings. The Society for Disability Studies' (2015) framework and UDL complemented this Sanford's (1967) challenge and support theory in this study by emphasizing the factors, attitudes, and beliefs around extended test time accommodations and the faculty's willingness to incorporate and adopt the flexibility the accommodation offers into their courses, respectively (Meyer et al., 2013; Powell & Pfahl, 2018).

## Sampling and Recruitment Plan

### Research Site

Past research has found that STEM instructors are less willing to readily provide necessary accommodations (Lee, 2011; Love et al., 2014; Rao & Gartin, 2003), and therefore, SWDs enrolling in STEM are less likely to receive reasonable academic accommodations than non-STEM fields (Lambert & Tan, 2019). Past research has also suggested that SWDs at R1 institutions often encounter unique challenges in these research-intensive environments (Castrodale, 2015). These challenges relate to the competitive nature of R1 schools, the emphasis on research, and the availability of support services, all resulting in SWDs being less likely to enroll in STEM classes, finish their STEM programs, and graduate with STEM degrees (Gottfried et al., 2014). At R1 institutions, where scholarship, research, and securing grants are central to traditional faculty responsibilities, most of the funding is directed to salaries of faculty researchers and conducting research (Quance, 2024). The allocation of funding at R1 institutions predominantly to research expenses can leave institutional support services lacking, and a prior study on life sciences faculty revealed that while many of those science faculty believe that providing accommodations to SWDs is the right thing to do, they often perceive it as a burden to their STEM-focused workloads and they feel a lack adequate institutional support (Goodwin et al., 2024). in an R1 institution, this research study aimed to provide insights into how STEM faculty experience providing extended test time accommodations within the context of the R1 institution, its resource allocation model, and how institutional support such as ODS influences or impacts their experiences.

The study was situated within a large (approximately 48,000 students) R1 state school in the southeast that emphasizes the academic fields of STEM and the availability of an extended

test-time accommodation for qualifying SWDs. This site allowed for exploring faculty experiences in a context where challenging STEM courses, known for being academically rigorous (Ashford et al., 2016), and support services for SWDs must be balanced to promote student learning and development, in accordance with Sanford's (1967) challenge and support theory.

**Target Population and Sampling Method**

The target population for this study comprised faculty members within STEM departments at a large R1 state school. The focus was on faculty with experience providing extended test time accommodations to SWDs in their undergraduate STEM courses. A purposive sampling strategy was employed to recruit 8-12 faculty members. This approach ensured that the selected individuals were well-positioned to provide in-depth perspectives relevant to the study's focus (Merriam, 2009; Moustakas, 1994). Initially, faculty members were contacted via personalized cold emails sent to their departmental email addresses. These emails, with a flyer (see Appendix A), detailed the study's purpose, the voluntary nature of participation, and the confidentiality measures in place (Trespalacios & Perkins, 2016). Exclusion criteria included those who had not taught a STEM course, were yet to provide such accommodations for a student in their STEM course, or did not consent to participate. In addition to receiving Institutional Review Board (IRB) approval from the researcher's home institutions, IRB approval and permission was secured from the university's IRB board of the research site.

Informed consent was obtained through a digital consent form (see Appendix B), ensuring participants fully knew their rights and the study's scope (Creswell & Creswell, 2018). Demographic data were collected through a short, confidential questionnaire before the interviews (see Appendix C), capturing essential information such as academic rank, years of

experience, STEM courses taught, and the number of times (frequency) extended test time accommodations had been provided.

## Data Collection Methods

### Interviews

Semi-structured interviews were the primary data collection method, allowing for flexibility in exploring faculty experiences while providing consistency across interviews (see Appendix D). Semi-structured interviews allowed respondents to answer to their preferred depth, with the interviewer only directing the conversation. Semi-structured interviews aligned with the constructivist paradigm, facilitating an in-depth exploration of faculty experiences and perceptions (Creswell & Creswell, 2018). This method enabled the capture of personal narratives essential for understanding the experiences under study.

Interviews were conducted and recorded via Zoom, through the researcher's home institution's Zoom account, to accommodate participants' schedules and preferences, ensuring a comfortable and convenient setting for open discussion. This digital administration of the interview aligned with the contemporary ubiquity of the integration of technological interphases of communication that facilitate virtual interaction, such as web conferences and recorded meetings, which is also an essential feature of consideration in providing accessible accommodation provisions.

An interview guide was used that included ten semi-structured questions intended to draw out the narratives of STEM faculty, revealing how they perceive, interpret, and implement extended test time accommodations, uncovering the faculty experiences and attitudes toward extended test time accommodations in STEM education within the three-dimensional space of temporality, sociality, and place (Clandinin & Connelly, 2000; Killam, 2013). Developing an

interview guide for semi-structured interviews was essential to achieving consistency across interviews while permitting the flexibility to explore deep insights based on respondents' answers (Jamshed, 2014). A pilot test was conducted with a small target population segment to fine-tune the interview questions and techniques. The pilot test ensured the questions were effectively crafted to provide comprehensive and relevant responses (Shoozan & Mohamad, 2024).

### Document Collection

While the primary data for this study was collected from the participant interviews, relevant documents such as accommodation policies, faculty guidelines, and training materials on disability services were reviewed. These documents were essential to inform the institutional environment concerning accessible and inclusive learning and development spaces (Meriam, 2009). This analysis helped contextualize the interviews and offered insights into the institutional framework surrounding extended test time accommodations. Access to these documents was requested through the university's ODS office, participants, and STEM departments (see Appendix E). Asking for permission ensured that the rights to use the acquired documents and information therein had been expressly granted. It also made acquiring such documents more accessible and faster due to the direction of the necessary offices in the institution.

## Data Analysis

This study adopted a basic narrative methodology and used thematic analysis to understand the experiences of faculty teaching undergraduate STEM courses with receiving and acting (or not acting) on extended test time accommodations. This methodological choice was well-suited for capturing faculty members' accounts and stories, highlighting the patterns and themes that emerge from their narratives and lived experiences, and ensuring their subjective experiences are examined (Creswell, 2014; Merriam, 2009).

Thematic analysis focused on identifying and analyzing patterns within qualitative data (Josselson, 2011; Merriam, 2009). This involved analyzing the narratives of STEM faculty, revealing how they perceive, interpret, and implement extended test time accommodations. By examining and analyzing these narratives, the study aimed to uncover the underlying themes that characterized faculty experiences and attitudes toward accommodations in STEM education within the three-dimensional space of temporality, sociality, and place (Clandinin & Connelly, 2000; Killam, 2013).

The thematic analysis design was appropriate for this study as it facilitated the researcher's understanding of the faculty members' experiences with extended test time accommodations (Merriam, 2009). It allowed for exploring how these experiences influence instructor attitudes and actions toward accommodating SWDs in STEM courses. This design aligned with the constructivist theoretical framework guiding the study, emphasizing the social construction of knowledge through faculty interactions and experiences (Clandinin & Connelly, 2000).

After each interview, the session was transcribed verbatim to capture the full context of responses, including subtle tone and emphasis crucial for accurate data interpretation (Creswell & Creswell, 2017). Data analysis was ongoing and proceeded concurrently with the data collection, including the transcription of interviews, document collection, and the recording of findings (Creswell, 2014). Merriam (2009) recommends engaging with the initial data so that any tentative themes that arise from earlier interviews with participants that are worthy to pursue in later interviews are not missed.

The thematic analysis proceeded with a rigorous two-phase coding process. Initially, open coding generated an expansive set of categories from the interview data. Open coding was

followed by axial coding, which helped identify relationships between categories and refined them into distinct themes (Kampira, 2021).

Complementing the interview data, document analysis was conducted to provide insights into the institutional and policy frameworks that influence the provision of accommodations (Malandrino, 2023). A comprehensive selection of relevant documents was systematically reviewed, including policies, training materials, and faculty guidelines. The systematic approach ensured a broad coverage of all aspects of the accommodation process. An analytical framework guided the document review process, focusing on elements such as the clarity of policies and their alignment with legal standards and describing support mechanisms for faculty to understand the institutional climate from which STEM faculty experiences, attitudes, and beliefs were evaluated. Sanford's (1967) challenge and support theory helped explain how faculty balance challenges and supports when providing accommodations, reflecting on how these accommodations influence students' personal development and academic success. Disability Studies was employed to interpret the influential factors and attitudes and beliefs of the faculty, shedding light on how context and perceptions impact the provision of accommodations (Society for Disability Studies, 2015). UDL was used to assess the inclusivity and accessibility of the courses and how the faculty chose to act on the accommodation requets, evaluating how the faculty members align with the principles of multiple forms of representation, expression, and engagement in teaching and learning, as well as assessments, as is the case in extended-test-time accommodations (Meyer et al., 2013).

To enhance the credibility of the findings, the document analysis was cross-validated with interview data by comparing and contrasting the themes from the interview transcripts with the information and themes identified in the documents, providing a robust check for consistency

and contradictions (Malandrino, 2023). The purpose of this was to reinforce the credibility of the findings.

### Protection of Subjects

Participants in this study had minimal risk for involvement in the study. The interviews were recorded and stored within the researcher's university Zoom account, behind their university login and passcode. Once transcriptions of the Zoom interviews had been made and notes about any nonverbal communication (facial expressions and body language) had been made on the transcript, the Zoom recordings were deleted, and a pseudonym used to label the interview transcription. The participant information provided was stored in a password-protected file separately from the transcription data to protect privacy. Participants' names or any other identifying facts do not appear in this dissertation, nor in any presentations or publications that resulted from this study.

## Trustworthiness and Positionality

Enhancing the trustworthiness and credibility of a qualitative study was essential, and applying rigorous trustworthiness strategies was crucial to validate the findings and ensure they accurately represent the experiences being investigated (Mertens, 2005). The strategies included triangulation, member checking, and reflexive journaling.

### Triangulation

This study's methodological triangulation integrated data from semi-structured interviews and document analysis to create a robust foundation for the findings (Bowen, 2009). The triangulation allowed for a comprehensive understanding of the instructors' experiences from their multiple, diverse perspectives, confirming the consistency and reliability of the data across various sources. By comparing themes that emerge from the interviews with the formal policies

and guidelines analyzed in the document review, the study authenticated the subjective data provided by participants with the objective data from institutional documents. This cross-verification helped to understand the institutional climate from which STEM faculty experiences, attitudes, and beliefs will be evaluated.

**Member Checking**

Mertens (2005) states that "member checking is the most important criterion in establishing credibility" (p. 255). Member checking in this research ensured that the interpretations of the data reflected the experiences and insights of the participants (Birt et al., 2016). After preliminary analysis, a summary of the key findings was shared with the participants, asking them to verify the accuracy of the themes identified. The sharing was part of a validity check where the participants' expertise in their lived experiences was acknowledged and respected. It was also an opportunity to engage the participants in providing more clarifications and insights about their lived experiences and what they had provided during the interview. This iterative feedback mechanism enhanced the credibility of the research findings and reinforced participant engagement, making the research process more collaborative and transparent (Birt et al., 2016; Mertens, 2005).

**Reflexive Journaling**

Maintaining a reflexive journal facilitated real-time documentation of the ongoing research process and the researcher's reflections on personal biases and assumptions. This journaling approach was more accurate than considering such biases and assumptions in advance or retrogression.

The following is an annotation of a reflexive journal entry that I had as a motivation for my study: *I became interested in understanding STEM faculty perceptions of extended test time*

*accommodations when I worked in a Disability Services Office. There, I witnessed the challenges that SWDs encounter in requesting accommodations. I believe in advocating for SWDs and upholding the academic integrity of institutions to make the collegiate environment accessible and equitable.*

Given the sensitive nature of disability accommodations and the potential for personal experiences to influence the interpretation of data, it was crucial for me as the researcher to engage in continuous self-reflection. The journaling served as a personal audit trail where decisions, methodological changes, and reflections on interactions with participants were recorded (Nowell et al., 2017). It helped identify personal or cultural biases affecting data collection and analysis. The reflexive journaling ensured a higher degree of introspection. Such reflection contributed to greater transparency and rigor in the research process, which was essential for strengthening the trustworthiness and ethical integrity of the study.

By adopting these techniques, the study aimed to be more trustworthy and credible. The findings obtained from the study can be traced back to the methodology adopted. It ensures that the reliability of the findings can be judged from a logical methodology. Because of the study population's description, the study's insights can be generalized to similar learning environments. As a result, it ensures that its findings are robust and resonate with the practical implication of providing extended test-time accommodations in STEM education (Nowell et al., 2017). This methodological rigor enhanced the validity of the research outcomes and contributes meaningfully to the ongoing discourse on educational accessibility and inclusivity.

# CHAPTER 4

# FINDINGS

This chapter presents the findings of this social constructivist narrative inquiry study that sought to understand faculty perspectives on extended test time accommodations for students with disabilities (SWDs) in science, technology, engineering, and mathematics (STEM) courses. More specifically, the study aimed to understand how STEM faculty perceive, interpret, and implement extended test time accommodations, and to uncover the underlying themes from the narratives that characterize STEM faculty experiences, attitudes, and beliefs toward accommodations in STEM courses within the three-dimensional space of temporality, sociality, and place (Clandinin & Connelly, 2000; Killam, 2013).

## Participants

The eight participants in this study were all faculty members teaching undergraduate STEM courses at a large R1 state university in the southeast that emphasizes the academic fields of STEM and the availability of an extended test-time accommodation for qualifying SWDs. Participants held various academic faculty ranks including a traditional tenured professorship and non-tenure track senior lecturer and senior academic professional faculty positions. Their teaching experience ranged from several years to decades, with some transitioning from research-focused roles to primarily teaching positions.

All eight participants in this study were recruited using a purposive sampling strategy to ensure that faculty members with relevant experience providing extended test time accommodations in STEM courses were selected. Initially, faculty members at the large R1 state

institution were contacted via personalized “cold” emails sent to their departmental email addresses after locating their names on the prior semester’s course teaching schedule (see Appendix A). These emails included a flyer detailing the study’s purpose, the voluntary nature of participation, and confidentiality measures. When that initial recruitment did not yield enough participants, an email was sent to the university’s office of disability services (ODS) staff seeking their assistance with faculty recruitment (see Appendix F).

All participants met the criteria to participate in the study, which included: (1) currently holding a faculty position within a STEM department at the large R1 state school identified as the research site for this study, (2) having experience providing extended test time accommodations to SWDs in their undergraduate STEM courses, (3) teaching STEM courses within the past five years, and (4) consenting to participate in the study.

Faculty members who had never taught a STEM course at the research site, had not provided extended test time accommodations in their courses, or did not consent to participate were excluded. This recruitment approach ensured that the study captured diverse faculty perspectives on providing accommodations within the research-intensive environment of an R1 institution.

Most participants held a faculty title of *academic professional*, one unique to the university in which the faculty member teaches for up to 50% of their workload, and the remaining workload is dedicated to administrative practices. Most of the administrative practices to which the participants were dedicated, however, were connected to managing their large STEM courses, some enrolling as many as 800 students (across multiple course sections, and sometimes with co-instructors or team-teachers) per year.

Table 1 details demographic and other characteristics of the participants from this study.

**Table 1**

*Characteristics of the Participants*

| Participant | Academic Rank | Years in Current Academic Position | Frequency of Teaching STEM Courses (Past 5 Years) | Frequency of Providing Extended Test Time Accommodations | Frequency of Interaction with ODS Staff | Formal Training on Disability Accommodations |
|---|---|---|---|---|---|---|
| Dr. Arthur | Principal Academic Professional | 16 | Very Frequently | Every Semester | Often | None |
| Dr. Barry | Senior Academic Professional | 11 | Frequently | Very Often | Often | Minimal |
| Dr. Gabrielle | Senior Lecturer | 3 | Exclusively | Always | Very Often | Very Minimal |
| Dr. Lorenzo | Principal Academic Professional | 12 | All the time | Very Often | Often | Minimal |
| Dr. Nestor | Senior Academic Professional | 8 | Every semester | Every exam | Rarely | None |
| Dr. Owen | Senior Academic Professional | 17 | Every semester | Every class | Very often | Minimal |
| Dr. Rene | Senior Lecturer | 4 | Very frequently | Very often | Often | None |
| Dr. Van | Associate Professor | 6 | Frequently | Every semester | Sometimes | Some |

***Respondent 1: Dr. Arthur***

Dr. Arthur is a principal academic professional, a mid-level non-tenure track faculty rank, with no more than half of his workload dedicated to teaching and the remaining workload dedicated to a university administration assignment. He said he has been teaching classes in the STEM area of Chemistry for 16 years. He also said that he provides an extended test time accommodation to a SWD every semester and often interacts with ODS staff on his campus. And while he has not received any formal training on providing accommodations to SWD, he said that has participated in workshops or other trainings on inclusive teaching practices.

One challenge the respondent, Dr. Arthur, highlighted was the complexity of managing extended time accommodations for large classes with the shift to online testing in his courses through the university's learning management system (LMS), Canvas:

> Now that in chemistry, actually, we now do Canvas exams, we use Canvas quizzes or, you know, learning management system quizzes. And so now it's sort of the juggling of making sure that I set everybody's time appropriately in the exam and the paranoia of 'Did I miss someone? Did I set the wrong time? Did I include the extended time [for the SWD]?' And so, it's a lot of conversations with students about, you know, look, there's several of you all, there's one of me. So, I need you to double check before you start your exam and make sure that I set it appropriately and alert the proctors if I didn't, you know, those sorts of things so that we can kind of…it's easier to fix at the beginning than in the middle. It's a sort of mitigating disaster.

Beyond the technical aspects, Dr. Arthur discussed the challenge of balancing student needs, institutional policies, and personal teaching responsibilities:

> The volume really is the issue. And it's not necessarily that it's, 'Oh my gosh, I have to do so many different things in Canvas.' It's more—I don't feel like I can offer extended time without using the testing center. Because, you know, I've got 264 students in a room, there's another class coming in shortly afterward—I can't navigate that in a way that I think would be beneficial for the students. So, the other option would be to give them all a test at a different time [in a smaller, available space like an office]. I often get feedback, 'Well, just have a TA do it,' but I'm just not comfortable having a TA do it because things come up that I don't want the TA to have to deal with. I don't want it to be stressful for the students because the TA is unsure of how to deal with it.

Dr. Arthur reflected on the broader institutional challenges, particularly the constraints on classroom space and testing center resources:

> We absolutely need more space. Well, I guess that's maybe a difference. We're extremely space constrained right now. With the enrollment growth, we just don't have the space [in available classrooms or testing to offer extended test times to multiple students at once]. There was a potential solution to expand this space pretty significantly, but it would have required moving the testing center out into [a far side of campus]. And I remember that—and why that wasn't a good idea for some of the students. But on the other hand, I also feel like sometimes we have to find the balance between horrible and not great. If your options are horrible and not great, then, I mean, yes, we want wonderful, but not great is better than horrible.

Dr. Arthur also spoke more specifically about the challenges of his university requiring him to make an exam available at least 30 days prior to its due date in order for the university's testing center to facilitate the exam with an extended test time accommodation for SWDs in his

courses: “And so, it’s like, someone [a student] can register [for extended test time accommodations to occur] 30 days out from their final. So that’s kind of a disservice [to the student].” He added, “And, and I get, you know, like I see, I totally see both sides of it. I understand that they can’t have people adding [tests to the testing center’s workload] at the last minute. I also felt like it was a disservice to the student” to take the exam earlier than other students.

However, if Dr. Arthur chose not to use the university’s testing center, his university would give him even more leeway on both when he offered the exam to the SWD and the amount of test time he could extend to SWDs with university-approved extended test time accommodations, but Dr. Arthur felt that was also a challenge:

> And that’s again, where I think it’s challenging because now it’s on me. It’s my... yeah. My call. And I’m, I’m kind of uncomfortable with it being my call. I’m going to try to move on the side of benefiting the student.

***Respondent 2: Dr. Barry***

Dr. Barry is a senior academic professional, which is a non-tenure track, top faculty rank at his institution, who has been teaching classes in the STEM area of chemistry for 11 years for 50% of his workload, while the other half of his workload is reserved for him to serve as the director for the first-year chemistry courses at the large R1 institution. Dr. Barry says he provides an extended test time accommodation to approximately 20 SWDs every semester and often interacts with ODS staff on his campus. Dr. Barry indicated that he has received minimal formal training on providing accommodations to SWDs and has participated in a moderate number of workshops or other trainings on inclusive teaching practices, including one on inclusive STEM teaching specifically.

When asked about his attitudes and beliefs about extended test time accommodations and the greater flexibility this accommodation can offer to students, Dr. Barry shared what he called his "philosophy" around accommodations and how his more senior colleague informed that philosophy:

> For as long as I can remember, my philosophy has always been to work with ODS as closely as possible when I feel like an accommodation…I'm not able to provide an accommodation myself. So generally, that's part of it. And then the other part of it philosophically is I'm going to build accommodations into my courses as much as I can. So, I inherited this from my predecessor, who had a great system for building flexibility into things like homework and in-class work that's graded. We have this system we use called the daily work system where the cap students can earn is 250, but there are 275 or sometimes more points available. So, if you miss a class, something like that, it doesn't require us to be constantly going in and granting extensions and that kind of thing.

Dr. Barry spoke about an experience he had in his STEM course when he received and acted on a request to provide an extended test time accommodation, and how doing so limited faculty grading time because the university's testing center needed additional days (beyond the exam due date) to administer the exam to the SWD. He shared how this can disadvantage SWDs in his team-taught courses:

> One challenge I have teaching a large course is the exam [submission] needs to be proofread [graded] by all the instructors, and what holding exams at the testing center [sometimes at later dates than the exam due date, due to testing center scheduling and staff availability] does is kind of push back that [faculty] deadline for the grading and proofreading of the exam. I tell my co-instructors that I'm coordinating courses for at

> least a week in advance of the exam itself [so that SWD have at least a week to take the exam at the testing center]. Try to get it [the exam] to ODS, you know, five days before the exam goes off [is due]. They [ODS] may say [they need] 48 hours [after the exam is due to administer it to the SWD], but I like to have it just kind of… But then getting that feedback from faculty [with now limited proofreading and grading time] can sometimes be difficult, and it's not common, but it has happened in the past where a faculty member doesn't get feedback in on time, sees a question, says, 'I didn't teach it this way,' or 'We didn't talk about this,' or 'This isn't how I taught it.' And then it becomes a bit of a thing [that we faculty don't have as much time to work out with the SWD, as we would for a student without a disability].

Dr. Barry described another experience where he and several other faculty members noticed a student who they suspected would qualify for an extended test time accommodation, but the student was initially resistant to their suggestions to seek it, perhaps to manage the impressions of her faculty:

> She [the SWD] finally this semester has gotten it together [the extended test time accommodation approved by the university]. And it's been a multi-semester process. [Then she] Didn't use them [the extended test time accommodation]. Didn't think she needed to use them. 'Right, Because I can handle this' [she must have wanted to display it to the faculty]. [She] Could not handle it.

Dr. Barry shared that he does not believe extended test times reduce the difficulty of his exams, and that the exam itself is challenging enough and an accurate assessment of student learning without clock time limitations:

> An exam should provide information about a student's knowledge and skill state under pressurizing conditions. An hour is arbitrary, right? An hour is just however long it takes for the clock to go around and how much time is allocated for the course. I think that that shows, for example, when we teach in the summer and classes are an hour and 15 or two hours instead of 50 minutes, and people will just let their exams go the whole time. But for a student with accommodations, pressure has a different meaning. I think it's still pressurizing conditions to take the exam with time and a half in the testing center, and I still get the information I want. And anybody who's being honest, who's looked at performance on time exams versus regular time exams, will tell you there is no difference.

Dr. Barry shared his belief that extended test time accommodations provided through ODS at his institution empowered SWD and encouraged them to be more autonomous. He also noted that SWD from diverse backgrounds benefitted when they combined the support of extended test time accommodations and the support from a program at his university to further develop students from diverse backgrounds, as the university addressed both of their intersecting identities simultaneously:

> At ODS, we want to see that, 'Absolutely, I can advocate for myself. I can still be successful in college without my parents holding my hand or guiding my every move' kind of thing [from SWD]. I have seen that, you know, at least indirectly, I think, where you see students become empowered and autonomous. It's already happened for a couple of students that I've taught. So, I teach in the [university's initiative to develop highly skilled learners and leading contributors from diverse backgrounds] Challenge Program. And I have a couple of students with accommodations from Challenge who have really

> just continued the momentum from Challenge. And their accommodations are part of that. I mean, they take exams at the testing center and all that jazz. But I think they really have a level of confidence they would not have without that [Challenge Program] resource.

Dr. Barry says he feels supported as a faculty member by the staff in his university's ODS, particularly because of the professional relationship he has built with the staff in ODS:

> In terms of support and resources, like for me, it's that human element of, I know the person to email or the email address to use. And, um, [if we encounter any questions or difficulty with the extended test time accommodation] it's likely yet to be resolved, like favorably. So, you feel supported [by ODS as a faculty member here]. Definitely.

However, he said he believes that not all faculty at his institution respond as he does to extended test time accommodations:

> A lot of faculty are meaner than I am, uh, in the sense of, if it's not officially on record [it the university has not approved the student for an extended test time accommodation], they'll [the faculty will] just say no. I mean, math will just say no. I mean, we can't accommodate you.

***Respondent 3: Dr. Gabrielle***

Dr. Gabrielle is a senior lecturer, a top-level non-tenure track faculty rank dedicated solely to teaching. While he has held his current role at the university for only three years, he clarified that he has been teaching classes for over three decades in the STEM area of engineering. He says that he provides an extended test time accommodation to a SWD in every course and very often interacts with ODS staff on his campus. And while he says he has received very minimal formal training on providing accommodations to SWD, he has participated in

seminars or other trainings on hidden biases in teaching and has also sought professional development for inclusive teaching practices from book clubs and his own personal critiques of his teaching.

When asked about his attitudes and beliefs about extended test time accommodations and the greater flexibility this accommodation can offer to students, Dr. Gabrielle had a mixed reaction:

> There's a definite double-edged sword. We work very hard trying to be equitable in our treatment of students. On one side, everyone else has to complete the test in a certain period of time, and I even design my exams so that students need to use their time efficiently rather than just searching for answers. On the other side, I have students, like a young man this semester who is quadriplegic, who are clearly moving heaven and earth to get an education. The idea of not helping someone like that is anathema. So where do you meet in the middle?

Dr. Gabrielle said that being a parent and treating his SWDs like he would want his own children treated by a faculty member, as well as his willingness to be a father figure to his SWDs in his courses, likely influences how he reacts to a request to provide an extended test time accommodation. He also commented on the impact being at a rigorous, STEM-focused, R1 institution has on the perceptions others hold:

> I tend to be a softie when stuff happens to people. This is somebody else's son. They've got a father and a mother that are like, 'Oh my gosh, she's at [the university].' Or 'He's at [the university].' And it's, yes, I've got to remember that there's somebody who cares just as much as I care about my kids. So, they all sort of become my kids. I can't tell them that. But it's very fun too, when the parent works at the university. And this is what I

> would tell my children. Sometimes they need that, though, I feel like. And the male, the teenage male mind will listen to men other than dad. And so sometimes I channel for their father. They probably appreciate that. Well, they don't have any idea what I'm doing to them. But I know how that works.

Dr. Gabrielle spoke about how the lack of testing center space and the growing number of students needing extended test time has been challenging to him when he received and attempted to act on a request to provide an extended test time accommodation in his STEM course last year, and that he worries that the logistics of administering extended test time accommodations are getting in the way of faculty ensuring that SWD have mastered the material from their STEM courses:

> I think there are definitely students who need extended time and a low-distraction environment. But that's one of the most difficult things for me to provide—I don't have a private suite. And when the number of students needing accommodations grows, it becomes much harder to manage. When I have three or four, it's not a burden. When I have 20 with 20 different sets of circumstances, it's tough to keep up. I worry that, at a certain point, the logistics of administering accommodations can start detracting from the core goal—ensuring students actually master the material.

He also spoke about his difficult experience with the testing center on his campus:

> The testing center in the last year seems to have changed their attitude because I am finding it more difficult to work with them. They keep changing their policies without actually making an announcement. I crash into, 'Well, it's not three days anymore; it's five days in advance.' And now they want final exams two months in advance. Meanwhile, I couldn't even get my final exam times nailed down until two weeks before

> exams. And yet, the testing center demanded I provide them with time. So, I had to say, 'Fine, they can take it anytime,' and just deal with it.

However, despite those scheduling difficulties with the testing center, Dr. Gabrielle still has confidence and trust in the ODS staff on his campus:

> I'm really pleased that I can trust those people. That I can send students that are in trouble to them and say, 'Go talk to these folks and make sure you have them on your team.' And I know that's what they're going to do. If you don't get what you need, come back and talk to me…but nobody ever comes back.

***Respondent 4: Dr. Lorenzo***

Dr. Lorenzo is a principal academic professional, a mid-level non-tenure track faculty member, who has been teaching classes in the STEM area of Physics for over a decade. He says that he provides an extended test time accommodation to a SWD very often, at least once every semester, and often interacts with ODS staff on his campus. He describes the formal training he has received on providing accommodations to SWDs as being minimal, but says that he has participated in a moderate amount of workshops or other trainings on inclusive teaching practices.

He expressed frustration with the timing of extended test time approvals, noting that receiving accommodation requests weeks into the semester disrupts his course planning and requires him to make adjustments after everything in his course is already planned and set up:

> Now, I would say as a professor, some students get approved for extended time up to the third week of class. And that's annoying because I've already set up everything and then I have to redo it again. So, if you're looking for that, those extended of time from an instructor would be great if they are pre-everything in place when we start classes. Yeah.

> Which is for a lot of reasons. I know it's not the case, but that would be a big help. I was actually thinking about it last week. That would be a big help because five got accepted after the second week and now I have to go back and do it all.

He discussed the logistical challenges and emotional strain associated with managing extended test time accommodations, particularly when students miss scheduling deadlines set by the Office of Disability Services (ODS):

> Now, the biggest challenge, and I'm not in sync with some of the recent changes that ODS has done on campus, is for students to schedule their time. I cannot. So far in advance. Yeah. And I understand you guys have to know it, but there is a flexibility that you need. It can happen that it slips. You know, the students forget to do it. And when that happens, it gets so stressful. And then here you're losing all the accommodations that you were trying to provide because now they are totally frantic. And it's very difficult for instructors. We have no resources to proctor. And we have no resources of classrooms to proctor with this kind of, you know, when they need quiet time and things like. We don't have that. And so, when we have to proctor because ODS said, no, you didn't do it in the three days or whatever, this is a lot of strain on us. It's really difficult for us to do.

Dr. Lorenzo expressed strong support for extended test time accommodations but raised concerns about equity in access:

> I am totally in favor of the extended time. I think it's needed for sure. And so, I am completely supportive about it. What I would say is I'm always a little concerned about the access for students to have this extended time in terms of equity. And, you know, my understanding, and I have not searched it in detail, but my understanding, it takes quite a bit of time, knowledge and resources to be tested and to have those approved. And some

> people either don't know or don't have those resources and do not have those accommodations. And so that's where really my concern is, is how accessible it is to everybody who really needs it.

He highlighted the challenges posed by resource limitations, noting that the long wait times for university-approved testing can delay students' access to extended test time accommodations by an entire semester:

> So that's how they can afford low-cost testing for students. However, here's the asterisk. Their wait list is so long [for university testing and paperwork to be university approved for extended test time accommodations]. It could be a semester long to get in there and test it. So what service are we doing for that student if they can't even get in? We do…we would provide it for a semester. Provisional semester. That's good to know. So, while they kind of get their act together, get their testing done, get their documents from home, whatever they need to do.

He emphasized the logistical difficulties of managing accommodations, particularly the lack of clear communication from the ODS staff about procedural changes:

> The biggest challenge is that students have to schedule their time, and I cannot do it far enough in advance. There's no communication whatsoever from ODS when the platform changes – I learned about a 'no more pass' rule from a student, not from an official update. When I have 440 students, that lack of clarity creates havoc, and it puts a lot of strain on us as instructors.

He expressed strong support for extended test time accommodations but also voiced concerns about equitable access:

> I am totally in favor of the extended time. I think it's needed for sure, and so I am completely supportive of it. What I would say is I'm always a little concerned about the access for students to have this extended time in terms of equity. My understanding is that it takes quite a bit of time, knowledge, and resources to be tested and have those approved, and not everyone has those resources. That's where my concern really lies—ensuring that every student who needs it can actually access it.

***Respondent 5: Dr. Nestor***

Dr. Nestor is a senior academic professional, a top-level non-tenure track faculty rank, who has been teaching classes in the STEM area of mathematics for over eight years. He says that he provides an extended test time accommodation to a SWD for every exam he has offered in every semester he has taught, but that he rarely interacts with ODS staff on his campus and only does so when there is "a problem." He says he has not received formal training on providing accommodations to SWD and that he has not participated in formal workshops or other trainings on inclusive teaching practices, but that he has participated in some informal development around inclusive teaching.

He described the challenges of managing accommodations at scale, particularly in large enrollment courses with hundreds of students each semester:

> My experience is largely making accommodations at scale. So, I run Math 1553. It has roughly one and a half thousand students in the fall and 600 students in the spring. So, we have a number of students with accommodations. Managing the scale is the main issue, and coordinating logistics has become a problem. We don't really have the option of using the testing center at night because it closes before our exams start. At the same time, we can't let students take the exam early without risking exam integrity. So that just

> means I have to come up with an alternative accommodation. I basically do it myself—I reserve an extra room, try to keep it as silent as possible, and have students with extra time begin early. A T.A. takes over midway so I can return to the main exam room. That's how we handle it.

He reflected on the growing demand for accommodations and the institutional challenges that come with it:

> My thoughts have changed more about logistics than the effectiveness of accommodations. When I started teaching 12 and a half years ago at a different university, even in a large class, there might have been one or two students who needed extended time. The testing center could handle that. But now, more students have accommodations relative to the past—maybe the world is catching up to better testing, which is not a bad thing—but this has overwhelmed testing centers. At [the university], the testing center doesn't stay open for our common exam times, which is the time when it's needed most. And yet, the administration hasn't prioritized fixing this issue. It's not the testing center's fault; they don't get enough staff or funding to operate at night. I've spoken to faculty at other large universities, and they report the same problem. Some testing centers even run out of private rooms for students who require them, and there's nothing faculty can do—we can't just rent silent private rooms out of nowhere. The system wasn't built for today's needs.

He noted that he does not have clear data on how extended test time impacts student performance, and says he believes outcomes likely vary based on multiple factors, including preparation:

> I don’t really get to see in detail how extended time impacts student performance. Some students with accommodations do great, some don’t, but I don’t know if that’s due to the accommodation itself or factors like preparation. What I do know is that most students who use our alternate testing room seem to find it sufficient—it’s quiet enough, and they don’t often request to take their exam at the testing center instead. Also, for the linear algebra course I coordinate, we design exams to have built-in buffer time, so students don’t feel rushed. Our exams aren’t meant to take the full 75 minutes; we want students to have extra time to check their work. Maybe that’s why some students with extended time finish in the normal test duration—it’s already built into our exam design. I think that’s a good approach.

He emphasized the importance of discussing accommodations with the SWDs and ODS staff in advance, noting that they should not be applied retroactively:

> I said, you have to do it beforehand. And I contacted the testing center to confirm. Like, hey, this is, you know. And then they said, yeah, that's right. The student didn't discuss the accommodations with you. It's not retroactive. Right. And again, that led me to put another sentence in the syllabus: If you have accommodations for flexibility with attendance or with due dates, you must contact me in advance to discuss it.

He highlighted the challenge of balancing fairness and flexibility when handling accommodations, particularly regarding retroactive extensions. While he is willing to provide extensions when notified in advance, managing retroactive requests at scale becomes impractical:

> It's just the retroactive extensions, you know, we can't. It's—I'm fine with knowing in advance and giving the extension [in order to take the exam with the testing center who

> can offer an extended test time accommodation]. But, you know, if you've got one and a half thousand students, there might be 30 or 40 who forget to do a homework assignment in a given week. Like, if they say, 'Oh, I have a reason retroactively,' I can't just go back and manually reopen assignments [in the university's LMS] for 30 or 40 students. It's just kind of silly.

***Respondent 6: Dr. Owen***

Dr. Owen is a senior academic professional who has been teaching for 17 years. He provides extended test time accommodations to SWDs every semester and in every physics class, frequently interacting with the ODS staff multiple times each semester. While he has received minimal formal training on providing accommodations to SWDs, he has gained some knowledge through other teaching workshops he has attended.

He described the challenges of accommodating students in large introductory STEM courses, particularly when classes and its exams are held in the evening and the testing center is closed:

> With the introductory course, not so much. Our test is in the evening, and the testing center is closed [in the evening]. This is the largest point of contention between students with accommodations and us is that they can't use the testing center. And they're [SWDs] often, you know, 'Why can't I just take it later in the week in the testing center?' Well, because there's a thousand students taking this test and the test will go online and be shared in the class forums within five minutes of the [originally scheduled] test [time]. And okay, 'Why can't you just make me another test?' Well, because the test is made by six faculty members who spend two weeks arguing about the four problems that will show up on it. And I can't just make another one out of whole cloth that would be fair to

> you. So, the best we can do is reserve rooms around campus that overlap with our testing time and try to spread out the students as much as possible and then put graduate students in those rooms to proctor.

He highlighted the growing challenge of accommodating students with limited university resources, noting that the number of students requiring accommodations increases every semester while the university's testing center remains unchanged in size:

> It gets worse every semester because the number of students with accommodations seems to go up every semester. But [the university] still just has the same tiny little testing center offices. They're not taking it seriously. It's just kind of left up to the instructor. And students are not happy. In the small classes, yeah, it totally works. But in these big ones, it throws it on the professors, honestly, especially those night tests. That's completely putting it on the professor to figure it out. I completely agree with you. And there've been multiple professors that I've talked to that have those same woes with the testing center. My life would be a whole lot easier if the testing center would just stay open from like five to seven. But that's not happening.

He expressed deep frustration over the university's lack of institutional support for accommodations, questioning how it has avoided legal repercussions despite apparent violations of the Americans with Disabilities Act (ADA):

> I mean, I don't understand how [the university] hasn't gotten sued, honestly. Because there have been times when a student has some complicated list of accommodations, and I'm like, this is the best I can do, and they're not happy about it. And I'm like, yeah, I'm sorry, that's the best of the resources I have to give you. How is it just that [the university] hasn't been sued? We're, you know, Americans with Disabilities Act—we're

> not meeting everyone's accommodations. But I know that, I mean, we have an observatory in the physics building, and the only way to get to it, it's on the roof, is through two sets of stairs. And when we teach a class that uses it, any student in a wheelchair or with mobility issues can't get up there. So, we have to put together some half-assed sort of lab thing for them to do instead of going to the observatory. It's like, how does this continue? Because [the university] doesn't want to invest the money to fix that, right?

Dr. Owen has also encountered SWD concerned with impression management, whereby SWDs in graduate school think that they cannot or should not access their accommodations in their graduate-level STEM courses:

> And then what I see more though is with, um, graduate students. Mm-hmm. So a lot of, uh, cause I also do the advising for our incoming graduate Ph.D. students. And a lot of them either don't know or feel like they're not supposed to use any accommodations they have in their graduate courses. Yeah. And so I've had a few instances where, uh, like a student was like failing out in their first semester. And then you talk with them and say like, 'How were you like almost a 4.0 as an undergrad and now you're failing?' And they say like, 'Oh, well, you know, I take medication. I usually get extended times and ability to reschedule and this or that.' And I'm like, 'Did you file all this with ODS?' And they're like, 'No, I didn't think that was for graduate students.'

***Respondent 7: Dr. Rene***

Dr. Rene is a senior lecturer who has been teaching for four years. He frequently provides extended test time accommodations to SWDs and often interacts with the ODS staff on his

campus for while teaching physics classes. While he has not received formal training on providing accommodations to SWDs, he has participated in an inclusive teaching workshop.

When asked to share a narrative about an experience Dr. Rene has had as a STEM faculty member receiving and acting on a request to provide an extended test time accommodation in his STEM courses, Dr. Rene spoke about the complexity of managing accommodations in his large courses:

> So, I manage intraphysics. It's a very large enrollment class. This semester, there's six sections with about 200 students. And so, every semester we get between 40 and 60 students with accommodations. The vast majority of those accommodations are extended exam times. I just…at the start of the semester, I get a flurry of emails from the Office of Disability Services. Up until literally like two semesters ago, the other coordinator for interphysics, Greco, told me, 'Oh, you can go to the ODS portal and just download all the accommodations in a spreadsheet.' And I was just like, why didn't I know this? I'm compiling them by hand from the emails. Yeah. Would have been nice if I had known that that was a thing.

The respondent shared another compelling anecdote about a student struggling to secure an extended test time accommodation from their university's designated office and staff, but Dr. Rene being willing to extend the accommodation anyway, and the student succeeding likely due to that flexibility Dr. Rene gave to her, despite it traditionally being reserved for only designated SWDs on her campus:

> So, I had one student last semester who was in talks with the ODS Center for almost the entire semester trying to get her accommodations processed. And she had failed the class the semester before with me and had failed it, like, horrendously... And for some reason,

> something always went wrong. Like, her accommodations never materialized. And so, I told her, 'Well, ODS will likely give you time and a half once this goes through. I will give you the time and a half in the tests...' She said she saw the test and she started having the flashbacks of when she took the test last time. And she could feel her heartbeat accelerating... And then she remembered, 'Wait, Dr. Alicia gave me extra time. Okay, maybe I can do it.' And she calmed down a little. And she was able to work on the test... She passed the class with a very low C... but she passed. She was so happy that she passed the class.

When asked about his attitudes and beliefs about extended test time accommodations and the greater flexibility this accommodation can offer to students, Dr. Rene shared that he has a nuanced view that varies by student and their level of preparedness or their disability:

> I don't know. Because, I think, in my opinion, it depends on the student. A student who is unprepared can have an infinite amount of time to do the test. And that will do nothing for them. A student who is prepared and maybe they need a little extra time because they look at the numbers and the numbers jump on the page for them. In addition, they have to take the time to read them carefully or because they have a physical disability that they have to write slowly…Then that extra time will likely help them. But in terms of, you know, in my opinion, it depends on the student. If the student is unprepared, it's not going to do anything.

***Respondent 8: Dr. Van***

Dr. Van is an associate professor, a mid-level tenured faculty member, who has been teaching classes in the STEM area of physics for 6 years. Dr. Van says that he provides an extended test time accommodation to at least one SWD every semester but only sometimes

interacts with ODS staff on his campus. Dr. Van indicated that he has received some formal training on providing accommodations to SWD and has participated in a moderate number of workshops or pedagogical trainings on inclusive teaching practices.

When asked about his faculty experiences with receiving and acting on a request to provide an extended test time accommodation in his STEM courses, Dr. Van reiterated that he does it every semester, and that he has a desire for more structured collaboration and guidance for faculty from staff at the university with expertise in SWDs and accommodations.

> While I've had some formal training on disability accommodations, I still feel there's room for growth. My interactions with Disability Services are occasional, and I sometimes find myself navigating situations without a clear framework. More structured collaboration and guidance could help faculty like me better support students with disabilities, rather than relying on ad-hoc solutions or assumptions.

Dr. Van said that being inclusive to SWDs with his teaching is important to him; however, he still struggles with doing so in his fast-paced STEM courses and the rigorous academic environment he is expected to uphold at his R1 institution:

> Inclusive teaching is something I try to improve upon, and I've attended a moderate number of workshops on pedagogical strategies. However, integrating these ideas into a fast-paced STEM curriculum isn't always straightforward. There's a balance between maintaining academic rigor and ensuring accessibility, and I believe more faculty development opportunities could help bridge that gap.

Dr. Van shared his attitudes and beliefs about extended test time accommodations and the greater flexibility this accommodation can offer to students:

Teaching STEM courses over the years, I've come to see firsthand how extended test time accommodations can make a real difference for students who need them. Every semester, I make sure these accommodations are in place, but I often wonder if there is more I could do beyond just providing extra time. The challenge isn't just about fairness—it's about ensuring that all students can fully demonstrate their understanding in ways that work for them.

## Thematic Analysis

This study uses Sanford's (1967) challenge and support theory, disability studies (Society for Disability Studies, 2015), and universal design for learning (UDL; Meyer et al., 2013) as theories and frameworks. The methodology of this study included semi-structured interviews that explored the experiences of the participants receiving requests for extended test time accommodations for SWDs, including their interactions with the institution's disability services office (ODS) and perspectives on inclusive teaching practices. The analysis is based on faculty interview transcripts, with ten themes identified through patterns in responses. The findings presented here detail how STEM faculty perceive, interpret, and respond to extended test time accommodations requests drawing upon the theoretical frameworks. Among the ten themes, the themes drawing on Sanford's (1967) challenge and support theory include: (1) faculty desires and struggles to balance accommodations with maintaining rigor and (2) impression management by SWDs. The themes drawing on the Society for Disability Studies' (2015) framework include: (1) social factors and relationships with ODS staff, (2), political and legal, (3), cultural and institutional, (4), and economic factors, as well as (5) attitudes and beliefs of faculty around extended test time accommodations. Finally, the themes drawing on Meyer's et al. (2013) UDL

include: (1) inclusivity and accessibility of accommodations, (2) efficacy of accommodations, and (3) training faculty on accommodations.

## Challenge and Support: Providing—or Not Providing—the Right Balance

Sanford's (1967) challenge and support theory, as applied in this study, posits that college environments present challenges and supports, which can act as obstacles when balanced incorrectly or as facilitators to fulfilling student goals correctly (Ward et al., 2005). Too much support or accommodation by a STEM faculty member can impede student growth and learning; however, too much challenge (and insufficient support) in STEM courses for SWDs can lead to little or no student growth and learning in the subject matter. Focusing on the unique position of the STEM faculty and their experiences and perspectives, two themes emerged regarding the STEM faculty providing adequate support in STEM courses while also keeping their courses challenging enough to facilitate growth and learning among their SWDs in their STEM courses.

### *Faculty Desires and Struggles to Balance Accommodations with Maintaining Rigor*

While some admitted to not always believing every student the university identified as qualifying for the accommodation should have qualified, all the faculty in this study viewed extended test time accommodations as a way to appropriately support their SWDs in meeting their STEM course's high standards and objectives in the balanced way described by Sanford's (1967) challenge and support theory. Most felt that extended test time accommodations did not remove the necessary level of challenge or make the course or its assessments easier or too easy when the student’s disability appropriately qualified for and warranted the extended test time accommodation. Dr. Nestor said, "We [Faculty] want to make sure students [with disabilities] know they have enough time to think. So, it's [the extended test time accommodation is] built-in with a lot of buffer time." Faculty emphasized that extended test time did not undermine the

difficulty of their courses but rather provided SWDs who they believed qualified for the accommodation with adequate time to demonstrate their learning without compromising academic standards. Dr. Lorenzo said, "I am totally in favor of the extended time. I think it's needed for sure. And so, I am completely supportive of it." Dr. Gabrielle also wanted to used extended test time accommodations as a way to be supportive of his SWDs: “I've got a young, young man in class this semester who is quadriplegic and is obviously moving heaven and earth too, to engage in education and make something significant of himself. And he's a very bright man. So, the idea of not helping somebody like that is anathema.”

Two Faculty members emphasized in their interviews that they believed accommodations like extended test time should be allowed, but only when doing so will not diminish the challenge of their courses, including their course assessment and exams. Dr. Barry said, "I want the conditions to be a little bit pressurizing." Dr. Rene seemed to feel similarly when he shared this comment:

> Not all employers will be accommodating. I mean, there's the Americans with Disabilities Act. Right. But, like, if someone goes into a career that is, like, high pressure, high demand, high stress environment that has, like, strict deadlines or strict time commitments, that may not help them.

However, the faculty in this study recognized their own challenges with balancing the need to support their SWD by providing accommodations while also ensuring that academic rigor remains intact at their R1 institution and that their courses remain challenging to their students. The logistics of balancing accommodations with rigor in large classes was one struggle reported by all participants in this study. Participants described having to manage supportive

extended test time accommodations for large numbers of students while worrying about the effect on the integrity of their exams. Dr. Arthur said:

> I couldn't proctor for six hours, so we sort of… I would say, okay, I'm going to open this portion of your exam in Canvas [the university's LMS], and then you're going to take a break and then sit in this room with this other professor [or testing center staff proctor].

Dr. Lorenzo recalled having a SWD complain about taking the exam with another professor or testing center staff as a proctor because that no longer allowed the SWDs' faculty member to be in the room as a supportive resource to answer any questions seeking clarification about the exam:

> Some students and it has happened in the past, will come back to me and say, "My exam was not equitable to the others because I [the instructor] was not there, [or] it was not the same exam as the rest of the class."

In addition, some faculty members shared concerns about fairness and academic integrity when test times differed for SWDs. For instance, Dr. Rene described the potential for cheating if SWDs were allowed to take tests at different times, whether before or after their peers:

> But some students insist on using the testing center. So that causes issues because either they take the test before everybody else, which could lead to cheating or take the test after everybody else, which could lead to cheating.

Dr. Owen seemed to have similar concerns about fairness and academic integrity when test times differed for SWDs, and felt like those faculty concerns could be misunderstood or misinterpreted by the SWDs:

> For some reason, a good chunk of students with extended time feel as if they should not have to do the test that way. They should be able to utilize the testing center on another

> day during the week. Because that's what they do in their other courses. And they feel slighted when I say, 'I'm sorry, we can't do that.' And they think that it's like us not wanting to honor their accommodation.

Dr. Owen had one SWD ask if another exam could be developed for them so that exam integrity would no longer be an issue:

> And okay, [The SWD asks] 'Why can't you just make me another test?' Well, because the test is made by six faculty members who spend two weeks arguing about the four problems that will show up on it. And I can't just make another one out of whole cloth that would be fair to you.

Dr. Gabrielle described having a student *without* a disability question the fairness of the practice of extended test times by asking the faculty member: "How do I know that you're not giving a test that's just right for them, and it'll be too long for me?"

Dr. Lorenzo also described their struggle to balance extended test time accommodations with the fast-paced nature of STEM courses and explained, "Organic chemistry is very fast-paced, very intense. I give back my exam usually within three days. And so, there's so much I can have flexibility" waiting for a student to take the exam with the testing center.

Some faculty members noted that while extended test time is a necessary support for specific SWDs, they felt that the accommodation had been overused or misused by other students in a way that could the detrimentally reduce necessary level of challenge of their course and impede student growth and learning. Dr. Barry said:

> I want the conditions to be a little bit pressurizing. With first-year students, I talk about this because they often have their first experience of bombing an exam. The pressure matters, and for a student with accommodations [SWDs], pressure has a different

> meaning. But anybody who's being honest, who's looked at performance on timed exams versus regular time exams, will tell you there is no difference. People will tell you otherwise, but it's all completely made up.

***Impression Management by SWDs***

Participants also described instances of them wanting to be supportive of their SWDs' need for the extended test time accommodation, but that their SWDs were hesitant to take the accommodations deemed necessary for them because altering the level of challenge in the course for the SWD in that way might lower the opinion of the faculty member or their peers. Dr. Barry said:

> She [SWD] finally this semester has gotten it together [the extended test time accommodation approved by the university". In addition, it has been a multi-semester process... [then she] did not use them [the extended test time accommodation]. Didn't think she needed to use them. 'Right, Because I can handle this' [she must have wanted to display it to the faculty]. [She] Could not handle it.

Dr. Lorenzo described this being especially true in their system that involved SWD being identified by peers when the instructors had to require SWDs to arrive and begin an exam earlier than their peers to receive an extended test time accommodation on the scheduled date of the exam without compromising the integrity of the exam for others:

> They [the SWD] are identified by the other students [when the other students enter the exam room after them, because the SWD were allowed to begin before the others], which always bothers me because some of them don't want to" be identified by peers.

Two faculty in this study spoke about recognizing the stigma that accommodations might carry for their SWDs among their faculty and peers. Faculty also described how some students did not

want to discuss accommodations with them, making it more difficult for faculty to ensure that accommodations were being effectively provided. Dr. Arthur stated, “Some students don't want to talk about it. They want you to have the letter...and it must be tedious to have to talk to every faculty member about those sorts of things.” In addition, there were challenges in accommodating students who preferred minimal interaction around the accommodation with the faculty, which sometimes led to logistical and scheduling issues, especially when students did not communicate their needs in advance to the faculty.

Finally, one faculty member, Dr. Gabrielle, commented on the impact being at the rigorous, STEM-focused R1 has on the perceptions others hold likely influences how he reacts to a request to provide an extended test time accommodation, when he spoke about taking a moment to consider that, “They’ve [the SWD] got a father and a mother that are like, ‘Oh my gosh, she's at [the university].’ Or ‘He’s at [the university].’”

## Disability Studies: Factors, Attitudes and Beliefs Around Extended Test Time Accommodations

In the context of this research, disability studies (Society for Disability Studies, 2015) provided a critical framework for understanding the broader social and cultural factors that influence the experiences of STEM faculty—and their attitudes and beliefs—while providing SWDs extended test time accommodations. Five themes emerged from the study regarding the Society for Disability Studies’ (2015) framework.

### *Social Factors and Relationships with Office of Disability Services Staff*

Participants in this study who described themselves as having a good working relationship with the university’s ODS staff also expressed confidence in their ability to provide accommodations effectively despite the institutional constraints. Dr. Barry said, "For as long as I

can remember, my philosophy has always been to work with ODS as closely as possible when I feel like an accommodation. I'm not able to provide accommodation myself." Some participants expressed appreciation for the support they received from the university's ODS staff and other administrative staff when trying to carry out an accommodation, indicating that when they reached out for help, they received effective guidance and support. Dr. Van said, "usually when you reach out to the disability services office, they reply and try to help you handle the specific challenges that you are going through with offering accommodations."

While faculty in this study seemed to value the support that they received when they actively sought assistance, the lack of proactive engagement from their university's ODS staff was cited as limiting the overall effectiveness of the accommodation process. Dr. Arthur said:

> It's always been the case that if I called and said, hey, I don't know how to deal with this… it's always been a great experience, but I just don't think that the staffing is really there for it to be super proactive.

Faculty usually need to take the initiative for these social interactions and relationship building with ODS staff when they sought guidance around the accommodation requests they received, which they described as adding to their faculty workload and further complicating the accommodation process. Dr. Owen said, "It's just kind of left up to the instructor. And students are not happy… it throws it on the professors, honestly, especially those night tests. Like that's completely putting it on the professor to figure it out."

***Political and Legal Factors***

Many faculty members expressed worries about their lack of formal training on the current legal requirements, their legal obligations, and the process of providing accommodations. Dr. Rene said, "I wish someone had told me this before. But then I downloaded them

[accommodation details].” Some faculty described how they tried to enforce or reiterate their institution’s policies for offering of accommodations in their courses, like Dr. Rene, who said:

> So, I talked her [the SWD] through it [how to get university approved accommodations]. And she was like, ‘Oh, okay, I will definitely do this.’ And then the next semester, she was in talks with her psychiatrist and her primary care and getting the paperwork and making appointments with ODS. And for some reason, something always went wrong. Like, her [university approved] accommodations never materialized [so accommodations were never given].

For legal compliance with laws such as the Americans with Disabilities Act (ADA), some faculty described relying on university policies and protocols and following its formal documentation procedures. Dr. Van said, “relying on formal documentation ensures that the students actually do need the accommodations, and one would be at fault to deny them.” However, other faculty circumvented the need for waiting on formal approval by adjusting their course practices based on ease of experience for the faculty. Dr. Barry said, “I inherited this really from my predecessor who had a great system for building flexibility into things like homework and in-class work that's graded [for all students but meets the needs of approved extended test time accommodations].”

Although three faculty expressed a preference for official documentation from the university, per its policy, before providing an extended test time accommodation—Dr. Gabrielle said, "I would prefer to have the formal official document because of all of the potential legal aspects"—others showed flexibility in providing accommodations informally, when necessary. Dr. Rene said:

> And then she [the SWD] proceeded to take the second test. And she took the third test. Her accommodations finally arrived in time for the final exam. So, I had been giving her extra time accommodation all throughout. But then for the final exam, she finally had the...they [the accommodation request documents] were formal.

***Cultural and Institution Factors***

Five faculty members expressed appreciation for their (shared, large, R1 state) university's ODS staff and the resources available to them at their current institution, noting that these staff and their services helped facilitate the accommodation process. For example, Dr. Gabrielle, with over 30 years teaching STEM courses at the research site and other institutions, expressed confidence in the institution's support for accommodations, saying, "I'm very appreciative of what I get." When faculty members in this study described their own experiences or the experiences of colleagues at other institutions, their responses revealed disparities in institutional support. One participant, Dr. Gabrielle, compared the support received at their current institution with what was depicted by a colleague who taught at another and described the colleague's institutional support as lacking: "He gets almost no help. It's amazing how little they do, even though they're a larger school in [our state]. They [the faculty] get the accommodation letters and basically get cut loose."

Other respondents echoed the importance of institutional support and the role of structured disability services in facilitating accommodations. Dr. Barry emphasized a proactive approach, integrating flexibility into his coursework to reduce the need for constant accommodation requests: "My philosophy has always been to work with ODS as closely as possible when I feel like I'm not able to provide an accommodation myself. I'm going to build accommodations into my courses as much as I can." They further highlighted the necessity of an

accessible testing center, explaining, "On some level, this is how we keep the testing center in business. Make it clear that there's demand. If faculty just handle everything, they will defund the testing center."

Reflecting on different institutional contexts, Dr. Barry noted the contrast between their current institution and their own graduate school experience: "At [another institution where I attended graduate school], their disability services were a well-oiled machine. One of the first disability services departments in the country. But that's not always the case everywhere."

While faculty seemed to appreciate the culture of accommodating SWDs at their institution, several faculty members mentioned how restrictive the culture of the testing center appears to be, such the center's inability to offer makeup exams or its lack of leniency for students forgetting their extended test time accommodation appointments. That restrictive culture put the faculty in difficult positions. Dr. Arthur said, "The testing center no longer gives a free pass if they [SWD] forget. But that puts me in an awkward position."

One faculty member, Dr. Gabrielle who had significant teaching experiences at other institutions, commented on the impact of being at the rigorous, STEM-focused R1 institution has on the perceptions others hold with regards to SWDs and their extended test time accommodations. Specifically, he spoke about how that STEM-focused or R1 culture likely influences how he reacts to a request to provide an extended test time accommodation, as he reminds himself about the SWD that, "They've got a father and a mother that are like, 'Oh my gosh, she's at [the university].' Or 'He's at [the university]'" and Dr. Gabrielle therefore wants to help the SWDs be successful.

### *Economic Factors*

Despite the acknowledgement that the institution mostly provided good political and legal support, as well as adequate cultural and institutional support for faculty to carry out extended test time accommodations for SWDs, some faculty expressed frustration around the economic and economic-related resources provided, or rather not provided. In fact, four participants described feeling economically unsupported by their institution overall when attempting to carry out extended test time accommodations, citing overwhelmed and under-resourced testing center and ODS, issues with extended test time scheduling, limited proctoring spaces, and staffing shortages for exam proctoring.

To accommodate extended test time accommodations, particularly when wanting to maintain student privacy, many faculty members in this study were required to rely on the university's testing center due to limited classroom space or classes being scheduled back-to-back, limiting the opportunity to extend test time for an exam held during a class meeting. Dr. Nestor spoke about the testing center's inability to stay open during necessary times: "The [university's] testing center doesn't stay open for our common exam times. And the administration doesn't keep it...they know it's a problem, and they don't spend resources to do it." Dr. Lorenzo shared a similar frustration: "The testing center is not open at night. And that is a big issue for them because their exam is at six o'clock at night." The inability of the testing center to accommodate after-hours exams, due to staffing, is an economic obstacle to meeting students' needs for extended test time accommodations. Dr. Nestor said, "The testing center only stays open till like 4:45 p.m. or 5:00 p.m., but our [normal class time and its regular] exam doesn't start until 6:30 p.m." creating yet another burden for the SWDs enrolled in an evening course but requiring them to get to the testing center during normal business hours in order to

receive an extended test time accommodation. Dr. Nestor shared how the limited testing center hours, combined with his large course sizes requires him to come up with alternative accommodations for students:

> My experience is largely making accommodations at scale. So, I run Math 1553. It has roughly one and a half thousand students in the fall and 600 students in the spring. Therefore, we have a number of students with accommodations. Managing the scale is the main issue, and coordinating logistics has become a problem. We don't really have the option of using the testing center at night because it closes before our exams start. At the same time, we can't let students take the exam early without risking exam integrity. Therefore, that just means I have to come up with an alternative accommodation. I basically do it myself—I reserve an extra room, try to keep it as silent as possible, and have students with extra time begin early. A T.A. takes over midway so I can return to the main exam room. That's how we handle it.

Many faculty noted that they struggled to align the scheduled exam date of the class with the testing center's available exam dates, with some even feeling the pressure to personally manage the extended test time accommodations when institutional support was insufficient. Dr. Owen said:

> This is the largest point of contention between students with accommodations and us is that they can't use the testing center. And they're often, you know, why can't I just take it later in the week in the testing center? Well, because there's a thousand students taking this test and the test will go online and be shared in the class forums, like within five minutes of the test.

When Dr. Nestor expressed concerns about the late date of the exam the testing center suggested for a SWD enrolled in his course due to staff shortages within the testing center, and he pointed out how their late suggested date might negatively impact the student's progression in the course, Dr. Nester was told by the university's testing center, "Well, sorry, professor, but if you don't want the student to take it at the makeup time, then you have to proctor it yourself," and the faculty member did not have any available time to do that. Dr. Lorenzo also said, "We have no [staff] resources to proctor."

The later exam dates for SWDs (held after the exam was given to the SWDs' peers) were also a problem in particularly in large courses where the exams required multiple reviews by co-instructors, as Dr. Barry explained:

> One challenge I have teaching a large course is the exams need to be proofread by all the [co-]instructors. The testing center pushes back [the exam date and, in turn, pushes back] that [faculty] deadline for grading and proofreading, where I tell my co-instructors to have it [their grading and proofreading feedback] ready at least a week in advance. Getting that feedback [from faculty] on time can sometimes be difficult [when the testing center has caused us a delay already].

Another way faculty described feeling economically unsupported by their institution when attempting to carry out accommodations was the lack of private room or classroom space necessary for extended test times, due to the university having limited physical space and buildings. Dr. Gabrielle said, "They put me [my students and their exam] in 18 [different] rooms. They [even] used my lab section rooms [for testing time and space," making it so the faculty member lost out on their own research and lab time.

Dr. Nestor noted that the level of economic support was also insufficient for the growing demand for accommodations at the institution: “Now, and it's not a bad thing...but more students have accommodations relative to the past, or at least anecdotally, in my experience this is leading testing centers to become overwhelmed.” Other faculty in the study were similarly concerned over the growing strain on testing centers and institutional resources. Dr. Van said, “The testing centers need to be improved and allocated more resources if they are to meet the growing demand.” Dr. Nestor said:

> My thoughts have changed more about logistics than the effectiveness of accommodations. When I started teaching 12 and a half years ago at a different university, even in a large class, there might have been one or two students who needed extended time. The testing center could handle that. But now, more students have accommodations relative to the past—maybe the world is catching up to better testing, which is not a bad thing—but this has overwhelmed testing centers. At [the university], the testing center doesn’t stay open for our common exam times, which is the time when it’s needed most. And yet, the administration hasn’t prioritized fixing this issue. It’s not the testing center’s fault; they don’t get enough staff or funding to operate at night. I’ve spoken to faculty at other large universities, and they report the same problem. Some testing centers even run out of private rooms for students who require them, and there’s nothing faculty can do—we can’t just rent silent private rooms out of nowhere. The system wasn’t built for today’s needs.

Some faculty members expressed concerns about the impact on their workload and questioned how well universities are prepared to handle the increasing number of students who qualify for accommodations. Dr. Nestor said, “I basically have to do it myself. I send out many

messages throughout the semester telling students the alternative. I reserve an extra room, which I try to keep as silent as possible." Dr. Nestor also emphasized the prevalence of extended test time accommodations among his students, stating: "Every time, every semester for years and years, there are always some students."

With class sizes sometimes reaching 300 students for the instructors in this study, faculty spoke about their struggles to ensure that extended test time accommodations were appropriately distributed to the correct students, especially when there were insufficient testing center rooms or staff to manage the accommodations effectively outside of the faculty member's normal testing environment. The following is an entry I, as the researcher, made in my reflexive journal demonstrating the significant effort required in organizing and ensuring that all accommodations are met in large courses.:

> Faculty noted that the scale of their courses exacerbated the practical challenges associated with accommodations. For example, Dr. Nestor, teaching large courses (e.g., Math 1553, with over 1,000 students) highlighted the complexity of managing these accommodations. As one faculty member described: "I run Math 1553. It has roughly one and a half thousand students in the fall and 600 students in the spring. So, we have a number of students with accommodations."

Dr. Owen discussed a similar concern:

> It gets worse every semester because the number of students with accommodations seems to go up every semester. But [the university] still just has the same tiny little testing center offices. They're not taking it seriously. It's just kind of left up to the instructor.

Finally, some faculty members described the investments made by their university in software or an online platform to manage their receipt of accommodation requests, as opposed to

receiving these requests in person from the student or via campus mail. This economic investment in technology created both benefits and challenges for the faculty. Dr. Owen appreciated the change and said:

> No, I created it [a spreadsheet exported to track accommodations] because only faculty members can log into AIM [online platform to manage faculty receipt of accommodations requests]. To see their accommodations. To see the list. If we rely on students self-identifying like, 'Hey, here's my accommodation list,' they get lost. So instead, every couple of weeks, I just redownload the latest list of students and put it in a spreadsheet.

However, Dr. Owen described the challenges of the technology, saying the resources to support the increased number of students in the online platform has not increased:

> It gets worse every semester because the number of students with accommodations seems to go up every semester. But [the university] still just has the same tiny little testing center offices. You know, they're not taking it seriously. It's just kind of left up to the instructor. And students are not happy.

### *Attitudes and Beliefs of Faculty Around Extended Test Time Accommodations*

All the participants in this study shared the belief that extended test time accommodations play a necessary role in helping some SWDs overcome challenges, specifically those SWDs deserving of and accountable for their accommodation-acquisition process, as stipulated in policies and procedures established by the institution. Dr. Rene saw extended test time as a practical solution for students who need additional time due to disabilities, like physical impairments or processing challenges, and said it could be a useful and fair accommodation for "a student who is prepared and maybe they need a little extra time because they look at the

numbers and the numbers jump in the page for them." Several faculty members shared similar examples of SWDs benefiting from extended test time accommodations, whereas they felt the standard test time would have been unfair. Dr. Gabrielle described how extended time helps students who have temporary injuries or impairments: "I do know it's been used several times when people have injured themselves," and they further clarified, "you know, they can't use their right hand. That slows you down" on an exam. Though this study focused on extended test time accommodations, Dr. Gabrielle provided an example of a student struggling in an unsuitable lab environment (Jeannis et al., 2017), and the student was able to benefit from adjustments made to accommodate their needs: "This young gentleman is in a lab room that doesn't have a table that can accommodate him. And we got to fix that."

Faculty participants highlighted how extended test time can also allow students to appropriately manage anxiety when they are able to test in the testing center, contributing to a calmer testing environment for everyone. Dr. Lorenzo explained, "It [the testing center where extended test time accommodations are made] provides that environment for the students [SWDs] to come in a more serene way to the exam," which allowed for a more accurate assessment of their learning and skills. Dr. Gabrielle also noted that this accommodation seems especially useful in reducing test anxiety for students who experience it: "I do know that the extended test time helps with the test anxiety, which I see is one of the biggest issues that some of my students have." Dr. Rene, too, noted that extended test time can significantly reduce anxiety, as seen in a specific case where a SWD improved their performance from a failing grade to a passing one after receiving the accommodation: "She got like a 60-something in that test, which was much better than the 20-something she got [when she took the exam without the accommodation]."

Faculty members expressed that providing the extended test time accommodation aligns with their teaching philosophy of supporting all students' success. Dr. Gabrielle stated, "We work very hard trying to be equitable in our treatment of students." Furthermore, some noted that even students who do not use the extra test time extended to them seemed to benefit from simply knowing they have the accommodation available to them.

Participants described having developed, over time, greater empathy for students needing accommodations, especially after personal or professional experiences highlighted for them the necessity of such adjustments, possibly indicating that those who had previously received accommodations themselves expressed greater empathy and understanding of the need for extended test time. Dr. Rene said:

> I actually grant extended time to some students that don't have ODS accommodations yet. Like, if a student tells me, 'I'm in the process of getting accommodations or tested,' I tell them, 'Can you show me where you are in the process?' And if I see that, yes, they actually are doing it and not just bluffing, I will add them to my list and give them accommodations.

Dr. Van similarly said, "Sometimes I just have to provide accommodations because I resonate with the student's needs even though they have not gone through the whole formal process." Personal experiences with disabilities and accommodations appeared to influence Dr. Van's perspective; he also shared: "I usually remember my own frustration whenever I had to request accommodations for temporary illnesses and this makes me try to view things from the perspectives of the students in need of accommodation."

While all faculty in this study expressed their personal support for warranted extended test time accommodations, some described also feeling frustration with students who failed to

follow procedures or waited too long into the semester to request the accommodation. For example, Dr. Nestor said, "I send email after email during the semester endlessly emphasizing the policy. I make announcements in class." This frustration was especially evident when students missed the accommodation registration deadline for a particular semester or term, but still demanded accommodations for the course. For instance, one faculty member noted, “One student...didn't sign up [for accommodations in time]. And I learned from the testing center, ‘You have to proctor it yourself,’ [if I wanted to provide them extended test time].” This complicated the faculty member’s schedule and added the burden of managing the accommodation to their workload. They added, "I think it's ludicrous. I think you have a right to extended time accommodation, sure, but if you don't you lose the ability to have no penalty." Another faculty member expressed frustration when accommodations were granted after the semester had already begun, requiring them to adjust their exams mid-course, and shared: "Five [requests for accommodations] got accepted after the second week [of class], and now I have to go back and do it all [reorganize the exam]."

## Universal Design for Learning, Teaching, and Assessment

UDL is an educational approach that aims to increase inclusivity and accessibility through flexibility in teaching and assessment (Meyer et al., 2013). In this study, UDL is a complementary theory relevant to understanding how accommodations, such as being flexible with test times, can be designed and implemented to all students in the class in order to create equitable and inclusive learning environments in STEM education for SWDs. Three themes emerged regarding UDL as faculty experienced implemented (or did not implement) extended test time accommodations.

### *Inclusivity and Accessibility of Accommodations*

At least two participants appeared to align with the UDL approach and said that they included accommodations for all students in their course to make their courses more inclusive and accessible to all. Dr. Van said:

> Teaching STEM courses over the years, I've come to see firsthand how extended test time accommodations can make a real difference for students who need them. Every semester, I make sure these accommodations are in place, but I often wonder if there is more I could do beyond just providing extra time. The challenge isn't just about fairness—it's about ensuring that all students can fully demonstrate their understanding in ways that work for them.

Similarly, Dr. Barry said:

> And then the other part of it philosophically is I'm going to build accommodations into my courses as much as I can. So, I inherited this from my predecessor, who had a great system for building flexibility into things like homework and in-class work that's graded.

By aligning with UDL principles, Dr. Barry said the model he has implemented has made his job easier because, **"**it doesn't require us [faculty] to be constantly going in and granting extensions and that kind of thing.**"**

By not aligning with UDL, some faculty encountered greater burdens for themselves. Dr. Arthur would only extend the test time for those with university approved accommodations in his courses, rather than for all students. This led to great complexity for Dr. Arthur around managing extended time accommodations for large classes with the shift to online testing in his courses through the university's LMS, Canvas:

> Now that in chemistry, actually, we now do Canvas exams, we use Canvas quizzes or, you know, learning management system quizzes. And so now it's sort of the juggling of

> making sure that I set everybody's time appropriately in the exam and the paranoia of 'Did I miss someone? Did I set the wrong time? Did I include the extended time [for the SWD]?' And so, it's a lot of conversations with students about, you know, look, there's several of you all, there's one of me. So, I need you to double check before you start your exam and make sure that I set it appropriately and alert the proctors if I didn't, you know.

Dr. Lorenzo spoke to concerns around equity for all students, when a faculty member does not utilize UDL principles in their course assessments with all of the students enrolled in their course:

> What I would say is I'm always a little concerned about the access for students to have this extended time in terms of equity. In addition, you know, my understanding, and I have not searched it in detail, but my understanding, it takes quite a bit of time, knowledge and resources to be tested and to have those approved. And some people either don't know or don't have those resources and do not have those accommodations. And so that's where my concern is, is how accessible it is to everybody who really needs it.

Similarly, Dr. Owen wondered how the university had not yet been publicly held accountable for its ADA obligations:

> I mean, I don't understand how [the university] hasn't gotten sued, honestly. Because there have been times when a student has some complicated list of accommodations, and I'm like, this is the best I can do, and they're not happy about it. In addition, I am like, yeah, I am sorry, that is the best of the resources I have to give you. How is it just that [the university] hasn't been sued? We're, you know, Americans with Disabilities Act—we're not meeting everyone's accommodations. But I know that, I mean, we have an

> observatory in the physics building, and the only way to get to it, it's on the roof, is through two sets of stairs. And when we teach a class that uses it, any student in a wheelchair or with mobility issues can't get up there. Therefore, we have to put together some half-assed sort of lab thing for them to do instead of going to the observatory. It's like, how does this continue? Because [the university] doesn't want to invest the money to fix that, right?

### *Efficacy of Accommodations*

Several faculty members indicated that they were unclear about the direct impact an extended test time accommodation had on the performance of their students. Dr. Gabrielle noted, "I don't think it's possible to measure that accurately, empirically, all the time," suggesting that he might not believe studies that claim to have assessed the impact of flexibility in assessment on student performance.

One faculty member, Dr. Barry, said he had seen the extended test time accommodation increase the confidence and autonomy of his SWDs, especially when SWDs who have intersecting identities are supported in other ways, too:

> I have seen that, you know, at least indirectly, I think, where you see students become empowered and autonomous. It's already happened for a couple of students that I've taught. So, I teach in the [university's initiative to develop highly skilled learners and leading contributors from diverse backgrounds] Challenge Program. In addition, I have a couple of students with accommodations from Challenge who have really just continued the momentum from Challenge. And their accommodations are part of that. I mean, they take exams at the testing center and all that jazz. But I think they really have a level of confidence they would not have without that [Challenge Program] resource.

Still, other faculty were not as certain, and Dr. Lorenzo mentioned that some students with extended time “do very well, some don’t. So, I have not seen any change,” suggesting that while the accommodation may help some, it does not guarantee improvements in academic performance. According to Dr. Van, “I believe these accommodations are supposed to help the students not to fail because of their unique challenges as opposed to helping them pass, which makes it a little difficult to know whether the accommodations are effective”

Despite these challenges, faculty members in this study largely agreed that accommodations, particularly extended test time, do not provide an unfair advantage. Dr. Barry noted, "Anybody who's being honest, who's looked at performance on time exams versus regular time exams, will tell you there is no difference. The numbers just don’t bear that out." They also highlighted the importance of maintaining transparency about data to address misconceptions: "As scientists and engineers, we should be looking at the data first. If scores are not different or are even worse with extended time, then we have no leg to stand on in terms of an unfair advantage."

Dr. Van said, “Teaching STEM courses over the years, I've come to see firsthand how extended test time accommodations can make a real difference for students who need them.” He added that being inclusive to SWDs with his teaching is important to him, however, he still struggles with doing so in his fast-paced STEM courses and the rigorous academic environment he is expected to uphold at his R1 institution:

> Inclusive teaching is something I try to improve upon, and I’ve attended a moderate number of workshops on pedagogical strategies. However, integrating these ideas into a fast-paced STEM curriculum isn’t always straightforward. There’s a balance between

> maintaining academic rigor and ensuring accessibility, and I believe more faculty development opportunities could help bridge that gap.

### *Training Faculty on Accommodations*

Several faculty members in this study noted the absence of formal training on carrying out accommodations in their courses, and so they relied on informal learning methods, such as peer discussions or workshop trainings. Dr. Lorenzo said:

> They changed the platform [that helps faculty understand what accommodations each student needs for each course]. Well, the platform, it's still AIM, but the way it looks is very different. And absolutely no communication from ODS to tell us, you know, ahead of time. No communication whatsoever.

Some, like Dr. Gabrielle, indicated a lack of awareness regarding institutional policies or specific procedural details about accommodations: "I don't know that I do [include an accommodations statement in my syllabus]," and as a result, some faculty felt inadequately supported by the institution and as though "we are left figuring it out on our own." Some faculty in this study also admitted to having a lack of awareness regarding the legal or university processes for granting or denying accommodations, leading to them feeling uncertainty when handling requests, especially requests that were unclear to them. Dr. Van said, "I am aware of the legal frameworks, but I am not entirely sure how they translate into the day-to-day of offering accommodations."

Many participants indicated that their understanding of inclusive teaching practices and accommodations developed through personal experiences and interactions with students and close colleagues, rather than structured professional development programs or training. Dr. Nestor said, "I don't have any experience in psychology or the psychometric psychology of

testing, but my thoughts have changed more about logistics," highlighting that his learning stemmed from firsthand challenges in accommodating students rather than formal training. Dr. Nestor shared, "More students have accommodations relative to the past, or at least anecdotally, in my experience this is leading testing centers to become overwhelmed," emphasizing that their perspective on accommodations evolved as they navigated growing demands. As a result, faculty in this study usually relied on institutional offices for guidance when navigating accommodation requests and when attempting to increase inclusivity and accessibility through flexibility in their teaching and assessment. Dr. Nestor said, "We just have to…I just have to basically do it myself." Even some faculty in this study who had formal training were still interested in more. Dr. Van said, "While I've had some formal training on disability accommodations, I still feel there's room for growth." Dr. Rene spoke about the lack of training offered by the university on its software it uses to provide faculty with accommodation notices, specifically, and how frustrating that was:

> So, I manage intro-physics. It's a very large enrollment class. This semester, there's six sections with about 200 students. And so, every semester we get between 40 and 60 students with accommodations. The vast majority of those accommodations are extended exam times... Just at the start of the semester, I get a flurry of emails from the Office of Disability Services... Up until literally like two semesters ago, the other coordinator for interphysics, Greco, told me, 'Oh, you can go to the ODS portal and just download all the accommodations in a spreadsheet.' And I was just like, why didn't I know this? I'm compiling them by hand from the emails. Yeah. Would have been nice if I had known that that was a thing.

Despite this lack of training, many faculty members demonstrated their own flexibility in providing extended test time accommodations, especially for students who were in the process of securing formal approval. Dr. Van said, “For me, showing that they have initiated the process of formally getting accommodations is usually a sign that the students should be accommodated.” Dr. Rene shared:

> Like, if a student tells me, I'm in... In the process of getting accommodations or tested or something. Like, I'm in the process, but it's not done yet. And the test is next week. Then I tell them, can you show me where you are in the process? And if I see that, yes, they actually are doing it. And not just bluffing. Right. I will add them to my list and give them accommodations.

Some faculty expressed a willingness to support students in need if there was evidence that the request was legitimate. For example, Dr. Nestor said:

> But I think one time the student, if a student came up to me and said, look, I'm in the process of getting accommodations. I reached out to the testing center, but it's going to be another couple of weeks or something like that before I get the letter. I think that what I said in those cases is all right, it's alright if you take this exam with extended time, but as a condition of this, it is required that you have accommodations that you say you're going to have. And if not, it's going to be a major problem because like, then you're effectively lying.

Others, including Dr. Gabrielle, expressed a willingness to adopt extended test time for all students, something that aligns with UDL principles: “I don’t actually care exactly when they prove their competence during the course [or how long it takes]. I just need them to prove it.”

## Chapter Summary

This chapter presents findings from a narrative inquiry study on STEM faculty perspectives regarding extended test time accommodations for SWDs at a large R1 state school in the southeast. The study examined how faculty interpret and implement these accommodations, considering temporality, sociality, and place. One tenured and seven non-tenured faculty members with varying teaching experience participated, recruited via purposive sampling. Faculty perspectives revealed ten themes around finding the right balance between supporting their students with extended test time accommodations while keeping their courses appropriately challenging; the factors that affect the faculty's experiences with and attitudes and beliefs around extended test time accommodations; and how the faculty are approaching, if at all, universal design for learning, teaching, and assessment. The following chapter provides a discussion of these themes and findings.

# CHAPTER 5

# DISCUSSION

This study explored one disability-inclusive accommodation—extended test time—from the perspective of science, technology, engineering, and mathematics (STEM) instructors, specifically how faculty members teaching STEM courses at a large R1 state school in the southeast that emphasizes the academic fields of STEM and the availability of an extended test-time accommodation for qualifying SWDs perceive, respond, and act on extended test time accommodations, as well as their attitudes and beliefs about those accommodations. This study was guided by the following research questions:

1. What experiences have STEM faculty had with receiving and acting on a request to provide an extended test time accommodation in their STEM courses?
2. What are faculty attitudes and beliefs about extended test time accommodations and the greater flexibility this accommodation can offer to students?

Using a qualitative constructivist design with a narrative inquiry approach, this study sought to examine faculty perspectives and uncover underlying factors influencing their attitudes and decisions (Clandinin & Connelly, 2000; Creswell & Creswell, 2018). By understanding the perspective of STEM instructors who have been shown to be resistant to providing these accommodations in previous studies (e.g., Lee, 2011; Love et al., 2014; Rao & Gartin, 2003) this study ultimately hoped "to reveal common barriers to STEM success that can be addressed through modifications to environments, which are more easily scalable and replicable than individualized accommodations" (Friedensen et al., 2021, p. 77).

The previous chapter presented the findings from the data analysis of interviews conducted with STEM faculty regarding their experiences with extended test time accommodations for students with disabilities (SWDs). Through personal narratives and statements, insights into their experiences, beliefs, and attitudes were collected, including perceived challenges, institutional support, and the broader implications of extended test time accommodations in STEM higher education. Thematic analysis identified ten themes around finding the right balance between supporting their students with extended test time accommodations while keeping their courses appropriately challenging; the factors that affect the faculty's experiences with and attitudes and beliefs around extended test time accommodations; and how the faculty are approaching, if at all, universal design for learning, teaching, and assessment.

## Summary of Findings

The eight participants in this study were all faculty members teaching undergraduate STEM courses at a large R1 state university in the southeast that emphasizes the academic fields of STEM and the availability of an extended test-time accommodation for qualifying SWDs. The majority of the participants held a faculty title of *academic professional* at their institution, a non-tenure track faculty position in which the faculty member teaches for up to 50% of their workload and the remaining workload is dedicated to administrative practices. Most of the administrative practices, however, were connected to managing their large STEM courses, some enrolling as many as 800 students per year (across multiple course sections throughout the year, and sometimes with the aid of co-instructors or team-teachers). One participant held a traditional tenured faculty position. Their teaching experience ranged from several years to more than three decades, with some transitioning from research-focused roles to primarily teaching and teaching-

administration positions. By utilizing a constructivist theoretical approach, this narrative study explored the experiences of the participants with extended test time accommodations needed by SWDs enrolled in their STEM courses, specifically how they perceive, respond, and act on those accommodations, as well as their attitudes and beliefs about them, by answering the RQs, which again were:

1. What experiences have STEM faculty had with receiving and acting on a request to provide an extended test time accommodation in their STEM courses?
2. What are faculty attitudes and beliefs about extended test time accommodations and the greater flexibility this accommodation can offer to students?

Please note, again, that many of the participants referenced the acronym *ODS* (office of disability services) in their interviews. That is the name of the office where the staff who assess accommodations for students on their campus are located. Faculty experiences with extended test time accommodations highlighted logistical, institutional, and philosophical challenges.

**RQ1. What experiences have STEM faculty had with receiving and acting on a request to provide an extended test time accommodation in their STEM courses?**

The STEM faculty in this study had many experiences with extended test time accommodations, describing the frequency of their own experiences as receiving requests from SWDs in their STEM courses for extended test time accommodations as *very often*, *every semester*, *every exam*, and with on participant saying they received as many as 20 requests each semester. This high frequency led to an availability of rich narratives from the participants about their experiences around how they received and acted on those requests to provide extended test time accommodations.

Starting with the initial request from the SWDs for the accommodation, three faculty members expressed frustration over SWDs failing to seek approval from the university for extended test time accommodations well in advance of their courses. This delay could highlight challenges with self-advocacy by SWDs, or the additional challenges (of seeking approval from the university for extended test time accommodations) posed to SWDs when compared to their peers without disabilities (Ertl et al., 2017; Pfeifer et al., 2020). Dr. Lorenzo explained, “some students get approved for extended time up to the third week of class. And that's annoying because I've already set up everything and then I have to redo it again.” Another faculty member expressed frustration over SWDs failing to pass along those university approved requests for extended test time accommodations in a timely manner to them, which led to scheduling conflicts and additional administrative burdens for the faculty leading to frustrations with accommodations process. Dr. Nestor noted, “It ultimately should fall back on them [the SWDs]. Yeah. But, yeah, that made me very angry.”

Institutional communication gaps and a lack of awareness about available tools for accommodation management further complicated things for faculty, and likely the SWDs, too. Dr. Rene described her experience with receiving a high volume of requests at the start of the semester, and not being adequately trained on the university’s accommodation management software:

> At the start of the semester, I get a flurry of emails from the Office of Disability Services. Up until literally like two semesters ago, the other coordinator for interphysics, Greco, told me, 'Oh, you can go to the ODS portal and just download all the accommodations in a spreadsheet.' And I was just like, why didn’t I know this? I’m compiling them by hand from the emails.

One faculty member also reported difficulties in tracking and managing accommodations, especially in large courses with hundreds of students—Dr Gabrielle stated that "keeping track of them [accommodations] and actually determining who needs them is something that's completely beyond my education and skills." These struggles align with past literature that suggests systemic issues should be addressed (Reid & Knight, 2006), especially to reverse the lack of accessibility, inclusive practices, and support within STEM discipline (Holmes et al., 2017).

Faculty like Dr. Barry faced difficulty with adjusting and extending test times correctly in the university's online learning management system (LMS) or platform, Canvas, for SWDs after he had already programmed the course in the LMS. Notably, Bhardwaj and Kumar (2017) found that students with visual, hearing, and learning disabilities also faced difficulty from their end accessing the online course materials that were not originally designed by faculty to be accessible. Other faculty like Dr. Arthur struggled with managing accommodations for large classes.

Jeannis et al. (2017) found that many STEM facilities, laboratories, and research environments were not historically designed with physical accessibility and that this design flaw can create significant barriers for mobility-impaired students. This study found that there was a need for more accommodating space in general, to carry out the extended test time accommodations the increasing numbers of students on campus were given. Dr. Barry said:

> We absolutely need more space. Well, I guess that's maybe a difference. We're extremely space constrained right now. With the enrollment growth, we just don't have the space [in available classrooms or testing to offer extended test times to multiple students at once].

Dr. Barry said some of this could be attributed to an increase in enrollment at the university, and also an increase in the number of extended test time accommodations the university was giving its students:

> The volume really is the issue. And it's not necessarily that it's, 'Oh my gosh, I have to do so many different things in Canvas.' It's more—I don't feel like I can offer extended time without using the testing center. Because, you know, I've got 264 students in a room, there's another class coming in shortly afterward—I can't navigate that in a way that I think would be beneficial for the students.

Dr. Gabrielle also noted the growth in the number of accommodations he has received, and similarly said, "And when the number of students needing accommodations grows, it becomes much harder to manage. When I have three or four, it's not a burden. When I have 20 with 20 different sets of circumstances, it's tough to keep up."

The testing center and faculty addressed this growth by offering the exam to groups of students at different times when the testing center or classroom space available for extended test time usage reached capacity; however, faculty also expressed concerns about exam security and integrity when this was done, noting that students taking exams at different times increased risks of content sharing. Designing equivalent but distinct exams was both time-consuming and difficult for faculty.

Managing extended test time accommodations within large enrollment classes was particularly challenging due to space constraints and scheduling conflicts, often requiring faculty to rely on the university's testing center, which faced its own limitations. The testing center appeared to be overburdened, understaffed, or both. Kendall (2017) noted inadequate support services being offered by universities to SWDs, specifically that the availability of support

services such as note-takers, assistive technology, or personal aides can vary widely between institutions. This inconsistency in services can impact the quality of education and research experiences for SWDs (Kendall, 2017).

Dr. Arthur also spoke more specifically about the challenges of this university used as the site for this study requiring him to make an exam available at least 30 days prior to its due date in order to for the university's testing center to facilitate the exam with an extended test time accommodation for the high number of SWDs in his courses: "And so, it's like, someone [a student] can register [for extended test time accommodations to occur] 30 days out from their final [and take the exam 30 days earlier or later than their peers]. So that's kind of a disservice [to the SWD]." Dr. Barry shared how these later exam dates for SWDs delayed his grading, which was frustrating not only for him, but also delayed the SWD receiving their feedback in as timely of a manner as their peers. Dr. Gabrielle said this caused him to leave it up to the SWDs on when they take the exam: "And now they [the testing center] want final exams two months in advance. Meanwhile, I couldn't even get my final exam times nailed down until two weeks before exams. And yet, the testing center demanded I provide them with time. So, I had to say, 'Fine, they can take it anytime,' and just deal with it."

One faculty member, Dr. Nestor, spoke about the enrollment of his class being so large that he cannot rely on the testing center, and instead, his "experience is largely making accommodations at scale" and that he must "come up with alternative accommodations" for his SWDs. He also noted the growth in the number of students qualifying for accommodations:

> When I started teaching 12 and a half years ago at a different university, even in a large class, there might have been one or two students who needed extended time. The testing center could handle that. But now, more students have accommodations relative to the

> past—maybe the world is catching up to better testing, which is not a bad thing—but this has overwhelmed testing centers.

He added:

> It's not the testing center's fault; they don't get enough staff or funding to operate at night. I've spoken to faculty at other large universities, and they report the same problem. Some testing centers even run out of private rooms for students who require them, and there's nothing faculty can do—we can't just rent silent private rooms out of nowhere. The system wasn't built for today's needs.

However, Dr. Arthur said that if a faculty member chose to not use the testing center, the university would give the faculty member even more leeway on both when they offered the exam to the SWDs and the amount of test time they could extend to SWDs, but Dr. Arthur felt that was also a challenge:

> And that's again, where I think it's challenging because now it's on me. It's my... yeah. My call. And I'm, I'm kind of uncomfortable with it being my call. I'm going to try to move on the side of benefiting the student."

Faculty responses indicated that institutional policies often placed the responsibility for ensuring accessibility on individual instructors, creating an environment where accommodations were seen as additional tasks or workloads for faculty rather than integrated supports. This responsibility could contribute to faculty hesitancy or even resistance to having flexible attitudes regarding extended test time accommodations (Jarman et al., 2023). Faculty confidence in implementing accommodations was higher when they had strong relationships with ODS in this study, though limited proactive engagement from support offices, including ODS, also added to their workload, according to participants.

Additionally, instructors described inconsistencies in student usage of accommodations, with some students hesitating to use them, likely due to impression management for their faculty or peers. Dr. Barry observed:

> She [SWD] finally this semester has gotten it together [the extended test time accommodation approved by the university". And it's been a multi-semester process. [Then she] Didn't use them [the extended test time accommodation]. Didn't think she needed to use them. 'Right, Because I can handle this' [she must have wanted to display it to the faculty]. [She] Could not handle it.

Actions by these students aligns with prior research that has demonstrated that extended test time accommodations may stigmatize students, and faculty may need help in proactively providing them with their accommodations (Karp & Yoels, 2020; Deckoff-Jones & Duell, 2018).

**RQ2. What are faculty attitudes and beliefs about extended test time accommodations and the greater flexibility this accommodation can offer to students?**

Faculty attitudes toward extended test time accommodations ranged from mostly viewing the accommodations as necessary and beneficial, with some questioning the legitimacy of need, particularly when students failed to follow proper procedures. Most of the faculty in this study agreed that extended test time ensured equitable access rather than providing an unfair advantage, consistent with prior research that shows extended test time enhances overall performance, allowing more critical thinking and improved knowledge demonstration (Kim & Lee, 2016). Most participants in this study seemed to agree that accommodations, such as extended test time accommodations, is one of the ways through which institutions may reduce the problem of the "leaky pipeline" in STEM, which is characterized by low enrollment and graduation rates (Bettencourt et al., 2018; Moriarty, 2007; Street et al., 2012).

While some faculty observed benefits from extended test time, others found unprepared students still struggled despite the extended test time accommodations. When asked about his attitudes and beliefs about extended test time accommodations and the greater flexibility this accommodation can offer to students, Dr. Rene said, “in my opinion, it depends on the student.” He could see it being helpful for some SWDs, but “a student who is unprepared can have an infinite amount of time to do the test. And that will do nothing for them.” According to Bettencourt et al. (2018), STEM faculty have differing views of what constitutes a disability and the types of support needed by SWDs, often favoring more visible disabilities such as mobility impairments while overlooking less obvious disabilities like learning disabilities or mental health conditions—leading to underrepresentation of SWDs in STEM fields and underscoring the need for an inclusive definition of disability.

Some faculty also expressed skepticism about the legitimacy of certain requests, particularly when students failed to secure accommodations in advance, with one instructor even proposing a policy that students should not receive accommodations if they missed the instructor’s deadline. Still, many instructors in this study had a willingness to provide accommodations, if they did not create excessive logistical burdens. Similarly, many instructors in this study were willing to provide accommodations as long as they did not diminish the rigor of the course or the integrity of its exams. These instructors perceived extended test time accommodations as supportive mechanisms that should be optimally balanced with unique challenges of SWDs in rigorous STEM courses; in other words, the faculty attitudes reflected a tension between maintaining course rigor and ensuring equitable access. Dr. Gabrielle described this tension:

> There's a definite double-edged sword. We work very hard trying to be equitable in our treatment of students. On one side, everyone else has to complete the test in a certain period of time, and I even design my exams so that students need to use their time efficiently rather than just searching for answers. On the other side, I have students, like a young man this semester who is quadriplegic, who are clearly moving heaven and earth to get an education. The idea of not helping someone like that is anathema. So where do you meet in the middle?

Dr. Barry felt the exam alone "should provide information about a student's knowledge and skill state under pressurizing conditions," and that time limits like, "an hour is arbitrary, right? An hour is just however long it takes for the clock to go around and how much time is allocated for the course." So he believed extended test time did not impact the rigor of his STEM exams:

> But for a student with accommodations, pressure has a different meaning. I think it's still pressurizing conditions to take the exam with time and a half in the testing center, and I still get the information I want. And anybody who's being honest, who's looked at performance on time exams versus regular time exams, will tell you there is no difference.

Faculty also raised legal and ethical concerns, questioning institutional compliance with applicable laws around disability and accessibility and highlighting structural barriers like inaccessible facilities, further illustrating that implementing laws related to accommodations varies across different levels of education and within the same levels (Cole et al., 1995). Some faculty strictly followed documentation requirements before granting an extended test time accommodation, while others provided informal accommodations to circumvent bureaucratic

delays, consistent with Nelson et al. (1990) who noted that faculty within institutions respond to accommodations differently. Some faculty perceived accommodations as legal obligations rather than pedagogical tools, leading to a focus on compliance rather than inclusivity. As Dr. Barry stated, “A lot of faculty are meaner than I am, uh, in the sense of, if it's not officially on record [if the university has not approved the student for an extended test time accommodation], they'll [the faculty will] just say no. I mean, math will just say no. I mean, we can't accommodate you.”

Others expressed concerns about accommodations policies conflicting with course structure, as Dr. Nestor noted, “The syllabus says no late homework ever under any circumstances, but like a flexibility with accommodations thing [university policy] says, well, you know, ‘if they [SWD] discuss it [the accommodation] in advance then….’” This ambiguity often placed additional burdens on instructors to balance fairness in their courses with accommodation needs of SWDs.

Dr. Lorenzo spoke about the unfair high expense for SWDs to get the necessary private testing and paperwork to be university-approved for extended test time accommodations. While the university does offer it more economically for students, that office is overwhelmed with need, he said, leaving SWDs who cannot afford private testing without university approval for extended test time accommodations when they begin their first semester. Dr. Lorenzo said, “Their wait list is so long [for university testing and paperwork to be university approved for extended test time accommodations]. It could be a semester long to get in there and test it. So what service are we doing for that student if they can't even get in?”

Many emphasized the need for clearer institutional support and training for faculty to manage accommodations effectively. At least one participant, Dr. Gabrielle, spoke about how the reputation of the large R1 state school in the southeast that emphasizes the academic fields of

STEM factors into and influences his beliefs around and approach to extended test-time accommodations for qualifying SWDs. Past research has also found that STEM instructors are less willing to readily provide necessary accommodations (Lee, 2011; Love et al., 2014; Rao & Gartin, 2003).

But again, most of the participants in this study recognized the benefit of the accommodation. Dr. Lorenzo said, “I am totally in favor of the extended time. I think it's needed for sure. And so, I am completely supportive of it.” Similarly, Dr. Van said, “Teaching STEM courses over the years, I've come to see firsthand how extended test time accommodations can make a real difference for students who need them.” Dr. Barry saw extended test time accommodations help his students not only with their exam performance, but also with their ability to advocate for themselves:

> At ODS, we want to see that, ‘Absolutely, I can advocate for myself. I can still be successful in college without my parents holding my hand or guiding my every move’ kind of thing [from SWD]. I have seen that, you know, at least indirectly, I think, where you see students become empowered and autonomous. It's already happened for a couple of students that I've taught.

And when SWD with intersecting identities are given extended test time along with other university support, Dr. Barry says he has really witnessed his SWD gain confidence:

> So, I teach in the [university’s initiative to develop highly-skilled learners and leading contributors from diverse backgrounds] Challenge Program. And I have a couple of students with accommodations from Challenge who have really just continued the momentum from Challenge. And their accommodations are part of that. I mean, they take

> exams at the testing center and all that jazz. But I think they really have a level of confidence they would not have without that [Challenge Program] resource.

Sireci et al. (2005) also found that extended test times empower SWDs, while leveling the academic field and resulting in significant score gains.

Faculty in this study spoke about the disparities in offices of disability services across institutions. Most were in favor of and even advocated for inclusive teaching practices, emphasizing research-driven approaches to dispel misconceptions about extended test time among skeptical colleagues. Some faculty not only embraced the benefit of extended test time for their SWDs, but for all students, consistent with UDL. Dr. Van said, "Teaching STEM courses over the years, I've come to see firsthand how extended test time accommodations can make a real difference for students who need them," and because of that he now embraces UDL in his courses, he explained:

> Every semester, I make sure these accommodations are in place, but I often wonder if there's more I could do beyond just providing extra time. The challenge isn't just about fairness—it's about ensuring that all students can fully demonstrate their understanding in ways that work for them.

Dr. Barry also embraced a model from his colleague that aligns with UDL by building "accommodations into my courses as much as I can" a system and philosophy he said that he inherited this from his colleague and predecessor. Dr. Barry said the model has made his job easier because, "it doesn't require us [faculty] to be constantly going in [to the LMS] and granting extensions and that kind of thing.**"** Dr. Nestor had a similarly good experience when he aligned his course assessments with UDL principles:

> We design exams to have built-in buffer time, so students don't feel rushed. Our exams aren't meant to take the full 75 minutes; we want students to have extra time to check their work. Maybe that's why some students with extended time finish in the normal test duration—it's already built into our exam design. I think that's a good approach.

On the other hand, Dr. Arthur described how not embracing UDL principles required him to go into the university's LMS and individually program test durations for individual students, rather than offering them all extended test time which would allow him to program the test duration in bulk for the entire class. Dr. Lorenzo spoke to concerns around equity for all students, when a faculty member does not embrace ULD:

> What I would say is I'm always a little concerned about the access for students to have this extended time in terms of equity. And, you know, my understanding, and I have not searched it in detail, but my understanding, it takes quite a bit of time, knowledge and resources to be tested and to have those approved. And some people either don't know or don't have those resources and do not have those accommodations. And so that's where my concern is really, is how accessible it is to everybody who really needs it.

Many recognized their own need for structured professional development to navigate accessibility while maintaining academic rigor, yet most relied on personal experiences rather than formal training. Dr. Van said, "While I've had some formal training on disability accommodations, I still feel there's room for growth." Many lacked awareness of available tools and formal training on accommodations, relying instead on personal experience.

## Interpretation of the Findings and General Discussion

The interpretation of the findings that follows presents the experiences of faculty members with extended test time accommodations through the theories and frameworks of

Sanford's (1967) challenge and support theory, the Society for Disability Studies (2015), and UDL (Meyer et al., 2013). Each framework is used to explore an analysis of the data and the different aspects of the narratives of STEM faculty around using extended test time as an accommodation for SWDs in their STEM courses, including how they perceive, interpret, and implement extended test time accommodations.

## Challenge and Support: Providing—or Not Providing—the Right Balance

Sanford's (1967) challenge and support theory, as applied in this research, posits that college environments present challenges and supports, which can act as obstacles when balanced incorrectly or as facilitators to fulfilling student goals correctly (Ward et al., 2005). Too much support or accommodations by a STEM faculty member can impede student growth and learning, including that of SWDs; however, too much challenge and insufficient support or accommodations can lead to little or no student growth and learning in the STEM courses. Two themes emerged regarding the STEM faculty providing adequate support in STEM courses while also keeping their courses challenging enough to facilitate growth and learning among their SWDs in their STEM courses.

### *Faculty Desires and Struggles to Balance Accommodations with Maintaining Rigor*

Faculty in this study appeared to assume their responsibility for maintaining the rigor and challenge of the STEM courses and related assessments, particularly within the context of their R1 institution with its strong reputation and STEM focus. At the same time, they also expressed a desire to be supportive and accommodating to SWDs, particularly those with apparent-to-them disabilities; yet sometimes this responsibility to maintain the rigor and challenge of their courses and associated exams created struggles for the faculty or even prevented them from offering the necessary, supportive accommodations to their SWDs. More specifically, faculty struggled to

balance the support of extended test time accommodations for SWDs with ensuring the challenge and integrity of their assessments in especially in large enrollment courses, courses with assessments held within the course's LMS, exams that required in-person proctoring, when requests for accommodations were received after the semester had begun, or for students with nonapparent disabilities or for whom the faculty questioned their legitimate need for an accommodation. Research has shown that SWDs face more restricted pathways to success in STEM majors and degree programs (Bettencourt et al., 2018; Lee, 2011; National Science Foundation [NSF], 2017), and that they perceive STEM majors and fields as unwelcoming or unaccommodating to persons with disabilities, with these perceptions are rooted in the historical lack of accessibility, inclusive practices, and support within STEM disciplines (Holmes et al., 2017). The findings of this study are consistent with this earlier research, including studies on R1 institutions, that suggests that SWDs often encounter unique challenges in these research-intensive environments, and that these challenges relate to the competitive nature of R1 schools, the emphasis on research, and the availability of support services (Castrodale, 2015).

Research by Lopez-Gavira et al. (2019) has also shown that when SWDs are supported with accessible facilities and accommodations, they have the potential to excel academically and play a pivotal role in advancing STEM knowledge and applications. If universities—particularly R1 institutions with rigorous STEM programs—can address the struggles the faculty in this study faced when attempting to balance supportive accommodations with the challenging rigor of their courses and assessments, they could help create a more inclusive environment where the undergraduate STEM SWDs at their university can confidently pursue their STEM interests and aspirations.

***Impression Management by SWDs***

In some cases, the supportive role of the faculty in this study was limited by impression management of SWDs who delayed seeking or self-advocating for the accommodations that they needed, leading to the student be overly or even unnecessarily challenged. This is not surprising, as earlier research has noted that SWDs may experience adverse reactions or a lack of understanding from their peers and faculty members when they disclose their disability status, and the stigmatization and lack of understanding among faculty and peers can create an unwelcoming and isolating environment for them (Deckoff-Jones & Duell, 2018). Further, SWDs who prefer minimal interaction with faculty around their disability or accommodations due to stigma, past negative experiences, or personal reasons, may struggle to confirm with faculty that the carrying out of the accommodation is being done and is meeting the student's needs for support in the course (Deckoff-Jones & Duell, 2018). However, only a quarter of the faculty in this study spoke about recognizing the stigma that accommodations might carry for their SWDs among their faculty and peers.

Unfortunately, this study found that without open, early, and clear communication between the instructor and the SWDs about the extended test time accommodation warranted by the SWDs, scheduling conflicts and misunderstandings arose, leading to unintentional exclusion from the accommodation despite the availability of accommodations or the willingness of faculty to offer it. Faculty training could help STEM instructors recognize bias and stigmas against SWDs in their field, as well as impression management done by SWDs, and proactively encourage SWDs to freely discuss their disability status and warranted accommodations and access the support from faculty that they need in their challenging STEM courses.

Faculty in this study described having developed, over time, greater empathy for students needing accommodations, especially after personal or professional experiences highlighted for

them the necessity of such adjustments in overly challenging situations, possibly indicating that those who had previously received accommodations themselves expressed greater empathy and understanding of the need for supportive extended test time. Faculty sharing this empathy and understanding with their STEM colleagues could be the goal of these trainings, and at the same time, address the absence of visible role models with disabilities in STEM fields that contribute to the perception of SWDs that individuals with disabilities are not meant to thrive in these disciplines (Atchison & Libarkin, 2016).

With faculty working to reduce their own biases and the stigma around disabilities, particularly in the STEM field, students may be more willing to self-advocate for their supportive accommodations and do so earlier in the semester. The tension between maintaining course rigor and challenge while also ensuring support for students highlights the need for a balanced approach between STEM faculty and SWDs, one that holds students accountable for following the procedures for securing accommodations in a timely manner, while also recognizing the institutional and social barriers that may prevent their timely and forthcoming requests to faculty.

**Disability Studies: Factors, Attitudes and Beliefs Around Accommodations**

Disability studies explore and examine social, political, cultural, and economic factors that help a program or entity—in this study, a STEM instructor—define disability and help determine their responses to differences (Society for Disability Studies, 2015). In the context of this study, these factors shape how faculty members in STEM fields at R1 institutions conceptualize disability and implement inclusive practices in their teaching and curriculum development. Five themes emerged from the study regarding the Society for Disability Studies' (2015).

### *Social Factors and Relationships with ODS staff*

Participants in this study who described themselves as having a good working relationship with the university's ODS staff also expressed confidence in their ability to provide accommodations effectively despite the institutional constraints. Some participants expressed appreciation for the support they received from the university's ODS staff and other administrative staff when trying to carry out an accommodation, indicating that when they reached out for help, they received effective guidance and support.

While faculty in this study seemed to value the support that they received when they actively sought assistance, the lack of proactive engagement from their university's ODS staff was cited as limiting the overall effectiveness of the accommodation process. Similarly, Love et al. (2014) identified barriers STEM faculty encounter when working with such students, such as lack of knowledge and training about accommodations and limited access to assistive technology solutions. Faculty in this study usually needed to take the initiative for these social interactions and relationship building with ODS staff when they sought guidance around the accommodation requests, which they described as adding to their faculty workload and further complicating the accommodation process. Again, studies on R1 institutions suggest that SWDs often encounter unique challenges in these research-intensive environments (Castrodale, 2015), and the faculty workloads around research or maintaining the competitive nature of these R1 schools could leave little time for relationship building with ODS staff.

Love et al. (2014) noted a need for more awareness among faculty regarding accommodations and an apparent need for additional training to support SWDs effectively, and ODS proactively providing this to faculty could help establish these relationships with faculty and equip them with sufficient knowledge and networks to ODS staff to assist their STEM

SWDs more effectively. As Dr. Van said, “I sometimes find myself navigating situations without a clear framework. More structured collaboration and guidance could help faculty like me better support students with disabilities, rather than relying on ad-hoc solutions or assumptions.”

### *Political and Legal Factors*

An evaluation of participants’ experiences in this study brings attention to the tension felt by instructors between legal responsibilities to receive university approved documentation for accommodations and providing those accommodations effectively, while conversely experiencing delays in receiving that documentation and also having inadequate training on the legal requirements to providing accommodations. This aligns with prior research also shows that SWDs in STEM fields face additional pressure to have formal permission or proof that they have initiated the formal process of acquiring accommodations (Reinholz & Ridgway, 2021). Yet, prior research also shows that expecting students to maneuver bureaucratic approval processes before receiving accommodations also points to an ableist administrative structure—a structure where access to necessary learning supports is contingent on institutional timelines rather than student needs (Reinholz & Ridgway, 2021).

However, some participants in this study circumvented the need for waiting on formal approval—and in turn, eliminated the ableist administrative structure—by adjusting their course practices so that extended test time was available to all students in order to make their faculty workload easier. Dr. Barry said, “I inherited this really from my predecessor who had a great system for building flexibility into things like homework and in-class work that's graded [for all students, but meets the needs of approved extended test time accommodations].”

Other participants who followed the reactive university policy of only offering extended test time accommodations when they received university approval, rather than proactively

embedding accessibility into course design for all students, risked reinforcing barriers and often created administrative and procedural hurdles that focused on compliance rather than fostering a more inclusive and flexible learning environment. Further, a willingness to come into legal compliance alone did not guarantee effective accommodations offered by participants, especially if the faculty felt unprepared to adjust their assessments in ways that maintain course integrity while also meeting student needs. This too was consistent with prior research that found faculty within institutions respond to accommodations differently (Nelson et al., 1990).

### *Cultural and Institutional Factors*

Faculty experiences in this study highlighted how the culture of the institution influences how extended test time accommodations are supported by faculty and delivered. More than half of the participants expressed appreciation for their university's ODS staff and the resources available to them at their current institution, noting that these staff and their services helped facilitate the accommodation process, and most of the participants were supportive of extended test time accommodations. This highlights how institutional culture and resource allocation can more positively shape faculty experiences and perceptions with accommodations to the benefit of SWDs. This aligns with the Society for Disability Studies' (2015) social model of disability, which finds that obstacles for SWDs arise primarily from institutional structures rather than individual impairments, and when faculty recognize accommodations as tools for removing these inequitable barriers for SWDs, they contribute to a broader cultural shift away from ableist perspectives in STEM education (Reinholz & Ridgway, 2021).

Participants also shared how the supportive culture of their current institution was different than those depicted to them by colleagues who taught at other institutions and described the cultures of those other institutions as lacking in support for SWDs and accommodations. Dr.

Gabrielle said, "He [my colleague at another institution] gets almost no help. It's amazing how little they do, even though they're a larger school in [our state]. They [the faculty] get the accommodation letters and basically get cut loose." These experiences by colleagues at other institutions align with the historical lack of accessibility, inclusive practices, and support within STEM disciplines (Holmes et al., 2017). The ability of the research site to reject that culture is noteworthy, especially given that many STEM facilities, laboratories, and research environments were not historically designed with accessibility, and that this design flaw can create significant barriers for SWDs in STEM, particularly mobility-impaired students (Jeannis et al., 2017). Further, the site is an R1 institution, and past research has suggested that SWDs at R1 institutions often encounter unique challenges in these research-intensive environments (Castrodale, 2015), resulting in SWDs being less likely to enroll in STEM classes, finish their STEM programs, and graduate with STEM degrees (Gottfried et al., 2014). However, this university is one known for emphasizing the academic fields of STEM and the availability of an extended test-time accommodation for qualifying SWDs, so this emphasis could be positively impacting its culture.

Despite the overall positive culture of the institution toward extended test time accommodations, several faculty members mentioned how restrictive the culture of the testing center appears to be, as evidenced by the center's inability to offer makeup exams or its lack of leniency for students forgetting their extended test time accommodation appointments. Many participants seemed to conclude, though, that this restrictive culture was due to a lack of testing center staffing, rather than the culture of the center itself or its limited staff there.

### *Economic Factors*

The positive, larger cultural support for offering extended test time accommodations unfortunately did not translate to the economic support necessary to carry out the logistics of

delivering those accommodations, particularly at a time of increased enrollment overall and increased numbers of students qualifying for the accommodations. The logistical challenge seems to originate from the faculty's need to rely on centralized testing center due to wanting to protect the SWDs' privacy from peers seeing them receive additional exam time or limited classroom space at the university which prevented the faculty in this study from offering the exams in their classrooms to SWDs for extended time periods, all while the testing center itself appeared to be constrained by its own limited space, lack of staff and proctors, and limited operational hours. In fact, four participants described feeling economically unsupported by their institution overall when attempting to carry out extended test time accommodations, citing overwhelmed and under-resourced testing center and ODS staff, issues with extended test time scheduling, limited proctoring spaces, unavailability within their own workloads for extended test times, and staffing shortages for exam proctoring. This was consistent with prior research that found the availability of support services such as note-takers, assistive technology, or personal aides can vary widely between institutions, and that inadequate support services can negatively impact the quality of education and research experiences for SWDs (Kendall, 2017).

Having to work around these limited university support services and staff often forced the faculty to decide to offer the accommodation in a way that might negatively impact the student's progression in the course another way, as many participants in this study noted that they struggled to align the scheduled exam date of the class with the testing center's available exam dates. Dr. Nester was told by the university's testing center, "Well, sorry, professor, but if you don't want the student to take it [the exam] at the makeup time [that was different than the rest of the course], then you have to proctor it yourself,"

Some faculty members expressed concerns about the growing demand for accommodations, its increased strain on testing centers and institutional resources, the impact this does and will continue to have on their workload, as well as how unprepared universities are to handle the increasing number of students who qualify for accommodations. Without institutional support mechanisms that reduce these procedural burdens, skepticism and resistance from faculty will continue to be a barrier to equitable accommodations (Jarman et al., 2023). While technological and software solutions could be plausible solutions for a streamlined coordination, reporting, and offering of accommodations, these platforms generally only streamline administrative tasks and they do not inherently reduce faculty workload, especially when accommodation requests require proctoring, manual adjustments to assessments, exam settings, or alternative testing arrangements (Alshawabkeh et al., 2021).

As Dr. Nestor noted, “More students have accommodations relative to the past, or at least anecdotally, in my experience this is leading testing centers to become overwhelmed.” The challenge for some faculty was not determining need or protocol, but managing logistics. “For us, it's not, you know, managing the scale is the main issue. And coordinating logistics is a problem. It's become a problem.” According to the NCES (2018), over 19% of students enrolled in undergraduate degree programs have at least one disability. This statistic emphasizes the substantial presence of SWDs in higher education. Research has consistently shown that extended test time benefits all students and leads to particularly substantial score improvements for SWDs (Sireci et al., 2005). The increasing demand for accommodations, particularly extended test time, creates additional pressure on faculty and institutional resources, raising the need for greater investment by institutions in facilitating these accommodations, particularly in large-scale or high enrollment courses.

### *Attitudes and Beliefs of Faculty Around Extended Test Time Accommodations*

All the participants in this study shared the belief that extended test time accommodations play a necessary role in helping some SWDs overcome challenges, specifically those SWDs deserving of and accountable for their accommodation-acquisition process, as stipulated in policies and procedures established by the institution. Many spoke about seeing the benefits of extended test time accommodations firsthand among their SWDs. For example, faculty participants spoke about how extended test time allowed their students to appropriately manage anxiety when they can test in the testing center, contributing to a calmer testing environment for everyone, which ultimately allowed for a more accurate assessment of their learning and skills. Likewise, Dr. Gabrielle noted that this accommodation seems especially useful in reducing test anxiety for students who experience it, as did Dr. Rene, who also noted that extended test time can significantly reduce anxiety. This is consistent with earlier research that shows extended test time enhances overall performance and allows for more critical thinking and improved knowledge demonstration (Kim & Lee, 2016), it empowers SWDs by leveling the academic field and resulting in significant score gains (Sireci et al., 2005), and it proves especially valuable for those with reading disabilities by allowing them time to overcome reading challenges and succeed academically (Lesaux et al., 2006).

Faculty members in this study expressed that providing the extended test time accommodation aligns with their teaching philosophy of supporting all students' success, particularly if they had a professional or personal connection to someone with a disability. This speaks to the importance of representation of persons with disabilities in the STEM fields, as the absence of visible role models with disabilities in STEM fields can further contribute to the

perception that individuals with disabilities are not meant to thrive in these disciplines (Atchison & Libarkin, 2016).

While all faculty in this study expressed their personal support for warranted extended test time accommodations, some described also feeling frustration with students who failed to follow procedures or waited too long to request the accommodation. This frustration was especially evident when students missed the accommodation registration deadline for a particular semester or term but still demanded accommodations within the course. Another faculty member expressed frustration when accommodations were granted by the university after the semester had already begun, requiring the faculty member to adjust their exams mid-course. However, these beliefs did not always acknowledge that institutional processes often require students to navigate bureaucratic approval systems before receiving accommodations, creating unnecessary delays that place additional strain on both students and faculty (Friedensen et al., 2021). One participant, Dr. Lorenzo, acknowledged the unfair high expense for SWDs to get the necessary private testing and paperwork to be given university approved for extended test time accommodations, and while the university does offer the testing for students, that testing office is overwhelmed with need, he says, leaving SWDs who cannot afford private testing without university approval for extended test time accommodations when they begin their first semester. Dr. Lorenzo said, “Their wait list is so long [for university testing and paperwork to be university approved for extended test time accommodations]. It could be a semester long to get in there and test it. So what service are we doing for that student if they can't even get in?”

Additionally, faculty in this study were concerned about the potential overuse or misuse of accommodations. Faculty often find it difficult to tell which students genuinely need help from those who might misuse the system. This is consistent with findings of earlier studies where

the difficulties faced by SWDs in accessing academic accommodations within the collegiate environment depended on the nature of their disability (Yssel et al., 2016), and academic accommodations were usually much more accessible for students with apparent disabilities, such as physical disabilities, than students with non-apparent disabilities (Friedensen et al., 2021). This disparity shows that the perception of a disability continues to matter when accessing accommodations. According to Bettencourt et al. (2018) and Reinholz and Ridgway (2021), it is necessary for shifts in attitudes and practices regarding disability perception within postsecondary STEM learning environments to address limitations associated with current perceptions and provide equal chances for success across STEM fields.

## Universal Design for Learning, Teaching, and Assessment

UDL is an educational approach that aims to increase inclusivity and accessibility through flexibility in teaching and assessment (Meyer et al., 2013). In this study, UDL helps understand how accommodations, such as being flexible with test times, can be designed and implemented for all students in the class to create equitable and inclusive learning environments in STEM education for SWDs. The study examines how faculty in STEM disciplines at R1 institutions engage with UDL principles, particularly in implementing extended test time accommodations, to create more inclusive learning environments. Three themes emerged regarding UDL as faculty experienced implemented (or did not implement) extended test time accommodations.

### *Inclusivity and Accessibility of Accommodations*

At least two participants appeared to closely align with the UDL approach and said that they included accommodations for all students in their course to make their courses more inclusive and accessible to all. One of these faculty members said that aligning with UDL

principles made his job easier because, **“**it doesn’t require us [faculty] to be constantly going in and granting extensions and that kind of thing.**”** Participants who did not align with UDL principles encountered greater burdens for themselves, especially has the number of students with accommodations grew. Dr. Gabrielle noted, "Keeping track of them and actually determining who needs them is something that's completely beyond my education and skills." Aligning with UDL principles also eliminated concerns from students without disabilities about inequities. This is consistent with Jarman et al. (2023), who write:

> Crucial to institutional belonging are faculty attitudes and approaches to students with disabilities. On one side, faculty can be resistant to accommodations or rigid in ways that impede student progress; on the other side, they can be compassionate collaborators who actively support the success of their disabled students—of all their students. (p. 3)

### *Efficacy of Accommodations*

Several faculty members indicated that they were unclear about the direct impact an extended test time accommodation had on the performance of their students, despite existing research consistently showing that extended test time benefits all students and leads to particularly substantial score improvements for SWDs (Sireci et al., 2005). Dr. Gabrielle commented that "it's not possible to measure that accurately, empirically, all the time." However, faculty members in this study largely agreed that accommodations, particularly extended test time, do not provide an unfair advantage in their anecdotal experience, as Dr. Barry noted, "Anybody who's being honest, who's looked at performance on time exams versus regular time exams, will tell you there is no difference. The numbers just don’t bear that out."

Dr. Barry also spoke about how he had seen extended test time accommodations increase the confidence and autonomy of his SWDs, especially among SWDs who have intersecting identities:

> I have seen that, you know, at least indirectly, I think, where you see students become empowered and autonomous. It's already happened for a couple of students that I've taught. So, I teach in the [university's initiative to develop highly skilled learners and leading contributors from diverse backgrounds] Challenge Program. In addition, I have a couple of students with accommodations from Challenge who have really just continued the momentum from Challenge. And their accommodations are part of that. I mean, they take exams at the testing center and all that jazz. But I think they really have a level of confidence they would not have without that [Challenge Program] resource.

Given that SWDs seeking STEM degrees programs face even more significant challenges as opposed to SWDs seeking other degree programs (Bettencourt et al., 2018; Lee, 2011; National Science Foundation, 2017; Isaacson et al., 2016; Sithole et al., 2017), and even more so if those STEM seeking degree program SWDs have another intersecting identity (Griffiths et al., 2020; Alexander & Hermann, 2016), Dr. Barry's narrative highlights the likely importance of these supportive accommodations and programs for STEM students, particularly those with intersecting identities.

Participants spoke about how data or empirical research around the fairness of extended test time for SWDs could be influential to STEM faculty beliefs and attitudes around extended test time accommodations. Dr Barry said, "As scientists and engineers, we should be looking at the data first. If scores are not different or are even worse with extended time, then we have no leg to stand on in terms of an unfair advantage." Pairing communication of those studies with

formal training on inclusive teaching practices of UDL in fast-paced STEM courses at rigorous R1 academic institutions could be even more helpful to faculty and SWDs, according to Dr. Van:

> Inclusive teaching is something I try to improve upon, and I've attended a moderate number of workshops on pedagogical strategies. However, integrating these ideas into a fast-paced STEM curriculum isn't always straightforward. There's a balance between maintaining academic rigor and ensuring accessibility, and I believe more faculty development opportunities could help bridge that gap.

### *Training Faculty on Accommodations*

While the STEM faculty in this study have significant experience with receiving and acting on extended test time accommodations in their courses, and they also say that the number of accommodations requests that they are receiving is large and still increasing in number, several faculty members in this study noted the absence of formal training on carrying out accommodations in their courses. The burden to respond to the increasing number of accommodations requests is increasing for faculty, too. As Dr. Arthur noted, "the volume really is the issue… I don't feel like I can offer extended time without using the testing center" because of logistical constraints in large enrollment classes.

While aligned with university policy, this approach of individualized accommodations reinforces a reactive approach, rather than proactive approach to accessibility, and the UDL framework advises against one-off fixes or accommodations while also aligning with university policy. By applying UDL principles in this scenario and others, extended test time accommodations could be built into course design for all students, rather than only those with university approval for extended test time accommodations, reducing or relieving some of this growing administrative burden for faculty by adjusting courses and assessments for all students

(Meyer et al., 2013). Incorporating this UDL could also reduce or relieve the administrative burden SWDs face when seeking university approval for accommodations (Meyer et al., 2013).

However, training and faculty attitudes, particularly those of faculty teaching STEM courses, impact the beliefs and actions around accommodations (Sandoval et al., 2020), and training STEM faculty in R1 institutions on UDL principles and inclusive practices is a necessary step toward shifting attitudinal perceptions and fostering a more accessible learning environment (Meyer et al., 2013). However, in research-intensive environments where faculty already have little time to spare, incentives for receiving this pedagogical training and integrating accessibility strategies into course design might not be clearly explained and offered but would likely be needed.

## Implications of the Findings

Faculty need assistance from universities around their struggles to balance the support they want to give their SWDs through extended test time accommodations while still ensuring the challenge and integrity of their STEM course assessments, especially in large enrollment courses, courses with assessments held within the course's LMS, exams that required in-person proctoring, when requests for accommodations are received after the semester has started, and for students with nonapparent disabilities or for whom the faculty question the student's legitimate need for an accommodation. If universities—particularly R1 institutions with rigorous STEM programs—can address these struggles faculty face when attempting to balance supportive accommodations with the challenging rigor of their courses and assessments, they could help create a more inclusive environment where the undergraduate STEM SWDs at their university can confidently pursue their STEM interests and aspirations.

Faculty training to help STEM instructors recognize bias and stigmas against SWDs in their field, as well as impression management done by SWDs, is also needed. Further, faculty training on how to proactively encourage their SWDs to freely discuss their disability status, necessary accommodations, and the support that they need from their faculty could also likely improve the STEM field. Faculty sharing their personal or professional experiences with disability could produce greater understanding and empathy of SWDs among their STEM colleagues, as they serve as or showcase visible role models with disabilities in STEM fields, dispelling the perception that SWDs are not meant to thrive in the STEM disciplines (Atchison & Libarkin, 2016).

Universities should carefully consider and explain the legal obligations of both faculty and students when it comes to accommodations. University staff in ODS should proactively take on the burden and responsibility of building professional relationships with faculty, and actively provide guidance and support to them, while being mindful of the time constraints of faculty, particularly those faculty within rigorous, research-intensive, R1 institutions.

Universities, like the one used as the research site for this study, can begin bucking past research (e.g. Castrodale, 2015) that has suggested that SWDs at R1 institutions often encounter unique challenges in these research-intensive environments by adopting a university-wide culture of emphasizing the availability of extended test-time accommodations for qualifying SWDs; however, a larger positive culture at the institution around extended test-time accommodations for qualifying SWDs does not eliminate the development of restrictive sub-cultures, like the restrictive testing center in this study. Having that culture also does not eliminate the need for universities to make increased economic investments in accommodations resources, such as

testing center and ODS staff, particularly alongside increases in enrollment and the number of students qualifying for the accommodations.

Faculty want training around accommodations and their biases around disability and SWDs, and training and faculty attitudes impact the beliefs and actions around accommodations, particularly those of faculty teaching STEM courses (Sandoval et al., 2020). Knowing the efficacy of extended test time accommodations for SWDs, and how the application of UDL principles in STEM courses—particularly how extended test time accommodations could be built into the course design for all students, and reduce or relieve some of the growing administrative burden for faculty and SWDs face when seeking university approval for accommodations—can be done in a way that does not diminish the rigor of the course or its assessments could be valuable to both STEM faculty and their SWDs (Meyer et al., 2013).

## Recommendations for Policy and Practice

By situating these findings within the disability studies framework, this study underscores how faculty attitudes and institutional structures within STEM fields at R1 institutions can either reinforce or dismantle ableist academic norms. Disability studies challenge the historical perception of disability as a deficit and instead position it as a social construct shaped by institutional and cultural barriers (Dolmage, 2017). When faculty express concerns about academic rigor or legitimacy regarding extended test time accommodations, these concerns often reflect ingrained biases about what constitutes "ability" in STEM. UDL provides a counter-framework to these concerns by shifting the conversation from individualized, reactive accommodations to proactively designing courses that anticipate and support diverse learners from the outset. The intersection of these theories emphasizes that faculty are not simply

implementing accommodations—they are actively shaping the epistemological and pedagogical norms of STEM education.

Future researchers and practitioners seeking to apply disability studies and UDL in STEM and R1 settings can build upon this work by exploring systemic changes at multiple levels—from course design to departmental policies to broader institutional commitments. Applying UDL as a structural intervention rather than a reactive measure for disability accommodations could lead to faculty development programs that integrate disability awareness into pedagogy, as well as policies that encourage faculty to design assessments with flexible time structures from the outset. In turn, this could reduce reliance on bureaucratic approval processes for accommodations and ease faculty concerns about academic integrity. This study highlights the urgency of shifting away from compliance-based models of disability accommodations toward holistic, UDL-driven STEM education reform, particularly in high-stakes, research-intensive academic environments.

Based on the findings of this study, several recommendations can address the challenges faculty face in implementing extended test time accommodations and to create more inclusive educational environments:

1. **Institutional Investment in Disability Services**: Institutions should increase funding and resources for *disability*/*accessibility* services to ensure consistent support for SWDs across campuses. This includes hiring more staff, expanding testing center capabilities, and developing clearer accommodations policies.
2. **Faculty Development and Training**: Faculty training programs should be enhanced to provide clear guidance on legal obligations, best practices for accommodations, and how UDL principles can be incorporated into STEM courses. Training should transcend the

legal obligations of providing accommodations to intentionally utilizing accommodations as a pedagogical tool.

3. **Streamlined Administrative Processes**: Institutions should work to simplify and expedite the processes for requesting and implementing accommodations, including documentation and approval procedures, in a way that is cost-effective for students.
4. **Integrating Accommodations into Course Design**: STEM faculty should include UDL principles in their courses from the start and as part of the course structure.
5. **Addressing Faculty Concerns on Fairness and Misuse**: Institutions should provide data collection mechanisms and clear communication about the effectiveness of accommodations, especially extended test time. Addressing fairness, misuse, and stigma concerns through transparent processes and evidence-based practices will help shift faculty attitudes and increase their support for accommodations.
6. **Improving Communication Systems**: Clear links between students, faculty, and disability services can ease the process and prevent extra burdens on everyone involved.

## Limitations and Recommendations for Future Research

This study provided insights into how faculty teaching undergraduate STEM courses perceive and experience providing extended test time accommodations for SWDs, with an aim to explore how faculty attitudes, beliefs, and other factors affect their receiving, interpreting, and ultimately granting (or not granting) of extended test time accommodations requests for SWDs in their STEM courses. Further investigation is warranted. Given the scope and methodology of this study, limitations that may have impacted the findings and their broader applicability should be acknowledged.

One limitation of this study was its sample size and recruitment method. Despite efforts to recruit participants through purposive sampling, the study included only one tenured and seven non-tenured STEM faculty members, which may not fully represent the perspectives of all STEM instructors. Expanding the study to include a larger and more diverse faculty sample across multiple institutions could provide a broader understanding of faculty attitudes and experiences regarding extended test time accommodations.

Another limitation of the study was the self-selection of participants. Faculty who chose to participate may have had a particular interest in disability accommodations or held strong opinions on the subject, which could have influenced the findings. A more randomized recruitment strategy or even full institution participation in a similar study could help mitigate this bias in future research.

A further limitation was the study's focus on faculty perspectives only. While understanding faculty experiences is critical, the exclusion of SWDs, disability services staff, and administrators means that the study does not present a comprehensive view of the experiences of extended test time accommodations. Including multiple stakeholder perspectives in future research could offer a more holistic understanding of accommodation practices in STEM education.

Another limitation was the study's reliance on narrative inquiry, which, while valuable for capturing deep insights, is inherently subjective. The interpretation of faculty narratives depends on researcher analysis, which may introduce unintended bias despite efforts to enhance trustworthiness through reflexive journaling and member checking. Conducting a mixed-methods study that incorporates quantitative measures could strengthen the validity of findings.

Additionally, the study's scope was limited to extended test time accommodations, potentially overlooking other critical accommodations that impact SWDs in STEM. While extended test time is one of the most common accommodations, other supports, such as alternative assessments, note-taking assistance, and flexible deadlines, also play a role in accessibility. Future research could explore a broader range of accommodations to better understand the full spectrum of support needed in STEM courses.

Finally, the study was conducted at a single R1 institution in the southeastern U.S., which limits the generalizability of the findings. Institutional policies, faculty training, and attitudes toward disability accommodations may vary significantly across different types of institutions, such as community colleges, liberal arts colleges, and non-research-intensive universities. Future research should examine faculty perspectives across multiple institutional settings to identify trends and variations in accommodation practices.

Looking ahead to future research, a broader study incorporating the perspectives of faculty from different or multiple institutions, even those across different geographic regions, would provide comparative insights into how cultural factors and institutional policies and resources affect faculty experiences. Further a quantitative study or one with a greater sample size could provide more generalizable results worth considering.

Future research should also investigate the impact of faculty training programs around legal obligations, best practices for accommodations, and how UDL principles can be incorporated into STEM courses on faculty perceptions of accommodations and their effectiveness, assessing whether faculty professional development and training leads to improved implementation and outcomes. Further qualitative research could also examine the perspectives of SWDs to better understand their experiences with accommodations and whether STEM

faculty support aligns with their needs. Similarly, an analysis comparing growth of economic and human resources for supporting accommodations alongside the growth in number of students who quality for accommodations at one or more universities could be valuable.

Moreover, studies involving faculty from majors beyond STEM, such as education, art, and business, could offer solutions for enhancing accessibility among all SWDs. The integration of emerging technologies, such as AI-driven assessment tools and universal design principles, also presents an avenue for future studies to explore scalable and inclusive testing solutions. By addressing these areas, future research can contribute to a more comprehensive understanding of the systemic barriers and opportunities in accommodating SWDs in STEM fields, ultimately leading to more effective and equitable educational practices.

## Chapter Summary

This study sought to explore faculty perspectives on extended test time accommodations for SWDs in STEM courses. More specifically, the study examined how STEM faculty perceive, interpret, and implement extended test time accommodations, and uncovered ten underlying themes from the narratives that characterize STEM faculty experiences, attitudes, and beliefs toward accommodations in STEM courses within the three-dimensional space of temporality, sociality, and place (Clandinin & Connelly, 2000; Killam, 2013). Among the ten, the themes drawing on Sanford's (1967) challenge and support theory included: (1) faculty desires and struggles to balance accommodations with maintaining rigor and (2) impression management by SWDs. The themes drawing on the Society for Disability Studies' (2015) framework included: (1) social factors and relationships with ODS staff, (2), political and legal, (3), cultural and institutional, (4), and economic factors, as well as (5) attitudes and beliefs of faculty around extended test time accommodations. Finally, the themes drawing on Meyer's et al. (2013) UDL

included: (1) inclusivity and accessibility of accommodations, (2) efficacy of accommodations, and (3) training faculty on accommodations. A summary of the findings in response to the study's research questions was presented, as well as an interpretation of the findings and general discussion. Finally, implications of the findings, limitations of the study, and recommendations for policy, practice, and future research were provided.

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# APPENDICES

## Appendix A

## Recruitment Email to Faculty

**Subject: Invitation to Participate in Research Study on Extended Test Time Accommodations in STEM**

Dear _____,

I am Sarah Allen, a doctoral candidate at The University of Georgia. I am conducting a study as part of my dissertation, which is to be submitted to the Graduate Faculty of The University of Georgia in partial fulfillment of the requirements for the degree of Doctor of Education. I am inviting you to participate in my research investigating the provision of extended test time accommodations for students with disabilities within STEM undergraduate courses.

Participation will involve a semi-structured interview conducted via Zoom, lasting approximately 45 minutes, at a convenient time.

Participation in this study is voluntary, and your responses will be confidential. The information gathered will be used solely for research purposes.

If you would like to participate, please respond to this email to schedule an interview or to request more information about the study. I appreciate your time and consideration.


Sincerely,

Sarah Allen

678.471.2016

*Sao54105@uga.edu*

Appendix B

**UNIVERSITY OF GEORGIA**

**CONSENT LETTER**
**HOW FACULTY TEACHING UNDERGRADUATE STEM COURSES EXPERIENCE EXTENDED TEST TIME ACCOMMODATIONS**

Dear Participant,

My name is Sarah Allen. I am a student in the College of Education at the University of Georgia (UGA) under the supervision of Faculty Advisor Dr. Lindy K. Parker. I am inviting you to take part in a research study.

I am researching the experiences of STEM professors who have been asked to give extra time for tests to students with disabilities. I want to understand their experiences and how they handle these situations. The main questions are:

1. What experiences have STEM faculty had with receiving and acting on a request to provide an extended test time accommodation in their STEM courses?
2. What are faculty attitudes and beliefs about extended test time accommodations and the greater flexibility this accommodation can offer to students?

By analyzing answers to these questions, I hope to discover findings that could make STEM courses fairer and more supportive for all students, especially those with disabilities, while maintaining appropriate academic integrity and rigor.

I am looking for instructors of undergraduate STEM courses who have been asked to give students with disabilities extra time for tests. If you have been asked this and are willing to share your experiences, you are invited to join this study.

If you agree to participate in this study, you will be asked to schedule an interview with the researcher. The interview will consist of one session, lasting about 45 minutes, and will be conducted via Zoom through my UGA Zoom account. During the interview, we will discuss your experiences, and the session will be recorded to ensure that everything you say is accurately captured.

Participation in this study is voluntary. You can refuse to participate or stop at any time without penalty. Your decision to refuse or withdraw will not affect any activities you are involved in, including your involvement in any STEM programs at the university.

There may be questions during the study that could make you feel uncomfortable. If you encounter questions you do not wish to answer, you can skip them as long as you are comfortable.

Your responses may help us understand how to better support students with disabilities in STEM courses by improving how extended test time accommodations are sought and provided. This

understanding could benefit you and your colleagues and future STEM students with disabilities who need these accommodations to succeed in their studies.

The interviews will be recorded and stored within my university Zoom account, behind my university login and passcode. Once transcriptions of the Zoom interview have been made, the Zoom recording will be deleted, and the interview transcription will be labeled with a study ID (pseudonym) going forward. Research records will be labeled with study IDs linked to your name by a separate list. The participant information will be stored separately from the transcription data to protect privacy. This list will be kept secure in a password-protected file and will only be accessible to me. Once I finish collecting information from all participants, the list linking your name to the study ID will be destroyed, ensuring your confidentiality. Participants' names or any other identifying facts will not appear in this dissertation, nor will any presentations or publications that result from this study.

If you are interested in participating or have questions about this research, please contact me at *678-471-2016, Sao54105@uga.edu*. If you have any complaints or questions about your rights as a research volunteer, contact the IRB at 706-542-3199 or by email at IRB@uga.edu.

Please keep this letter for your records.

Sincerely,

Sarah Allen

# Appendix C

## INTERVIEW PROTOCOL

**Introduction**

I will begin the meeting by introducing myself, sharing my background, and explaining my role in the research.

**Student Disclosure**

I will explain the study's relevance in understanding the experiences of STEM faculty in providing extended test time accommodations and how the insights will contribute to improving the educational environment for students with disabilities.

**Explanation of the Study**

I will describe the research process, including the data collection methods (semi-structured interviews and document analysis) and their expected involvement duration.

**Stop for Their Questions**

I will allow participants to ask any questions about the study. I will address their questions or concerns and provide clarifications to ensure they fully understand the study's intent and procedures.

**Review Informed Consent**

I will go over the informed consent document with the participants, outlining the following key points:

- **Voluntary Participation**: I will emphasize that their participation is voluntary without any consequences if they choose to withdraw from the study at any time.
- **Confidentiality**: I will explain the measures in place to protect their identity and the confidentiality of the information they provide through the anonymity of pseudocodes.

- **Data Usage**: I will clarify how the data collected will be used, stored, and eventually disposed of as per ethical research practices.
- **Benefits and Risks**: I will outline any potential benefits of participating in the study, such as contributing to a better understanding of educational practices and potential improvements in accommodations. I will also address any minimal risks associated with participation.
- **Contact Information**: I will provide my contact information and that of the university's research ethics board should they have any further questions or concerns after the meeting.

**Obtaining Consent**

After reviewing the informed consent, I will ensure that participants have understood all aspects of their involvement. I will answer any remaining questions they may have. If they agree to participate, I will guide them through signing the digital consent form (see Appendix B).

**Interview Questions**

Table 1 and Appendix D list the interview questions I plan to ask and their rationale and justification for being asked.

**Closing Remarks**

I will thank the participants for their time and willingness to contribute to the study. I will inform them about the next steps, including scheduling the interview sessions and any additional information they need to prepare for participation.

# Appendix D

## INTERVIEW QUESTIONS WITH RATIONALE

| INTERVIEW QUESTION | RATIONALE |
|---|---|
| Can you describe your experiences with providing accommodations to undergraduate students, particularly in the context of the competitive and resource-intensive environment of an R1 institution? How do you perceive their needs and abilities in comparison to graduate students? | Sanford's Challenge and Support Theory (Sanford, 2003); Constructivism |
| What challenges have you encountered in offering extended test time accommodations, and how do you think these challenges differ between R1 institutions and regional or teaching-focused institutions? In your opinion, what factors influence your decision to provide accommodations to graduate students as opposed to undergraduates? | Sanford's Challenge and Support Theory (Sanford, 2003); Disability Studies (Jarman et al., 2023) |
| What are your thoughts on the effectiveness of extended test time accommodations for students with disabilities in an R1 context? | Universal Design for Learning (UDL) (Roski et al., 2021); Constructivism |
| How have your attitudes and beliefs about extended test time accommodations changed, | Constructivism; Disability Studies (Jarman et al., 2023) |

| | |
|---|---|
| especially in response to the competitive demands of an R1 institution? | |
| In what ways do you think extended test time accommodations affect learning outcomes for students with disabilities in the competitive environment of STEM courses at R1 institutions? | Universal Design for Learning (UDL) (Roski et al., 2021) |
| Can you share specific instances where extended test time accommodations significantly impacted student performance in your STEM courses? | Constructivism; Universal Design for Learning (UDL) (Roski et al., 2021) |
| How does your institution's policy on accommodations, particularly within an R1 research-focused environment, influence your ability to provide extended test time? | Disability Studies (Jarman et al., 2023); Sanford's Challenge and Support Theory (Sanford, 2003) |
| What kind of support and resources have you received from your R1 institution to offer these accommodations effectively, and how do you think these resources compare to those available at regional institutions? | Sanford's Challenge and Support Theory (Sanford, 2003); Disability Studies |
| How do you balance the need for accommodations with maintaining the rigor of your STEM courses in the highly | Sanford's Challenge and Support Theory; Constructivism |

| | |
|---|---|
| competitive, research-driven environment of an R1 institution? | |
| What are your thoughts on extending test time accommodations to all students, including those who may need them but have yet to explicitly request them? How might this approach prevent potential disadvantages resulting from a lack of self-advocacy? | Universal Design for Learning (UDL) (Roski et al., 2021) |
| In your experience, how could extending test time to all students impact those who might otherwise struggle without accommodations, potentially affecting their resilience and competitiveness in STEM courses? | Universal Design for Learning (UDL) (Roski et al., 2021) |
| How might offering extended test time to all students, rather than only those who request it, contribute to creating a more inclusive learning environment in your STEM courses that is not dictated by normative and ableist views? | Universal Design for Learning (UDL) (Roski et al., 2021) |
| What formal training have you received on the legal requirements for accommodations for students with disabilities, including extended test time? | Legal Frameworks (ADA, Section 504) |

| | |
|---|---|
| How confident are you in understanding the legal implications of providing or denying accommodations such as extended test time? | Legal Frameworks; Disability Studies |
| What role does institutional legal guidance play in your decision-making process when offering accommodations? | Legal Frameworks |
| Have you encountered situations where legal or institutional policies on accommodations were unclear or difficult to implement in STEM courses? | Legal Frameworks; Disability Studies |

# Appendix E

## DEMOGRAPHIC QUESTIONS FOR PARTICIPANTS

**Academic Rank:**

- Please indicate your current academic rank.
    - Assistant Professor
    - Associate Professor
    - Full Professor
    - Other (please specify): _____

**Years of Experience:**

- How many years have you been teaching in your current position?
    - Less than 1 year
    - 1-3 years
    - 4-6 years
    - 7-10 years
    - More than 10 years

**STEM Courses Taught:**

- In the past five years, how frequently have you taught STEM courses?
    - Never
    - Rarely
    - Occasionally
    - Frequently

- Very Frequently

**Experience with Extended Test Time Accommodations:**

- How often have you provided extended test time accommodations to students with disabilities in your undergraduate STEM courses?
  - Never
  - Rarely
  - Sometimes
  - Often
  - Very Often

**Interaction with Office of Disability Services:**

- How frequently do you interact with your institution's Office of Disability Services regarding accommodations?
  - Never
  - Rarely
  - Sometimes
  - Often
  - Very Often

**Training and Professional Development:**

- How much formal training or professional development have you received related to disability accommodations and inclusive teaching practices?
  - None

- Minimal
- Some
- Moderate
- Extensive

# Appendix F

## EMAIL TO SITE'S (UNIVERSITY'S) OFFICE OF DISABILITY SERVICES

**Subject:** Assistance in Identifying Faculty for STEM Accessibility Research

**To:** Office of Disability Services,

I am Sarah Allen, a doctoral candidate at The University of Georgia. I am conducting a study as part of my dissertation, which is to be submitted to the Graduate Faculty of The University of Georgia in partial fulfillment of the requirements for the degree of Doctor of Education. The study is on extended test time accommodations in undergraduate STEM courses to enhance accessibility and inclusivity in STEM education.

To achieve our research objectives, we are looking to recruit a diverse group of 8-12 STEM faculty members who have experience with or insights into extended test time accommodations. I am seeking your assistance in identifying potential participants for this study. If possible, could you provide contacts of eligible faculty members interested in participating?

I have attached a flyer for the study and would appreciate the opportunity to share it with your office for distribution to interested faculty members.

Please feel free to reach out if you have any questions or require further information.


STEM
HELP DISABILITY SERVICES STAFF WORK BETTER WITH STEM FACULTY!
STUDY : HOW FACULTY TEACHING UNDERGRADUATE STEM COURSES EXPERIENCE EXTENDED TEST TIME ACCOMMODATIONS
Researcher: Sarah Allen
DRIVE CHANGE IN STEM
Contribute to:
Better informed disability services staff
Helping staff understand faculty perspectives
WHY PARTICIPATE?
Help improve support for faculty
Increase STEM enrollment
STUDY DETAILS
Confidential
45-minute Zoom interview with the researcher
SCAN CODE TO PARTICIPATE
678.471.2016
Sao54105@uga.edu

Sincerely,

Sarah Allen

678.471.2016

*Sao54105@uga.edu*