UNIVERSAL DESIGN FOR LEARNING IN POSTSECONDARY EDUCATION: MEASURE AND EXPLORE PERSPECTIVES OF STUDENTS WITH DISABILITIES

A Dissertation

by

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ABSTRACT

The purpose of this dissertation was to examine the attitudes of faculty and students with disabilities toward Universal Design for Learning (UDL) teaching practices. The first article reviewed studies related to faculty attitudes toward and applications of UD teaching practices in their classes. Results of the review revealed the factors that influenced faculty members' attitudes toward and applications of UD teaching practices. Some studies showed a gap between faculty members' positive attitudes toward UD teaching practices and their limited applications. The second article examined attitudes held by students with disabilities related to UDL teaching practices and whether these practices were implemented by instructors in classrooms from students' point of view. An online survey was administered at a large public research university in the south-central United States. The article indicated, among other findings, that most UDL teaching practices were considered important by students; however, students perceived that some important UDL teaching practices were not fully addressed by instructors. The third article described a study that served as a follow-up to the second study to further examine the learning experiences of students with disabilities in regard to UDL teaching practices. The third study used a qualitative research method, interpretative phenomenological analysis (IPA), to conduct the study. Students with disabilities who previously participated in the online survey were invited to join focus groups for this study, and ten participants were divided into three focus groups for data collection. The standard IPA data analysis process was used to analyze the data, and seven final themes were identified in addition to other findings and discussions presented.

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NOMENCLATURE

PSE	Postsecondary Education
UD	Universal Design
UDI	Universal Design for Instruction
UID	Universal Instructional Design
UDL	Universal Design for Learning
EFA	Exploratory Factor Analysis
CFA	Confirmatory Factor Analysis
IPA	Interpretative Phenomenological Analysis

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I. INTRODUCTION

In the 21st century, work and learning environments have been rapidly changing. As Wehmeyer et al. (2019) described the evolution in career development; the essential job skills needed for career readiness are not the same as in past decades. This change has reshaped the teaching practices and instruction provided by teachers. Students are also exposed to different learning experiences for lifelong career development.

This evolution can also be found in legislation, such as the Americans with Disabilities Act and Section 504 of the Rehabilitation Act, which demonstrate the importance of protecting the rights and accessibility of individuals with disabilities in multiple contexts, including education. Because of this legislation, individuals with disabilities are able to continue their education and prepare for their careers through postsecondary education.

As higher education institutions open their doors for students with diverse backgrounds, student attrition is an issue that needs to be addressed. O'Keeffe (2013) explored groups of students who were at risk of noncompletion of postsecondary education. These groups of students included those who experienced financial and social hardships, students of ethnic minorities, students with disabilities, probationary students, and first-generation students. O'Keeffe identified that the risk of noncompletion remains due to the role expectations of students that are applied to them. For majority students, meeting role expectations is effortless, as they have resources and support to help them throughout their education. For disadvantaged students, however, failing to meet role expectations can lead to those students dropping out of school.

One of the main solutions to support disadvantaged students, including students with disabilities, is improving accessibility. Michalski et al. (2017) described the effort made by

postsecondary institutions to increase access for students with disabilities, such as creating an accessible environment. Michalski et al. also emphasized that campus cultures play an important role in supporting disadvantaged students. Postsecondary institutions should create a welcoming and inclusive campus climate for all students. To better increase accessibility and create a welcoming learning environment, a scientifically valid framework, Universal Design for Learning (UDL), has been proposed by the research community as a theory that uses multiple teaching practices to teach all students (Eitzen et al., 2016). UDL is an approach used to accommodate students' diverse learning needs. The UDL framework is grounded in neuroscience (Meyer & Rose, 1998). Researchers have found three neuro pathways that affect the learning process, and they have used these three pathways to propose three principles: multiple means of representation, multiple means of expression, and multiple means of engagement.

Compared to students without disabilities, students with disabilities may experience more challenges (e.g., Kreider et al., 2015). The literature has demonstrated that UDL is one of the most effective ways to support students with disabilities (Smith & Buchannan, 2012). UDL teaching practices can be implemented to maximize flexibility in presenting course information. These practices also reduce the learning barriers by providing choices for students as to how they demonstrate what they learned in class and how they want to be engaged in class.

The implementation of UDL teaching practices relies on the effort of instructors. In order to encourage instructors to implement these practices, several studies found it important to investigate faculty attitudes toward UDL teaching practices. These studies also explored whether faculty implemented the practices in their classrooms. The results of these studies informed practices of professional training for instructors. For instance, one study proposed using a

measurement to survey instructors' comfort levels with using the practices (Dallas et al., 2014). Another study suggested providing concrete examples of how to implement UDL teaching practices in different areas (Dallas & Sprong, 2015). Dallas and Sprong also suggested that students with disabilities should be invited to participate in the professional training for instructors. Students with disabilities could share their perspectives on UDL teaching practices and demonstrate how teachers can use the practices to support the students.

Recently, the research community has suggested that students' voices can inform practices (e.g., Quaglia & Corso, 2014). Student perspectives toward UDL teaching practices can be found in studies. For example, two studies invited students to complete a survey to evaluate whether the UDL professional training was effective for instructors wishing to implement the practices (Davies et al., 2013; Schelly et al., 2011). These studies demonstrated what and why practices worked for students individually. Another study interviewed students with disabilities to demonstrate the possible benefits and drawbacks of using UDL teaching practices (Griful-Freixenet et al., 2017). Overall, these studies highlighted the importance of student perspectives when using UDL. In addition, the results of the studies also revealed students' self-determination and autonomy while they shared their ideas and perspectives toward their university experiences.

In an effort to contribute to existing research, this dissertation is comprised of three articles. In the first article, the researcher reviewed the studies regarding faculty attitudes and actions toward UDL practices. The growing body of studies invited faculty or instructors to express their attitudes toward UDL practices and to show whether they implemented the practices in their classrooms. These studies had significant implications for designing professional development for faculty or instructors. The researcher, therefore, reviewed these studies and synthesized strategies for developing a UDL-related training program for instructors.

In the second article, the researcher used an online survey to explore the attitudes of students with disabilities toward UDL teaching practices. The online survey also asked students with disabilities whether they had experienced an instructor utilizing the practices. The researcher used descriptive statistics to demonstrate what teaching practices were considered important by students and whether these practices were implemented by instructors. Moreover, the researcher used inferential statistics to demonstrate the relationship between participants' demographic variables and their attitudes toward and perceptions of UDL practices.

The third article served as a follow-up to the second study. Based on responses from the online survey, the researcher used online focus groups to interview students with disabilities. During the focus groups, the researcher further explored participants' perspectives toward UDL teaching practices. In addition, the UDL framework involves the learning practices of goal setting, planning, and monitoring (The Center for Applied Special Technology, 2018); therefore, the researcher also explored the connection between UDL and self-determination based on participants' perspectives.

The researcher identified gaps in each article regarding research about UDL studies in postsecondary education, thereby emphasizing why the three articles in this dissertation are essential. Consequently, the following questions guided these three articles:

First article:

(a) What factors influenced faculty's attitudes and actions toward applications of UD principles?

(b) Did a gap exist between the attitude and action responses?

(c) What suggestions did the literature imply for UD-based training opportunities for faculty?

Second article:

(a) What UDL practices were considered important by students with disabilities?

(b) What UDL practices were being used by instructors or faculty members based on the perceptions of students with disabilities?

(c) Based on the attitudes and perceptions of students with disabilities, what UDL practices were considered important and addressed satisfactorily?

(d) Based on the attitudes and perceptions of students with disabilities, what UDL practices were considered important but not addressed satisfactorily?

(e) How do demographic variables (e.g., gender, academic department, and academic year) affect students' attitudes and perceptions of UDL practices?

Third article:

(a) How do students with disabilities describe their college experiences?

(b) How do students with disabilities describe their learning experiences with UDL teaching practices?

(c) How do students with disabilities describe their learning experiences without UDL teaching practices?

II. UNIVERSITY FACULTY ATTITUDES AND ACTIONS TOWARD UNIVERSAL DESIGN: A LITERATURE REVIEW[1]

Recently, the number of students with disabilities attending postsecondary education (PSE) has risen. As many as 19% of undergraduates reported having a disability (National Center for Education Statistics, 2019). Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 paved the way for students with disabilities to receive PSE. In today's society, individuals with disabilities participating in PSE are viewed as representing diversity and inclusion. However, research shows that students with disabilities have encountered challenges in adjusting to the PSE environment (e.g., Lindsay et al., 2018; Redpath et al., 2013).

One of the major challenges students with disabilities face is identifying appropriate services or academic accommodations. In PSE, once students with disabilities are otherwise qualified to attend a program, the PSE institution is required to provide them with reasonable accommodations (ADA Amendments, 2008; Rehabilitation Act, 1973). However, due to the differences in regulations between secondary education and PSE, students with disabilities in PSE must take the responsibility to self-disclose their disabilities and apply for academic accommodations (Madaus & Shaw, 2006). Once students get approval for accommodations from the campus disability services office, receiving accommodations is not automatic. The student must still talk with their instructors to facilitate the necessary accommodations.

The disclosure process could place students at a disadvantage and result in several issues. The first issue is related to stigma and discrimination. Studies identified barriers to the

1. Li, Y., Zhang, D., Zhang, Q., & Dulas, H. (2020). University faculty attitudes toward disability and universal design: A literature review. *Journal of Inclusive Postsecondary Education, 2*, 1-20.

application and utilization of disability supports by students with disabilities in PSE (Dowrick et al., 2005; Lyman et al., 2016). For example, students with disabilities feared potential negative social reactions from professors and peers, causing hesitation in utilizing accommodations. The phenomenon is even more evident for students with hidden disabilities, such as a learning disability, because instructors tend to overlook their needs (Moriña, 2017). The second issue students with disabilities in PSE experience is a lack of knowledge of available supports (Redpath et al., 2013). Students with disabilities may not realize their needs for accommodations, or they may lack the knowledge regarding eligibility and the documentation requirements needed to access these accommodations. Third, students may be reluctant to disclose their disabilities in order to access accommodations and may choose to use their own means to deal with academic challenges (Lyman et al., 2016). Consequently, they might risk failing classes. The fourth issue is associated with self-determination skills. Yamamoto, Stodden, and Folk (2014) stated that individuals with disabilities have fewer opportunities to practice self-determination skills. Thus, these individuals may not possess the skills to advocate for themselves. Gil (2007) also highlighted the importance of self-advocacy for students with disabilities prior to the implementation of their post-secondary career plan. One way to help students with disabilities enhance their roles as self-advocates is learning their rights and responsibilities.

Another challenge that students with disabilities face in acquiring accommodations is the lack of understanding and cooperation from faculty who have concerns over providing accommodations in their classes. Scott, McGuire, and Shaw (2003) stated that although most faculty are the experts in their specific areas, pedagogy or effective instructional strategies are not accentuated in their professional careers. Due to the lack of training in instructional practices, faculty may not have the adequate knowledge to provide appropriate accommodations. Without

training in providing accommodations for students with disabilities, college instructors have understandable concerns that they will be asked to modify instruction and compromise the course standard (Lombardi, Murray, & Gerdes, 2011). These concerns hinder faculty from properly providing accommodations for students with disabilities.

Since the process of applying for accommodations can be challenging to both students and instructors, some university stakeholders are considering other alternatives to support students with disabilities. In recent years, the concept of universal design (UD) has drawn considerable interest among university faculty and the PSE research community. The Higher Education Opportunity Act emphasizes the value of UD and considers UD a "scientifically valid framework for guiding educational practice." The Centre for Excellence in Universal Design (2020) defined UD as "the design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by all people regardless of their age, size, ability or disability."

Scholars have developed two UD primary models and applied these models in the education field. Universal Design for Instruction (UDI) is a model pertaining to instructional practices. Scott, McGuire, and Shaw (2003) proposed nine primary principles for UDI: equitable use, flexibility in use, simple and intuitive, perceptible information, tolerance for error, low physical effort, size and space for approach and use, a community of learners, and instructional climate. The other model is Universal Design for learning (UDL), which focuses on learners' learning experience, includes three principles: multiple means of representation, multiple means of expression, and multiple means of engagement (Meyer & Rose, 1998). Principles from UD models ensure every learner can benefit from the whole environment. The proactive nature of UD creates a more tolerant learning atmosphere in classrooms that addresses the various needs of

all students. Pliner and Johnson (2004) showed that UD is an effective approach to promote inclusion for diverse learners. Consequently, university stakeholders have adopted UD as one of the ways to include and support diverse students, particularly those who are historically under-represented in higher education. By doing so, the need for accommodations is minimized (Dallas & Sprong, 2015; Lombardi & Murry, 2011).

Previous research investigated and discussed how faculty or instructors created a UD-based curriculum and instruction (e.g., Rao et al., 2014; Roberts et al., 2011). In PSE settings, for example, studies showed that preservice teachers can learn to design a lesson plan by incorporating UD principles (Mcguire-Schwartz & Arndt, 2007; Spooner et al., 2007). In another example, Rose et al. (2006) employed multiple means to represent instruction, including traditional lectures, providing sign language interpreters, and videotaping each lecture and placing the video on a website. Rose et al. also asked some students to take notes and displayed these notes to every student. Sharing lecture notes facilitates collaborations and discussions among students. Students recreate and organize what they have learned in class, making the learning process more personally relatable and helping them to interact with the course content.

Faculty can also benefit from using UD principles. Rose et al. (2006) indicated that faculty and instructors have strengths and weaknesses; UD provides "choices" for instructional methods. They can choose the way they are more comfortable interacting with and teaching students. Supporters of UD have suggested that PSE faculty should be required to take a leadership role in the applications of UD principles (Dallas et al., 2016).

University faculty play an important role in the applications of UD. A clear understanding of faculty's attitudes toward and applications of UD will help plan training opportunities for college instructors and learn their barriers when applying UD principles.

Studies used a researcher-designed instrument to investigate faculty's attitudes and actions toward UD principles (e.g., Dallas et al., 2016). These studies explored factors that influenced faculty's attitudes and actions toward UD principles. Some of the studies found a gap between attitudes and actual applications. For example, due to the lack of experiences and knowledge of applying UD, even though faculty considered the applications important, their actual applications were low. In order to address the gap, these studies suggested certain training activities or approaches that would help faculty apply UD in their classes.

The study examined the current state of research that investigated PSE faculty's attitudes and actions toward UD by conducting a systematic review of the literature. This study used UD to refer to UDL or UDI, because principles from both models are relevant and similar. The primary purpose of this study was to review literature regarding faculty's attitudes and actions toward the applications of UD principles in PSE. The secondary purpose of this study was to investigate implications for faculty training opportunities. The research questions for this study were: (a) what factors influenced faculty's attitudes and actions toward applications of UD principles? (b) did a gap exist between the attitude and action responses? and (c) what suggestions did the literature imply for UD-based training opportunities for faculty?

Method

Search Procedures

The study used a literature search process derived from Booth, Sutton, and Papaioannou (2016). The literature search process helped validate the search results and was comprised of five stages. First, initial search of the literature: the researcher searched existing reviews, learned about the UD-related existing research, and found two existing reviews which gave the researcher insight into determining the databases and key search terms (Rao et al., 2014; Roberts

et al., 2011). Second, conduct search: the researcher used four databases to search by using the identified search terms. Third, bibliography search: in addition to searching databases, the researcher also searched the articles by the reference lists of all papers for additional studies that the researcher did not find in online databases. Fourth, verification: the researcher revised the searching process after discussion with an expert. Fifth, documentation: the researcher documented the details and made notes with the inclusion and exclusion criteria when determining useful studies during the search process.

The study used EBSCOHost to conduct the literature search using the following databases: PsycINFO, Education Full Text (EBSCO), Psychology and Behavioral Sciences Collection and ERIC. Primary keywords were used to generate results targeted to "*participants"* (e.g., faculty, professors, instructor, college teachers), "*UD models"* (e.g., universal design for learning, universal instructional design, universal design of instruction, and universal design), and "*context"* (e.g., college, university, postsecondary education); in addition to the primary keywords, the following secondary keywords were used: disabilities, or students with disabilities. The search terms generated 216 articles across the databases. In the first round, the researcher screened articles by reading the title and abstract to exclude the studies that did not meet the inclusion criteria. In the second round, the researcher skimmed through the text if necessary.

Screening: Inclusion and Exclusion Criteria

The researcher selected studies for review based on the following four inclusion criteria. First, study participants had to be faculty, instructors, or college teachers in higher education, such as research professors and clinical professors in four-year universities or a community college. To gather more in-depth results, teaching assistants (TAs) could be participants as well.

Second, the dependent variable had to present faculty's attitudes or actions toward applications of UD principles. Third, the selected studies had to use an instrument which included UD models or principles. Fourth, the studies had to be written in English and published in peer-reviewed journals.

The researcher applied three exclusion criteria in selection of studies. First, the researcher excluded those studies that only included students or disability service providers as participants. Second, the researcher excluded studies that used traditional accommodations rather than using UD models or principles as a framework to design their instrument because the instrument was not appropriate for this study. Third, the researcher excluded studies whose purposes did not align with purpose of this study; that was studies investigated intervention effects by incorporating different UD models into instruction and did not particularly explore faculty's attitudes toward these UD models.

After two rounds of the screening process, the researcher identified 14 studies that met the inclusion criteria. These articles were used to analyze faculty's attitudes and actions toward applications of UD principles.

Coding and Interrater Reliability

Two raters coded the 14 articles. The coding table consisted of the following categories: including research methods, participants, selected instruments, results, and discussions and implications. The two raters checked interrater reliability using a three-phase process. The first phase was coding training. In this training phase, the raters coded one article together, discussed the coding process, and then the raters reached consensus about the definition of each category. The definitions are as follows: (a) research methods: the design and strategy used to implement a research plan. (b) participants: persons who took part in research, only including number of

participants and specifying a context if authors conducted their studies across different settings. (c) selected instruments: tools authors used in research to collect data. (d) results: faculty's attitudes and actions toward applications of UD principles (including factors and a perceived gap between attitudes and actions). (e) discussions and implications: suggestions for faculty training opportunities. Second, the raters coded three articles independently and checked interrater reliability using the following formula: the number of agreements divided by the total number of agreements plus disagreements then multiplied by 100. This process allowed the raters to check whether both raters had recorded the same information from the studies. In the second phase, if there were discrepancies on selected passages or information from studies, the raters resolved it by discussing the definition of each category and the selected passages again to reach an agreement on the information from the studies. In the third phase, the raters continued to code the remaining 10 articles and discuss the discrepancies if necessary. After completing the coding process, the researcher, who is one of the raters, organized the coding table and checked each category to ensure the information was correct. The average interrater agreement was 86%. The inconsistences lay in the part of discussion and implications. Both raters agreed that most of the studies discussed the necessity of disability-related training for faculty, however, they had extracted different information about the development of disability-related training. After several discussions and reading the passages again, the raters broadened the definition for discussions and implications in order to get rich details noting how service providers can develop an effective disability-related training experience for college teachers.

Results

Table 2-1 includes a summary of studies that have addressed faculty's attitudes and actions toward applications of UD principles. It also includes a summary of suggestions for faculty training opportunities.

The Factors Influencing Faculty's Attitudes and Actions

The findings of these studies identified the following factors that influenced faculty's attitudes and actions toward applications of UD principles: age, ethnicity, academic rank, and gender. For example, Gawronski, Kuk, and Lombardi (2016) showed that respondents who were 35-44 years old and of European heritage had a slightly higher tendency to implement UD principles. Non-tenured faculty demonstrated more willingness to provide UD-based instruction (e.g., Lombardi et al., 2011). Hartsoe and Barclay (2017) demonstrated that female faculty were more likely to adopt UD principles. Academic discipline also influenced faculty's attitudes and actions. For example, Lombardi and Murray (2011) found that faculty in the College of Business and Architecture were more likely to minimize instructional barriers and make course materials accessible. Similarly, Dallas, Upton, and Sprong (2014) found that faculty from the College of Applied Sciences and Art and Mass Communication and Media Arts had more positive attitudes toward the UD principles. Some studies identified a university setting as an influencing factor. Lombardi, Vukovic, and Sala-Bars (2015) investigated faculty's attitudes toward UD-based and inclusive instructions across three countries. This study showed that a university context had an influence on attitudes and actions toward inclusive instruction strategies. Similarly, Lombardi, Murray, and Dallas (2013) also discovered that different university environments resulted in significant differences. However, Dallas et al. (2016) did not find any differences among different universities. Experiences of teaching or interacting with individuals with disabilities

also resulted in differences in attitudes and actions of using the principles (e.g., Black et al., 2014).

In addition, previous disability-related training played a crucial role in shaping faculty's attitudes and actions toward applications of UD principles. Many studies showed that regardless of the amount of the training hours, faculty who had disability-related training were more likely to incorporate UD principles in their instructions and consequently had more positive attitudes toward UD (e.g., Lombardi & Murray, 2011). Although studies did not explicitly define the training topics, training can provide disability-related knowledge, inclusive teaching strategies and information regarding UD principles and guidelines.

Attitudes and Actions toward the Applications of UD Principles

From the synthesis of these research studies, the findings on attitudes and actual actions were mixed. For example, in Dallas et al. (2016), the study presented consistent results on attitudes and actions dimensions, meaning that faculty who had positive attitudes toward inclusive strategies were more likely to embed these practices into instruction. LaRocco and Wilken (2013) found that faculty were nonusers of the practices, and the stage of concern focused on learning the new strategies. Faculty were also uncertain about whether they had the abilities to perform these strategies.

Even faculty who expressed positive attitudes toward applications of UD-based practices reported the actual implementations were limited on some of the subscales (Lombardi et al., 2011). They also found counterintuitive results on some subscales, showing that faculty were adopting the inclusive teaching strategies based on UD principles even when they did not have positive attitudes toward these principles. Similarly, Lombardi et al. (2015) noticed a gap between attitudes and actual applications of UD principles, especially from faculty in American

and Spanish universities. Cook, Rumrill, and Tankersley (2009) found that faculty considered UD principles important, but did not implement them fully in the classroom. West, Novak, and Mueller (2016) also noted inconsistent attitudes and actions in some subscales.

Suggestions for Training Development

Some studies demonstrated the need for disability-related training. For example, in the Cook et al. study (2009), faculty rated the UD principles important but did not have enough knowledge on how to implement these principles in classrooms. LaRocco and Wilken (2013) found that faculty did not use UD principles even though they believed these innovative UD-based practices might enhance their preparation for instruction. These researchers further suggested that training could enhance instructors' confidence to implement UD-based practices. Izzo, Murray, and Novak (2008) conducted focus groups to investigate the use of UD principles by faculty. Participants expressed that they were frustrated with the barriers and challenges that impeded them from addressing the learning needs of diverse learners, and 27% of the participants indicated that they were interested in attending UD principle trainings.

Another reason why disability-related training should introduce UD principles is that faculty considered that some UD-based practices may either compromise course standards or require numerous modifications of instruction and resources. Dallas et al. (2016) found that some faculty were hesitant toward some UD-based practices while they were in favor of others. For example, some faculty were willing to provide a minor accommodation if the accommodation did not take more time and resources to prepare. Faculty also had a concern that certain specific practices such as assessment adjustments might compromise course standards. To reduce these

concerns and increase faculty's willingness to implement UD principles, it is necessary to provide faculty with disability awareness training including the introduction of UD principles.

Studies also suggested ways to develop disability-related training. For example, service providers, who plan training development for faculty, can use an instrument or a survey to identify the needed topics. The instrument can serve as a self-assessment for instructors to examine their instruction (e.g., Lombardi et al., 2015). Other suggestions include: collaborations between service providers and academic departments to enhance the effectiveness of training (e.g., West et al., 2016), inviting students with disabilities to be co-presenters in training (e.g., Dallas & Sprong, 2015), and delivering training in multiple ways such as a workshop and printed materials. Service providers can also embed various scenarios in their training that exemplifies the process of applying UD-based practices (Lombardi et al., 2013).

Discussion

UD is a revolutionary paradigm that changes how college students use campus resources (Block et al., 2006). This review revealed that multiple factors played important roles in influencing faculty's attitudes and actions toward applications of UD. Among these factors, previous disability-related training had a tremendous impact on how faculty perceived UD principles. Murray, Lombardi, Seely, and Gerdes (2014) demonstrated the effectiveness of short-term training to improve faculty's self-efficacy. They conducted a four-day disability-focused training covering a wide range of topics including universal design principles. At the end of the training, faculty were more confident to apply inclusive instructional strategies and support students with disabilities.

However, many post-secondary stakeholders do not know how to develop a training program. This study organized the following steps from the synthesis of research studies. First,

before developing a professional training, service providers can use an instrument or a survey to evaluate faculty's attitudes and experiences regarding embedding UD principles into instruction. It is also important to explain the direct or indirect links between effective teaching strategies and students' academic performance. Item-level scores or subscale scores on the measurement can give insight into the strengths and weaknesses of faculty in certain areas. Due to the diverse backgrounds of faculty, it is a good idea to consider faculty demographic characteristics when selecting applicable training topics for a specific faculty group. Second, the training should focus on practical steps of implementing UD principles. Sometimes, faculty may be willing to apply these principles, but are unsure how to do it without compromising course standards (Cook et al., 2009). In light of this concern, Ouellett (2004) suggested faculty start by identifying major course components and expectations for students. By doing so, course standards will not be compromised and students will benefit from knowing the course expectations upfront. Third, a collaborative model can be used to implement training. For example, students with disabilities can be co-presenters and share how their disabilities affect the learning process, and how UD principles can meet diverse learning needs. Gawronski et al. (2016) found the comparison of perspectives between faculty and students led to a clear pattern of the essential training topics. Black et al. (2014) also found a gap between the faculty's and students' attitudes toward instructional strategies derived from UD principles, which strengthens the need to include students' learning experiences as one of the considerations when developing a training opportunity for faculty. Another example is the collaboration between various campus units and academic departments. At Texas A&M University, the Center on Disability and Development, the Department of Disability Resources, and the Center for Teaching Excellence have collaboratively offered disability awareness workshops to campus communities. A collaborative

model brings together resources for a more diverse training experience for participants. Fourth, disability-related training can be delivered in different ways (Lombardi et al., 2011), such as workshops, courses, books, articles, websites, and brochures, which are all useful methods to disseminate information and give faculty options to gain knowledge without influencing their tight schedules. Although the steps to develop a UD-based training program are not comprehensive, equipping faculty members with extensive knowledge of UD will allow postsecondary education institutions to become more inclusive. The application of UD principles in postsecondary education settings will allow diverse learners to reach their goals and realize their potential.

In addition to faculty, similar training can be offered for all students, including students with disabilities. Self-determination should be one of the foci in the training. Due to the differences between secondary education and PSE, students in higher education have the responsibility to gain a better understanding of their learning. When teaching students with disabilities to speak up for themselves, this study suggests using a self-determination model such as Field and Hoffman's (2015) Action Model for Self-Determination. This model consists of five steps: Know Yourself and Your Context, Value Yourself, Plan, Act, and Experience Outcomes and Learn. Once students learn the UD principles and practices, they can apply these principles and practices into real life of advocating for themselves. First, students understand their disability and its impact on their learning (Know Yourself and Your Context). Second, through learning UD principles and practices, students consider and indicate which practices are most applicable to them. Every student is unique and should consider practices that are more applicable to them (Value Yourself). Third, students make a plan to discuss these practices with their instructors (Plan). Fourth, students use self-advocacy and communication skills to communicate these

practices with instructors (Act). Fifth, if instructors agree to implement these practices, students can assess how UDL practices help them learn more efficiently (Experience Outcomes and Learn).

Most studies used researcher-designed instruments addressing multiple facets of disability-related knowledge and law, while very few studies used a survey solely based on a UD model. Some studies investigated faculty's attitudes and actions toward providing accommodations. Although UD principles and accommodations seem to overlap to a certain extent, the spirit of universal design and accommodations are quite different. Block et al. (2006) expressed that the idea of providing accommodations can be replaced with a UD model. Other studies also suggested that the concept of applying UD is different from providing accommodations (e.g., West et al., 2016). In addition, Pliner and Johnson (2004) suggested UD transforms teaching practices to create an inclusive learning classroom. Postsecondary education opens its doors to welcome diverse learners, which results in changing student demographics and characteristics. Hence, research instruments, which measure faculty's perspectives and opinions toward inclusive instructional practices, should be developed by presenting UD models only (Hartsoe & Barclay, 2017). For example, Schelly, Davies, and Spooner (2011) developed a survey based on the three UD principles (multiple means of representation, expression, and engagement) to investigate students' perceptions of faculty implementations of UDL principles in classrooms. Among UD educational models, UDI is suggested to be primarily applied in postsecondary education settings (Pliner & Johnson, 2004; Black et al., 2014). If an instrument focuses on UDI principles, it facilitates the understanding of how faculty view these practices and the specific practices that faculty feel difficult to perform. Moreover, the instrument can serve as guidelines for faculty to implement UD principles in their instruction.

Through this review study, the study concluded the following differences between accommodations and UD. First, proactive versus reactive: UD adopts different methods to engage diverse students in learning before knowing their needs (proactive); accommodations are provided after knowing students' needs (reactive). Second, all diverse learners (including students with disabilities) versus students with disabilities only: All diverse learners can benefit from UD-based approaches; only students with disabilities can benefit from accommodations. Third, non-disclosure versus disclosure: By applying UD principles in classrooms, the needs for disclosure decrease because student needs are already accommodated; whereas, if no UD principles are applied in classrooms, students with disabilities need to disclose their disabilities and identify their needs. Fourth, stepping out versus staying in the box: For UD users, they try to step out of the box and use innovative teaching methods when designing curriculum; for non-UD users, they tend to keep the same teaching methods while making accommodations to respond to the needs from students with disabilities. Fifth, two-way versus one-way communication: Universal design emphasizes interactions in classrooms between students and instructors and creates a positive classroom climate; accommodations, on the other hand, create one-way communication by having students with disabilities discuss the needed accommodations with instructors.

Limitations and Implication for Future research

This study had several limitations. First, the study results were not comprehensive because only 14 studies were included. Future literature reviews should include more studies to provide a much richer and more realistic picture. Second, the literature the study has found mainly used survey methodology to collect data. Although the study obtained a clear pattern of the attitudes and actions toward UD principles through survey research, future researchers will

be more likely to acquire a deeper understanding through studies that used different research methods. Third, this review presented a basic investigation of faculty's attitudes and actions toward UD; however, focus group or one-on-one interview research is needed to obtain richer information about implementations of UD principles. Scott, Loewen, Funckes, and Kroeger (2003) suggested that future research look into the following questions before exploring the effect of applications of UD-based practices: Does UD help students with disabilities decrease reliance on others? Does UD change the way service providers provide accommodations? How do UD-based practices impact the student learning process? Finally, Black et al. (2014) demonstrated a gap between faculty and student perspectives toward teaching strategies used. This study recommends future researchers use different data collection instruments for faculty and students. In this way, direct comparison can be made between faculty and student perspectives in order to bridge the gap between what students need and what faculty can offer.

Table 2-1 Summary of the included articles.

Title	Method & Participants	Instruments	Results	Discussion & Applications
Black, Weinberg, and Brodwin (2014)	Research method: Survey methodology Participants: 73 faculty members	• The format was based on a survey developed by Izzo, Murray, and Novak (2008). • Survey items included: Faculty characteristics, disability familiarity and attitudes and familiarity with universal design. • Survey response: Some items' response indicated attitudes; others indicated actions.	• Factors influencing attitudes toward instructional methods and universal design: Affiliated college, experience of teaching students with disabilities.	• Developing training opportunities may increase faculty knowledge and experiences with teaching students with disabilities.
Cook, Rumrill & Tankersley (2009)	Research method: Survey methodology Participants: 307 faculty members from 8-campus universities	*Faculty Priorities and Understanding Regarding College Students with Disabilities Scale* • Subscales: Legal issues, UDI, characteristics of specific disabilities, accommodations-willingness, accommodations, policy, and disability etiquette. • Survey response: Importance (attitudes) and agreement (actions).	The result related to UDL: • High-importance and high-agreement: Having high expectations for all students/making learning environment accessible. • High-importance and low-agreement: Being experienced with assistive technology/using different format to present materials/making course content easily nderstood/organizing course content/promoting reciprocal interaction in classrooms.	• A gap between attitudes and actual actions provided insight into the development of disability-related training. University faculty members were not proficient at implementing specific instructional practices based on UDI.
Dallas, Upton, & Sprong (2014)	Research method: Survey methodology Participants: 381 faculty members	*Inclusive Teaching Strategies Inventory* (ITSI) • Subscales: Multiple Means of Presentation/ Inclusive Lecture Strategies/Accommodations. • Survey response: Attitudes.	• Factors influencing attitudes toward Multiple Means of Presentation: Affiliated college and training experience.	• Service poviders can use the information from the survey results to develop disability-related training. • Service Providers can determine the training topics by investigating different demographic backgrounds of faculty.

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Table 2-1 Summary of the included articles (continued).

Title	Method & Participants	Instruments	Results	Discussion & Applications
Dallas and Sprong (2015)	Research method: Survey methodology Participants: 397 faculty members	*Inclusive Teaching Strategies Inventory* (ITSI) • Subscales: Disability Laws and Concepts/Inclusive Lecture Strategies/ Accommodations/ Inclusive Assessment/Accessible Course Materials/ Inclusive Classroom, and/Course Modifications. • Survey response: Attitudes.	• Factors influencing attitudes: Number of students with disabilities taught, years of teaching experience, previous disability training.	• When designing professional training for faculty, service providers can use an instrument first, review the subscale scores and decide the training content. • Training sessions may start with an introduction to UD specific changes, which focus on practical action steps and include students with disabilities as co-presenters. • Service providers can work with teaching experts or department faculty to develop training sessions.
Dallas, Sprong, and Kluesner (2016)	Research method: Survey methodology Participants: 208 faculty members at university 1, 115 faculty members at university 2, and 99 faculty members at university 3	*Inclusive Teaching Strategies Inventory* (ITSI) • Subscales: Disability Laws and Concepts/Inclusive Lecture Strategies/ Accommodations/Campus Resources/Inclusive Assessment/Accessible Course Materials/Inclusive Classroom/Course Modifications. • Survey response: Attitudes and actions.	• Previous disability-related training positively affected attitudes and actions. • Faculty with positive attitudes toward inclusive teaching strategies are more willing to embed these practices into instruction. • There was no difference among the three universities.	• Faculty should be informed of training opportunities on different disability-related issues including UD-based practices. • The inconsistencies between actions and attitudes responses indicated that major changes are considered hard to fully implement, due to limited time, resources, knowledge and support. • Instructors review UD principles before implementation and make changes based on students' feedback.

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Table 2-1 Summary of the included articles (continued).

Title	Method & Participants	Instruments	Results	Discussion & Applications
Gawronski, Kuk, and Lombardi (2016)	Research method: Survey methodology Participants: 179 faculty members	*Inclusive Teaching Strategies Inventory* (ITSI) • Subscale: Accommodation/ /Accessible Course Materials/Course Modifications/ Inclusive Lecture Strategies/Inclusive Classroom/Inclusive Assessment. • Survey response: Attitudes and actions.	• Factors influencing actions: Age and ethnicity. • Mixed results between attitudes and actions.	• It is necessary to know the barriers faculty encountered. • The comparison of the results between faculty and students generated a clear pattern in understanding the quality of education received by students and the needed training topics for faculty.
Hartsoe and Barclay (2017)	Research method: Survey methodology Participants: 179 faculty members	*Inclusive Teaching Strategies Inventory* (ITSI) • Subscale under three domains: Inclusive Classroom Strategies/Inclusive Lecture Strategies/ Accommodations/ Course Modifications/ Inclusive Assessment/ Accessible Course Materials/Disability Law/Campus Resources. • Survey response: One response to indicate their beliefs, confidence and knowledge.	• Factors influencing the results: Faculty ranking and gender.	• Service providers can provide training on UDI principles to help faculty expand the knowledge in UDI areas. Graduate program can promote UD strategies and encourage graduate students, who might be faculty, to use UDI in college teaching.

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Table 2-1 Summary of the included articles (continued).

Title	Method & Participants	Instruments	Results	Discussion & Applications
Izzo, Murray, and Novak (2008)	Research method: Survey methodology and focus group Participants: 271 faculty members and teaching assistants	• Survey-22 questions regarding training topics and attitudes of teaching students with disabilities and using UD instructional practices. • Survey response: Some items' response indicated attitudes; others indicated actions. • Focus group topics: Experiences with students with disabilities/information requested by faculty or TA about disability and accommodations/perspectives about instructional practices/ other suggestions for enhancing learning experiences for students.	• 27% respondents stated that they wanted training on UDL. • Instructional methods used by respondents: 84% lecture, 71% class discussion and 66% critical thinking or problem-solving activities. • Themes from the results of focus groups: (a) uncertainty about handling the learning needs from a diverse student body, (b) instructional strategies used by TA and faculty to support students, (c) the need for training and technical assistance.	• Faculty and TA expressed needs for training on UDL topics. On-demand training is one of the options. • Some effective strategies have been identified. The strategies that have been suggested are related to UD concepts.
LaRocco and Wilken (2013)	Research method: Action research Participants: 46 faculty members	*CBAM (the Concerns Based Adoption Model)* • 18 questions. Questions were developed based on the three UDL principles and the nine guidelines. • Survey response: Stages of concern and levels of actions.	• More than half of the respondents reported that their stage of concern was how an innovative teaching strategy affects their preparation of a course. And their levels of actions were at an orientation level, meaning that they were nonusers of UDL.	• Disability-related training should help faculty understand why they need to learn effective teaching strategies and make a connection between classroom performance and teaching strategies.
Lombardi and Murray (2011)	Research method: Survey methodology Participants: 289 faculty members	*ExCel* • Subscales: Fairness in Providing Accommodations/ Knowledge of Law/ Adjustment of Course/ Minimizing Barriers/Campus Resources/Willingness to Invest Time/Accessibility of Course Materials/ Performance Expectations. • Survey response: Attitudes.	• Factors influencing faculty attitudes: Gender, professional rank, affiliated college, and prior training experiences.	• Service providers can use an instrument to investigate the areas of weaknesses and strengths of faculty and decide the needed topic in disability-related training. • An instrument can serve as a self-assessment for faculty to improve their teaching skills.

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Table 2-1 Summary of the included articles (continued).

Title	Method & Participants	Instruments	Results	Discussion & Applications
Lombardi, Murray, and Dallas (2013)	Research method: Survey methodology Participants: 381 faculty members at university 1; 231 faculty members at university 2	*Inclusive Teaching Strategies Inventory* (ITSI) • Subscales: Accommodations/Accessible Course Materials/Course Modifications/Inclusive Lecture Strategies/Inclusive Classroom/Inclusive Assessment/Disability Laws and Concepts. • Survey response: Attitudes.	• Factors influencing faculty attitudes: Gender, different university contexts and prior training experiences.	• Training opportunities and resources can be disseminated through more and less intensive training. • An instrument can be served as a pre- and post-assessment to see the effect of a training opportunity. • Scenarios can be used as examples to guide faculty to implement strategies in a specific situation. • Service providers can collaborate with academic departments to design the faulty training program and provide faculty with incentives to join a training opportunity.
Lombardi, Murray, and Gerdes (2011)	Research method: Survey methodology Participants: 233 faculty members	*Inclusive Teaching Strategies Inventory* (ITSI) • Subscales: Multiple Means of Presentation/ Inclusive Lecture Strategies/ Accommodations/Campus Resources/Inclusive Assessment/Accessible Course Materials. • Survey response: Attitudes and actions.	• Comparison of attitudes and actions: Most faculty who reported positive attitudes toward instructional practices also implemented actions. Two subscales were exceptions: Accommodations and Inclusive Assessment. • Factors influencing attitudes: Gender, teaching status, and disability-related training, personal experience with people with disabilities. • Factors influencing actions: Gender and training opportunity.	• Faculty may consider the major modifications as compromising the integrity and standards of courses. • Disability-related training could be delivered in different ways, such as workshops, newsletters, website tools, and resources.

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Table 2-1 Summary of the included articles (continued).

Title	Method & Participants	Instruments	Results	Discussion & Applications
Lombardi, Vukovic, and Sala-Bars (2015)	Research method: Survey methodology Participants: 231 faculty members at a single university in the U.S. 315 faculty members at a single university in Canada. 649 faculty members across 76 public and private universities in Spain.	*Inclusive Teaching Strategies Inventory* (ITSI) • Subscales: Accommodations/Accessible Course Materials/Course Modifications/Inclusive Lecture Strategies/Inclusive Classroom/Inclusive Assessment/Disability Laws and Concepts. • Survey response: Attitudes and actions.	Different results among the three countries: • The university in Canada had consistent results in attitudes and actions. • The universities in Spain and the U.S. had inconsistent results, meaning that faculty had high positive attitudes, but low actions in practices.	• An instrument, such as ITSI, can serve as a self-assessment to gain feedback from results. • Service providers can use an instrument prior to the planning of disability-related training.
West, Novak, and Mueller (2016)	Research method: Survey methodology Participants: 52 faculty members of college of education.	*Inclusive Teaching Strategies Inventory* (ITSI) • Subscales: Accommodations/ Accessible Course Materials/ Inclusive Lecture Strategies/ Inclusive Assessment/ Campus Resources/ Multiple Means of Presentation. • Survey response: Attitudes and actions.	• Inconsistent results in attitudes and actions responses: <u>Actions over attitudes:</u> Inclusive Lecture Strategies and Accessible Course Materials <u>Attitudes over actions:</u> Multiple Means of Presentation, Accommodations and Inclusive Assessment.	• Disability-related training may improve instructors' confidence and willingness to apply these vital instructional practices. • The concepts of UDL and accommodations are different and UDL should be more emphasized. • Services providers and instructors should collaborate to facilitate services. • Technology should be highlighted in the training processes.

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III. UNIVERSAL DESIGN FOR LEARNING IN POSTSECONDARY EDUCATION: MEASURING ATTITUDES AND PERCEPTIONS FROM STUDENTS WITH DISABILITIES

In the 21st century, both educational institutions and the workforce have experienced tremendous changes in disability-related issues. These changes concern educators about how to better support individuals with disabilities when they transition to postsecondary education and the job market (Rowe et al., 2015). In terms of postsecondary education, students with disabilities enter a learning environment that is not as structured as high school. Given the differences between secondary and postsecondary education laws, college students with disabilities need to disclose their disabilities and apply for reasonable accommodations to support their learning (Eckes & Ochoa, 2005). The disclosure process, however, could place students at a disadvantage and result in students experiencing stigma and discrimination. Moreover, the quality of the accommodations is not always positive, so students may apply for accommodations but not use them (Lyman et al., 2016). Scholars have called for more studies to investigate evidence-based instructional practices to support students with disabilities as they persist and succeed in postsecondary education (PSE; Dukes et al., 2017). In order to increase retention and graduation rates for students with disabilities, postsecondary institutions have tried to adopt universal design (UD) strategies to support these students. For example, Getzel (2008) suggested that UD is one of the key strategies to support students with disabilities and address retention issues. Duke and Shaw (2008) demonstrated the standards and daily practices used by the Office of Disability Services in college; one of the standards is to promote UD practices. By using UD practices on campus, students' reliance upon the Office of Disability Services can be reduced. Similarly, in Dukes et al. (2017), a four-domain taxonomy was developed to organize

the issues related to students with disabilities in PSE. In the taxonomy, UD practices are categorized as a service delivery model that needs additional study to gather empirical evidence in PSE.

The concept of UD can be traced back for decades. The earliest usage of UD was applied in architecture to make environments usable for everyone to the greatest extent possible (West et al., 2016). In the past two decades, the UD concept has been adopted in the field of education, including PSE. The basic objective of UD in education is to provide an accessible, flexible, and intuitive learning environment to address the diversity of the student body (McGuire, 2014). In other words, the main goal of the UD concept is to use teaching techniques to guide the design of the curriculum, materials, teaching methods, and assessments to support a diverse student population.

Different UD frameworks emerged, such as Universal Design for Learning (UDL), Universal Design for Instruction (UDI), and Universal Instructional Design (UID). Among these frameworks, UDL is most widely used and promoted in legislation (e.g., the reauthorization of the Perkins Act of 2018 and the Higher Education Opportunity Act of 2008). The Center for Applied Special Technology (CAST, 2020) defined UDL as: "Universal design for learning (UDL) is a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn." UDL aims to make a learning environment accessible and welcoming for a wide range of students.

To further construct UD practices for teaching students with disabilities in higher education, previous studies tended to focus on faculty attitudes and perspectives toward UD (e.g., Hartsoe & Barclay, 2017); in contrast, the voices of students with disabilities were less likely to be heard. The current study provided an avenue for students with disabilities at a

research-oriented four-year university to express their attitudes toward and perceptions of UDL practices through an online survey.

The UDL framework originated from the ideal of innovative education to meet students' individuality and teaching flexibility. CAST (2018) used brain networks to demonstrate the variability of all learners. They found three brain networks: affective networks, recognition networks, and strategic networks. The *affective networks* influence whether learners can stay motivated, engaged, and interested in learning. The *recognition networks* influence how learners perceive and understand the learning content. Finally, the *strategic networks* influence whether students can use executive function skills in learning (e.g., planning, goal setting, and monitoring). The three brain networks direct the learning paths for all learners.

Through the introduction of neurovariability, three principles of UDL—aligned with the three brain networks—were developed to facilitate and optimize the learning process. The three principles of UDL include: (a) multiple means of representation, (b) multiple means of expression, and (c) multiple means of engagement (Meyer et al., 2014). Based on these three principles, corresponding guidelines and checkpoints that demonstrate how to implement UDL in classrooms were developed. First, for multiple means of representation, the guidelines suggest that educators may present class materials in different formats, use class materials to activate prior knowledge and highlight key concepts for better comprehension, and make the language or text clear in learning. Second, for multiple means of expression, the guidelines suggest that educators may guide students to use executive function skills and provide alternative ways for students to express what they learn in class. Third, for multiple means of engagement, the guidelines suggest that educators may challenge and motivate students to persist and self-

regulate in the learning process. Overall, the UDL principles and guidelines demonstrate that classroom learning is a dynamic communication between students and instructors.

Other UDL application tips were developed as well. For example, the ACCESS project team from Colorado State University developed "UDL Quick Tips," which was based on the three UDL principles (The ACCESS Project, 2010). The UDL quick tips present four dimensions for educators to consider if they want to apply UDL: (a) objectives and benchmarks, (b) instructional materials, (c) teaching methods, and (d) assessment methods. The four dimensions basically cover the overall teaching components in classrooms to ensure that UDL principles can be fully applied.

The application of UD in higher education is a multistep process. As Burgstahler (2015) stated, a list of steps for applying universal design in higher education include: (a) identify the application, (b) define the universe, (c) involve consumers, (d) adopt guidelines, (e) apply guidelines, (f) plan for accommodations, (g) train and support, and (h) evaluate. Among these steps, the second and third—define the universe and involve consumers—remind instructors to think about the diversity of the class audience and how to involve the audience in UD applications, respectively.

Before applying UDL strategies in class, it is important to address instructors' concerns in order to maintain high academic standards and keep the essential components of a course. Smith and Buchannan (2012) showed how faculty and disability resource professionals can collaborate to create a UD strategy-based course. Before modifying a course, faculty and disability resource professionals can ask the following questions: "What is the point of the course? How is the point conveyed? What is critical to students' assessment? What can't be changed? What won't be changed? How will changes impact all students? What assumptions are

being made about students?" (Smith & Buchannan, 2012, p. 260). These questions can help educators target course components that can be altered to meet students' diverse needs.

A study demonstrated how to use three UDL principles in a university classroom. Rose et al. (2006) applied three principles of UDL in a university course offered at the Harvard Graduate School of Education. Students enrolled in the class came from diverse backgrounds. The instructor presented the lecture in alternative ways to offer multiple representations of the class content (e.g., videotaping each lecture, orally describing visual materials, and presenting class notes and materials on an online platform). The instructor also used small-group discussions to engage students. In addition, the assessment approach included multiple options. Students were able to choose one form of media (e.g., texts, images, sound, and videos) to express what they had learned in class. Izzo (2012) also demonstrated implementations of UDL in PSE. The utilization of UD technology improves learning outcomes for all students, including students with disabilities. For example, college professors can ask students to use electronic voting machines called "clickers" to answer test questions. Izzo stated that by using the clickers, students earned higher scores on the exam. This combination of UDL principles and technology creates an optimal learning environment and enhances student engagement.

Another advantage of using UDL is to respond to current trends in online education. Coy (2016) used CAST principles and guidelines to demonstrate the UDL implementations for access to digital learning environments. For example, following the principle of multiple means of engagement, instructors can provide office hours through Skype, Zoom, or Google Hangout to connect with students; using the principle of multiple means of expression, instructors may provide options for students to choose a different program or software to complete assignments.

The methods of enhancing access to online learning environments need study and practice; however, UDL indeed assists instructors in constructing a positive online learning experience.

Recently, increasing numbers of studies have explored faculty attitudes and actions toward UD-based teaching practices (e.g., Dallas et al., 2016). These studies serve as a reference for developing disability-related training for faculty. Students' opinions, however, are also an important source for the stakeholders to use to understand the quality of education received by these students.

Studies have implied that a measurement can be used to examine students' attitudes and perceptions of faculty UDL implementations. For example, after a faculty training program, Davies et al. (2013) and Schelly et al. (2011) administered a questionnaire to students to examine the program's effectiveness. The results of the studies showed that the UDL training programs for faculty were highly effective. Similarly, Gawronski et al. (2016) utilized an inventory to explore both faculty and student attitudes toward inclusive teaching practices in a community college. They found that students considered the practices important, but those practices—especially course modifications and inclusive assessment—were rarely implemented by instructors. Gawronski et al. demonstrated that students' attitudes and perceptions, to some degree, reflected the effectiveness of teaching strategies used by instructors. It is important to note that only a few studies exclusively recruited students with disabilities as study participants. Future studies may invite students with disabilities to discuss how to make education more accessible for different class audiences.

Other studies utilized a qualitative methodology to explore students' voices on UD teaching strategies. Black et al. (2015) conducted interviews to assess students' perceptions toward UDL and UDI teaching strategies; they interviewed 12 students with disabilities and

three without disabilities. The results of the study showed that students with disabilities experienced challenges in learning and considered UD-based teaching strategies to be useful and helpful. For example, students expressed that having slides or notes before a class starts can help them prepare for the class and reduce the need to write considerable notes. Student perspectives serve as an important source of feedback when instructors design curricula using UD practices. Griful-Freixenet et al. (2017) explored the learning needs of students with disabilities in a higher education institution and whether their needs were addressed by instructors using UDL practices. The study conducted semistructured interviews with 10 students with disabilities. The results demonstrated that students experienced benefits or barriers based on UDL practices. For example, instructors may assign cooperative exercises in class. Some students considered the cooperative exercises to be helpful; however, other students perceived group work as a challenge if their health problems did not permit them to communicate effectively. The results of the study reminded researchers to consider possible barriers and benefits that UDL teaching practices can bring to students.

In summary, the research community has increasingly emphasized students' perspectives. Compared to students without disabilities, students with disabilities encounter more challenges in succeeding in PSE. How UDL strategies can facilitate the optimal learning environment and support students with disabilities in PSE is a crucial issue.

The purpose of this study is to measure the attitudes students with disabilities held related to UDL practices. This study also explores whether these UDL practices were implemented in their classrooms. The results of the online survey can be used to inform practices.

Schelly et al. (2011) developed the online survey used in the current study. The original survey contained a perception scale to test whether students perceived faculty implementation of

UDL teaching strategies after receiving UDL training. The current study adds an attitude scale and modifies the description of the survey questions. The following questions guide the current study:

- What UDL practices are considered important by students with disabilities?
- What UDL practices are being used by instructors or faculty members based on the perceptions of students with disabilities?
- Based on the attitudes and perceptions of students with disabilities, what UDL practices are considered important and fully addressed by instructors?
- Based on the attitudes and perceptions of students with disabilities, what UDL practices are considered important but not fully addressed by instructors?
- How do demographic variables, such as gender, academic department, and academic year, affect students' attitudes and perceptions of UDL practices by using the factor scores in the attitude and perception scales?

Method

Research Design

This study used a quantitative lens to explore students' attitudes toward and perceptions of UDL teaching practices. Hesse-Biber (2017) stated that "quantitative research stresses a deductive model of inquiry and seeks confirmation through testable hypotheses" (p. 12). One of the quantitative research types is relational research or correlational research. Thompson et al. (2005) stated that "correlational studies are quantitative, multisubject designs in which participants have not been randomly assigned to treatment conditions" (p. 182). Similarly, Cook and Cook (2016) stated that relational research examines the relationship between independent and dependent variables. The current study used an online survey to examine the correlation

between independent and dependent variables. The online survey was the only source of data; the variables were not manipulated, and the participants were not placed in any research-design conditions.

Online surveys have been an increasingly common method in research because they can be used for a variety of purposes (Fowler, 2009). One of the reasons for using an online survey in the current study is that online surveys can help researchers understand participants' concerns and attitudes. Hutchinson (2004) stated that a self-report survey has been an acceptable method to solicit respondents' attitudes and predict their behaviors. In addition, considering cost-effectiveness issues and applicability, an online survey can be used in research situations in which the direct manipulation of variables may not be possible. In this study, given that its purpose was to examine participants' perceptions of and attitudes toward instructors' teaching practices, the direct manipulation of variables or any experimentation was not necessary. Using an online survey to collect data, therefore, was appropriate for the current study.

Independent Variables and Dependent Variables

A correlational research design involves measuring the relationship between independent and dependent variables. In this study, the independent variables included participants' gender, academic school year, and affiliated primary academic department. All the independent variables were categorical variables.

The survey responses on the attitude and perception scale created the dependent variables. The attitude scale was scored on a Likert scale from 1 to 3, and the perception scale was scored on a Likert scale from 1 to 5. The dependent variables were the composite scores by summing scores per factor.

Internal Validity and External Validity

An empirical study is used to reveal the relationships between variables; however, it relies on whether the research is "valid" to rule out alternative explanations (Kazdin, 2017). One type of validity is internal validity, described by Kazdin (2017) as "to what extent can the intervention, rather than extraneous influences, be considered to account for the results, changes, or group differences?" (p. 23). Although the current study was not experimental, the study still needed to account for threats to internal validity (e.g., any history or event that occurred during the distribution of the online survey, instrumentation [the online survey] design, and participant selection). In order to avoid the threat of intervening historical events, the researcher limited the time period for the online survey distribution. The online survey was distributed two times—once each in early September and November. Also, the study used campus-wide emails to distribute the online survey. By using campus-wide emails, the study was able to reduce participant selection biases. Last, the study adopted the instrumentation from a prior study. After the researcher made modifications to the survey items but before the online survey was distributed, the researcher invited experts to review the survey again. Please see the section of Survey Instrument Development for the attitude scale development. In this way, the threats from instrumentation design could also be reduced.

Kazdin (2017) stated that "external validity refers to the extent to which the results of an investigation can be generalized beyond the conditions of the experiment to other populations, settings, and circumstances" (p.36). External validity encompasses the concept of generalization (i.e., how well the research results can be generalized to different samples of participants). In the current study, an effort was made to provide the setting and participants' background information. Based on the information provided, future researchers may evaluate whether the results can be generalized to other settings.

Survey Instrument Development

This study used an online survey to: (a) gain information on the attitudes students with disabilities held related to UDL teaching practices, and (b) understand whether students perceived these UDL practices as implemented by instructors. The online survey development was based on the existing survey from Schelly et al. (2011). The researcher obtained permission to modify and use the survey in this study from the authors through an email.

The researcher chose to use this survey for three reasons: (a) The survey was developed based on the three principles of UDL; (b) According to Schelly et al. (2011), before the formal research began, researchers conducted a pilot survey with hundreds of students and collected extensive feedback about the survey questions; and (c) Survey questions were clear and straightforward, and the total time needed to complete the survey was 10 to 15 minutes. The survey, however, did not include reliability and validity information although they did a pilot before they administered the survey to a sample of participants. For these reasons, the researcher decided to employ the survey in this study by providing preliminary reliability and validity information in this study.

The researcher, however, made some modifications to fit the current study's purpose and answer the research questions. Some modifications the researcher made were as follows: (a) The original survey only included a "perception" part, which asked participants whether they perceived that instructors used UDL practices in classrooms. Because the researcher was also interested in learning how important each UDL practice was to students with disabilities, the researcher added an "attitude" part to the survey. (b) The original survey was administered to students in a specific course. To make the survey questions more general and straightforward to all students, the researcher deleted one survey question and rephrased a couple of survey

questions. For example, at Question 4, the original statement was: "The instructor often speaks while facing the board/screen or looking down at his/her notes, laptop, or overhead transparency." The researcher rephrased the question: "Instructors often speak while facing audiences." Another example is at Question 16, the original statement was "In this course I feel interested and motivated to learn." The researcher rephrased the question: "Instructors use strategies to motivate me to learn." After the modifications of the survey questions, the researcher invited a group of fellow doctoral students, two faculty members, and personnel from the Office of Disability Resources to review the survey questions again before the survey was distributed.

The final self-reported online survey in the current study included two parts with a total of 55 questions. The first part of the survey sought participants' demographic information (nine questions). The second part of the survey regarded attitudes toward (23 questions) and perceptions of (23 questions) UDL teaching practices.

In the first part, eight questions pertained to participants' demographic information. This information included the following:

- Current student status (undergraduate student, master student, doctoral student, and other)
- International student or not,
- Academic years (0–2 years, 3–4 years, 5–6 years, and 7 years or more),
- Affiliated primary academic department,
- Gender**,**
- Disability categories (autism, deaf-blindness, mental health, hearing impairment/deafness, intellectual disability, orthopedic impairment, other health

impairment, specific learning disability, speech or language impairment, traumatic brain injury, visual impairment/blindness, ADHD, temporary disabilities, multiple disabilities and other),

- Accommodation request experiences, and
- One open-ended question asking participants to briefly describe how their disabilities have influenced their learning.

The second part of the survey questions pertained to UDL teaching practices. Each survey item had a question statement seeking two types of responses: attitude and perception. There were 23 questions for the attitude response and 23 questions for the perception response. Both of the scales' questions had the same question statement but offered two different responses in order to compare participants' attitudes and perceptions.

The researcher used Likert scales to design the response format for questions. As to attitude, participants were asked how important each UDL practice was to them; the responses were: *not important, somewhat important,* and *very important*. Regarding perception, participants were asked whether their courses' instructors had implemented the practice in classrooms; the responses were: *none of my instructors use the practice, less than half of my instructors use the practice, half of my instructors use the practice, more than half of my instructors use the practice,* and *all of my instructors use the practice*.

After participants completed the survey, they were directed to a web page asking them whether they would like to enter their email for the purpose of a gift card drawing. They could decide whether they wanted to share their email information for the drawing. After this response, participants were directed to a final web page, which introduced UDL resources and the Action Model for Self-Determination (Field & Hoffman, 2015). The UDL resources included the web

links to Think College, UDL in Higher Ed, DO-IT, and CAST. These websites offered comprehensive UDL information and resources. The Action Model for Self-Determination consists of five steps: (a) Know yourself and your context, (b) Value yourself, (c) Plan, (d) Act, and (e) Experience outcome and Learn. The study presented the model at the end of the survey to inform participants that they could use the model to advocate for themselves and to communicate the UDL practices with instructors. Appendix A presents the full list of survey items.

Setting and Participants

This study was conducted in a large, research-oriented public university located in the south central United States. The inclusion criterion for participation in this study was students with disabilities at the university. They could be either graduate students or undergraduate students. Students who identified themselves as having one or more disabilities were eligible to participate in this study and voice their opinions.

From the information derived from the Office of Disability Resources' website, approximately 2,300 to 2,400 students registered for disability services in the academic year 2018 to 2019. Because some students with disabilities chose not to register, however, the number of students with disabilities at the university could be greater. A total of 160 students with disabilities participated in this online survey.

Ethical Considerations

The study was approved by the Institutional Review Board (IRB) at the university. Participants could review the research information page and the consent letter through a link in an email invitation. The consent letter addressed issues including confidentiality, the right to withdraw from the study at any time, and the researcher's contact information. Participants were informed that responses were kept confidential; even the researcher did not have access to

participants' personal information. Participants were also informed that they could skip any questions they were not comfortable answering. The researcher kept all responses confidential for publication purposes.

Recruitment and Data Collection Procedures

After the university IRB approved the study, the data collection procedures began. After the modifications of the survey questions, the researcher invited a group of fellow doctoral students, two faculty members, and personnel from the Office of Disability Resources to review the survey questions again before the survey was distributed. The survey was sent out twice through a campus-wide email—once each in early September and November. In order to reach a broader pool of participants, the study also collaborated with the Office of Disability Resources to distribute the online survey through emails to students with disabilities.

In the emails, the researcher introduced the research purpose and provided the researcher's contact information and IRB approval number. The researcher also attached a link to the online survey through Qualtrics.com. Participants were told that their participation was completely voluntary and that all the information collected from the survey would be kept confidential.

After they clicked on the link, participants read an informational cover sheet, which provided detailed information about the study. If they were interested, they went to the second page, an informed consent letter. On the informed consent page, participants clicked on the "I agree" button and were taken to the survey if they were willing to participate. Due to the inclusion criterion for participation, Question 1 of the survey asked participants whether they identified themselves as a student with one or more disabilities. If the participant clicked "No," then the survey ended with thanks for their time.

Data Analysis Procedures

Before the Data Analysis

Before the data analysis, survey responses were excluded if one of two conditions existed: Either (a) the respondent did not identify themselves as a student with one or more disabilities, or (b) the respondent failed to answer more than 90% of questions (i.e., 49 out of 55 questions). The first condition resulted in 101 responses being excluded, while the second resulted in 20 responses being excluded. Therefore, the final sample size for the study was 160.

Among these 160 respondents, one respondent did not answer all the background information, and 11 respondents only answered the first part of the survey (i.e., background information), but not the second part of the survey (i.e., attitudes and perceptions toward UDL teaching practices). Additionally, 14 participants only answered the part of the survey concerning attitudes toward UDL teaching practices, which meant they did not answer questions regarding the perceptions toward UDL teaching practices.

Variables Coding Process

The researcher examined the frequency of each independent variable (i.e., gender, academic school year, and affiliated primary academic department). The researcher found an insufficient sample size using these independent variables; therefore, these variables were regrouped to make the sample size comparable. Gender was regrouped into two groups (1 = not female and 2 = female). Academic school year was also regrouped into two groups (1 = 0–2 years and 2 = more than two years). The affiliated primary academic department was regrouped from 18 groups into 7 groups (1 = life and health professions, 2 = engineering, 3 = education and human development, 4 = business, 5 = science, 6 = liberal arts, and 7 = others or not specified).

For dependent variables, the attitude portion was a 3-point Likert scale (i.e., means *not important, somewhat important,* and *very important*). The perception portion was a 5-point Likert scale (i.e., *none of my instructors use the practice*, *less than half of my instructors use the practice*, *half of my instructors use the practice, more than half of my instructors use the practice*, and *all of my instructors use the practice*).

Data Analysis

Statistical Analysis Software. The current study used descriptive and inferential statistics to answer the research questions. All the data were analyzed through IBM SPSS Statistics Version 26 and Mplus Version 8.4, and STATA Version 16. SPSS was used to run descriptive statistics, reliability tests, and exploratory factor analysis (EFA). Mplus was used to run confirmatory factor analysis (CFA). STATA was used to run multiple regression.

Descriptive Statistics. Descriptive statistics (e.g., mean, median, percent, and standard deviation) were used to present participants' demographic information and their attitudes and perceptions for each item. To analyze which UDL practices were considered *important* based on the attitude scale results, the researcher used the average percentage of all practices considered *very important* as a cutoff point. The researcher also used the grand mean of all practices as another cutoff point.

To analyze what UDL practices were being used by instructors based on the perception scale results, the researcher referred to Cook et al. (2009), who used four Likert scale assessments to assess faculty attitudes toward accommodations and UD-related teaching practices. They combined *very important* and *important* to fully represent the importance score for each practice. The researcher also combined the percentages of *more than half* with *all of the instructors use the practice* to obtain a cutoff point. Again, the researcher also used a grand mean

of all practices as another cutoff point. The researcher then compared the results of the attitude scale and perception scale to explore what UDL practices were considered important and addressed satisfactorily (or not).

Reliability Analyses. In order to accurately examine reliability, the study used Cronbach's alpha and Spearman-Brown split-half coefficients to generate reliability values. Raykov and Marcoulides (2011) stated that alpha and split-half methods are appropriate for a single test administration. Raykov and Marcoulides further stated that one of the ways to split the whole set of items into two groups is through separating odd-numbered and even-numbered items. In this study, the split-half method was used only for evaluating the whole 23-item survey separately per attitude and perception considering that the split-half method should be used with sufficient survey items. The researcher split the whole set of survey items into an odd-numbered group and an even-numbered group. For each factor's internal consistency, this study chose Cronbach's alpha to examine internal consistency separately per attitude and perception.

Validity Analyses. For validity, the study used EFA and CFA to examine construct validity. Before using EFA and CFA to verify the validity, the researcher referred to the UDL guidelines (CAST, 2018) and UDL quick tips (The ACCESS Project, 2010) to group items for a factor. The UDL guidelines and quick tips provided a main concept of each principle and concrete examples. For representation, the main concept is the use of multiple ways to provide course materials, objectives, and expectations and to help participants comprehend the information taught in class. For expression, the main idea is to use technologies and employ different "strategies" to manage information (e.g., providing key points for note-taking or providing prompts for executive function learning). For engagement, the main idea is that instructors are approachable for students to contact or communicate with them, and that

instructors provide feedback and create a respectful class climate to engage students. After the researcher tentatively grouped items for each factor, EFA and CFA were used subsequently.

Raykov and Marcoulides (2011) mentioned that EFA was used to explore the latent structure of a measurement. There were five steps to run EFA. First, the researcher used the principal axis method analysis as the extraction method and Promax rotation. Considering that the theory and literature supported correlations among factors, the Promax rotation—an oblique rotation—was a more appropriate method than an orthogonal rotation. Second, the researcher used eigenvalues. According to Raykov and Marcoulides, the eigenvalue rule was a suggested value that could be used to decide the number of latent factors. A factor was identified when the eigenvalue was greater than 1. Third, in addition to the eigenvalue rule, the methods used to retain factors also considered theoretical plausibility. Based on the UDL framework, the researcher decided on three or four factors that were aligned with UDL principles. Fourth, the researcher then deleted one item at a time if an item' factor loading was lower than .25 across all factors (cutoff factor loading .25). After examining the lower factor's loading items, the researcher then added one item back at a time to see the overall factor loadings until all items in each factor were interpretable.

After EFA, the researcher used CFA to test the latent structure of the factors. Raykov and Marcoulides (2011) explained that CFA was used to test hypothesized factors based on a theory. First, the researcher used the best solution from EFA to run CFA for both scales separately (attitudes and perceptions). Second, the researcher selected weighted least squares (WLS) estimation method because 3-points (the attitude scale) and 5-points (the perception scale) may be considered as categorical variables. Third, the researcher used model fit indices, such as chi square and degrees of freedom, Comparative Fit Index (CFI), Tucker-Lewis Index

(TLI), and Root Mean Square Error of Approximation (RMSEA) to evaluate the model fit. Forth, the researcher reported the results by checking standardized estimates and factor correlations.

Multiple Regression Analyses. After running EFA and CFA, multiple linear regressions were used to analyze the relationships between the independent variables and dependent variables. As previously described, the independent variables were participants' gender, academic year, and affiliated primary academic department. The dependent variables were the composite scores from each factor of the attitude and perception scales. Using composite scores is a nonrefined method to form a factor score by summing scores by a factor (DiStefano, et al., 2009). Additionally, the researcher decided to run simultaneous multiple regressions, in which all the predictor (i.e., independent) variables were added to the model at the same time. Only a few UDL-related studies had used hierarchical regression to verify the relationships between independent variables and dependent variables, implying that the guidelines for specifying the predictors' sequence for a model were not clear.

Results

The study used an online survey to explore participants' attitudes toward and perceptions of UDL teaching practices. The results demonstrated participants' attitudes and perceptions by using descriptive statistics. Next, the researcher showed the results of reliability and validity of the online survey. Finally, multiple regressions per factor were conducted to reveal the relationships between the predictors and participants' attitudes and perceptions.

Missing Data Examination

For the attitude scale, approximately 6.9% to 7.9% responses were missing. The results of Little's MCAR test for the attitude scale were not statistically significant ($P = 0.999$), indicating that the data in the scale were missing at random.

For the perception scale, approximately 15.0% to 17.5% responses were missing. The results of Little's MCAR test for the perception scale were also not statistically significant ($P = 0.249$), indicating that the data in the scale were missing at random.

For the full scale, the results of Little's MCAR test were statistically significant ($P = .048$), indicating that the data in the full scale were not missing completely at random. The results also indicated a trend that participants may have become fatigued and lost motivation because of the length of the online survey.

Considering that the percentage of missing data was common (15% to 20%), the researcher used the software default setting to deal with missing data. STATA's method to handle missing data for regression is listwise deletion. For Mplus, full information maximum likelihood is a method for handling missing data.

Descriptive Information About the Participants

The total number of participants was 160, of whom 130 (81.3%) were undergraduate students. Of the 160 participants, 113 (70.6%) were female. Reporting academic years, 122 (76.3%) participants were in years 0–2, and 31 (19.4%) participants were in years 3–4, meaning that most participants were freshmen or sophomores. Regarding academic programs, most participants were in the following five colleges or schools: College of Engineering (20.0%), College of Liberal Arts (15.6%), College of Education & Human Development (14.0%), College of Agriculture and Life Sciences (11.9%), and College of Science (10.0%). While 121 (75.6%)

participants had requested accommodations, 32 (20%) participants were aware of the accommodation resources from the Office of Disability Resources but did not request any of the services, and only 6 (3.8%) participants were not aware of the available accommodations. As to the disability category, some participants may have had more than one disability. Among the disability categories, the largest groups were in the following categories: mental health, ADHD, other health impairment, specific learning disability, and "other." Table 3-1 presents the details of participants' demographics.

Table 3-1 Participants' demographic information.

Measures	The number of the participants n (%)
Current student status	
Undergraduate student	130(81.3)
Master student	13(8.1)
Doctoral student	12(7.5)
Other	5(3.1)
Gender	
Male	34(21.3)
Female	113(70.6)
Other	8(5.0)
I prefer not to answer	4(2.5)
No responses	1(0.6)
Academic years	
0-2 years	122(76.3)
3-4 years	31(19.4)
5-6 years	6(3.8)
7 years and more	0
No responses	1(0.6)
Primary college or school	
College of Agriculture & Life Sciences	19(11.9)
College of Architecture	1(0.6)
Mays Business School	6(3.8)
College of Dentistry	0
College of Education & Human Development	23(14.4)
College of Engineering	32(20.0)
College of Geosciences	5(3.1)
Bush School of Government & Public Service	2(1.3)
School of Law	1(0.6)
College of Liberal Arts	25(15.6)
College of Medicine	3(1.9)
College of Nursing	0
Irma Lerma Rangel College of Pharmacy	1(0.6)
School of Public Health	2(1.3)
College of Science	16(10.0)
College of Veterinary Medicine & Biomedical Sciences	9(5.6)
Texas A&M University at Galveston	12(7.5)
Other	2(1.3)
No responses	1(0.6)

Table 3-1 Participants' demographic information (continued).

Measures	The number of the participants n (%)
International student	
Yes	4(2.5)
No	151(94.4)
No responses	5(3.1)
Accommodation request experiences	
Yes, I have requested accommodations	121(75.6)
No, I have not requested accommodations	32(20.0)
I did not know I could request an accommodation from the Office of Disability Resources	6(3.8)
No responses	1(0.6)
Disability category	
Autism	16
Deaf-blindness	3
Mental health	59
Hearing impairment/Deafness	8
Intellectual disability	10
Orthopedic impairment	14
Other health impairment	25
Specific learning disability	19
Speech or language impairment	2
Traumatic brain injury	4
Visual impairment (including blindness)	7
Attention Deficit Hyperactivity Disorder (ADHD)	37
Temporary	6
Multiple disabilities	14
Other	28

Participants' Attitudes and Perceptions

UDL Teaching Practices Considered Important (Attitudes)

The attitude scale was scored using a 3-point Likert scale. Mean scores ranged from 1.72 to 2.85. The Likert scale ratings were as follows: an average 64% of participants considered the UDL practices *very important*; an average 26% of participants considered the UDL practices *somewhat important*; and an average 9.9 % of participants considered the UDL practices *not important*.

The researcher compared the percentage of each UDL item with the average percentage of participants who considered the UDL practices *very important*. Based on the fact that an average of 64% of participants considered the UDL practices *very important*, a UDL practice with a *very important* percentage above 64% was considered *important*. Based on the criterion (i.g. percentage above 64%), 13 items were considered important by participants. The researcher also compared the mean of each UDL practice with the grand mean. The grand mean was 2.54, which is the mean of the means of all UDL practices. Items with means of above 2.54 were considered *important*. Adding on the second criterion (i.e. means above 2.54), item 20 was also considered important by participants. Therefore, according to the two criteria, 14 items in total were considered important by participants (i.e. items 1, 2, 3, 6, 7, 8, 11, 13, 18, 19, 20, 21, 22, and 23). Table 3-2 presented item characteristics for the attitude scale.

The results demonstrated that participants considered all three UDL principles important. For the multiple means of representation, for instance, presenting accessible and organized information in multiple formats was considered useful by participants. For the multiple means of expression, participants considered that strategies used by instructors to help them organize and process information were important, such as summarizing key points. For the multiple means of

engagement, for instance, instructors expressing enthusiasm and creating a respectful class climate were meaningful for participants.

UDL Teaching Practices Used by Instructors (Perceptions)

The perception scale was scored using a 5-point Likert scale. Mean scores ranged from 2.35 to 4.36. An average of 21.1% of participants perceived that *all of their instructors implemented the UDL practices*; an average of 31.0% of participants perceived that *more than half of their instructors implemented the UDL practices*; an average of 24.5% of participants perceived that *half of their instructors implemented the UDL practices*; an average of 19.3% of participants perceived that *fewer than half of their instructors implemented the UDL practices*; and an average of 4% of participants perceived that *none of their instructors implemented the UDL practices*.

The researcher combined the percentages of *more than half of their instructors implemented the UDL practices* with *all of the instructors use the practices*. The combined percentage was 52.1% (21.1% plus 31.0%). An UDL practice was then considered "used" if the combined percentage was above 52.1%. The researcher also compared the mean of each UDL practice with the grand mean, which was 3.38. The means of the practices above 3.38 were considered being used. The results demonstrated that applying the two criteria generated the same practices that were being used by instructors. 14 items in total were fully used by instructors based on participants' perceptions (i.e. items 1, 2, 4, 7, 8, 9, 11, 14, 15, 18, 19, 21, 22, and 23). Table 3-3 presented item characteristics.

The results demonstrated that instructors implemented multiple UDL strategies across three principles based on participants' perceptions (e.g. presenting information in multiple

formats, expressing enthusiasm toward the covered topic, or students submitting assignments electronically).

UDL Teaching Practices Are Considered Important and Fully Addressed by Instructors

Prior results indicated that some UDL practices were considered *important*, and these practices were addressed satisfactorily, meaning that more than half of the instructors had used the practice in class. 10 items in total were considered important and fully addressed by instructors (i.e. items 1, 2, 7, 8, 11, 18, 19, 21, 22, and 23). These items mainly focused on the multiple means of representation and engagement. For the multiple means of representation, for instance, instructors used multiple formats to present information, provided electronic equivalents of handouts, and provided accessible and organized materials. For the multiple means of engagement, instructors created a respectful class climate for student diversity, provided multiple ways for contacting instructors, and expressed enthusiasm toward the covered topic.

UDL Teaching Practices Are Considered Important but Not Fully Addressed

Prior results also indicated that some UDL practices were considered important, but these practices were not addressed satisfactorily, meaning that less than half of the instructors had used the practice in class. The practices were the following: Item 3 (providing important points consistent to the larger objectives), item 6 (instructors summarizing key points), item 13 (students receiving feedback on assignments), and item 20 (connecting the real-world importance to the content). These four items focused more on the multiple means of expression. This implied that participants considered that strategies used by instructors to help them process and organize information were important, but instructors did not implement the strategies very often.

Participants also implied that oftentimes, they did not receive feedback on assignments from instructors.

Table 3-2 Item characteristics for the attitude scale.

Item	Not important *n* (%)	Somewhat Important *n* (%)	Very Important *n* (%)	M(SD)/Median	Min.	Max.
1.Instructors present information in multiple formats (e.g., lecture, text, graphics, audio, video).	7 (4.7)	35 (23.5)	107 (71.8)	2.67(0.56)/3	1	3
2.Instructors' expectations are consistent with the learning objectives stated in the course syllabi or on the study guides.	9 (6.0)	23 (15.4)	117(78.5)	2.72(0.57)/3	1	3
3.During lecture, instructors tie the most important points of the lessons to the larger objectives of the courses.	8(5.4)	43(28.9)	98(65.8)	2.60(0.59)/3	1	3
4.Instructors often speak while facing audiences.	20(13.4)	35(23.5)	94(63.1)	2.50(0.72)/3	1	3
5.Instructors begin each lecture with an outline of what will be covered.	29(19.5)	62(41.6)	58(38.9)	2.19(0.74)/2	1	3
6.Instructors summarize key points throughout the lectures.	6(4.0)	36(24.2)	107(71.8)	2.68(0.55)/3	1	3
7.Course syllabi clearly describe the content and expectations of the courses, specifically or in broad terms.	8(5.4)	29(19.6)	111(75.0)	2.70(0.57)/3	1	3
8.Instructors provide electronic equivalents (e.g., HTML, Word, PDF) of all paper handouts.	12(8.1)	29(19.6)	107(72.3)	2.64(0.63)/3	1	3
9.Required reading assignments (other than the textbook) are available online.	20(13.4)	46(30.9)	83(55.7)	2.42(0.72)/3	1	3
10.Instructors use instructional technologies (e.g., clickers) to enhance learning.	69(46.3)	53(35.6)	27(18.1)	1.72(0.75)/2	1	3
11. Course materials (other than the textbook) are accessible, clearly organized, and easy to use	4(2.7)	18(12.2)	126(85.1)	2.82(0.45)/3	1	3

Table 3-2 Item characteristics for the attitude scale (continued)

Item	Not important *n* (%)	Somewhat Important *n* (%)	Very Important *n* (%)	M(SD)/Median	Min.	Max.
12.Students are allowed to express their comprehension of materials in ways other than traditional tests and exams (e.g., written essays, projects, portfolios).	27(18.1)	60(40.3)	62(41.6)	2.23(0.74)/2	1	3
13.I receive prompts and constructive feedback on assignments.	4(2.7)	42(28.2)	103(69.1)	2.66(0.53)/3	1	3
14.Instructors employ technology to facilitate communication among students and between students and instructors.	16(11.4)	58(38.9)	74(49.7)	2.38(0.68)/2	1	3
15.Assignments can be submitted electronically.	26(17.4)	48(32.2)	75(50.3)	2.33(0.76)/3	1	3
16.Instructors use strategies to motivate me to learn.	20(13.5)	39(26.4)	89(60.1)	2.47(0.72)/3	1	3
17.Instructors provide challenging and meaningful assignments.	14(9.5)	58(39.2)	76(51.4)	2.42(0.67)/3	1	3
18.Instructors express enthusiasm for the topics covered in class.	4(2.7)	31(20.8)	114(76.5)	2.74(0.50)/3	1	3
19.Instructors offer ways for students to contact them outside of class time in flexible formats (e.g., face-to-face, email, online chat, telephone).	3(2.0)	26(18.1)	119(79.9)	2.78(0.46)/3	1	3
20.Instructors explain the real-world importance of the topics taught in courses.	7(4.7)	48(32.2)	94(63.1)	2.58(0.58)/3	1	3
21.Instructors create a class climate in which student diversity is respected.	12(8.1)	22(14.8)	115(77.2)	2.68(0.61)/3	1	3
22.Instructors are highly approachable and available to students.	3(2.0)	16(10.7)	130(87.2)	2.85(0.40)/3	1	3
23.Instructors supplement lecture and reading assignments with visual aids (e.g., charts, diagrams, interactive simulations).	9(6.0)	31(20.8)	109(73.2)	2.67(0.59)/3	1	3
Overall average	14.7(9.9)	38.6(26.0)	95.4(64.0)	2.54(0.25)/2.64		

Table 3-3 Item characteristics for the perception scale.

Item	None *n* (%)	Less than half *n* (%)	Half *n* (%)	More than half *n* (%)	All *n* (%)	M(SD)/Median	Min.	Max.
1.Instructors present information in multiple formats (e.g., lecture, text, graphics, audio, video).	1(7)	23(16.9)	34(25)	55(40.4)	23(16.9)	3.56(.99)/4.00	1	5
2.Instructors' expectations are consistent with the learning objectives stated in the course syllabi or on the study guides.	1(0.7)	7(5.2)	28(20.7)	68(50.4)	31(23.0)	3.90(.84)/4.00	1	5
3.During lecture, instructors tie the most important points of the lessons to the larger objectives of the courses.	3(2.2)	32(23.7)	45(33.3)	41(30.4)	14(10.4)	3.23(1.00)/3.00	1	5
4.Instructors often speak while facing audiences.	0	4(3.0)	15(11.1)	45(33.3)	71(52.6)	4.36(.80)/5.00	2	5
5.Instructors begin each lecture with an outline of what will be covered.	16(12.0)	55(41.4)	28(21.1)	20(15.0)	14(10.5)	2.71(1.18)/2.00	1	5
6.Instructors summarize key points throughout the lectures.	4(3.0)	44(32.8)	48(35.8)	25(18.7)	13(9.7)	2.99(1.02)/3.00	1	5
7.Course syllabi clearly describe the content and expectations of the courses, specifically or in broad terms.	1(0.7)	5(3.7)	19(14.2)	61(45.5)	48(35.8)	4.12(.84)/4.00	1	5
8.Instructors provide electronic equivalents (e.g., HTML, Word, PDF) of all paper handouts.	5(3.7)	21(15.6)	24(17.8)	53(39.3)	32(23.7)	3.64(1.12)/4.00	1	5
9.Required reading assignments (other than the textbook) are available online.	3(2.3)	17(12.9)	27(20.5)	45(34.1)	40(30.3)	3.77(1.09)/4.00	1	5
10.Instructors use instructional technologies (e.g., clickers) to enhance learning.	28(20.7)	66(48.9)	15(11.1)	18(13.3)	8(5.9)	2.35(1.13)/2.00	1	5

Table 3-3 Item characteristics for the perception scale (continued).

Item	None *n* (%)	Less than half *n* (%)	Half *n* (%)	More than half *n* (%)	All *n* (%)	M(SD)/Median	Min.	Max.
11. Course materials (other than the textbook) are accessible, clearly organized, and easy to use.	3(2.2)	19(14.1)	36(26.7)	57(42.2)	20(14.8)	3.53(.99)/4.00	1	5
12.Studentswereallowed to express their comprehension of materials in ways other than traditional tests and exams (e.g., written essays, projects, portfolios).	20(14.8)	49(36.3)	33(24.4)	20(14.8)	13(9.6)	2.68(1.18)/2.00	1	5
13.I receive prompts and constructive feedback on assignments.	5(3.7)	51(37.8)	48(35.6)	19(14.1)	12(8.9)	2.87(1.01)/3.00	1	5
14.Instructors employ technology to facilitate communication among students and between students and instructors.	6(4.5)	20(14.9)	36(26.9)	45(33.6)	27(20.1)	3.50(1.11)/4.00	1	5
15.Assignments can be submitted electronically.	1(0.7)	12(8.9)	16(11.9)	60(44.4)	46(34.1)	4.02(.94)/4.00	1	5
16.Instructors use strategies to motivate me to learn.	8(6.0)	40(30.1)	53(39.8)	24(18.0)	8(6.0)	2.88(.98)/3.00	1	5
17.Instructors provide challenging and meaningful assignments.	4(3.0)	24(17.9)	41(30.6)	50(37.3)	15(11.2)	3.36(1.00)/3.00	1	5
18.Instructors express enthusiasm for the topics covered in class.	2(1.5)	10(7.4)	41(30.4)	43(31.9)	39(28.9)	3.79(.99)/4.00	2	5
19.Instructors offer ways for students to contact them outside of class time in flexible formats (e.g., face-to-face, email, online chat, telephone).	0	9(6.7)	25(18.5)	43(31.9)	58(43.0)	4.11(.94)/4.00	1	5

Table 3-3 Item characteristics for the perception scale (continued).

Item	None *n* (%)	Less than half *n* (%)	Half *n* (%)	More than half *n* (%)	All *n* (%)	M(SD)/Median	Min.	Max.
20.Instructors explain the real-world importance of the topics taught in courses.	3(2.2)	32(23.9)	40(29.9)	37(27.6)	22(16.4)	3.32(1.08)/3.00	1	5
21.Instructors create a class climate in which student diversity is respected.	2(1.5)	16(12.0)	18(13.5)	41(30.8)	56(42.1)	4.00(1.09)/4.00	1	5
22.Instructors are highly approachable and available to students.	0	8(6.0)	38(28.4)	59(44.0)	29(21.6)	3.81(.84)/4.00	2	5
23.Instructors supplement lecture and reading assignments with visual aids (e.g., charts, diagrams, interactive simulations).	3(2.2)	24(17.8)	35(25.9)	49(36.3)	24(17.8)	3.50(1.05)/4.00	1	5
Overall average	5.2(4.0)	25.6(19.3)	32.3(24.5)	42.5(31.0)	28.9(21.1)	3.38(0.54)/3.53		

Analyses of Validity and Reliability

Validity

The researcher ran EFA first for the two scales separately (attitudes and perceptions) with principal axis method analysis as the extraction method and Promax rotation. Schelly et al. (2011) mentioned that some survey questions capture more than one UDL principle. Considering that the theory and literature supported correlations among factors, the Promax rotation—an oblique rotation—was a more appropriate method than an orthogonal rotation. The results showed that the KMO and Bartletts' test was statistically significant (<.05) for both scales, meaning that the sample size was adequate. The results of the scree plot and eigenvalues for both scales suggested seven factors; however, considering the theoretical plausibility, 3-factor or 4-factor solutions should be considered. In addition, more than 4-factor solution may result in some factors consisting of only one or two items, which caused more issues for the internal structure; therefore, the researcher decided to run EFA again with 3-factor and 4-factor solutions for both scales.

After EFA, the researcher used CFA to confirm the constructive validity of both scales. The researcher used the following indices to evaluate whether a model was a good fit or not: (a) the comparative fit index (CFI) and Tucker–Lewis index (TLI) and (b) the root mean squared error of approximation (RMSEA). The suggested cut-off points or good fit for CFI and TLI was closer to or greater than .90. The cut-off points or good fit for RMSEA was less than .08 (Hooper et al., 2008). The researcher used the cut-off points as a reference to decide whether a model was a good fit or not. Table 3-4 demonstrated the results of the confirmatory factor analysis.

Table 3-4 The results of the confirmatory factor analysis for the attitude and perception

Model	χ^2	df	ρ value	CFI	TLI	RMSEA
Attitude scale (3-factor model)	85.513	41	0.0001	0.863	0.816	0.085
Perception scale (4-factor model)	134.607	71	0.0000	0.888	0.856	0.081

Validity results for the attitude scale. For the attitude scale, based on the comparison between 3-factor and 4-factor solutions, for the 4-factor solution, the cumulative variance was 32.80 %, and only one item substantially loaded one of the factors; for the 3-factor solution, the cumulative variance was 29.36 %, and at least 3 items substantially loaded on each factor. Therefore, the researcher decided to choose the 3-factor solutions. The researcher then deleted one item at a time if an item' factor loading was lower than .25 across all factors (cutoff factor loading .25). After examining the lower factor's loading items, the researcher then added one item back at a time to see the overall factor loadings. Item 16 was a complex structure item. The item had an acceptable factor loading on two factors (i.e. multiple means of expression and engagement). Because item 16 mainly described the strategies used by instructors to motivate students, and multiple means of expression also emphasized strategies used to help students learn, the researcher decided to move item 16 to the factor—multiple means of expression.

The results of EFA from SPSS demonstrated that the first factor was multiple means of representation (i.e., items 7, 2, and 3). The factor loadings were 0.875, 0.568, and 0.286 (0.261 on SPSS), respectively. The second factor was multiple means of expression (i.e., items 17, 12, 5, and 16). The factor loadings were 0.564, 0.509, and 0.436, and 0.250 respectively. The third factor was multiple means of engagement (i.e., items 19, 22, 13, and 14). The factor loadings were 0.640, 0.538, 0.509, and 0.461, respectively.

The results of CFA from Mplus showed that the CFI and TLI were 0.863 and 0.816, respectively. The RMSEA was 0.085. These indices showed that the model was not an acceptable fit to the data. Based on the STDYX standardization, the items significantly loaded on their proposed latent factors (coefficients ranged between 0438. and 0.790). See Table 3-5 for the factor loadings of the attitude scale.

Validity results for the perception scale. For the perception scale, the cumulative variance for the 3-factor solution was 35.24%, and the cumulative variance for the 4-factor solution was 38.61%. The researcher decided to use the 4-factor solution because the fourth factor can independently represent another important aspect of multiple means of representation. The researcher then deleted one item at a time if an item' factor loading was lower than .25 across all factors (cutoff factor loading .25). After examining the lower factor's loading items, the researcher then added one item back at a time to see the overall factor loadings. Based on the rule, 14 items in total remained in the perception scale. Item 3 and 6 were the complex structure items. Item 3 and 6 mainly described the strategies used by instructors to help participants process the learning information (e.g. summarizing key points). Therefore, the researcher grouped item 6 and 3 in the factor— multiple means of expression.

The first factor was multiple means of representation (i.e., items 2, 7, and 23). The factor loadings were 0.890, 0.692, and 0.505, respectively. The second factor was also multiple means of representation (i.e., items 9, 8, and 11). The factor loadings were 0.722, 0.559, and 0.357 respectively. The second factor was more closely related to making courses' learning materials accessible. The third factor was multiple means of expression (i.e., items 5, 10, 6, 3, and 14). The factor loadings were 0.761, 0.413, 0.379, 0.358, and 0.336, respectively. Finally, the fourth

factor was multiple means of engagement (i.e., items 22, 21, and 4). The factor loadings were 0.820, 0.741, and 0.499, respectively.

The results of CFA from Mplus showed that the the CFI was 0.888, and the TLI was 0.856. The RMSEA was 0.081. These indices showed that the model was not an acceptable fit to the data. Based on the STDYX standardization, the perception scale items significantly loaded on their proposed latent factors (coefficients ranged between 0.302 and 0.742). See Table 3-6 for the factor loadings of the perception scale. Table 3-7 presented for the means, standard deviations, and correlations of the factors of both scales.

Table 3-5 Item factor loading on the attitude scale in CFA.

Items		3-factor solution		
	α	1	2	3
Multiple means of representation	0.61			
7. Course syllabi clearly describe the content and expectations of the courses, specifically or in broad terms.		.790		
2. Instructors' expectations are consistent with the learning objectives stated in the course syllabi or on the study guides.		.438		
3. During lecture, instructors tie the most important points of the lessons to the larger objectives of the courses.		.502		
Multiple means of expression	0.61			
16. Instructors use strategies to motivate me to learn.			.656	
12. Students are allowed to express their comprehension of materials in ways other than traditional tests and exams (e.g., written essays, projects, portfolios).			.688	
17. Instructors provide challenging and meaningful assignments.			.545	
5. Instructors begin each lecture with an outline of what will be covered.			.467	
Multiple means of engagement	0.60			
14. Instructors employ technology to facilitate communication among students and between students and instructors.				.569
19. Instructors offer ways for students to contact them outside of class time in flexible formats (e.g., face-to-face, email, online chat, telephone).				.503
22. Instructors are highly approachable and available to students.				.662
13. I receive prompts and constructive feedback on assignments.				.615

Table 3-6 Item factor loading on the perception scale in CFA.

Items		4-factor solution			
	α	1	2	3	4
Multiple means of representation	0.66				
2. Instructors' expectations are consistent with the learning objectives stated in the course syllabi or on the study guides.		0.432			
23. Instructors supplement lecture and reading assignments with visual aids (e.g., charts, diagrams, interactive simulations).		0.302			
7. Course syllabi clearly describe the content and expectations of the courses, specifically or in broad terms.		0.588			
Multiple means of representation-making materials accessible	0.63				
11. Course materials (other than the textbook) are accessible, clearly organized, and easy to use.			0.314		
8. Instructors provide electronic equivalents (e.g., HTML, Word, PDF) of all paper handouts.			0.337		
9. Required reading assignments (other than the textbook) are available online.			0.371		
Multiple means of expression	0.63				
6. Instructors summarize key points throughout the lectures.				0.497	
3. During lecture, instructors tie the most important points of the lessons to the larger objectives of the courses.				0.623	
5. Instructors begin each lecture with an outline of what will be covered.				0.322	
10. Instructors use instructional technologies (e.g., clickers) to enhance learning.				0.414	
14. Instructors employ technology to facilitate communication among students and between students and instructors.				0.619	
Multiple means of engagement	0.68				
22. Instructors are highly approachable and available to students.					0.647
21. Instructors create a class climate in which student diversity is respected.					0.557
4. Instructors often speak while facing audiences.					0.742

Table 3-7 Factors, means, standard deviations, and correlations of the two scales.

The attitude scale						
Factor	*M*	*SD*	1	2	3	
1. Multiple means of presentation	2.676	0.433	1.000			
2. Multiple means of expression	2.330	0.482	0.254	1.000		
3. Multiple means of engagement	2.670	0.357	0.190	0.251	1.000	
The perception scale						
Factor	*M*	*SD*	1	2	3	4
1. Multiple means of presentation	3.837	0.705	1.000			
2. Multiple means of presentation--making materials accessible	3.649	0.811	0.342	1.000		
3. Multiple means of expression	2.968	0.690	0.320	0.392	1.000	
4. Multiple means of engagement	4.055	0.717	0.191	0.318	0.213	1.000

Reliability

The study used Cronbach's alpha and Spearman-Brown split-half coefficients to examine reliability. The Spearman-Brown coefficient was calculated by splitting whole items into odd and even item sets. For the full attitude scale, the Cronbach's alpha value was .85. The Spearman-Brown coefficient was 0.86 (unequal length). The reliability results demonstrated that the reliability value of the attitude scale met the criteria for internal consistency. For the full perception scale, the Cronbach's alpha value was .88. The Spearman-Brown coefficient was 0.91 (unequal length). Again, the reliability results demonstrated that the reliability value of the perception scale met the criteria for internal consistency. Research suggested that alpha value between 0.6 and 0.7 indicates an acceptable level of reliability, and 0.8 indicates a good level of reliability (Ursachi et al., 2015). The results showed that the reliabilities for the two scales were at a good level.

The study also calculated Cronbach's alpha for each factor. For the attitude scale, the first factor, multiple means of representation (i.e., items 2, 3, and 7), the Cronbach's alpha value was 0.61. For the second factor, multiple means of expression (i.e., items 5, 12, 16, and 17), the Cronbach's alpha value was 0.61. For the third factor, multiple means of engagement (i.e., items 13, 14, 19, and 22), the Cronbach's alpha value was 0.60. Overall, the alpha value between 0.6 and 0.7 indicates an acceptable level of reliability (Ursachi et al., 2015).

For the perception scale, the first factor, multiple means of representation (i.e., items 2, 7, and 23), the Cronbach's alpha value was 0.66. For the second factor, multiple means of representation (i.e., items 8, 9, and 11), the Cronbach's alpha value was 0.63. For the third factor, multiple means of expression (i.e., items 3, 5, 6, 10, and 14), the Cronbach's alpha value was 0.63. For the fourth factor, multiple means of engagement (i.e., items 4, 21, and 22), the Cronbach's alpha value was 0.68. Overall, the alpha value between 0.6 and 0.7 indicates an acceptable level of reliability (Ursachi et al., 2015).

Predictors of Student Attitudes and Perceptions

The researcher ran multiple regressions per factor to investigate the relationships between predictors and students' attitudes and perceptions. Considering that the predictors (i.e. independent variables) were categorical variables, the researcher converted these variables into a set of code variables. Dummy-variable coding was used to convert the variables. A reference group was chosen based on the following considerations: (a) the group was expected to score higher than other groups, and (b) the group had a relatively large sample size. For the three independent variables, the researcher selected females as a reference group for the gender variable, 0 – 2 years as a reference group for the academic year variable, and the College of Education and Human Development as a reference group for the academic department variable.

The researcher checked multicollinearity to ensure that independent variables were not highly correlated in a regression model. The variance inflation factor (VIF) of a predictor was used to decide whether multicollinearity existed. The commonly suggested VIF threshold is 10 or 5 (Kock & Lynn, 2012). In this study, the mean of the VIF value for three independent variables was around 1.5, meaning that problematic multicollinearity did not exist.

The researcher also checked assumptions. First, based on previous UD-related survey research, demographic variables were used as independent variables; accordingly, the researcher identified three demographic variables as independent variables for this study. To determine normality of residuals and homoscedasticity, skewness and kurtosis and the Shapiro Wilk test were used to check normality of residuals, and the Breusch-Pagan and Cook-Weisberg tests were used to test homoscedasticity. Each observation in the online survey sample was independent from the others. In addition, because the researcher ran multiple regression per factor, the type I error was inflated. An alpha level of 0.05 was used to determine levels of significance. The

researcher adjusted the alpha level—dividing .05 by the number of tests conducted (0.05/7 = .007). Thus, the test-wise alpha used for the study was .007. The followings were the multiple regression results.

The first analysis demonstrated associations between independent variables and the representation factor in the attitude scale. The first analysis did not meet normality of residuals ($p = 0.000 < .05$) and homoscedasticity assumptions ($p = 0.000 < .05$). The skewness and kurtosis were -1.123 and 4.206, respectively. The researcher considered the violation of normality of residuals to be serious; thus, a standard and a robust simultaneous regression was considered and presented in Table 3-8. From the standard simultaneous regression, the set of predictors or the model explained accounted for 12.3% of the variance in representation teaching strategies and were not statistically significant, $F(8, 139) = 2.44$, $p = 0.017$ (>0.007). The robust simultaneous regression, however, was not statistically significant, $F(8, 139) = 0.79$, $p = 0.615$ (>0.007), and none of the independent variables were significant. Although there were no significant results, compared to the reference group, students in Business had .528 lower attitudes toward the UDL practices in the representation factor.

Table 3-8 The simultaneous regression summary table between the independent variables and the representation factor in the attitude scale.

Source	SS	df	*MS*	*F*	*R-Squared*
Model	31.632	8	3.954	2.44* (0.79)	0.123
Residual	225.362	139	1.621		
Total	27.543	147			

Variables	Coefficient (b)	SE	β
Academic Year	.153 (.044)	.252 (.218)	.050
Gender	-.120 (.053)	.244 (.212)	-.041
Life and health professions	.367 (.270)	.347 (.300)	.116
Engineering	-.336 (-.132)	.368 (.318)	-.101
Business	-1.532(-.528)	.555 (.480)	-.247
Science	.408 (.295)	.402 (.348)	.101
Liberal arts	-.340 (-.228)	.380 (.329)	-.095
Others or not specified	-.027 (-.088)	.443 (.384)	.006

Note 1: Female, 0-2 year, and College of Education & Human Development were the references groups for the three independent variables.
Note 2: Numbers in the parentheses were the results for the robust regression.

The second analysis demonstrated associations between independent variables and the expression factor in the attitude scale. The second analysis met the homoscedasticity assumption ($p = 0.113$); however, the assumption of normality of residuals was violated ($p = 0.000 < .05$). The skewness and kurtosis were -.596 and 2.937, respectively. Although the values did not show perfect symmetry and mesokurtic distribution, which were close to 0 and 3, respectively, the values were in the acceptable range (Aminu & Shariff, 2014). A standard simultaneous regression was conducted and presented in Table 3-9. The set of predictors or the model explained accounted for 2.4% of the variance in expression teaching strategies, which was not statistically significant, $F(8, 139) = 0.43$, $p = 0.900$ (>0.007). None of the independent variables was significant in influencing student attitudes toward the UDL expression teaching strategies. Although there were no significant results, compared to the reference group, students in Science had .445 higher attitudes toward the UDL practices in the expression factor.

Table 3-9 The simultaneous regression summary table between the independent variables and the expression factor in the attitude scale.

Source	SS	df	*MS*	*F*	*R-Squared*
Model	13.807	8	1.73	0.43	0.024
Residual	554.700	139	3.990		
Total	568.510	147			

Variables	Coefficient (b)	SE	β
Academic Year	-.454	.395	-.099
Gender	.286	.383	.066
Life and health professions	.181	.545	.039
Engineering	-.288	.577	-.058
Business	.074	.871	.008
Science	.445	.630	.074
Liberal arts	.197	.596	.037
Others or not specified	.415	.696	.062

Note 1: Female, 0-2 year, and College of Education & Human Development were the references groups for the three independent variables.

The third analysis demonstrated associations between independent variables and the engagement factor in the attitude scale. The third analysis did not meet normality of residuals ($p = 0.000 < .05$) and homoscedasticity assumptions ($p = 0.000 < .05$). The skewness and kurtosis were -1.468 and 5.935, respectively. The researcher considered the violation of normality of residuals serious; thus, a standard and a robust simultaneous regression was considered and presented in Table 3-10. From the standard simultaneous regression, The set of predictors or the model explained accounted for 5% of the variance in engagement teaching strategies and were not statistically significant, $F(8, 139) = 0.91, p = 0.512$ (>0.007). From the robust simultaneous regression, the variance in student attitude toward engagement teaching strategies was not statistically significant, $F(8, 139) = 0.54, p = 0.820$ (>0.007). Although there were no significant results, compared to the reference group, students in Science had .472 higher attitudes toward the UDL practices in the engagement factor.

Table 3-10 The simultaneous regression summary table between the independent variables and the engagement factor in the attitude scale.

Source	SS	df	*MS*	*F*	*R-Squared*
Model	14.934	8	1.867	0.91(0.54)	0.050
Residual	285.843	139	2.056		
Total	300.777	147			

Variables	Coefficient (b)	SE	β
Academic Year	-.097 (-065)	.284(.243)	-.029
Gender	-.220 (-.303)	.275(.235)	-.070
Life and health professions	.321 (.245)	.391(.334)	.094
Engineering	.219 (.117)	.414(.354)	.061
Business	-.794 (-.112)	.626(.534)	-.118
Science	.536 (.472)	.453(.386)	.123
Liberal arts	.514 (.356)	.428(.366)	.133
Others or not specified	.589 (.374)	.499(.426)	.120

Note 1: Female, 0-2 year, and College of Education & Human Development were the references groups for the three independent variables.
Note 2: Numbers in the parentheses were the results for the robust regression.

The fourth analysis demonstrated associations between independent variables and the representation factor in the perception scale. This analysis met the homoscedasticity assumption (p = 0. 976); however, the assumption of normality of residuals was violated (p = 0.000 < .05). The skewness and kurtosis were -.785 and 4.06, respectively, which were in the acceptable range (Aminu & Shariff, 2014). A standard simultaneous regression was conducted and presented in Table 3-11. The set of predictors or the model explained accounted for 2.8% of the variance in representation teaching strategies, which was not statistically significant, $F(8, 126) = 0.46$, p = 0. 881(>0.007). None of the independent variables was significant in influencing student perceptions toward the UDL representation teaching strategies. Although there were no significant results, compared to the reference group, students in Engineering and Science had lower perceptions (.844 and .551, respectively) toward the UDL practices in the representation factor.

Table 3-11 The simultaneous regression summary table between the independent variables and the representation factor in the perception scale.

Source	SS	df	*MS*	*F*	*R-Squared*
Model	19.192	8	2.400	0.46	0.028
Residual	656.541	126	5.211		
Total	675.733	134			

Variables	Coefficient (b)	SE	β
Academic Year	.230	.474	.043
Gender	.105	.454	.022
Life and health professions	.165	.652	.031
Engineering	-.844	.698	-.147
Business	-.162	1.07	-.015
Science	-.551	.736	-.084
Liberal arts	-.046	.721	-.007
Others or not specified	-.202	.809	-.027

Note: Female, 0-2 year, and College of Education & Human Development were the references groups for the three independent variables.

The fifth analysis demonstrated associations between independent variables and the second representation factor in the perception scale. This representation factor is more related to making materials accessible. This analysis met the homoscedasticity assumption ($p = 0.281$); however, the assumption of normality of residuals was violated ($p = 0.000 < .05$). The skewness and kurtosis were -.793 and 3.633, respectively, which were in the acceptable range (Aminu & Shariff, 2014). A standard simultaneous regression was conducted and presented in Table 3-12. The set of predictors or the model explained accounted for 9.25% of the variance in these strategies, which was not statistically significant, $F(8, 126) = 1.60$, $p = 0.130$. (>0.007). Although there were no significant results, compared to the reference group, students in Engineering, Liberal Arts and Others had lower perceptions (1.092, 1.467, and 1.836, respectively) toward the UDL practices in the second representation factor. Not-female students also had lower perceptions compared to female students.

Table 3-12 The simultaneous regression summary table between the independent variables and the second representation factor in the perception scale.

Source	SS	df	*MS*	*F*	*R-Squared*
Model	86.791	8	10.849	1.60	0.925
Residual	851.978	126	6.762		
Total	938.770	134			

Variables	Coefficient (b)	SE	β
Academic Year	-.267	.540	-.043
Gender	-.418	.517	-.073
Life and health professions	-.224	.743	-.035
Engineering	-1.092	.795	-.161
Business	.486	1.219	.038
Science	.093	.838	.012
Liberal arts	-1.467	.821	-.202
Others or not specified	-1.836	.922	-.212

Note 1: Female, 0-2 year, and College of Education & Human Development were the references groups for the three independent variables.

The sixth analysis demonstrated associations between independent variables and the expression factor in the perception scale. The analysis met the homoscedasticity assumption (p = 0.607) and normality of residuals assumption (p = 0.456). The skewness and kurtosis were .094 and 2.799, respectively, which were in the acceptable range (Aminu & Shariff, 2014). A standard simultaneous regression was conducted and presented in Table 3-13. The set of predictors or the model explained accounted for 12.6% of the variance in these strategies, which was not statistically significant, F (8, 125) = 2.04, p = 0.046 (>0.007). The variable, however, Academic Department, was statistically significant, showing that the mean of the perception score in Engineering was 3.50 lower than the reference group (p<0.007). Students in other departments, such as Science, Liberal arts, and Others, also had lower perceptions than the reference group However, not-female students had higher perceptions in this factor than the reference group.

Table 3-13 The simultaneous regression summary table between the independent variables and the expression factor in the perception scale.

Source	SS	df	*MS*	*F*	*R-Squared*
Model	191.036	8	23.880	2.04	0.126
Residual	1460.6128	125	11.685		
Total	1651.649	133			

Variables	Coefficient (b)	SE	β
Academic Year	-.133	.710	-.016
Gender	1.316	.684	.171
Life and health professions	-.884	.977	-.105
Engineering	-3.501*	1.046	-388
Business	-.799	1.603	-.047
Science	-1.269	1.102	-.123
Liberal arts	-2.837	1.088	-.288
Others or not specified	-2.499	1.212	-.218

Note 1: Female, 0-2 year, and College of Education & Human Development were the references groups for the three independent variables.
Note 2: *p<.007

The seventh analysis demonstrated associations between independent variables and the engagement factor in the perception scale. This analysis met the homoscedasticity assumption ($p = 0.914$); however, the assumption of normality of residuals was violated ($p = 0.000 < .05$). The skewness and kurtosis were -.968 and 3.586, respectively, which were in the acceptable range (Aminu & Shariff, 2014). A standard simultaneous regression was conducted and presented in Table 3-14. The set of predictors or the model explained accounted for 3.8% of the variance in these strategies, which was not statistically significant, $F(8, 125) = 0.62$, $p = 0.761(>0.007)$. None of the independent variables was significant in influencing student perceptions toward the UDL engagement teaching strategies. Although there were no significant results, compared to the reference group, students in Engineering, Liberal arts, and Life and Health Professions had lower perceptions (.782, .769, and 606 respectively) toward the UDL practices in the second representation factor.

Table 3-14 The simultaneous regression summary table between the independent variables and the engagement factor in the perception scale.

Source	SS	df	*MS*	*F*	*R-Squared*
Model	2.957	8	.370	0.70	0.044
Residual	64.783	123	.526		
Total	67.740	131			

Variables	Coefficient (b)	SE	β
Academic Year	.381	.474	.071
Gender	.243	.457	.050
Life and health professions	-.606	.652	-.112
Engineering	-.782	.699	-.135
Business	.452	1.070	.042
Science	.111	.736	.017
Liberal arts	-.769	.727	-.122
Others or not specified	-.150	.810	-.020

Note: Female, 0-2 year, and College of Education & Human Development were the references groups for the three independent variables.

Discussion

This study used an online survey to explore attitudes about and perceptions of UDL teaching practices by students with disabilities. Student attitudes indicated which teaching practices were considered important and effective; in the meantime, student perceptions indicated which teaching practices were fully used by instructors. As previous studies expressed (Black et al., 2015; Griful-Freixenet et al., 2015), student voices can provide genuine feedback toward UDL teaching practices and challenge the dominant value. Dallas et al. (2016) also suggested that students should be surveyed to evaluate the effectiveness of UDL teaching practices. In this study, most teaching practices were considered *important* or *somewhat important* by students with disabilities; however, some teaching practices were not considered as important as previously assumed. For example, Question 10 ("Instructors use instructional technologies [e.g., clickers] to enhance learning") was considered to be between *not important* and *somewhat important*. Kortering et al. (2008) also found similar results, showing that issues with technological devices were one of the barriers for UDL-based activities. Although technology makes education accessible—one of the goals of UDL—the technical issues could be the challenges while using it. Furthermore, technology is invented and updated frequently; sometimes, instructors and students need time to adjust to new learning technologies. Additionally, the results challenged previous studies, which suggested that technology should be highly incorporated with instruction (West et al., 2016).

The study results also indicated a gap between student attitudes and perceptions, meaning that students considered some teaching practices important but not fully implemented by instructors. For example, Question 3 and Question 6 mainly focus on key lecture points organized and summarized by instructors. Students with disabilities may experience difficulties

in organizing the lecture notes. Boyle et al. (2015) described a note-taking intervention for students with disabilities. The study showed that instructors can help students summarize key lecture points or provide "guided notes," so students are able to improve their note-taking. Some universities also suggested that instructors provide a lecture outline and summarize key points for students with disabilities (e.g., Thurber & Bandy, 2018). Another teaching practice that was not fully implemented is described in Question 13 and relates to students receiving feedback from instructors. Robinson and Wizer (2016) demonstrated that providing feedback on assignments is one of the criteria for Quality Matters. Providing feedback for students is an interaction between students and instructors. Instructors should plan ways to provide feedback. For example, instructors may use a checklist or rubric as a form to provide feedback on student assignments. Question 20, which students also considered important but perceived as not fully implemented by instructors, highlights the value of connecting real-world importance to the content. This effort necessitates providing experiences for students to practice concepts and skills; however, participants perceived that this practice was not implemented by instructors very often in class, implying that students' learning may stay on a conceptual level. The inconsistency between student attitudes and perceptions indicates that some practices should be implemented more in class. Similarly, Gawronski et al. (2016) found inconsistency between attitudes and actual implementation of UDL teaching practices based on student responses. This study indicated that students considered some practices important, but instructors did not use the practices very often. It is important to further explore why effective practices were not fully implemented from both student and faculty perspectives.

The instrument used in this study was derived from Schelly et al. (2011). They used the instrument to provide tentative evidence of effective UDL training for instructors as perceived by

students. Schelly et al. designed the instrument particularly for postsecondary settings and included the concepts of UDL. Schelly et al. did not, however, establish reliability and construct validity; thus, this study was able to tentatively establish construct validity by using the specific sample and the following steps. First, the researcher identified that UDL has three principles (i.e., representation, expression, and engagement). Second, the researcher referred to the main concepts of each principle and concrete examples provided in the guidelines to group items (CAST, 2018; The ACCESS Project, 2010). For representation, the main concept is to use multiple ways to provide course materials, objectives, and expectations and help participants comprehend the information taught in class. For expression, the main idea is to use technologies and employ different "strategies" to manage information, such as providing key points for note-taking or providing prompts for executive function learning. For engagement, the main idea is that instructors are approachable for students to contact or communicate with them, and that instructors provide feedback and create a respectful class climate to engage students. Third, the researcher used psychometric evaluations (EFA and CFA) to verify the factors for the two scales. Lombardi and Murray (2011) also used similar steps to establish construct validity for a disability- and UD-related survey. The difference was that they developed an initial item pool based on the theory and used EFA to select and group items.

Based on the results of EFA and CFA, the researcher found overlapping ideas among the UDL principles. Schelly et al. (2011) stated that some questions from the survey capture more than one UDL principle. The overlapping ideas across three UDL principles can be found in other studies as well. For example, the idea of providing prompts and scaffolding can be found in two principles. Austin et al. (2017) described that faculty provided scaffolding and different assessment opportunities when discussing multiple means of expression. However, a similar idea

could be perceived in multiple means of engagement, which highlighted different levels of challenges and scaffolding. Another instance can be found in Question 14 ("Instructors employ technology to facilitate communication among students and between students and instructors"). Question 14 was placed in the engagement factor for the attitude scale, but it was placed in the expression factor for the perception scale. The overlapping concepts among different UDL principles can also be attributed to how participants interpreted the same question from different perspectives (e.g., attitudes and perceptions). Nevertheless, it is still reasonable to perceive similar ideas across the three UDL principles because of the ripple effect. For instance, adjusting the levels of assignments can help students fully demonstrate what they learned in class, while at the same time motivating them to learn. In this study, the researcher strictly followed the UDL guidelines to group items and verified the factor with EFA and CFA. Some items' EFA factor loadings were low. These low factor loadings could have resulted from interpretation issues. Participants could have interpreted the questions differently from the researcher, which implied the question statements should be revised.

The study also provided tentative evidence for the predictors of student attitudes and perceptions. In this study, the hypothesized predictors included participants' gender, academic year, and academic department. For the attitude scale, although overall, there were no significant relationships between the hypothesized predictors and student attitudes, one of the predictors, academic department, played a crucial role that impacted student attitudes toward the UDL teaching practices. The results showed that students in Science had higher attitudes toward the UDL teaching practices in the expression and engagement factors compared to the reference group (i.e., students in College of Education and Human Development). Students in Business, however, had lower attitudes toward the UDL teaching practices in the representation factor.

For the perception scale, the results demonstrated a pattern showing that students in Engineering and Liberal Arts had lower perceptions toward the UDL teaching practices than the reference group across the four factors. Similarly, students in Science had lower perceptions toward the UDL teaching practices than the reference group in the representation and expression factors. The results meant that participants in the reference group perceived that instructors applied the UDL teaching practices more frequently than instructors in Engineering, Liberal Arts, and Science. These results implied that more investigations are needed to examine what challenges instructors may face while applying the UDL teaching practices in the curriculum and instruction design, especially in the areas of Engineering, Liberal Arts, and Science. Previous studies also demonstrated that a faculty's affiliated college was a factor that influenced faculty's attitudes and actions toward UD-related practices. For example, Lombardi and Murray (2011) found that faculty in the College of Education had more positive attitudes toward implementing UD-related practices. This may explain why students in the College of Education and Human Development had higher perceptions.

The tentative evidence also demonstrated that gender may influence students' perceptions. Although the results were not statistically significant, students who were not female had lower perceptions toward the UDL teaching practices in the second representation factor, but higher perceptions in the expression factor compared to the reference group. The results were partially consistent with previous research. Previous studies revealed that gender was one of the factors that influenced faculty's attitudes and actions toward UD-related practices (e.g., Hartsoe & Barclay, 2017). It seems gender may be a factor that influenced both students' and faculty's perspectives toward the UDL teaching practices. Future research may further investigate why gender differences have an impact on the implementations of the UDL teaching practices.

Overall, this study contributed to the current literature base by using the UDL questionnaire to survey students' attitudes toward and perceptions of UDL teaching practices. This study also established the reliability and validity of the questionnaire by using the UDL principles. Other UD-related measurements were developed using constructs from broad inclusive instructional practices instead of relying on exclusively UDL principles (e.g., Lombardi et al., 2015). Faggella-Luby et al. (2017) described that ways to measure UDL treatment integrity are scarce. Although the reliability and validity of the UDL questionnaire were not ideal in this study, the results can serve as an initial reference for future researchers seeking to develop more measurements.

Limitations and Implications for Future Research

There were several limitations in this study. The first major limitation was the design of the online survey. For instance, the two scales had different numbers of Likert scale points. (i.e., the attitude scale used a 3-point Likert scale, and the perception scale used a 5-point Likert scale). Different numbers of Likert scale points might have caused biases when comparing the two scales. In another instance, the 3-point Likert scale might not detect changes, meaning that it might have resulted in less validity and reliability for the attitude scale. Darbyshire and McDonald (2004) demonstrated the advantages of using a greater spread of ratings, including increased sensitivity of the scale, more choices for respondents, and appropriateness for advanced statistical analysis. Thus, the 3-point Likert scale was not adequate for the design of the online survey. This study suggested that future research studies use the 5-point Likert scale to design a survey to investigate students' attitudes and perceptions toward UDL practices. In addition, the original survey (Schelly et al. (2011) was developed for the perception scale. The researcher added the attitude scale. The two constructs, however, are different constructs. Future research should re-develop the attitude scale.

The second major limitation was related to the inherent issue in survey research. Although participants in this study could easily fill out the online survey and maintain their anonymity, the survey could not fully capture participants' learning experiences related to UDL; it could not provide a sufficient explanation as to why participants considered certain items (e.g., Question 10) less important than others. This suggested that further inquiry regarding participants' thoughts on the teaching practices was needed. In addition, different participants might interpret the survey questions from different angles. Future research can use focus groups or interviews to capture participants' in-depth learning experiences, based on this study's results.

Through participants' descriptions, researchers can explore how UDL practices work for students with disabilities and can identify ways to improve.

The third major limitation was associated with the evaluation of the instrument. The reasonable way to run CFA and EFA was by using different data sets. The sample size in this study was not large enough to split into halves, however, so the researcher used the same data set to run EFA first and run CFA. In addition, the researcher used WLS to run CFA. The results from CFA were not ideal. Future researchers may revise the survey items based on the results from EFA, and recruit a new group of participants to run CFA again. Nonetheless, this study was able to contribute to the current literature base by establishing the main properties of a UDL measurement. Lombardi et al. (2015) demonstrated that the UD-related measurements were sparse, and future research could use UD constructs to develop a reliable and valid measurement.

The fourth major limitation was associated with statistical errors. One error was related to the insufficient sample size in independent variables. Although the researcher regrouped some variables, the group sample sizes in the variables were not even, potentially causing statistical error. Future research should recruit a large and diverse sample to run statistical analysis.

The fifth major limitation was that the results of the study were limited to a single university. Although the study used campus-wide emails to recruit a representative sample, participants could refuse to take part in the study, making the sample participants not entirely representative. Additionally, because of survey design issues, participants' ethnicity information was missing, although the study tried to report thorough demographic information for the participants. Future researchers could administer an online survey across multiple universities and compare the results.

IV. UNIVERSAL DESIGN FOR LEARNING IN POSTSECONDARY EDUCATION: A QUALITATIVE STUDY TO EXPLORE PERSPECTIVES OF STUDENTS WITH DISABILITIES

Since legislation paved the way for students with disabilities to enter PSE, pursuing a higher education degree or certificate has become a goal for this population. In order to better support students with disabilities in PSE, the Office for Civil Rights (OCR; 2002) provided specific guidance about their rights and responsibilities. In the OCR guidance, Section 504 and Title II of the Americans with Disabilities Act of 1990 were listed as the most important pieces of legislation that protect students with disabilities from being discriminated against based on their disabilities. The guidance also explained the process for requesting academic adjustments, such as voluntary disclosure of a disability, documentation of a disability, and the grievance process to fight discrimination. Although two decades have passed since the publication of this guidance, students with disabilities studying in PSE have had mixed experiences, with some students experiencing academic concerns and emotional difficulties (e.g., Cai & Richdale, 2016; Knott & Taylor, 2014), while other students develop strategies (e.g., self-determination and self-sufficiency) to support their own study (e.g., Connor, 2012; Lyman et al., 2016). While recognizing the benefits of academic accommodations, researchers in PSE believe that accommodations alone may not be sufficient to address the unique needs of some students with disabilities. They, therefore, recommend practices based on UDL to improve teaching and mentoring of students (e.g., Rose et al., 2006). CAST (2020) defined UDL as "a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn." UDL includes three principles: (a) multiple means of representation, (b) multiple means of expression, and (c) multiple means of engagement (Meyer et al., 2014). With its three

principles, UDL reminds instructors to appreciate students' differences in order to enhance teaching and learning and to fully engage students. Research has shown that college students can be stakeholders in providing opinions and perspectives toward UDL teaching practices. For example, Dallas and Sprong (2015) suggested that students can be co-presenters or collaborators for UDL training sessions for faculty. Inviting students to discuss UDL teaching practices may provide instructors with a better understanding of effective teaching practices and an opportunity to reflect on what should be improved based on students' perspectives. Additionally, Dukes and Shaw's (2008) research showed that the implementation of UDL can reduce the reliance on accommodations provided by the Office of Disability Services, and that UDL can increase students' self-determination as a result.

UDL consists of promising teaching practices. Research has demonstrated how to use these teaching practices in PSE (e.g., Rose et al., 2006). The perspectives of students with disabilities on UDL teaching practices in higher education settings, however, are still unclear in the literature. The researcher of this study previously conducted an online survey to investigate attitudes toward and perceptions of UDL teaching practices from students with disabilities. The results of the online survey demonstrated that some teaching practices that participants considered important were not utilized by instructors. This study serves as a follow-up intended to further examine how UDL teaching practices impact students' educational experiences. In addition, UDL provides opportunities for students to have choices. Students may practice their self-determination skills by choosing the best way for them to learn. The winning combination of UDL and self-determination has been revealed in the literature (e.g., Dukes & Shaw, 2008); however, the relationships between UDL and self-determination are still unknown. This study,

therefore, explores students' perspectives on how UDL teaching practices affect students' self-determination.

Several studies explored the educational experiences of students with disabilities in PSE. Cai and Richdale (2015) conducted focus groups with 23 students with autism spectrum disorder (ASD) and their family members to examine students' experiences in a postsecondary institution. In the focus group discussions, participants shared their experiences with course selection, disclosure experiences, disability support, social life, and daily living. Results of the focus groups revealed that most students did not initially disclose their disabilities or actively request accommodations. Instead, their family members, high school teachers, or college instructors prompted them to disclose their disabilities. Students also experienced a loss of interest in university coursework for reasons including content difficulty, poor motivation, and heavy workload. Knott and Taylor (2014) conducted focus groups with staff who regularly worked with students with ASD and four students with ASD. The aim of the focus group was to explore challenges and support for students with ASD in higher education. The topics of the discussions included academic work and other on-campus activities. Knott and Taylor found that students with ASD experienced academic concerns related to their social and communication skills. A lack of adequate social and communication skills resulted in some academic challenges, such as completing projects that required teamwork and oral presentations. These social challenges also caused some students to experience depression and anxiety.

Research further examined the educational experiences of students with different types of disabilities. Garrison-Wade (2012) interviewed 59 students with disabilities and six coordinators serving students with disabilities to investigate factors that inhibited the successful completion of PSE. Based on the results, some inhibiting factors included low expectations and lack of

understanding toward students with disabilities and students' limited awareness about their disabilities. Some participants, however, expressed that these inhibiting factors also served as motivation for them to develop self-determination skills (e.g., self-advocacy and independence).

Students with hidden disabilities might experience different challenges. Kreider et al. (2015) interviewed students with "invisible" disabilities (e.g., ASD, attention deficit hyperactivity disorder [ADHD], and learning disabilities) to expand the scope of disability-related experiences in PSE. Participants of the study included 13 students, a family member, and nine university personnel. The researchers asked students to describe their experiences related to their disabilities during their time in PSE. The study results demonstrated that students with invisible disabilities experienced challenges similar to those experienced by students with visible disabilities. For example, some students with invisible disabilities struggled to manage their time and keep up with classes. These struggles made it more time-consuming to complete assignments. They also struggled to fulfill class assignments that required collaboration with others, particularly when they needed to find their own groups. Because the participants' disabilities were invisible, the challenges were compounded by the ignorance of instructors.

Overall, research has found that students continue to experience some common challenges due to their disabilities. Although support services and self-determination skills were identified as the keys to mitigating these disability-related challenges, research has suggested that more effective strategies should be put in place to support students with disabilities. Accordingly, UDL has been identified by research and legislation as one of the most effective strategies.

As students with a wide number of categories of disabilities (particularly hidden or invisible disabilities) enroll in PSE, providing needed accommodations has become more

complex. For example, about 67% of students with learning disabilities (LD) who left high school within 8 years reported enrollment in PSE (National Center for Learning Disabilities, 2014). Orr and Hamming (2009) indicated that students with LD accounted for the largest group of students with disabilities enrolling in PSE; however, the learning needs of students with LD could be overlooked by instructors because their disabilities were invisible. Part of the problem was that students with hidden disabilities tended to not actively seek accommodations unless the academic challenges became worse from struggles with disability identity issues (Kreider et al., 2015). On the other hand, Cai and Richdale (2016) described that students with visible disabilities were more likely to advocate for themselves to negotiate for academic accommodation. Some of these students who advocated for themselves had positive experiences and received support from the disability services, while others encountered negative feedback (e.g., insufficient or unsuitable support, often provided late). Similarly, McCall (2015) demonstrated that students encountered communication barriers with staff and instructors when they requested accommodations. The communication barriers may push students to opt out of the accommodation requests and turn to other resources.

Given the challenges mentioned above, recent research has sought UD approaches to better teach and mentor students with disabilities. UD was originally proposed in environmental design and architecture (Scott et al., 2003). When UD is applied to a physical environment, the environment is designed to provide access for all possible users. One of the characteristics of UD is the built-in feature, which uses proactive techniques to accommodate the needs of a broad range of users. By doing so, the environment is inclusive and accessible to diverse users, whether they are individuals with disabilities or not. In addition, UD approaches facilitate the service model shift to provide accommodations for students with disabilities. Mole (2012) proposed a

social model that provides an alternative approach to understanding the concept of disability. This model argues that a disability is a result of barriers surrounding an individual. Some postsecondary institutions not only used the social model to serve students with disabilities, but also adopted UD as a dominant service approach, which transformed their service model from remediating an individual's disability to changing the design of curriculum and instruction.

One of the frameworks from UD is UDL. King-Sears (2009) mentioned that UDL is not only related to using technology in education, but also a pedagogy or instructional practice that can be applied in classrooms to accommodate students with disabilities. UDL includes three principles: multiple means of representation, multiple means of expression, and multiple means of engagement (Meyer et al., 2014). Based on these three principles, instructors can use the corresponding guidelines and checkpoints to implement UDL teaching practices step by step.

Several studies showed that UDL had a positive impact on the learning experience. For example, Orr and Hammig (2009) conducted a literature review to examine inclusive teaching strategies implemented by instructors in PSE to teach students with LD. A total of 38 studies generated five themes: (a) backward design, (b) multiple means of presentation, (c) inclusive teaching strategies and learner supports, (d) inclusive assessment, and (e) instructor approachability and empathy. These five themes suggested that instructors had applied UD-based strategies to provide needed support for all learners, and that support could contribute to successful learning experiences for students. Similarly, Rose et al. (2006) implemented three principles of UDL in a university-level course. They presented the materials in different ways (e.g., videotaping, visual materials, class notes, and sign languages). Different types of discussion groups facilitated students' engagement in learning. Moreover, students could choose different media (e.g., texts, images, sounds, and videos) to demonstrate their learning outcomes.

In summary, postsecondary institutions adopted a social model with the UD approach that viewed a disability as a result of the barriers surrounding an individual. UDL minimizes learning barriers and fosters inclusion for diverse student learners. Research demonstrated how UDL was used in college classrooms and how the teaching practices reshaped lesson delivery. Nevertheless, student perspectives on the impact of using UDL teaching practices in classrooms still need further investigation. Student perspectives can also provide information about what parts of UDL teaching practices do or do not work.

Recently, research has stressed the importance and effect of listening to students' voices to enhance instruction. For example, Quaglia and Corso (2014) defined students' voices as a genuine and authentic conversation with students to get their input. Inviting students to speak empowers them to provide input in the decision-making process. In reality, however, students' voices have not been heard very often. To promote this valuable practice, Quaglia and Corso described the benefits of listening to students' voices; for instance, students are more likely to actively engage in school and have mutual trust relationships with teachers if they are invited to talk. Similarly, Lubelfeld et al. (2018) stated that students should be allowed to participate in different aspects of decision-making. Students are able to tell schools' stories, to express what they think about the latest instructional practices, and to demonstrate how technology has impacted their learning.

Studies also used students' voices to explore the students' perspectives toward UDL teaching practices. For example, Kortering et al. (2008) designed an intervention based on UDL principles for use in high school algebra and biology. The participating teachers used the three principles of UDL to design classroom activities. Both students with and without disabilities participated in this study, and after the class, students were asked to describe the best and worst

parts of the activities. Although the effect of the UDL-based activities on academic performance was unclear, participating students reported that these activities were engaging and collaborative. Students also, however, expressed negative experiences during the activities (e.g., technical issues with technological devices; team activities being required to work within a team). In higher education settings, Griful-Freixenet et al. (2017) conducted interviews with 10 students with disabilities to investigate the barriers and opportunities provided by the UDL framework. These interviews revealed different perspectives toward UDL teaching practices. For instance, for UDL guideline 1 (i.e., providing options for perception), many students shared the benefits of having class notes, lecture PowerPoints, or other combinations of sensory inputs in class; however, some students expressed discomfort with materials presented via multiple media. Overall, in the two studies, students' voices offered genuine feedback on teaching practices. When educators or researchers solicited feedback from students, students actively engaged in the conversation. Most importantly, the studies showed that students' voices and feedback might challenge the mainstream values on some topics. This provided opportunities for instructors and researchers to reflect on what should be improved based on students' perspectives.

Studies also found that when researchers encourage students to use their voices, students are more likely to engage in self-determined behaviors. For example, Connor (2012) argued that special education's excessive adherence to positivism was problematic; therefore, he endorsed using students' voices to explore their experiences. He used narratives with three students, each with a learning disability, to reveal students' stories in PSE. Students consciously shared their experiences dealing with disability-related challenges through the use of proactive strategies. As students shared their college experiences in detail, the author found that self-directed actions assisted students in facing adversities. As Getzel and Thoma (2008) demonstrated, multiple self-

determination strategies that students used in PSE were problem solving, goal setting, self-awareness, and self-management. These strategies helped students request accommodation services, form relationships with instructors, and select courses of study.

The connection between UDL teaching practices and self-determination has been introduced in the literature, but it still needs the perspectives of students with disabilities to verify the connection. For instance, Dukes and Shaw (2008) implied that applying UDL teaching practices can increase students' self-efficacy. Because UDL makes the whole learning environment accessible and engages all learners, students can practice self-determination skills in a conducive environment. In addition, the UDL guidelines support self-assessment, reflection, goal setting, and strategy learning (CAST, 2018). These are essential elements of self-determination; however, current research has not fully examined how UD impacts self-determination in learning for students with disabilities. Whether students consider UDL important for practicing self-determination is still unclear.

The existing problems and research gaps guide the purpose of this proposed study. Students with disabilities have encountered numerous challenges in PSE that have not been fully addressed. The research community and legislation have proposed that UDL, as a teaching framework, is one of the most effective strategies to support students with disabilities. Nevertheless, the current research gaps show that the perspectives of students with disabilities have not been fully tapped by other researchers. Previously, the researcher conducted an online survey to investigate attitudes toward and perceptions of UDL teaching practices by students with disabilities. The results of the online survey study demonstrated that participants considered some teaching practices important, but these practices were not being fully utilized by

instructors. The final study serves as a follow-up using online focus groups to further examine how UDL teaching practices impact students' educational experiences.

In addition, UDL provides opportunities for students to be engaged in a learning environment and to self-regulate their progress. The connection between UDL and self-determination has been introduced by prior research, but available studies are limited; therefore, it is still unclear whether the connection is consistently present. This study explores how UDL teaching practices impact students' self-determination experiences.

The following questions guided this study:

1. How do students with disabilities describe their college experiences?
2. How do students with disabilities describe their learning experiences with UDL teaching practices?
3. How do students with disabilities describe their learning experiences without UDL teaching practices?

Method

Research Design

The research design in this study addressed the alignment of the researcher's ontology, epistemology, and methodology. Ponterotto (2005) explained that the philosophy of science, including ontology and epistemology, is made up of the beliefs and assumptions toward a researcher's view on social reality. The researcher adopted an *interpretive ontology* position, meaning that the nature of social reality is constructed based on human interaction and individual experiences and perspectives (Hesse-Biber, 2017). Ponterotto further explained that the constructivism-interpretivism position explores the hidden meaning and reflection from lived experiences of the individuals within it. Moreover, the lived experiences should be brought to the

surface through the interaction between researchers and participants. With the interpretive ontology, the researcher adopted an interpretive perspective for her epistemology, meaning that the researcher and participants are co-creators in the process of knowledge acquisition. Interpretive epistemology emphasizes participants' perspectives because participants are the individuals who are living the experiences (Hesse-Biber, 2017).

Based on the ontological and epistemological standing, this study took a qualitative approach to explore participants' lived learning experiences related to UDL teaching practices. The qualitative approach can dig into the meaning and understanding of social issues; thus, compared to the quantitative approach, subjective experiences are privileged in the qualitative approach (Hesse-Biber, 2017). Similarly, Drew et al. (2008) maintained that qualitative research is suited for exploring a broad phenomenon or context using thick description.

This study used interpretative phenomenological analysis (IPA) as the research methodology to conduct this qualitative research. Smith et al. (2009) defined IPA as "a qualitative research approach committed to the examination of how people make sense of their major life experiences" (p. 1). IPA is interested in exploring lived experiences, so researchers using IPA strive to engage with and listen to participants who are reflecting on their major experiences. Researchers also endeavor to make sense of participants' major experiences based on the participants' languages, descriptions, and expressions.

There are three principles grounded in IPA: phenomenology, hermeneutics, and ideography (Smith et al., 2009). The word "phenomenon" implies real-life experiences; thus, everyday events or situations are the focus in the IPA (Seah & Wilson, 2011). IPA uses *phenomenology* as an approach to think about the essence of real-life experiences. *Hermeneutics* is the theory of interpretation using methods and purposes to uncover the meaning of a major

experience. *Ideography* emphasizes that subjective and experiential phenomena are considered unique by particular people. Taken together, the IPA philosophy utilizes systematic methods to interpret major experiential phenomena from individuals who experience these phenomena in their daily lives.

Smith et al. (2009) further proposed that the idea of "experience" is complex. Similarly, Sullivan and Forrester (2019) described IPA as seeking to interpret individual experiences that took place in a certain time and space. Those experiences are unique to individuals as a particular history under a specific society and cultural context. Sullivan and Forrester further explained that researchers and participants are interactive during the knowledge process. Researchers may figure out how participants make sense of their worlds by "wearing their shoes." The adoption of IPA is important to this study because it is aligned with the researcher's ontology and epistemology (Hesse-Biber, 2017).

Researcher Positionality

The researcher was a fourth-year international female doctoral student who grew up in an Asian culture family. She had been a special education teacher in a high school for 5 years.

Not until her time in high school did the researcher realize that she has a one-ear hearing impairment. After she found out the truth, she finally realized why she could not talk by phone with the left ear and needed to be on the left side when walking with people.

During her time in college, she did not know about academic accommodations. After coming to the United States for her PhD program, she obtained accommodation information from the disability services office. After using the accommodations for one to two semesters, however, she found the accommodations were not as effective as she had expected. Based on the experience, she was intrigued by learning other approaches that support students with disabilities

in PSE. Then, the researcher found that the UD approach is one of the effective methods that the existing literature has mentioned most frequently.

In addition, the researcher valued students' voices and considered self-advocacy as an essential skill for all learners. Standing in an interpretive position led her to the increasing motivation for the interaction with participants. The researcher privileged and emphasized participants' descriptions of their own experiences.

Setting and Participants

The study was conducted at a public Carnegie Classified Doctoral University with High Research Activity in Texas. The university was quite large, with 64,961 students enrolled in the Spring 2020 semester and 2,300–2,400 of those students registered with the Department of Disability Resources in the academic year 2018–2019. Because this study served as a follow-up to a prior online survey, 127 of the previous participants were invited to take part in the follow-up.

The researcher sent two email invitations to invite the participants to participate in this study. The invitation emails included the purpose and the eligibility criteria for this study. Interested participants filled out the application form to receive further information, including a consent form and focus group protocol. Interested participants had time to review the consent form before they signed it, and they could also prepare themselves for the discussion by reading the focus group protocol.

The eligibility criteria for participation in this study were: (a) students who identified themselves as students with disabilities and who participated in the prior online survey, either as graduate students or undergraduate students; (b) students who were willing to share their perspectives or experiences with UDL teaching practices. They could also share the strategies

they used to support their learning; (c) students who were available for the duration of the 60- to 90-minute period of a focus group session; and (d) students who met the technology requirements (i.e., laptop, speaker, microphone, stable internet or Wi-Fi, and optional webcam).

For an IPA study, it is important to select homogeneous participants based on their common experiences. Previous literature implied that students with disabilities in PSE experienced similar challenges and difficulties (e.g., Garrison-Wade, 2012). The common learning experiences of students with disabilities were the focus of the study.

Ethical Considerations

The study was conducted with IRB's approval. Participants willing to take part in the research were asked to complete an informed consent form. As Sullivan and Forrester (2019) stated, several ethical issues in a study should be addressed (e.g., informed consent, confidentiality, deception). The researcher did not use deception in the study; instead, the researcher revealed her identity and positionality. In the informed consent form, the researcher informed participants that the Zoom call used for the interview would be recorded, and she detailed the following strategies to keep participants' information confidential.

First, all focus group participants were asked to register before coming into the virtual discussion room. Participants waited in the waiting room, and the researcher admitted one participant at a time. After a participant was admitted into the room, they changed their name. The researcher then moved the participant to a breakout room and admitted the next participant. The discussion and recording began after all participants had changed their names.

Second, the researcher introduced the ground rules for the focus group. All participants were asked not to disclose anything said within the context of the discussion.

Third, the researcher kept participants' pseudonyms for data analysis and publication purposes. The researcher also de-identified participants' personal information before analyzing the data.

Fourth, the researcher stored all data securely in a password-protected laptop. Finally, participation in the study was voluntary. Participants could choose not to join the study or initially agree to take part and later withdraw.

Data Collection Method

Studies have suggested that semistructured individual interviews are most commonly used in IPA (e.g., Miller et al., 2018); however, focus groups have recently been used in IPA studies (e.g., Palmer et al., 2010). The differences when using focus groups instead of individual interviews are the interactional elements. The interactions among participants and between participants and facilitators should be considered while analyzing data. Other than that, focus groups are appealing methods to collect data in that participants may share more during group discussions. Participants' experiential reflections can be elicited by hearing someone else's experiences; therefore, the study used small, homogeneous focus groups to collect data.

Focus groups are a data collection method that listens to people (Morgan, 1997). Similar to individual interviews, focus groups can explore personal experiences in a group format. Members of the focus groups create an open communication or discussion on the chosen topic. Morgan (1997) also demonstrated that researchers can draw on the three strengths of focus groups: exploration and discovery, context and depth, and interpretation. Group discussions create an opportunity to explore and discover a common phenomenon that participants have experienced in a certain time and place. In addition, focus groups are an appropriate data collection method to help researchers further understand the responses to a survey (Kleiber,

2004). Based on the reasoning above, the researcher used three focus groups to collect data. Each focus group had between two and four participants who engaged in an approximately 90-minute discussion. The participants in this current study provided insights into the interpretation of the prior survey responses. Each participant was also able to share an in-depth story regarding their learning experiences at the university.

Under the circumstances of COVID-19, the Centers for Disease Control and Prevention suggested that everyone should avoid close contact and keep at least 6 feet away from other people (Centers for Disease Control and Prevention, 2020). Compared to face-to-face meetings, the researcher considered meetings on the internet at a specific time to be more reasonable. Hesse-Biber (2017) also claimed that online focus groups have been increasingly popular because participants do not need to travel to an unfamiliar place to meet strangers. In addition, meeting online allows participants to stay in a familiar place while socializing with people, which may make participants more comfortable sharing and talking.

This study used Zoom videoconferencing to conduct online synchronous focus groups. A couple of reasons led to the researcher's decision to use Zoom for the focus groups. First, Zoom was available to students, instructors, researchers, and other employees at the university. During these special circumstances, Zoom was used to conduct several activities (e.g., classes and meetings). Second, Zoom addressed security and privacy issues with many features, such as waiting rooms, password setting, screen share control, and recording control (Zoom, 2019). Finally, the accessibility techniques on Zoom reflected the principles of UDL. For instance, the "share screen" feature could allow the researcher to visually share the focus group protocol. Another example was the ability to enable live transcripts. Hosts and participants could view the closed captions during the discussions.

Two moderators facilitated the focus groups. One of the moderators was the researcher in the study. The other moderator was a female doctoral student. Both of them were interested in studying PSE for students with disabilities. The two moderators took a semistructured approach to facilitate the discussion. Less-structured questioning was more appropriate for discovering and exploring a common phenomenon (Kleiber, 2004).

The Focus Group Protocol

A focus group protocol was developed to guide group discussions (see Table 4-1). The protocol was developed based on the "funneling" rules (Smith et al., 2009). The *funnel approach* to designing questions suggests that researchers can solicit the general experiences from participants and then move on to specific experiences. The researcher also reviewed literature references to create the protocol (e.g., Griful-Freixenet et al., 2017; Lyman et al., 2016). The protocol included a brief introduction of the purpose of the focus groups. Some ground rules for online focus groups via Zoom were explained as well. Before the formal focus groups started, the researcher used the protocol to conduct a pilot interview with a student. The results of the pilot interview suggested that more follow-up questions should be added to the protocol. These follow-up questions mainly targeted exploring participants' common experiences and their feelings and perspectives toward these experiences (e.g., differences between high school and university experiences, experiences of disclosing disabilities to instructors, experiences of using accommodations, their perspectives toward implementations of UDL, and self-learning strategies they had used). In addition, before discussing UDL teaching strategies, the researcher invited the other moderator to read the examples of UDL teaching practices to participants. By doing so, while the moderator was reading the practices, participants were able to recall an experience in which their course instructors had used the practices.

In this protocol, the general questions helped the moderators explore the general views of participants on their disabilities and how their disabilities affected their learning experiences at the university. For example, the moderators asked, "How were your overall experiences studying at the university?" or "Has your disability affected your learning at the university?" After the general questions, the moderator asked specific questions related to UDL teaching practices. These questions asked participants about their views on UDL teaching practices and their experiences with instructors implementing these teaching practices and with instructors who did not use them. For instance, the moderators asked, "What parts of the UDL teaching practices were or were not helpful for you?" In addition, in order to explore the connection between the development of self-determination skills and UDL teaching practices, participants were asked their perspectives of how UDL teaching practices helped develop their self-determination skills.

Table 4-1 Focus group protocol.

Welcome and introduction

Title: Universal Design for Learning in Postsecondary Education: A qualitative study to explore perspectives of students with disabilities

- **Introduction (10-15 mins)**

1. ***Welcome focus group participants.***
2. ***Introduce the focus group moderators and thank participants.***
3. ***Briefly explain the purpose of the focus group and explain the informed consent letter and confidentiality.***

- Introduce the purpose of the focus group: The focus group is a follow up on the results of the online survey. The online survey investigated attitudes towards and perceptions of UDL teaching practices by students with disabilities. Based on the results of the online survey, some UDL teaching practices that are considered important have been satisfactorily addressed, while others have not. This focus group is to further explore and compare the learning experiences of students whose instructors implemented UDL teaching practices to those whose instructors did not implement UDL teaching practices.
- Term introduction: UDL and introduce examples of UDL teaching practices, and briefly introduce the results of the online survey.
- Explain confidentiality: The focus groups will be conducted via Zoom with recording. Participants may turn on the web-camera during the discussion, though it is not required. After the focus group, the recording will be transcribed. The researchers acknowledge that complete confidentiality will not be guaranteed. The researchers will use participants' pseudonyms and de-identify their personal information before analyzing the data.

4. ***Group rules for online focus groups on Zoom***

- Everyone is encouraged to share and fully participate in the discussion. In this focus group, group members are just trying to express our experiences. Experience from everyone is unique and very valuable. However, they do not have to share if they do not feel comfortable talking about some experiences. They can just say "I pass" or "I want to answer the question later."
- In order to have everyone share experiences, please listen to other participants respectfully. Again, in this focus group, group members acknowledge everyone's experiences without any judgement.
- Some issues relating to internet connection may appear during the focus group discussion. The following tips can help run the online focus group smoothly: speaking slowly, using the closed caption, one person talking at a time, and using the raise hand function. Group members can also take turns to answer questions.
- The focus group may last 60-90 mins. Please feel free to use the restroom or take a short break.
- Last but not least, please respect the confidentiality of the focus group. All the discussion from the focus group should not be shared and discussed outside of this group.

Table 4-1 Focus group protocol (continued).

Focus group questions
➢ **General questions (10 mins):** 1. How were your overall experiences studying at the university? 2. Has your disability affected your learning at the university? *Follow-up questions: What is the difference (in support) between high school and university experience? How has the difference affected you? How do you feel about disclosing your disabilities to professors?* ➢ **Reading the example UDL teaching practices to participants (3 mins).** ➢ **Questions related to UDL teaching practices (40-50 mins):** 3. Can you share any learning experiences about instructors who has implemented these teaching practices? *Follow-up questions: What parts do you think were helpful for you? What parts do you think were not helpful for you? What is your opinion if you see instructors implement the strategies? Do you* *feel you gain more or less support from the instructors?* 4. Can you share any learning experiences about instructors who did not implement these teaching practices? what would you do to accommodate your learning? *Follow-up questions: Have you ever used any strategies or skills to accommodate your learning* *needs? Any self-directed strategies, such as self-sufficiency, self-determination, self-learning? If you have used self-directed strategies or self-learning, what do you think about it? Do* *you feel more or less confident in using self-directed strategies? Can you share any strategies you* *have used?* 5. Do you think UDL teaching practices are helpful or not with your self-determination learning? (presenting the UDL teaching practices on the PowerPoint)? Why? ➢ **Ending question (10 mins):** 6. As you may know, students with disabilities studying in postsecondary education have encountered more challenges than students without disabilities. Based on your experiences, would you give any advice to students with disabilities who are struggling with studying in postsecondary education?

Data Analysis

This study used the standard IPA data analysis process as the main method to analyze data. Additionally, this study used focus groups to collect data; therefore, the data analysis for focus groups needed to consider participants' experiential accounts under the social and interactive contexts. To do this, the approach to analyzing data for focus groups was required.

Before analyzing the data, the researcher invited the other focus group moderator and another doctoral student to form a data analysis team. The team followed the standard IPA analysis steps (e.g., writing summary memos, creating initial codes and emergent themes, revisiting the transcripts to check themes to ensure accuracy) to complete the data analysis through weekly or biweekly research meetings.

The data analysis team used Dedoose software to analyze the qualitative data (Dedoose, 2020). The team was able to independently code a transcript for each focus group on Dedoose, and then they discussed the coding consensus as a team. Additionally, the diverse features of Dedoose allowed the team to create initial themes and conduct further data management.

The standard IPA analysis steps were derived from Smith et al. (2009) and Sullivan and Forrester (2019). The steps include:

1. Transcribing the data and reading through the data before analysis,
2. Phenomenological coding or summary coding,
3. Interpretative coding and identifying initial themes,
4. Clustering themes,
5. Naming and defining themes,
6. Adding data extracts to themes,

7. Finalizing themes for the first transcript,
8. Repeating the steps for the second transcript,
9. Comparing themes across transcripts,
10. Clustering themes across transcripts, and
11. Finalizing all themes across all transcripts.

The data analysis steps utilized the iterative process for qualitative research. First, after the first focus group, data were transcribed. The researcher then familiarized herself with the data by reading through the transcript. The researcher transcribed the data with the aid of Zoom recording. The first two focus groups were transcribed by the researcher. For the third focus group, the researcher had difficulty transcribing due to participants' accents; therefore, the third focus group data were transcribed by using an online audio transcription service, Rev.com. Data were protected confidentially and guaranteed high quality by using the service (Rev, 2020).

After completing the transcription for the first focus group, each team member wrote the phenomenological coding independently. The phenomenological coding was a descriptive summary of participants' ideas, thoughts, feelings, or issues and events they described in the focus groups. The team used the "memo" function in Dedoose to record the phenomenological coding.

After completing the phenomenological coding, the team reviewed it together and came up with the interpretative coding. The interpretative coding yielded initial themes, which made sense and represented the meaning of the participants' accounts. The two coding processes ensured that the analysis process was data-driven and inductive. After the two coding processes, the researcher developed definitions for the initial themes for the first focus group by using a

code spreadsheet. The researcher then shared the code spreadsheet with the team to discuss the accuracy of the original voices from participants.

The process was repeated to conduct phenomenological and interpretive coding of the next two transcripts. The only difference in the process for these transcripts was that the phenomenological coding for them was created solely by the researcher, while the other two team members reviewed the phenomenological coding. Similarly, the researcher independently completed the interpretative coding for the latter two transcripts, but the other two team members independently completed the interpretative coding for Focus Group 2 and Focus Group 3, respectively. The team members then discussed the coding consensus during the meeting. Additionally, although the initial themes established in the first focus group could guide the subsequent analysis, the team came up with other initial themes when analyzing the second and third focus groups.

As the team completed the interpretive coding for a transcript, the researcher tried to cluster and group initial themes until all the initial themes created from all transcripts were regrouped and clustered; this was a gradual and ongoing process. When clustering and grouping themes, the researcher examined their connections and relationships by utilizing abstraction, subsumption, and contextualization strategies. Smith (2009) defined *abstraction* as creating a new superordinate theme for the clustered initial themes; *subsumption* meant an initial theme was assigned to have a superordinate status and group other initial themes. *Contextualization* meant that initial themes are grouped for a temporal moment, thereby presenting a series of key events. The researcher also used graphic representations to present how the initial themes were grouped and clustered based on the strategies. The researcher then shared the graphic representations with the team and asked for feedback.

After finalizing the clustered themes across the three focus groups, the excerpts under the themes were added. Smith (2011) mentioned that high-quality interpretative phenomenological work should include experts from every participant or at least three participants for each theme. Considering that this study used focus groups to collect data, the researcher tried to include excerpts from at least one participant in each focus group so each group had a member to represent their voices. Different focus groups emphasized different themes, however, and some participants were more vocal than others. There was inevitably an imbalance in excerpts across themes, although the researcher tried to include equal representation from all participants for each theme. The researcher also used the code spreadsheet to document the number of excerpts used to ensure each participant's voice could be heard.

The other consideration for selecting excerpts is to examine whether the selected excerpts present the essence of the themes (Dickson et al., 2008). In this study, the selected experts should be able to represent the definition of the themes in order for readers to check the evidence and interpretation the researcher made. See Appendix B for the excerpt documentation.

Finally, the researcher was able to conduct the individual- and group-level analyses (Smith et al., 2009), meaning that the themes were compared within a group or across groups. See Figure 4-1 for IPA standard data analysis steps.

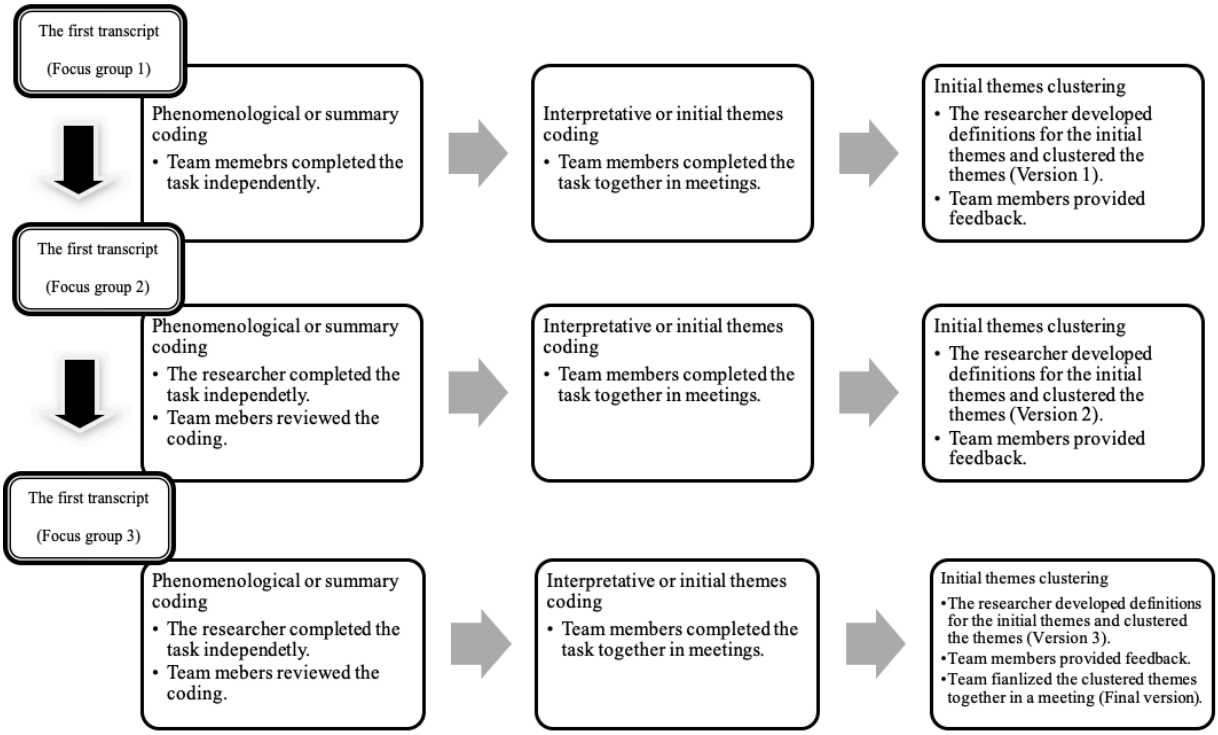

Figure 4-1. IPA standard data analysis steps.

For the approach to analyzing data for focus groups, Palmer et al. (2010) proposed a protocol for using IPA with focus groups. Most of the elements in the protocol are similar to the standard IPA data analysis process. Palmer et al. suggested that researchers using IPA with focus groups should examine participants' and facilitators' positionalities. This implies that as a participant shares their experience, researchers examine other participants' and facilitators' responses. The interactional dynamic can generate intersubjective patterns and explain how the themes in the group are developed. Palmer et al. further suggested that researchers need to check the degree of homogeneity and variability within a group and across groups. As Smith et al. (2009) mentioned, researchers should look for convergences and divergences in the data. In this study, the researcher was able to conduct the group- and individual-level analyses and to compare the results for convergence and divergence purposes.

In addition, a reflexive journal is also a key for an IPA study. In this study, the researcher wrote a reflexive journal at three points in time: at the beginning of reading through the transcript, after writing phenomenological coding, and after interpretive coding. The researcher also shared the reflexive journal with the team. Sullivan and Forrester (2019) described the reflexive journal as a link between early and later analysis processes. Shaw (2010) expressed that reflexivity is an "explicit evaluation of the self." Shaw used reflexivity notes when conducting an IPA study to reveal her researcher identity's presuppositions and how the presuppositions impacted the interaction with participants. The researcher used the reflexive journal to document her thoughts, presumptions, feelings, ideas, subjectivity, and biases while reading the transcripts. The reflexive journal also revealed the examination of the relationship and connection among different initial themes and how these themes were grouped and clustered. In this way, different points in time to practice reflexivity could provide readers with an explicit explanation of how the conclusion was drawn based on the data. In an IPA study, the double hermeneutic process is at work. The *double hermeneutic process* means "the participants are trying to make sense of their world; the researcher is trying to make sense of the participants trying to make sense of their world" (Smith et al., 2009). Based on the double hermeneutic process, it was important for the researcher to interpret and analyze the data with the use of the reflexive journal.

Credibility and Trustworthiness

Qualitative research credibility and trustworthiness can be confirmed through multiple strategies. Sullivan and Forrester (2019) and Brantlinger et al. (2005) suggested the following approaches for researchers to conduct a good qualitative study.

First, because the researcher was the main instrument in the qualitative study, the researcher used the reflexive journal to document her thoughts and feelings when interpreting

data. The reflexivity demonstrated the researcher's awareness and subjective impact on the study.

Second, for the purpose of transparency and audit trails, the researcher presented the data collection and analysis steps in a systematic and consistent manner, including methods for recruiting participants and transcribing and analyzing data. The researcher used a research note to document the steps of data collection and data analysis. The researcher also used a code spreadsheet to document the themes and definitions. The code spreadsheet also included how the themes were clustered and evolved over the course of data analysis across the three focus groups. The researcher shared the research notes and code spreadsheets with the team to ensure transparency. Most importantly, the IPA standard data analysis depicted how themes were shaped from phenomenological coding to interpretative coding, from interpretative coding to clustered themes. The researcher followed the steps diligently to make the process systematic and consistent.

Third, the researcher strived to establish strong coherence by bridging the links among the researcher's ontology and epistemology, the selected methodology, the data collection method, and the data analysis method. In addition, because this study was a follow-up to an online survey study, the research questions were developed based on the results of the online survey. By completing the follow-up study, the coherence was extended across studies.

Finally, the researcher used triangulation to seek evidence convergence from multiple sources. For instance, the researcher invited two doctoral students to analyze the data. The data analysis team examined and coded the data together, and each member brought a unique perspective toward the analysis. The researcher also shared the code spreadsheet, research notes, and reflexive journal to seek feedback and consensus with the team members.

Results

The researcher conducted three focus groups with a total of 10 participants. Each participant joined one focus group based on their schedule. Each focus group had two to four participants for an approximately 90-minute discussion. By doing so, each participant was able to share an in-depth story regarding their learning experiences at the university. Most participants were female (n = 7), White (n = 7), and undergraduate students (n = 7). Their college affiliations were different, meaning that they came from diverse backgrounds. See Table 4-2 for a summary of participants' demographic information. Participants came from different backgrounds and shared common challenges and experiences as well as experiences that were unique and different from others.

Table 4-2 Participant Characteristics.

Pseudonym	Student status	College Affiliation	Self-reported disability type	Gender	Race/ethnicity	Focus group number
Ashley	Undergraduate	College of Liberal Arts	Physical disability	Female	White	Pilot
Mary	Undergraduate	College of Agriculture and Life Sciences	Dyslexia	Female	White	Group 1
Aggies	Undergraduate	College of Education and Human Development	Generalized anxiety disorder	Female	White	Group 1
Rob	Undergraduate	College of Engineering	ASD	Male	White	Group 1
Rachel	Undergraduate	Mays Business School	Slow processing	Female	White	Group 1
Cassie	Undergraduate	College of Liberal Arts	Mental disorder	Female	Hispanic/Latino	Group 2
Ann	Master's	Mays Business School	LD	Female	White	Group 2
Toby	Undergraduate	College of Engineering	Speech impairment	Male	Mexican/Latino	Group 3
Jessica	Doctoral	College of Agriculture and Life Sciences	Blind/low vision	Female	White	Group 3
Matt	Undergraduate	College of Science	ASD	Male	White	Group 3
Alias	Doctoral	College of Medicine	Systemic Lupus Erythematosus and ASD	Female	Multiracial	Group 3

The standard IPA process was used to analyze the data. After coding the first transcript, the research team clustered and regrouped the initial themes. As the research team created more initial themes when coding the next two transcripts, they kept clustering and regrouping the initial themes into final themes. In addition, some initial themes were merged if two or more initial themes had similar definitions and occurred in the same excerpts regularly. Appendix C represents how the themes evolved from an initial draft to a final version.

In total, seven final themes were identified from the data. One final theme stood alone without merging with other themes. Another final theme was created using the contextualization strategy because the initial themes were related to a temporal moment representing a series of key events. Three final themes were created using the abstraction strategy, meaning that the researcher developed a new superordinate theme to group initial themes. Lastly, two final themes were created through the use of the subsumption strategy. Under the subsumption strategy, the researcher utilized an existing initial theme as a superordinate theme to bring together a series of similar initial themes. The seven final themes depicted a holistic story about participants' overall college and disability-related experiences and their experiences with or without UDL teaching practices. Tables 4-3 and 4-4 present an overview of the definitions for each initial theme and a results comparison table within a group and across groups.

The researcher also used the reflective note to document how the researcher organized the themes. For example, one of the reflexive notes described the researcher's decision not to merge two initial themes:

> After completing coding for Focus Group 2, I moved "Embraced challenges" to "Independence in learning." I found that "Embraced challenges" usually went with "Used self-learning strategies helped them learn better." However, the difference is that

"Embraced challenge" means participants had "challenges," and they used strategies to overcome the challenges. But for "Used self-learning strategies helped them learn better", participants did not mention challenges. So, I did not merge them for now (Reflectivity note—merging themes).

The reflectivity notes also documented the team discussion. For example, one of the research team members suggested that a final theme's name should be changed. The original name was "self-advocacy is not an option." The team decided to rename the final theme as "reasons not to disclose their disabilities" because the new name was able to fully represent the concepts of the initial themes.

Table 4-3 The overview of the definitions for each initial theme.

Final theme	Initial theme	Definition for initial theme
The university experience was overall positive.	The university experience was overall positive.	Participants explicitly said their university experience was overall positive or rewarding.
Issues encountered at different settings	Issues related to transferring between colleges	Participants expressed issues encountered when transferring to another college
	Compared learning experiences from different stages of education	Participants compared their learning experiences between different stages of education, such as from PreK-12 to college, or from undergraduate to graduate school. They mentioned differences, such as people's attitudes toward disability, skills needed or learned, or learning environment.
Issues related to disability and university resources	Struggled with issues related to disability or accommodation	Participants shared their difficulties or challenges from their disability or accommodation.
	Others' understanding of their disability or accommodation	Participants shared other people's (e.g. peers or professors) reactions toward participants' disability or accommodation.
	Used university resources (including accommodations)	Participants used university resources from disability services or other on-campus resources or services. The resources can be for students only or the public/community.
Building influence through advocacy and education	Advocacy and acceptance of their own disability identities	Participants spoke up for themselves or others about accommodation or disability issues, and demonstrated they accepted their disability identities.
	Educated others about disability	Participants demonstrated a willingness to share their disability experiences with others by speaking up so people can learn from them.
	*Reasons not to disclose their disabilities	Participants described the reasons why they chose not to disclose their disabilities or speak for themselves.

*The contrasting description to the narratives of building influence through advocacy and education.

Table 4-3 The overview of the definitions for each initial theme (continued).

Final theme	Initial theme	Definition for Initial theme
Impact of the pandemic on learning experience	Impact of the pandemic on learning experience	Participants described how the pandemic made their learning experience differently.
	Figured out how to navigate the two systems: online and face-to-face learning.	Participants mentioned benefits of both systems or figured out how to learn through both systems.
	Preferred in-person learning to see peers around them	Participants expressed preference toward in-person learning, and seeing their peers around inspired them to study.
	Online learning was challenging	Participants shared difficulties or frustration from online learning
UDL practices were helpful for students	*UDL practices were helpful for students	Participants described that the UDL practice implemented in class was helpful for all students.
	Feedback was important	Participants expressed that feedback kept them on track and identified the area for improvement.
	Approachable instructors made communication easier	Participants described that they could approach instructors (professors) to communicate their disability, accommodations, and feedback (including the contrasting description).
	Instructors expressing enthusiasm made class interesting	Participants expressed that an instructor or professor was excited and loved what they taught.
	Interactive learning or class practices solidified understanding	Participants mentioned class activities that were helpful to enhance their learning and understanding.
	Multiple formats solidified their learning experience	Participants mentioned that different forms or types of materials, such as videos, pictures, slides, made learning effective and accessible.
	Restating important points helped not to miss points	Participants expressed that instructors summarizing or repeating important points helped them grasp important concepts.
	Choices gave them an opportunity to demonstrate comprehension	Participants described that they had choices to demonstrate what they learned in class (their comprehension).

* An initial theme itself acquires a superordinate status as it helps bring together a series of related themes.

Table 4-3 The overview of the definitions for each initial theme (continued).

Final theme	Initial theme	Definition for Initial theme
Independence in learning	Embrace challenges	Participants demonstrated independence to figure out or overcome the challenges they encountered.
	Figure out how to study for themselves	Participants had self-awareness to figure out the best way to learn for themselves
	Used self-learning strategies helped them learn better	Participants expressed that they used strategies for themselves to study, such as textbooks, online resources or flashcards.
	Knew their learning preference/strength	Participants had awareness of their preferred learning methods or strengths
	Had more control over learning	Participants had a chance to choose what they were interested in or had flexibility to use their preferred methods or schedule to learn.
	Built confidence in study skills	Participants exhibited confidence in using their study skills or they verbally expressed confidence in their study skills.

Table 4-4 The result comparison table within a group and across groups.

Final theme	Initial theme	Focus group 1				Focus group 2		Focus group 3			
		Mary	Aggies	Rob	Rachel	Cassie	Ann	Toby	Jessica	Matt	Alias
The university experience was overall positive	The university experience was overall positive	•	•	•		•					
Issues encountered at different settings	Issues related to transferring between colleges			•			•				
	Compared learning experiences from different stages of education	•	•	•	•	•	•	•	•	•	•
Issues related to disability and university resources	Struggled with issues related to disability or accommodation	•	•	•	•	•	•	•	•	•	•
	Others' understanding of their disability or accommodation	•	•	•	•	•	•	•	•	•	•
	Used university resources (including accommodations)	•	•		•	•	•	•	•	•	•
Building influence through advocacy and education	Advocacy and acceptance of their own disability identities	•	•	•	•	•	•	•	•		•
	Educated others about disability		•		•	•		•	•		
	*Reasons not to disclose their disabilities			•	•		•			•	•

*The contrasting description to the narratives of building influence through advocacy and education.

Table 4-4 The result comparison table within a group and across groups (continued).

Final theme	Initial theme	Focus group 1			Focus group 2			Focus group 3			
		Mary	Aggies	Rob	Rachel	Cassie	Ann	Toby	Jessica	Matt	Alias
Impact of the pandemic on learning experience	*Impact of the pandemic on learning experience		•	•	•	•	•		•	•	•
	Figured out how to navigate the two systems: online and face-to-face learning.		•		•			•			
	Preferred in-person learning to see peers around them	•		•	•		•	•	•		
	Online learning was challenging			•	•		•	•	•	•	
UDL practices were helpful for students	*UDL practices were helpful for students	•		•		•	•	•	•	•	
	Feedback was important			•		•	•	•	•		•
	Approachable instructors made communication easier		•			•	•	•	•	•	•
	Instructors expressing enthusiasm made class interesting		•		•		•		•		
	Interactive learning or class practices solidified understanding	•	•	•					•		
	Multiple formats solidified their learning experience	•	•		•	•	•		•		
	Restating important points helped not to miss points				•	•					
	Choices gave them an opportunity to demonstrate comprehension		•		•	•				•	•

*The contrasting description to the narratives of building influence through advocacy and education.

Table 4-4 The result comparison table within a group and across groups (continued).

Final theme	Initial theme	Focus group 1			Focus group 2			Focus group 3			
		Mary	Aggies	Rob	Rachel	Cassie	Ann	Toby	Jessica	Matt	Alias
Independence in learning	Embrace challenges	•	•	•	•	•	•	•	•		•
	Figure out how to study for themselves	•	•	•	•	•	•	•	•	•	
	Used self-learning strategies helped them learn better	•	•	•	•	•	•		•	•	•
	Knew their learning preference/strength	•	•	•	•	•	•	•	•	•	•
	Had more control over learning	•	•	•	•	•	•	•	•	•	•
	Built confidence in study skills	•	•			•	•				

Research Question 1: How Do Students with Disabilities Describe Their College Experiences?

Before participants discussed their disability-related experiences, they were asked about their overall college experiences. Four participants were adamant that their overall experiences were positive. As Mary said, "I think it's been overall positive because I get to" (Mary, Focus Group 1, October 21, 2020). Aggies also said, "My experiences were good once I figured out what works for me pretty much" (Aggies, Focus Group 1, October 21, 2020). Cassie also confirmed her positive university experience by saying, "I would say in general, I've had a positive experience with this university and with the classes" (Cassie, Focus Group 2, October 27, 2020). Rob not only affirmed his positive experience but also stated the reasons. He said:

> Overall, it's been positive. I appreciate the ability to set up my classes, so I can have time to study and work of homework right after each class and listen to music while I do so. This kind of do it my own way (Rob, Focus Group 1, October 21, 2020).

Based on their positive experiences, it seemed participants figured out a way to persist through their university studies. Under this broad and general experience, four final themes were derived from the analysis: (a) issues encountered in different settings, (b) issues related to disability and university resources, (c) building influence through advocacy and education, and (d) the impact of the pandemic on the learning experience.

Issues Encountered in Different Settings

Under this final theme, participants mainly compared different stages of education and their experiences when transferring between colleges. First, most participants (n = 9) compared how different their experiences were in different stages of education. Mary compared her experiences in high school and college. She found that she could pursue what she was passionate

about at the university, so she felt university study was more flexible compared to high school. She said:

> I've actually found that school has strangely gotten easier. Elementary school is very difficult. Basically, bottom of all my classes, really, really struggling. And then as I got to high school, it got a little bit better but foreign language classes were an absolute nightmare. But now in college I have the opportunity to study something I'm very interested in and passionate about. And I find it much easier. And I find that I do better on the application of things not just memorizing facts (Mary, Focus Group 1, October 21, 2020).

In contrast, Toby shared a different perspective: He thought high school was much easier than university. He said:

> From high school, there was more just doing your own time, and work was so much easier. And right now, I'm an undergraduate. You got to actually focus and, you're got to find places to study. I can't stay in my dorm. You got to go to the library. You got to find that time and space to study. You have to plan a lot (Toby, Focus Group 3, November 4, 2020).

Based on Toby's descriptions, he realized that he needed to push himself to find time and space to study, which was different from his high school experiences. Similarly, Jessica also shared that she needed to learn time management and figure out the best way to study when she went from high school to undergraduate. She also shared the differences between undergraduate and graduate study. She said:

> Going into graduate school I've done both a master and I'm now on my PhD. I would say the biggest difference is that you can't devote your whole life to school. You're still

> expected to maintain progress with your research, even though you are taking classes and so unlike undergraduates where you might be able to just devote your whole weekday and go and focus for four hours on the class, when you have research going on or papers or a manuscript in progress (Jessica, Focus Group 3, November 4, 2020).

Based on participants' descriptions, although moving to the next stage of education did not necessarily mean an easier path, most participants realized that they needed to learn more self-discipline skills if they wanted to succeed.

Second, only two participants described issues related to transferring between colleges. Rob described how transferring from community college to university made him aware that he needed to work on his study skills. He said:

> Back at the community college and physics class, which is the first class I ever felt any need to try and study for…so I have already been made aware that my poor study habits could be a problem … being an electrical engineering major here made me realize just how much of a problem, like study habits, are (Rob, Focus Group 1, October 21, 2020).

On the other hand, Ann shared that she had mixed experiences regarding disability services when transferring between universities. She said:

> I would have to say my experience at [university 1] is very good. The disability service there is exceptional. With [university 2], I have used their testing facility. I feel like they could have done better. With that, I feel like they could do better, advocating for students with disabilities there (Ann, Focus Group 2, October 27, 2020).

Issues Related to Disability and University Resources

When asked how their disabilities affected their learning experiences at the university, participants shared issues related to disability and university resources. First, most of the

participants (n = 9) used university resources. The resources included accommodations from the Department of Disability Resources and supplemental instruction or tutoring from the Academic Success Center. As Aggie described a testing accommodation she received, she said:

> So, my combinations I received from the disability center have helped so much. It gives me time to calm down and be able to understand I do have time to calm myself down and then get my knowledge out that I do now (Aggies, Focus Group 1, October 21, 2020).

Another participant, Matt, thought about applying for accommodations but then decided against it. He was, however, able to find help from the Academic Success Center. He said:

> Definitely, the thing with the SI sessions, those . . . I'm also a biology major like most people here are. And yeah, basically, very much SI sessions are necessary for many cases. And we're certainly not used to that at all, and I'm really grateful to have these kinds of things (Matt, Focus Group 3, November 4, 2020).

In addition, professors are also one of the greatest resources for students who hope to succeed. Some participants gained extra support from course professors. For example, Toby described how he used the accommodation letter to gain support from a professor. He said:

> I had to make the documentation with the services, and all I had to do was to write a letter and just print them out and just hand them to my professors. They'd take the paper, and they were asking me questions. They were asking for what to do and I say: "Just don't call my name because I can't be caught on just by random. I need time to prepare my answer." And the same for presentations like, "Oh, can I present first or last? I just need time to prepare" (Toby, Focus Group 3, November 4, 2020).

Based on participants' descriptions, the Department of Disability Resources was not the only resource they could use for study on campus. There were other resources available, based on their preferences and needs.

Second, all participants (n = 10) struggled with issues related to disability or accommodation, meaning that they encountered challenges when using accommodations. These challenges could also result from others' lack of understanding of a participant's disability or accommodation (n = 10) because other people demonstrated attitudinal barriers toward participants' disability or accommodation. The following narratives used three participants' experiential accounts to describe how the two initial themes were intertwined.

Rachel shared an awkward experience that occurred when she and other students with disabilities were singled out to leave a class for a test. She said:

> One of my professors was my business initiative class for freshmen. Whenever we had a quiz, before we started, he'd be like, "Okay anybody with disability get up and go outside and take the quiz." And so, it was so uncomfortable to exit the classroom, and everybody around me knew (Rachel, Focus Group 1, October 21, 2020).

Because the professor had provided the accommodation inappropriately, Rachel had a misunderstanding of how the accommodation should be implemented properly. She continued, saying, "At the moment I didn't realize, oh, like this is actually making it harder for me to succeed in this course" (Rachel, Focus Group 1, October 21, 2020). Similarly, Alias expressed that she did not receive a respectful attitude from the accommodation coordinator, which made the process of getting accommodations even harder for her. She said:

> Some of the attitudes expressed by the coordinator for the medical school was a little bit– it felt not super supportive or respectful. And so, for example, I didn't ask for

accommodations a couple of times because I was so nervous about what the repercussions would be. So that was really stressful, and I think that they don't talk about the accommodations process (Alias, Focus Group 3, November 4, 2020).

Another participant, Ann, shared her disclosure and accommodation experiences with professors. Some responses she received from professors were positive, but others were not. She said:

> I had pretty good responses from most professors. I had a couple of professors that I felt like we had a language barrier to some degree or maybe it was cultural. The one was a finance class, and then I had a math business math class that, you know, I got no feedback from the professor. And it felt like they were almost, especially with the finance professor, it was a hassle to deal with me (Ann, Focus Group 2, October 27, 2020).

Based on the three participants' experiences, it is obvious that the attitudes from professors or service providers played an important role in participants' experiences when dealing with disability or accommodation issues.

Building Influence Through Advocacy and Education

Participants were able to influence others by advocating for themselves and educating others about their disability and accommodations. The initial theme—advocacy and acceptance of their own disability identities (n = 10)—means that when participants advocated for themselves and others, they demonstrated that they accepted their disabilities as part of their identity. For example, Rachel shared that she explained her disability to friends. She said:

> I like talking about those things [disability and accommodations]. I do talk about it with my friends but normally I have to feel pretty comfortable, because I know that I'll receive some questions that I have to explain myself and like "What, you're smart"; I'm like,

that's not what it's for. It's not for that kind of ability (Rachel, Focus Group 1, October 21, 2020).

When Rachel shared her disability or accommodation issues with her friends, she knew she needed to be prepared to advocate for herself. Her friends might feel shocked toward her disability, which demonstrated that people might have misconceptions about a disability. They might consider a person with a disability to not be smart or intelligent. Even though Rachel knew she might encounter such misconceptions, she was prepared to advocate for herself.

Another participant, Cassie, used advocacy skills to communicate her disability and accommodations with professors. She said:

> I am pretty vocal about my disability, so I don't mind sharing. Normally, when I send an email at the beginning, I've never told a professor about the dissociative identity disorder. I mentioned the bipolar disorder. That's normally what we talked about is email professors and will be like "Hey we have this and makes learning difficult sometimes because we're not able to attend class. We're going through an episode; it's extremely difficult to get things done" (Cassie, Focus Group 2, October 27, 2020).

Although Cassie mainly suffered from dissociative identity disorder, she chose not to mention it when disclosing her disability to professors, considering that some professors might refuse to believe in her situation. From her self-advocacy experience, she had a plan for how to advocate and, at the same time, protect herself from being hurt.

Toby was a military student. He shared how he advocated for himself in a rigorous and military type of environment. He said:

> It's really hard for me to speak fluently, and they want us to be perfect in every possible, the way we look, the way we walk, and the way we talk. Whenever I see someone

> looking at me or even, I hear them talking about me, "Hey, why is he talking that way?" I go talk to them or I message them on text or something and say, "Hey, what you did is not right. I've stuttered" (Toby, Focus Group 3, November 4, 2020).

Toby was courageous and went up to the person to explain himself. He said, "I've stuttered," demonstrating that he accepted that stuttering was part of his identity.

In addition to advocating for themselves and showing that they embraced their disability identity, participants further educated others about their disabilities and accommodations (n = 5). Aggie shared her personal stories to encourage others. She said:

> I'm not going to be too hard on myself about it, because I do know that there are others dealing with it. So, I feel like if I show that it's okay to be dealing with something like this, others will feel that they can share their experiences and seek help. I always talk about how much help the disability center has given me, and I hope by me speaking about that they'll go and seek help (Aggie, Focus Group 1, October 21, 2020).

The experience of being supported motivated Aggie to educate others who also suffered from a disability. Jessica also expressed how she educated others about her disability and accommodations. She said:

> So, I know for me, I started the habit very early in high school of writing a letter to all of my teachers explaining my blindness because I think when people hear the term blind, they assume it's a very polar thing. So even though the disability services office would write me letters, I would make it a point to introduce myself to these professors and make sure they knew who I was. And then say, "Do you have any questions about how I use my tools, how I access material? Would you like me to show you how voiceover works, how my screen magnifier works?" (Jessica, Focus Group 3, November 4, 2020).

The way Jessica advocated for herself and educated others was very strategic. She was willing to show professors how she used the technology, which bridged the gap between her professors and herself. Similarly, Cassie also shared how she educated her friends that her dissociative identity disorder was never a barrier for her when making friends. She said, "Yes, all of our friends know [my dissociative identity disorder]. We even wear a different color bracelet each day so that everyone can tell who's front, or they just asked, but most of my friends know" (Cassie, Focus Group 2, October 27, 2020).

However, some participants chose not to advocate for themselves ($n = 5$). The reasons why they decided not to practice self-advocacy varied. Rob said, "I'm really not good at [self-advocacy]. I was taught that was selfish" (Rob, Focus Group 1, October 21, 2020). He equated self-advocacy with being selfish, which impeded him from learning and practicing self-advocacy. Other participants considered feeling alone made self-advocacy harder. As Alias said:

> I didn't ask for accommodations a couple of times because I was so nervous about what the repercussions would be. So that was really stressful, and I think that they [the accommodation coordinators] don't talk about the accommodations process because of this fear that everyone's just going to try to get accommodations (Alias, Focus Group 3, November 4, 2020).

Alias felt alone when she thought about applying for accommodations. She felt she was the only one who had an issue with accommodations. On the other hand, Rachel shared a different reason why she chose not to self-advocate. She said:

> I think the reason that I don't advocate for myself that much is because I also want to feel like I can meet their expectations, so I don't want to go and change things again. I don't

> want to feel like I can't do what they expected from me (Rachel, Focus Group 1, October 21, 2020).

Rachel wanted to meet professors' expectations and prove that she could do what was expected from her. This goal demonstrated that Rachel strived to show her independence in learning.

Impact of the Pandemic on Learning Experience

Considering the global pandemic, the moderators were able to collect extra information regarding how the pandemic made participants' learning experiences different. Eight participants shared the impact of the pandemic on their learning experiences. One immediate change was that students did not receive timely feedback from professors during the pandemic. As Rob shared, "I've seen the least, especially with us going to online only, feedback has basically disappeared" (Rob, Focus Group 1, October 21, 2020). Jessica and Matt also agreed that it was so much harder to reach out to professors by using online office hours. On the other hand, Alias said, "So ironically, with the pandemic and our transition to virtual learning, it really helped me because there was not a lot of chatter and noise" (Alias, Focus Group 3, November 4, 2020). Cassie also shared that virtual learning actually provided flexibility for her. She said:

> We've seen a lot more of that with COVID, it's been nice we have a class, for instance, that class opens the exams for two weeks at a time and you just go and take it so then, who's actually been going to class or who's actually been preparing for, that alter can take it, instead of sometimes we get stuck in (Cassie, Focus Group 2, October 27, 2020).

Based on participants' descriptions, the pandemic changed how students learned in both negative and positive ways.

There were three initial themes to elaborate on how the pandemic impacted participants' learning, including: Figured out how to navigate the two systems: *Online and face-to-face learning* (n = 3), *online learning was challenging* (n = 6), and *preferred in-person learning* (n = 6). Some participants figured out how to navigate online and face-to-face learning. Aggie said, "For me personally, online learning hasn't been too much of a difference for health majors; we have a lot of online health class options we can do before the pandemic. So, I was kind of already doing that" (Aggie, Focus Group 1, October 21, 2020). Aggie was already familiar with learning online, so she did not find any difference before and after the pandemic. Similarly, Toby described the importance of the routine for the online format. He said, "I think it's a routine just to get used to learning online. You got to stick to your routine. You got to stick to a certain way so you can learn better online. It's very different in person" (Alias, Focus Group 3, November 4, 2020).

A few students, however, stated that online learning led to more challenges in learning. As Ann said, "I really think testing online is really hard for me. That's been difficult during this COVID thing. In the past, you don't test in the classroom. There's lots of times, you can schedule your exam" (Ann, Focus Group 2, October 27, 2020). Ann expressed the challenge resulting from the online testing, which totally changed the nature of her accommodations. Not only did some students say online learning was challenging, participants also expressed that they preferred in-person over online learning. As Jessica said:

> I personally struggle with online lectures. I lacked that community that I really enjoy from classes. I personally struggle with it. I also like to associate my learning with a time and a place. I do like having the recorded lectures if the professors are okay with it. But I think overall, I prefer face-to-face lectures (Jessica, Focus Group 3, November 4, 2020).

The lack of community feeling made online learning even more difficult for Jessica. Similarly, Mary said she preferred in-person learning. “I personally prefer in-person learning. I think that's because I'm a competitive person. And I think that's what has driven me to overcome my disability. I need that competitiveness to see my peers.” (Mary, Focus Group 1, October 21, 2020). Rob also responded to Mary by saying:

> I have a similar thing to what Mary said about, but to me, it's always been more of a cooperative idea. Because one of the things for me is I recognize that I'm turning 33 next week, so I'm probably a good bit older than most of my peers in the classroom. So, I feel like I'm supposed to set kind of an example and be able to help them. So, that feeling of responsibility spurred me on to actually try and focus better pay more attention, and learn the material better (Rob, Focus Group 1, October 21, 2020).

Mary and Rob both shared the importance of learning with peers, which motivated them to study harder. Nevertheless, the rise of online learning has led to the disappearance of community learning.

Research Question 2: How Do Students with Disabilities Describe Their Learning Experiences with UDL Teaching Practices?

When asked what they thought about UDL teaching practices, all participants acknowledged their value. Participants described that UDL practices implemented in class were helpful for all students (n = 7), not only for students with disabilities. As Mary summed up the purpose of UDL, she said, “Advice I would give to a professor is, ‘Yes, you should care, or you shouldn't care, people with disabilities just whatever you do for the whole class is probably going to help us’” (Mary, Focus Group 1, October 21, 2020). Matt also said UDL teaching practices were helpful for all students. He said, “I guess it's very helpful for students in general, not just

people who are disabled because even though it's a hard class, it's what people have managed to get pretty high grades in it. So, I guess it works" (Matt, Focus Group 3, November 4, 2020). Another participant, Ann, shared multiple UDL practices, implying these practices were helpful in general. She said:

> When you have a professor who is engaged with their students, who's excited about teaching the material, who gives positive feedback, but also gives constructive criticism, who connects the material to real situations and gives you an overview of where this course is taking you know that, I mean that's what you're paying for, that's what you want, as a student (Ann, Focus Group 2, October 27, 2020).

There were six initial themes under this final theme. Each of these initial themes represented a UDL teaching practice, including: *Feedback was important* (n = 6), *Approachable instructors made communication easier* (n = 7), *Instructors expressing enthusiasm made class interesting* (n = 4), *Interactive learning or class practices solidified understanding* (n = 4), *Multiple formats solidified their learning experience* (n = 6), and *Restating important points helped not to miss points* (n = 2).

For the first initial theme, *Feedback was important*, participants explicitly expressed how feedback was helpful for their learning. Rob stated the importance of feedback: "That [feedback] is what's always been most helpful for me it's like, this is where you're wrong or this is how you can do it better" (Rob, Focus Group 1, October 21, 2020). Ann also described that receiving feedback was like reciprocal communication with a professor. She said:

> I had a couple of different classes with the same professor who I did get some extra help from. It was a writing intensive course. I felt like I needed more feedback. And I felt like I was well received, and that was reciprocal, and then I really gained something out of the

> experience. If I had not asked, I wouldn't have gotten (Ann, Focus Group 2, October 27, 2020).

Another participant, Jessica, expressed that she was thankful for receiving detailed feedback from a teaching assistant. She said, "I remember he gave us very detailed feedback on our first-ever lab report. And as an undergraduate, you never had to write a lab report before, and I remember being very thankful for that" (Jessica, Focus Group 3, November 4, 2020).

The second initial theme, *Approachable instructors made communication easier*, mainly focused on how having approachable instructors was helpful to students when communicating about their needs. As Alias said:

> One of my professors, she's a psychiatrist and she leads two of the blocks. And she also has open office hours and she's very approachable and she really believes in students. And she would help me come up with strategies for different things like how to show empathy when we're in a practice patient interaction, things that might be challenging if you're on the spectrum, or how to deal with sensory overload (Alias, Focus Group 3, November 4, 2020).

Matt also shared that having approachable professors was very helpful for his learning. He said:

> One of my teachers is basically very good with most of these things. He's very approachable, very visual, very, I guess, understanding and respectful towards these kinds of things. And I really appreciate that I would always go to that teacher before office hours and I managed to pass that class with an A, so it seems like that class worked very well (Matt, Focus Group 3, November 4, 2020).

Ann shared that a professor provided multiple means of contact, so she could easily reach out to the professor; however, sometimes, obtaining a response from professors could be very frustrating. Ann said:

> I have a professor right now with the multiple points of contact. He will text message you back, and it's immediate. I have to say that I think that's really awesome. So, you know, for me that's comfortable, another professor who I can send an email and I won't hear anything from [the professor], like nothing, nothing. You don't even know if you're emailing right (Ann, Focus Group 2, October 27, 2020).

The third initial theme, *Instructors expressing enthusiasm made class interesting*, meant participants described professors who were enthusiastic toward teaching. As Aggie said:

> Instructors expressing enthusiasm towards the topic that made a world of a difference with lectures. If someone is just reading off the slide, saying what they know with no enthusiasm and no personality, it's kind of like going in one ear out the other (Aggie, Focus Group 1, October 21, 2020).

Rachel also responded to Aggie and said, "Enthusiasm is also just so good, like my favorite class is my marketing class because the professor, she's so excited and loves what she teaches" (Rachel, Focus Group 1, October 21, 2020). Jessica shared that a teaching assistant was enthusiastic toward teaching students. The teaching assistant even shared his personal experience with students. Jessica said:

> He [the teaching assistant] is also really enthusiastic and approachable. And I remember when I talked to him after the class about needing extra assistance in lab, he actually disclosed to me that he himself had a disability, which in my mind, made him even more

approachable and empathetic towards his students (Jessica, Focus Group 3, November 4, 2020).

The fourth initial theme, *Interactive learning or class practices solidified understanding*, meant class activities enhanced students' learning and understanding. As Rob stated, "I will say I do find myself engaging more in the professor who has class exercises. I've had a couple of professors that will have class exercises scattered throughout the lecture" (Rob, Focus Group 1, October 21, 2020). Aggie also described that interactive activities helped her learn better. Sha said, "Interactions, like if you do Kahoot or clicker questions, you know things like that to solidify our understanding" (Aggie, Focus Group 1, October 21, 2020). Indeed, having class exercises or using interactive learning technology can augment students' engagement in learning.

The fifth initial theme, *Multiple formats solidified their learning experience*, described how different forms or types of materials made learning effective and accessible. As Mary said, "With Covid-19, if professors do with distance learning, if they're doing live Zoom lectures, I tend to do better than if they're having us just watch YouTube videos" (Mary, Focus Group 1, October 21, 2020). Cassie, who had dissociative identity disorder, described that having multiple formats of materials helped her different alters learn and prepare for exams. She said:

> I think they're very helpful especially, providing multiple formats of handouts, if it's somewhere that's in multiple areas. That's really helpful for us, because if one person didn't go to a class, they can read the handout, or if the lectures recorded or if there's some sort of summary that's provided. We can access that and know if someone wasn't able to go to class, they're still able to study for the exam, that's really helpful (Cassie, Focus Group 2, October 27, 2020).

Jessica also described a teaching assistant using different teaching formats: “He [the teaching assistant] made sure to not only explain it verbally, but he'd come around to our little groups and show us all individually rather than showing the whole group, the entire class at the big lab” (Jessica, Focus Group 3, November 4, 2020). Based on Jessica’s descriptions, multiple formats can also mean different types of teaching demonstration, such as whole group teaching and small group teaching, which made a lecture more engaging for students.

The sixth initial theme, *Restating important points helped not to miss points*, meant that instructors summarizing or repeating important points helped participants grasp important concepts. As Rachel shared, “Normally when somebody's talking to you, what they're saying is important. So, I feel I'm going to miss the point, and the fact that they're restating it. My Professor, he does this right now. It makes me so happy” (Rachel, Focus Group 1, October 21, 2020). Cassie also found that instructors summarizing key points of a lecture was helpful. She said:

> I would say summarizing key points that's important for studying because that helps us down the right track, so I like when professors have a summary for the day, or small handout which has the key points or, before they're going to lecture, they have learning objectives at the top because they know what you're supposed to be focusing on (Cassie, Focus Group 2, October 27, 2020).

Participants were also asked about their thoughts regarding the connection between UDL teaching practices and self-determination learning. During the focus groups, the moderators and participants drew on the idea that UDL provides opportunities for students to have choices in three important areas of instruction: how students are engaged, how course content is presented, and how students demonstrate what has been learned. One initial theme*, Choices gave them an*

opportunity to demonstrate comprehension, was generated. This theme mostly described the impact of professors providing choices for participants' learning. Five participants expressed that choices gave them an opportunity to demonstrate what they learned or comprehended in class. As Aggie said, "I feel that it gives students a chance, give students a better opportunity to show and prove that they are comprehending what's being taught in their class they understand" (Aggie, Focus Group 1, October 21, 2020). Matt also shared how having choices for an assignment kept him engaged. He said:

> I have research to do like for that class. I really appreciate that research was completely personalized. I could read about history. I could read about anything I wanted to. I could study for exams in that topic, anything. That really kept me engaged (Matt, Focus Group 3, November 4, 2020).

Alias shared that she participated in journal club presentations, and she was given an opportunity to choose a topic she preferred for the presentation. She said:

> One thing I really like in our program is we get to give journal club presentations, and it can be on any topic in the literature that we want to present on. For example, I got to present on the connection between auto-immunity and autism. That was something where I felt like I learned a lot, was also able to practice presentation skills and it was something that I'm passionate about (Alias, Focus Group 3, November 4, 2020).

Another participant, Rachel, not only described the benefit of having choices on an assignment, but also shared that having choices meant her instructor cared about students' learning success. She said:

> This semester, because it's online, we have a group project in my women's gender studies course. And my professor was confused on what the best way would be to have us go

about doing this group project. So, she took a poll of the class. She just asked the students, "If you have any ideas, feel free to email me. I'd love to hear what you have to say because you're my students." I appreciate that. She actually cares more about like she's not just trying to have us do this presentation she's trying to have us be successful in it (Rachel, Focus Group 1, October 21, 2020).

Research Question 3: How Do Students with Disabilities Describe Their Learning Experiences Without UDL Teaching Practices?

When asked if they used any self-directed strategies to accommodate their learning needs, participants demonstrated independence in learning. There were six initial themes under this final theme: *Embraced challenges* (n = 9), *Used self-learning strategies helped them better* (n = 9), *Figured out how to study for themselves* (n = 9), *Knew their learning preference or strength* (n =10), *Had more control over learning* (n =10), and *Built confidence in study skills* (n =4). Interestingly, these six initial themes were not completely independent. They were related to each other to some degree, meaning that they may coexist in some excerpts.

Most participants embraced challenges, meaning that they demonstrated independence to overcome the learning difficulties they encountered. Some participants chose to endure an unpleasant situation and, at the same time, demonstrated how they adjusted their perceptions of their situations. As Rachel shared that she was singled out to leave the classroom for taking an exam, she said, "It didn't feel very safe or comfortable, but for that I just dealt with it I guess and I made it like, I just need extended time I don't know why" (Rachel, Focus Group 1, October 21, 2020). Rachel just dealt with "being singled out" and told herself she just needed more time for the exam. Cassie also shared a difficult situation. She said:

> The biggest challenge for us has been exam time for an alter who doesn't front very often will sometimes front and then they'll have to take an exam that they haven't prepared for it all and we can't get an extension on that (Cassie, Focus Group 2, October 27, 2020).

When asked how to overcome the challenge, she continued saying, "In that situation, we kind of bite the bullet and just go through and take the exam if the professor won't work with us because sometimes they're not willing to" (Cassie, Focus Group 2, October 27, 2020). On the other hand, Mary demonstrated that students with disabilities needed to adapt to a new learning environment. She said, "You [professors] don't have to do anything like special, and it's also up to us. I think it's up to us to figure out how to adapt" (Mary, Focus Group 1, October 21, 2020).

The initial theme, *Embraced challenges*, also became involved with other initial themes to represent that participants used different approaches to deal with learning challenges. One of the approaches was self-advocacy, which was described previously. Participants reached out to people for extra support. Participants also used self-learning strategies to help them learn efficiently, and because they used self-learning strategies, they finally figured out how to study for themselves. As Ann described:

> I'm in a couple of different instances where there's been student tutoring available, I took advantage of that. Bring on different subjects, being consistent with it, starting that early. You know, just as keep motivated to doing something that's not really easy (Ann, Focus Group 2, October 27, 2020).

Ann was not simply using the tutoring but also understanding how to use it strategically. Similarly, Cassie shared that she relied on good notes for different alters to study. She said, "Yes, we take very diligent notes on everything that way. Whoever is taking the exam whoever's studying for the exam has enough information accessible" (Cassie, Focus Group 2, October 27,

2020). Other participants also described that they counted on taking diligent notes for studying. As Jessica said, “I'll do a combination of like rewriting my notes, or taking my notes and formatting them into re-bulleted lists or tables” (Jessica, Focus Group 3, November 4, 2020). Matt also expressed how he made his notes as fun as possible to read. He said, “My notes would look less like history textbook, and more like a classmate explaining it to you from one friend to another” (Matt, Focus Group 3, November 4, 2020). These participants used self-learning strategies, such as taking notes, to figure out the best way to study.

Next, participants exhibited they used self-learning strategies and figured out how to study. They also knew their learning preferences or strengths when applying self-learning strategies, which in turn demonstrated that they had more control over their preferred learning methods or schedules. For instance, Mary expressed that she could choose to join a lecture by a professor she preferred. She said:

> I don't really like my chemist, or my chemistry teacher, I just don't like her lectures. I actually joined another chemistry person's lectures, so I attend them every single day. So that's been helpful. And I know I learned auditory so the more I can hear it, the more I'm going to understand it. So, I emailed another professor and got his link (Mary, Focus Group 1, October 21, 2020).

Similarly, Alias shared that she used self-learning strategies by knowing her learning preferences and strengths. She also gained more control over her learning. She said:

> One thing that has helped me a lot is just making sure I'm in a quiet place to study without distractions. That's one thing that has helped, and having a very consistent, steady routine. I think for me, writing things over by hand, especially within 24 hours, copying my notes within 24 hours of lecture helps me to remember it really well. And I

take the quizzes. So, I do practice questions. I also like to read the textbook if it's a good textbook (Alias, Focus Group 3, November 4, 2020).

Another example was shared by Cassie. She said: “Sometimes if a professor does post a lecture we will go back and rewatch it or use it to take the exam depending on what it is, but note taking is the main strategy, good note taking” (Cassie, Focus Group 2, October 27, 2020). Cassie mentioned going back and rewatching lectures to show having more control over learning if professors provided lecture recordings; however, she knew that taking notes was her main and most useful learning strategy.

Lastly, four participants demonstrated confidence in their study skills. When asked if they had any advice for students with disabilities who were struggling with studying in PSE, Mary said:

> I would honestly say have more confidence in yourself, life gets a lot easier. And it doesn't always have to be challenging, you can find what you're passionate about and find what you're good at and do that play up your strengths, I think helps a lot (Mary, Focus Group 1, October 21, 2020).

Mary suggested that students with disabilities should have more confidence in themselves and explore their own strengths. Similarly, Ann said:

> You know it doesn't have to be a rush to get through it if you didn't learn anything. And when you rush through it, what was the point? So, you know there's a whole gamut of strategies and techniques that you can use depending on different disabilities. I think you just have to try things and see if it works for you (Ann, Focus Group 2, October 27, 2020).

Ann encouraged students with disabilities to consider trying new strategies for

themselves. Based on the final theme, *Independence in learning*, participants demonstrated strong motivation to overcome challenges and develop their own learning strategies.

Discussion

The purpose of this study was to further examine how UDL teaching practices impacted students' educational experiences. The study used focus groups to collect data, although the main data collection method for IPA is one-on-one interviews. Palmer et al. (2010) demonstrated that group dynamics can provide additional information, which makes the data more robust. The data from this study contained sufficient details to reflect the different issues participants encountered. Each participant was able to share their learning experiences in depth and came up with concrete examples to illustrate how the UDL practices supported them. As Smith (2004) also expressed, if researchers believe that the data are sufficient to discuss participants' personal experiences, even though the data collection method is through focus groups, then IPA is an appropriate methodology.

The group dynamics in focus groups allowed participants to co-constitute accounts for a single experience. For example, in Focus Group 1, Rachel mentioned that students with disabilities were singled out to leave the classroom for taking a quiz. After she shared the experience, another participant, Mary, made an immediate shift in tone by saying that "being singled out" happened a lot in high school. Another salient instance also revealed that a group discussion elicited something extra to enrich the data. Online learning, which has been used recently to tackle social distancing, was not originally on the focus group protocol; however, a participant's sharing of online learning experience evoked others' responses, which delved further into the UDL topic because UDL also played an important role in remote learning. In addition, from the dynamic responses, the researcher was able to examine the roles played by

moderators and participants. As Palmer et al. (2010) described, researchers should contextualize the data by identifying participants' and moderators' positionalities (i.e., the function of statements made by the members in focus groups should be examined). Overall, the focus group members' positionalities were clear, whether they agreed with others' experiences or had unique perspectives. Also, different members in focus groups also had an impact on the dialogue and dynamics. For instance, Focus Group 1 had four undergraduates. The researcher believed that because they were all undergraduates, they had similar experiences; thus, they could bounce some ideas off each other and make the conversation go naturally. For Focus Group 3, however, two members were undergraduates, and two members were graduates. They mainly took turns sharing their learning experiences and occasionally responded to others' stories. This dynamic and complexity would not have been possible without using focus groups.

This study's results demonstrated commonality and individuality within a group and across groups. Regarding commonality, all participants compared learning experiences from different stages of education, and most participants shared issues related to disability and university resources and advocacy. Most participants also demonstrated independence in learning. The commonality or highly recurrent themes meant participants encountered similar challenges at the university and used self-learning strategies to overcome those challenges. In addition, the commonality could be attributed to the homogeneous sample, which allowed the researcher to uncover participants' common experiences. As Smith et al. (2009) suggested, homogeneous samples are selected purposively for an IPA study so that researchers are able to observe and discover a common phenomenon among participants.

On the other hand, this study's results also demonstrated individuality within and across groups. For example, some participants chose not to disclose their disabilities for a specific

reason. Experiences with UDL also revealed various responses. The variance of the results could be attributed to the group dynamics. For instance, when the members in Focus Group 3 shared their experiences with UDL teaching practices, all of them used concrete examples to describe how their professors incorporated UDL practices in teaching. From their examples, they emphasized that having approachable professors was helpful, an observation that was different from those of the other two groups. This phenomenon was documented in the researcher's reflexivity note: "This group also shared a lot of interaction experiences with instructors when we talked about UDL strategies. Again, it was a unique piece that I did not see from previous focus groups" (Reflectivity note—group 3). The individuality or divergence within a group and across groups ensured that participants' unique experiences could be recognized.

This study's results also reflected coherence with the previous online survey study. As previously mentioned, this study served as a follow-up to the online survey study. The results from the online survey showed a gap between student attitudes and perceptions, meaning that some teaching practices were considered important by students but were not satisfactorily utilized by instructors. For example, the online survey results demonstrated that students with disabilities considered receiving feedback important, but instructors did not provide feedback very often. Consistent with the previous study's finding, participants in this study also revealed that feedback was missing, even though they tried to request it from professors. Another example is related to instructors summarizing and organizing lecture key points. Participants in this study (e.g., Rachel and Cassie) expressed that instructors summarizing key points helped them prepare for exams because they could better grasp important points. In addition, the online survey demonstrated that students with disabilities considered the use of instructional technologies somewhat important. Similarly, participants in this study expressed that, compared to learning by

using technologies only, they preferred a face-to-face learning community in which they could learn and study with their peers and instructors. Moreover, the results of this study also further reveal how long-term online learning impacted participants' experiences. This illustrates that technology is useful but cannot replace in-person learning.

The results of this study responded to previous literature. First, West et al. (2016) showed that although UDL teaching practices were useful and practical, students with disabilities also benefited from the accommodations provided by disability services. Similarly, some participants in this study were adamant that they received adequate support from disability services. For example, one of participants, Aggie, shared that the accommodations she received helped her stay calm to deal with exams. West et al. (2016) also revealed that students with disabilities did not realize the importance of self-advocacy and educating others about their disabilities and accommodations. Some participants in this study expressed that they wished they would have learned self-advocacy earlier. However, other participants (i.e., Jessica and Aggie) demonstrated that they were very vocal when educating others about disability and accommodation issues.

Second, the literature also found that students with disabilities utilized self-learning strategies to support their learning (e.g., Connor, 2012; Lyman et al., 2016). This study also confirmed that participants demonstrated independence in learning. For example, without the instructor summarizing key points, participants relied on taking diligent notes. Participants also attempted to find resources to support their learning. As Connor (2012) demonstrated, students' self-directed actions assisted them in facing adversity. Participants in this study embraced challenges and figured out the best ways for them to learn. It seemed participants performed self-determination strategies, such as problem solving and self-management (Getzel & Thoma, 2008), although the results did not clearly indicate that participants used self-determination strategies.

Another important aspect of the finding is associated with the connection between UDL teaching practices and self-determination. Dukes and Shaw (2008) implied that UDL teaching practices can increase students' self-efficacy. This study's results did not explicitly describe how UDL impacts students' self-determination in learning; however, participants expressed that UDL offering choices facilitates their autonomy, meaning that they can independently choose what they prefer based on their needs and abilities, and they feel in control of their learning (Wehmeyer et al., 1996). Based on this study's results, choices were offered by instructors with deadlines and formats of assignments, time schedules for an exam, and different formats of materials used in class. It is obvious that choices can be provided in different areas. The UDL guidelines also verified that optimizing individual choice can develop self-determination (CAST, 2018). This study generated preliminary results regarding the connection between UDL teaching practices and self-determination.

Finally, the reflectivity journal was introduced when the researcher analyzed the data. As Shaw (2010) utilized reflectivity to reflect upon the interaction of her experiences and the phenomena she was studying, the researcher also used the reflectivity journal to process the focus group discussions. The researcher was able to use the reflectivity journal to interrogate her own presuppositions and move beyond those to interpret participants' experiences. For instance, the researcher preferred online learning over in-person learning. The researcher subconsciously assumed that participants preferred online learning as well. What struck the researcher, however, was that most participants favored in-person learning over online learning because they liked the face-to-face community atmosphere and seeing peers in person. Another instance revealed that the reflectivity journal helped the researcher to generate new ideas. When participants shared self-learning strategies, these self-learning strategies were aligned with UDL principles.

Thinking through the phenomenon, the researcher could not help but use her reflectivity journal to document whether researchers or educators can turn to encourage students to adopt UDL strategies to supplement their academic learning. Reading through the reflectivity journal was quite an interesting process for the researcher. Participants' experiences were "dancing around" and demonstrated how participants faced and dealt with their challenges. Additionally, the reflectivity journal also documented how the superordinate themes were evolved and regrouped, which enhanced the study's transparency.

Limitations and Implications for Future Research

There were several limitations involved in the study. First, in-depth interviews are the main data collection method for an IPA study. This study, however, used focus groups to collect data. Although each focus group contained only two to four participants, it was suggested that in-depth interviews can gather more detailed experiences (Smith, 2009). Before conducting an IPA study, future researchers may consider using in-depth interviews to collect data.

Second, the researcher was a novice at IPA methodology, so she followed the standard IPA data analysis process. Future researchers may explore a different IPA data analysis process and compare the differences between interviews and focus groups. For example, future researchers may explore how the interactional dynamics in focus groups impacted the data analysis process.

Third, for the study credibility and trustworthiness, although the researcher used different methods to ensure the credibility of results, such as reflection journal and investigator triangulation, the researcher did not use member checking and invite an auditor to validate the study conclusions. Future researchers should invite an auditor to review the conduct of the study

and oversee how the researchers draw the valid conclusions based on the data. Similarly, member checking or respondent validation should be used to establish the credibility of results.

Fourth, although this study provided preliminary results regarding connections between UDL and self-determination, the connection still needs to be verified by further research. The UDL guidelines (CAST, 2008) provide options for executive function learning (e.g., goal setting and planning). Future researchers may discuss how UDL provides opportunities for students to practice executive functions and improve self-determination.

V. CONCLUSION

This dissertation is comprised of three articles. The first article reviewed the studies regarding faculty attitudes and actions toward UD teaching practices. The article found different factors (e.g., age, ethnicity, academic rank, and gender) that influenced faculty's attitudes toward and applications of UD principles. There was a gap between the faculty's attitudes and the actual implementations of UD teaching practices, meaning that faculty who expressed positive attitudes toward UD-based teaching practices also reported that the actual implementations were limited in some areas. However, studies also showed that faculty adopted the UD teaching practices even when they did not have positive attitudes toward these practices. The article also proposed other suggestions for UD-related professional training and development.

The second article used an online survey to explore the attitudes about and perceptions of UDL teaching practices by students with disabilities. Participants in this study considered most UDL teaching practices important; however, there were gaps between students' attitudes and perceptions for some teaching practices, meaning that these teaching practices were considered important by students but were not fully implemented by instructors. This study also provided tentative evidence for the predictors of student attitudes and perceptions toward UDL teaching practices. There were no significant relationships between the hypothesized predictors and student attitudes, although participants' academic department and gender could be predictors for student perceptions.

The third article served as a follow-up to the second study. This study used online focus groups to examine how UDL teaching practices impacted students' educational experiences. This study identified seven final themes from the data. The seven final themes depicted a holistic

story regarding participants' experiences at the university and how UDL teaching practices impacted their learning.

Future research can build upon the findings of this dissertation to further explore how UDL teaching practices affect students in PSE. First, faculty and students may not be familiar with the concepts of UDL. Future researchers and service providers may promote UDL in higher education settings and further explore how UDL can be applied in different academic fields. Second, this dissertation only focused on students with disabilities with a limited sample size; future researchers may collaborate with faculty or service providers to reach out to a larger sample of disadvantaged students, such as students who experienced financial and social hardships, students of ethnic minorities, probationary students, and first-generation students. The purpose of UDL is to serve a diverse student body; therefore, it is important and valuable to hear the voices of different students. Third, future research may keep exploring the connection between UDL teaching practices and self-determination. Although this dissertation provided tentative findings regarding the connection, future researchers may continue to verify how UDL teaching practices support students' self-determination in learning.

The dissertation has implications for the practical value in two aspects. First, for faculty members, "good teaching is good teaching." Many faculty members in higher education have implemented effective teaching practices for the curriculum and instruction design. Implementing the UDL teaching practices may seem like a daunting task for faculty members. However, UDL serves as teaching guidance for effective teaching for faculty members who aim to improve and optimize their teaching and learning. If faculty want to make their teaching accessible to all students, regardless of students' cultural, disability, and language backgrounds, UDL provides principles and practices for faculty to refer to. In addition, it is important to

include students' perspectives while designing curriculum and instruction. Students' feedback can be collected by using a course evaluation at the end of a semester. A culture of feedback should be created in the classroom to make the teaching process interactive between students and instructors.

Second, for students, when they express their voices, they are using and practicing self-advocacy. In postsecondary education, self-advocacy or self-determination should be the skills for students to develop. Self-determination leads to independence and success. Students can practice self-determination by providing effective feedback for instructors. The feedback should reflect on what teaching practices can help meet their needs and learning preferences. In addition, similar to faculty members, students can learn the UDL learning framework and use the framework to improve their study skills. Chapter 4 demonstrated that students with disabilities used some UDL practices to help them learn efficiently. For example, students with disabilities collected learning resources and used multiple means to improve their learning. They also liked to learn with peers to keep themselves motivated. Therefore, UDL is also a good resource for students to apply learning strategies for themselves.

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APPENDIX A
The online survey questions

Survey Questions	Importance to you			Your perceptions of instructors' implementation of this practice				
	Not important	Somewhat Important	Very important	None of my instructors use the practice	Less than half of my instructors use the practice	Half of my instructors use the practice	More than half of my instructors use the practice	All of my instructors use the practice
1. Instructors present information in multiple formats (e.g., lecture, text, graphics, audio, video).								
2. Instructors' expectations are consistent with the learning objectives stated in the course syllabi or on the study guides.								
3. During lecture, instructors tie the most important points of the lessons to the larger objectives of the courses.								
4. Instructors often speak while facing audiences.								
5. Instructors begin each lecture with an outline of what will be covered.								
6. Instructors summarize key points throughout the lectures.								
7. Course syllabi clearly describe the content and expectations of the courses, specifically or in broad terms.								
8. Instructors provide electronic equivalents (e.g., HTML, Word, PDF) of all paper handouts.								
9. Required reading assignments (other than the textbook) are available online.								
10. Instructors use instructional technologies (e.g., clickers) to enhance learning.								
11. Course materials (other than the textbook) are accessible, clearly organized, and easy to use.								

Modified from Schelly, C. L., Davies, P. L., & Spooner, C. L. (2011) Student perceptions of faculty implementation of universal design for learning. *Journal of Postsecondary Education & Disability, 24*, 17–30.

Survey Questions	Importance to you			Your perceptions of instructors' implementation of this practice				
	Very important	Somewhat Important	Very important	None of my instructors use the practice	Less than half of my instructors use the practice	Half of my instructors use the practice	More than half of my instructors use the practice	All of my instructors use the practice
12. Students are allowed to express their comprehension of materials in ways other than traditional tests and exams (e.g., written essays, projects, portfolios).								
13. I receive prompts and constructive feedback on assignments.								
14. Instructors employ technology to facilitate communication among students and between students and instructors.								
15. Assignments can be submitted electronically.								
16. Instructors use strategies to motivate me to learn.								
17. Instructors provide challenging and meaningful assignments.								
18. Instructors express enthusiasm for the topics covered in class.								
19. Instructors offer ways for students to contact them outside of class time in flexible formats (e.g., face-to-face, email, online chat, telephone).								
20. Instructors explain the real-world importance of the topics taught in courses.								
21. Instructors create a class climate in which student diversity is respected.								
22. Instructors are highly approachable and available to students.								
23. Instructors supplement lecture and reading assignments with visual aids (e.g., charts, diagrams, interactive simulations).								

Modified from Schelly, C. L., Davies, P. L., & Spooner, C. L. (2011) Student perceptions of faculty implementation of universal design for learning. *Journal of Postsecondary Education & Disability, 24*, 17–30.

APPENDIX B
The number of excerpt documentation

Final theme	Initial theme	Focus group 1			Focus group 2			Focus group 3			
		Mary	**Aggies**	**Rob**	**Rachel**	**Cassie**	**Ann**	**Toby**	**Jessica**	**Matt**	**Alias**
The university experience was overall positive	The university experience was overall positive	√	√	√		√					
Issues encountered at different settings	Issues related to transferring between colleges			√			√				
	Compared learning experiences from different stages of education	√						√	√		
Issues related to disability and university resources	Struggled with issues related to disability or accommodation				√		√				√
	Others' understanding of their disability or accommodation										
	Used university resources (including accommodations)		√					√		√	
Building influence through advocacy and education	Advocacy and acceptance of their own disability identities				√	√		√			
	Educated others about disability		√			√			√		
	Reasons not to disclose their disabilities			√	√						√

APPENDIX B

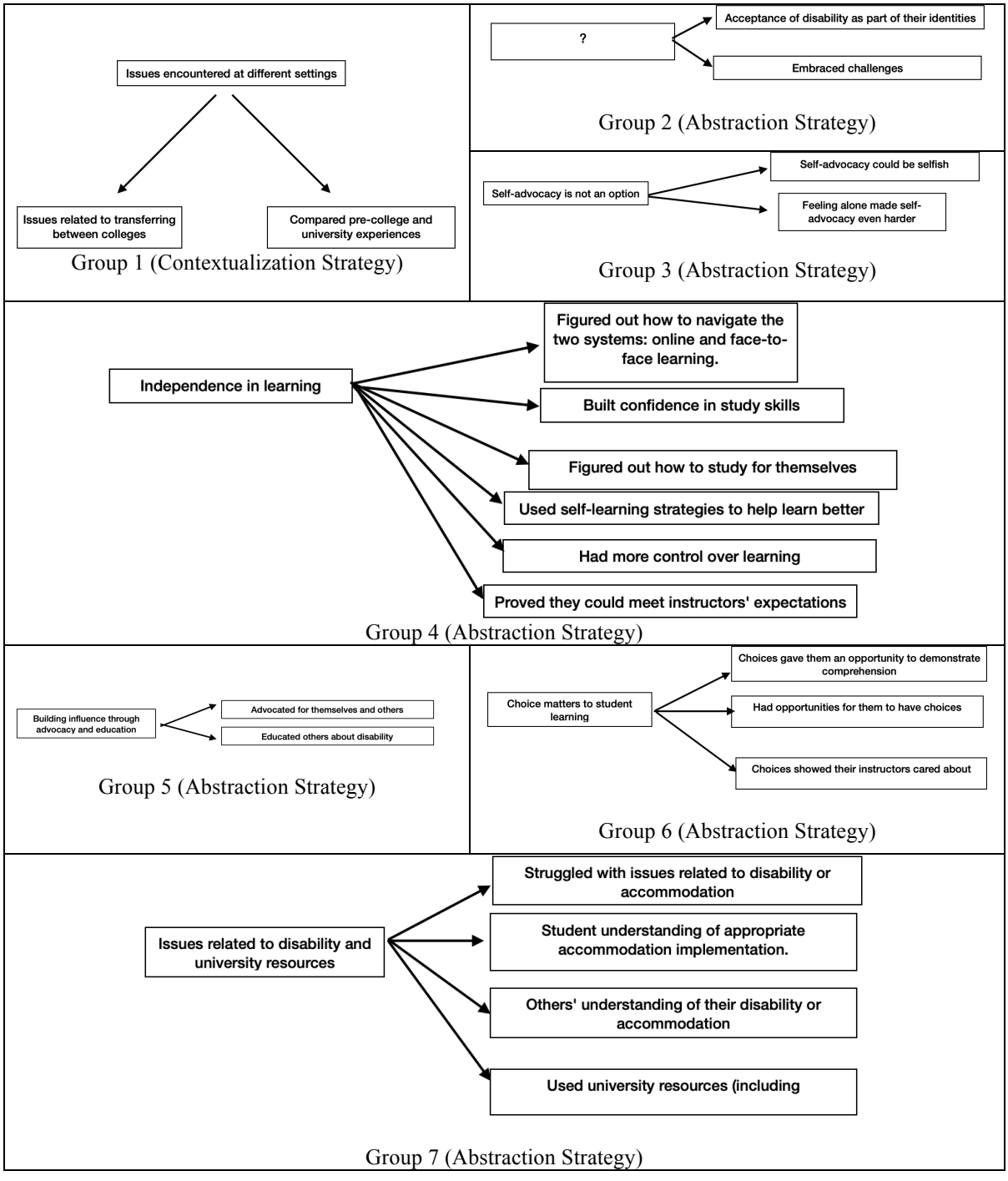
The number of excerpt documentation (continued)

Final theme	Initial theme	Focus group 1			Focus group 2			Focus group 3			
		Mary	**Aggies**	**Rob**	**Rachel**	**Cassie**	**Ann**	**Toby**	**Jessica**	**Matt**	**Alias**
Impact of the pandemic on learning experience	Impact of the pandemic on learning experience			√		√			√	√	√
	Figured out how to navigate the two systems: online and face-to-face learning.		√					√			
	Preferred in-person learning to see peers around them	√		√			√		√		
	Online learning was challenging										
UDL practices were helpful for students	UDL practices were helpful for students	√					√			√	
	Feedback was important			√			√		√		
	Approachable instructors made communication easier						√			√	√
	Instructors expressing enthusiasm made class interesting		√		√				√		
	Interactive learning or class practices solidified understanding		√	√							
	Multiple formats solidified their learning experience	√				√			√		
	Restating important points helped not to miss points				√	√					
	Choices gave them an opportunity to demonstrate comprehension		√		√					√	√

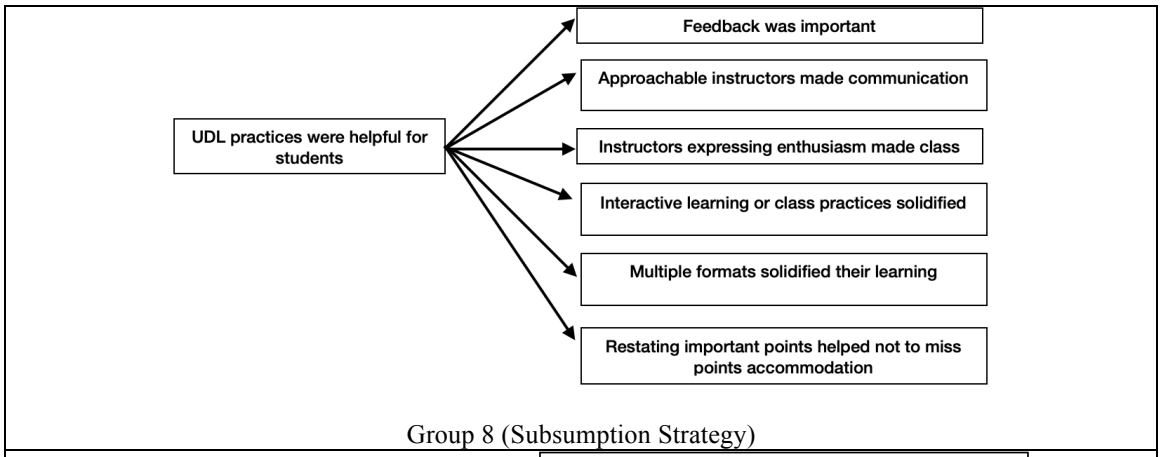
APPENDIX B
The number of excerpt documentation (continued)

Final theme	Initial theme	Focus group 1			Focus group 2			Focus group 3			
		Mary	**Aggies**	**Rob**	**Rachel**	**Cassie**	**Ann**	**Toby**	**Jessica**	**Matt**	**Alias**
Independence in learning	Embrace challenges	√			√	√					
	Figure out how to study for themselves					√	√		√	√	
	Used self-learning strategies helped them learn better										
	Knew their learning preference/strength	√				√					√
	Had more control over learning										
	Built confidence in study skills	√					√				
	Total number	8	7	7	7	9	8	4	7	6	6

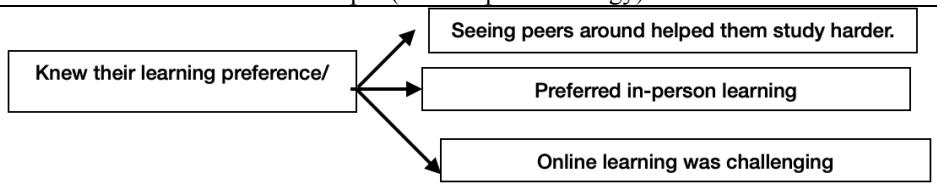
APPENDIX C
Theme evolution
Version 1



APPENDIX C
Theme evolution
Version 1(continued)

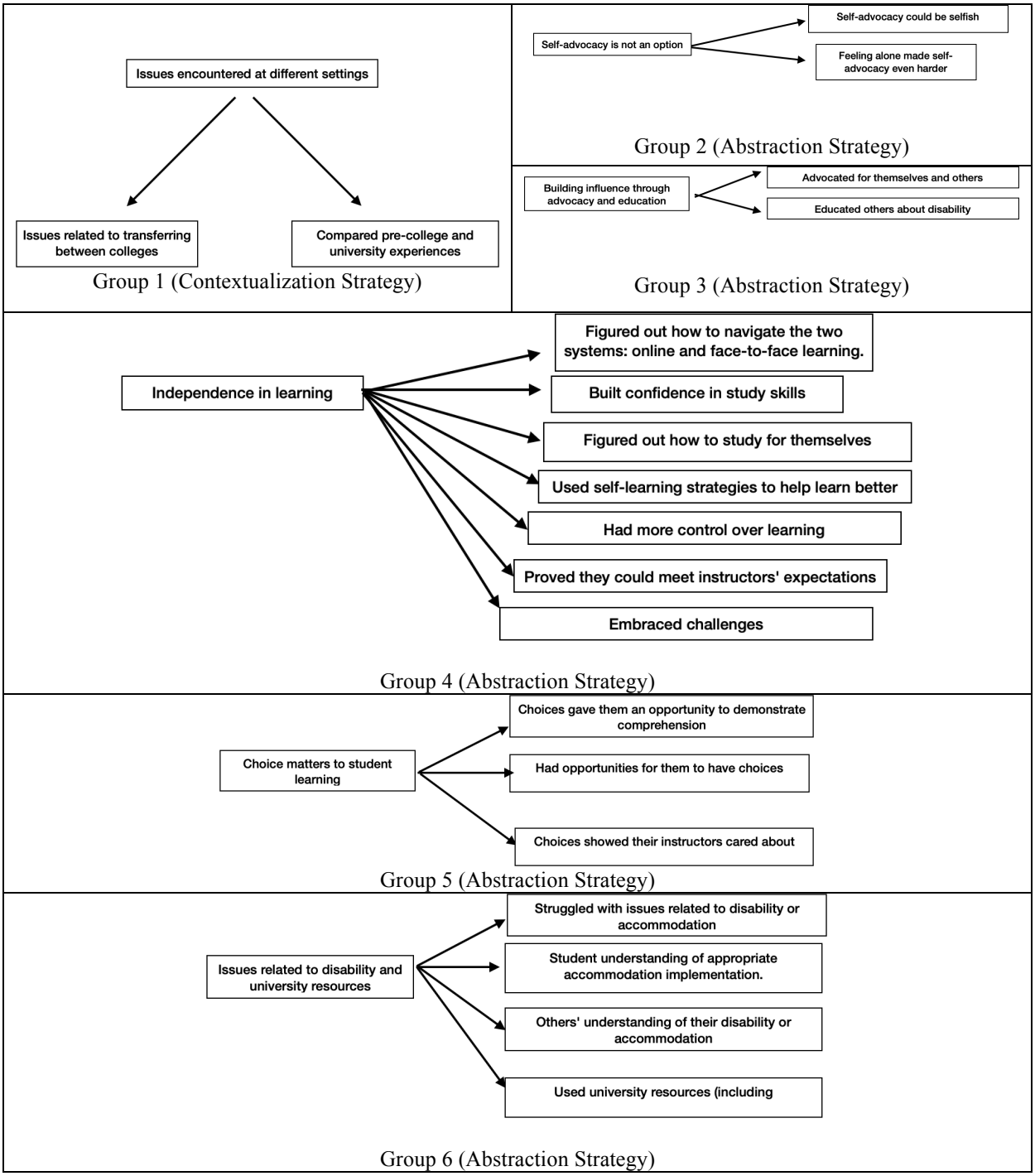


Group 8 (Subsumption Strategy)

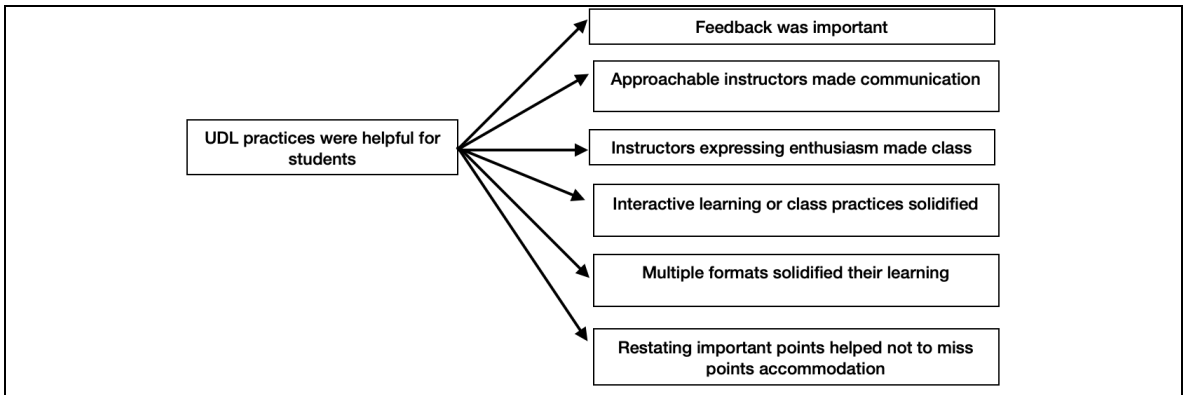


Group 9 (Subsumption Strategy)

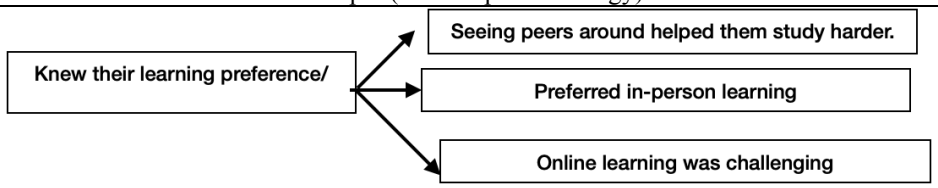
APPENDIX C
Theme evolution
Version 2



APPENDIX C
Theme evolution
Version 2 (continued)

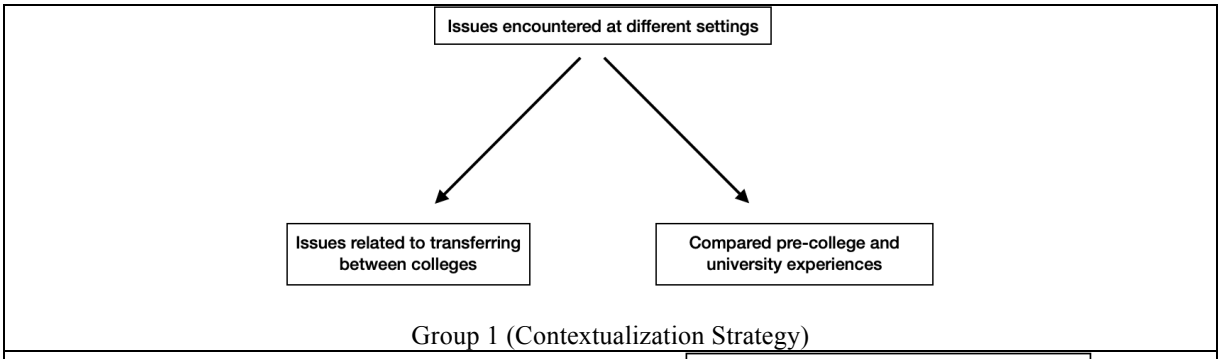


Group 7 (Subsumption Strategy)

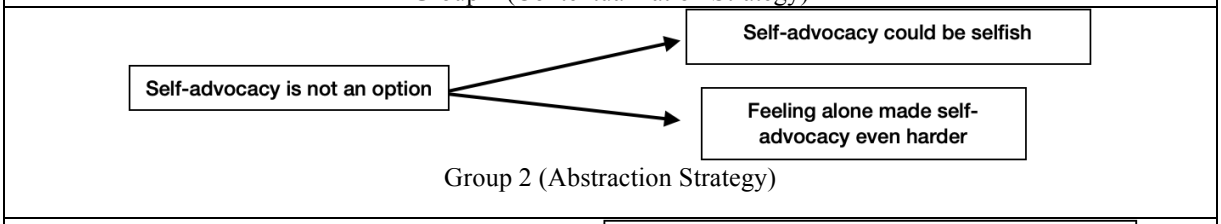


Group 8 (Subsumption Strategy)

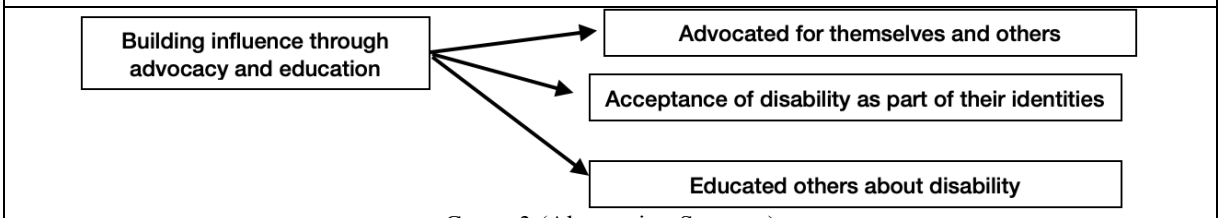
APPENDIX C
Theme evolution
Version 3



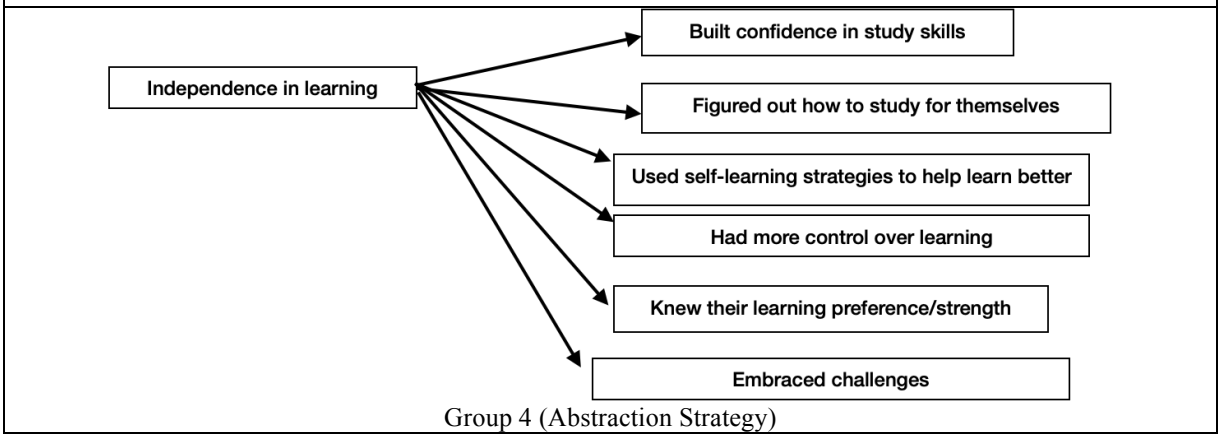
Group 1 (Contextualization Strategy)



Group 2 (Abstraction Strategy)

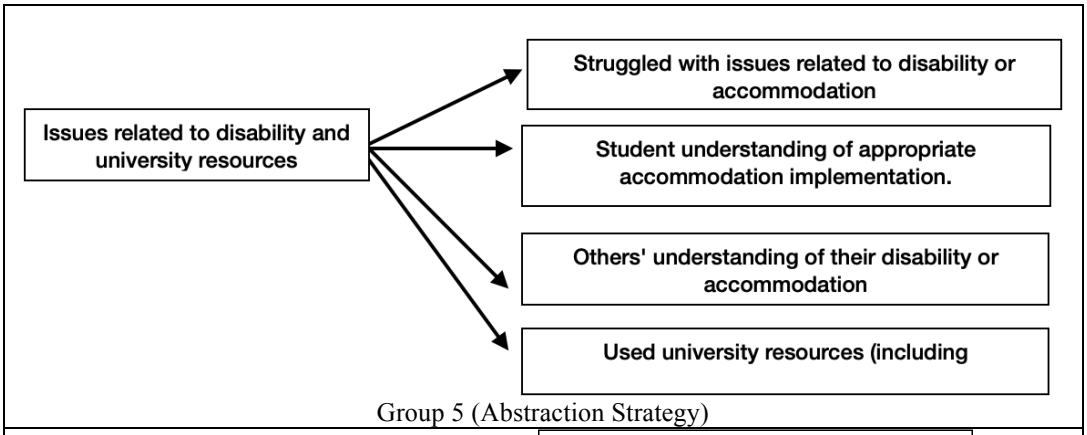


Group 3 (Abstraction Strategy)

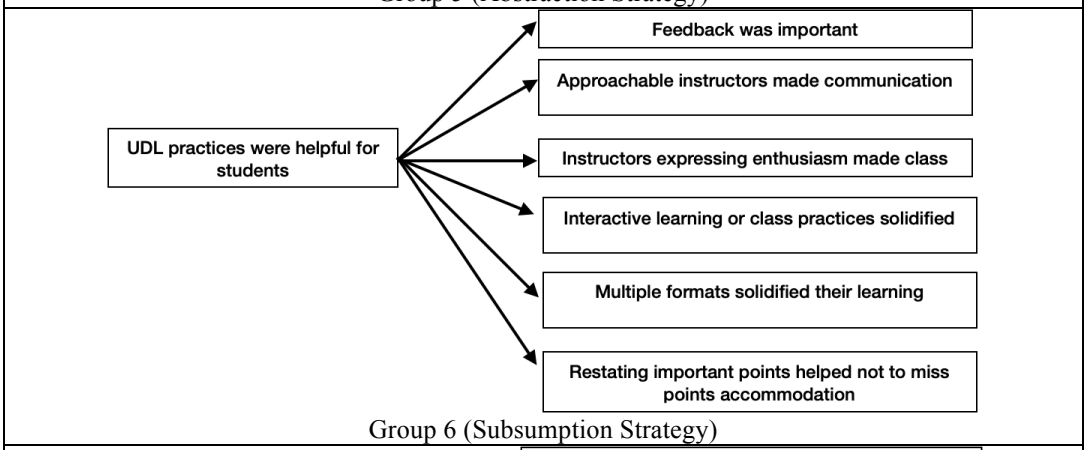


Group 4 (Abstraction Strategy)

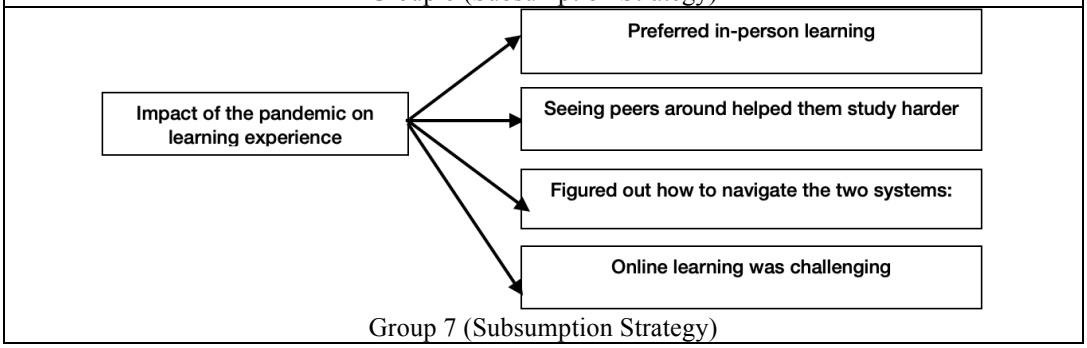
APPENDIX C
Theme evolution
Version 3(continued)



Group 5 (Abstraction Strategy)

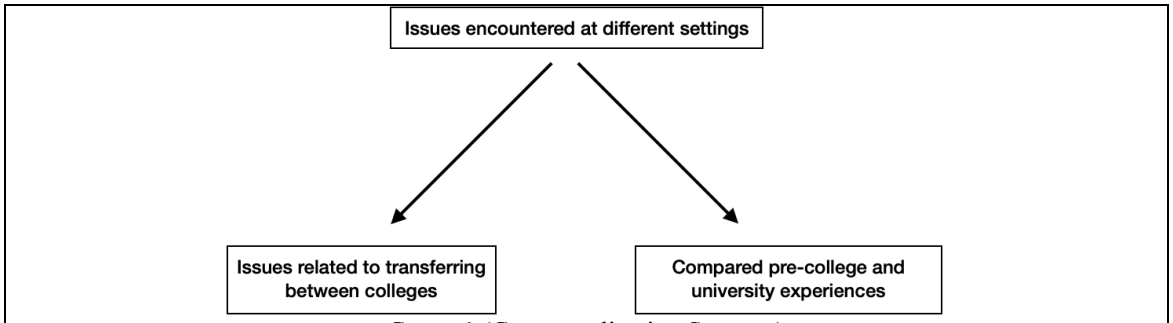


Group 6 (Subsumption Strategy)

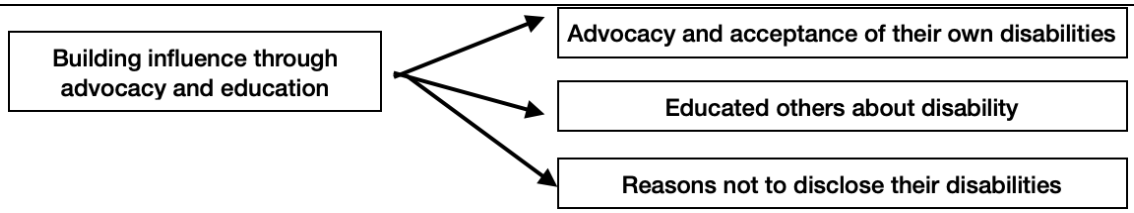


Group 7 (Subsumption Strategy)

APPENDIX C
Theme evolution
Final version

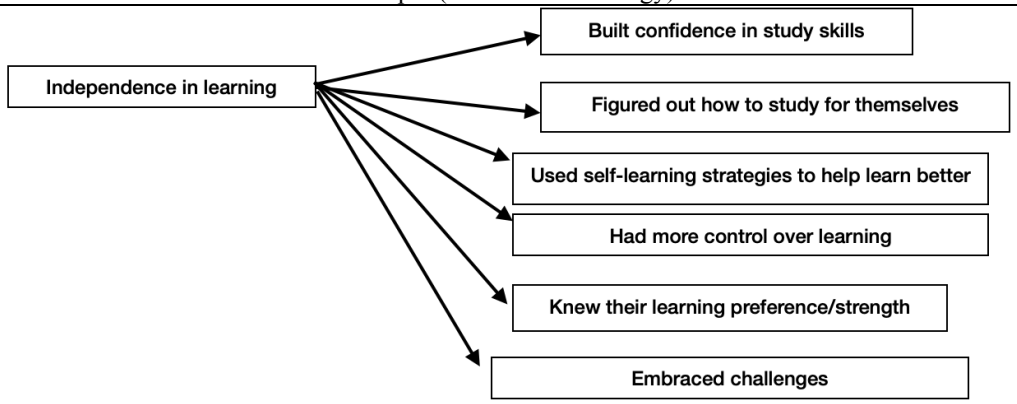


Group 1 (Contextualization Strategy)



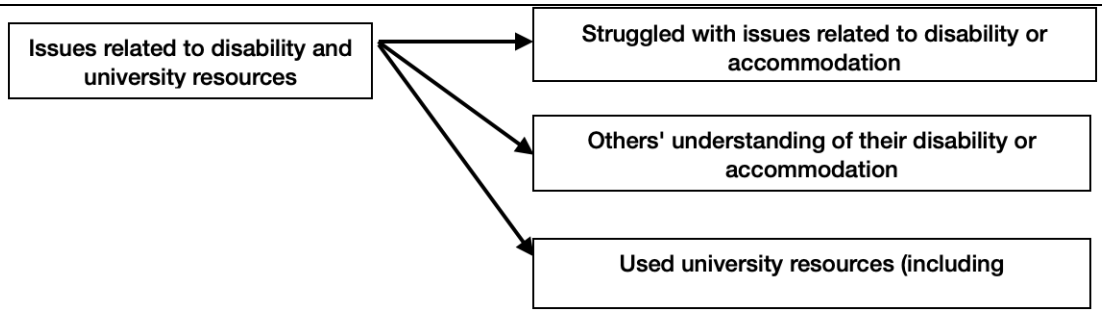
"Reasons not to disclose their disabilities" showed the contrasting narratives to the narratives of building influence through advocacy and education. "Reasons not to disclose their disabilities" brought a series of initial themes together: "Feeling alone made self-advocacy even harder", "Self-advocacy could be selfish", "Proved they could meet instructors' expectations."
"Acceptance of disability as part of their identities" merged with "Advocated for themselves and others"

Group 2 (Abstraction Strategy)



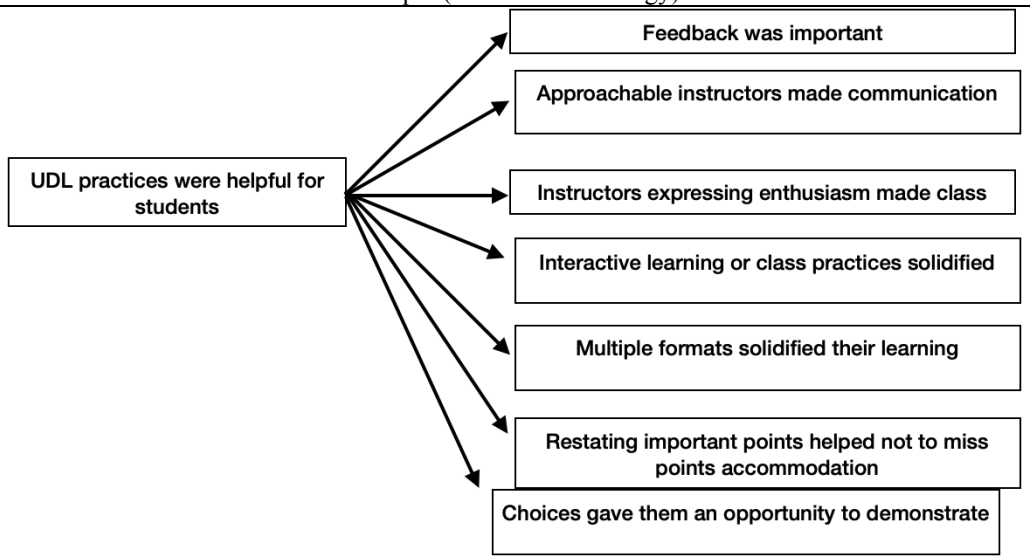
Group 3 (Abstraction Strategy)

APPENDIX C
Theme evolution
Final version (continued)



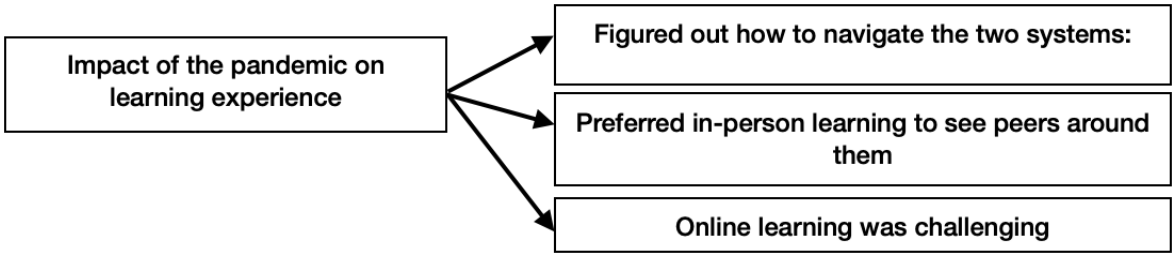
"Struggled with issues related to disability or accommodation" merged with "Student understanding of appropriate accommodation implementation"

Group 4 (Abstraction Strategy)



"Choices gave them an opportunity to demonstrate comprehension" merged with "Had opportunities for them to have choices."

Group 5 (Subsumption Strategy)



"Preferred in-person learning" merged with "Seeing peers around helped them study harder."

Group 6 (Subsumption Strategy)