

Article

Perceptions of UDL Teaching Practices among University Students with Disabilities

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Abstract: The purpose of this study was to investigate how students' disabilities impacted their learning at the university and to measure their perceptions of universal design for learning (UDL). An online survey was administered at a large public research university in the south-central United States; 160 students with disabilities completed the survey. These students with disabilities described how their disabilities influenced their learning in the following aspects: attention issues, slow processing, absence, accessibility issues, reading and writing challenges, mental health challenges, and social interaction challenges. The results also revealed that some UDL teaching practices were not being fully utilized by instructors based on the perceptions of students with disabilities. We discussed those UDL practices which were not being used by instructors and highlighted the impact of using the practices on students' learning. These practices include effective teaching methods such as helping students organize and summarize learning content, using technology to increase accessibility, providing flexibility in assessments and assignments, providing meaningful feedback, and recruiting students' attention and engagement.

Keywords: postsecondary education; universal design for learning; disabilities



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1. Postsecondary Education for Students with Disabilities

Transition to postsecondary education is an important factor indicating successful post-school outcomes for students with disabilities [1]. In postsecondary education, students with disabilities enter a learning environment that is not as structured as high school [2]. While students in postsecondary education have greater flexibility in choosing their courses, they may lose focus and direction in the unstructured work environment. In addition, to receive reasonable accommodations for their learning, students with disabilities in postsecondary education need to disclose their disabilities and apply for accommodations [2]. The disclosure process, however, can place students at a disadvantage and result in their experiencing stigma and discrimination. And even when students are able to obtain needed accommodations, the quality of those accommodations is not always ideal or even adequate [3].

2. Universal Design for Learning

Recently, relevant stakeholders in postsecondary education have called for inclusive teaching practices to support students with disabilities as they navigate the learning environment [4]. One framework for such practices is universal design for learning (UDL), which is widely used in postsecondary institutions to increase the retention of and graduation rates for students with disabilities [5]. UDL has been defined as “a framework to

improve and optimize teaching and learning for all people based on scientific insights into how humans learn" [6]. The key concept of UDL is to provide flexible learning experiences that incorporate options for learners. Students in the flexible learning environment become expert learners who are actively engaged in learning, goal-oriented, and resourceful and knowledgeable [7]. In the initial stage of UDL's development, Rose and Meyer [8] suggested that it was the curriculum, rather than the students, that posed challenges to education. In other words, the curriculum should be re-designed to enhance accessibility for all students. Dukes et al. [4] developed a four-domain taxonomy of the issues related to students with disabilities in postsecondary education and suggested that instruction for such students should embed UDL practices.

The UDL framework responds to the ideals of recognizing and honoring students' individuality and allowing teachers maximum flexibility in meeting students' needs. The three principles of UDL—(a) multiple means of representation, (b) multiple means of expression, and (c) multiple means of engagement—guide instructors to create and design inclusive learning environments [9]. For multiple means of representation, instructors can utilize various methods to present the class content (e.g., videotaping each lecture, orally describing visual materials, presenting class notes and materials on an online platform). Since learners use different ways to perceive and comprehend information, multiple means of presenting course materials can enhance accessibility for all learners. For multiple means of engagement, in order to help learners stay engaged or motivated to learn, different methods to engage students can be implemented, such as offering choices, building relatedness, fostering collaboration, providing feedback, and facilitating self-regulation. For multiple means of expression, flexibility in responses and communications can help students demonstrate what they learn in class. Assistive technologies are often used to remove barriers to expression and communication so learners can use alternative modalities to express what they learn and complete assignments. To support students with disabilities in higher education, Sejdic [10] asserted that UDL teaching practices positively impact students with disabilities by using proactive strategies to address their needs. Disability services offices and relevant stakeholders in higher education should actively promote UDL on campus.

3. Students with Disabilities and UDL in Postsecondary Education

Prior research studies mainly explored faculty's attitudes toward UDL teaching practices [11,12]. These studies serve as a reference for postsecondary institutions looking to develop UDL training for instructors. However, there has been a dearth of research gathering evidence as to how to implement UDL practices appropriately to address the needs of students with disabilities. Students' opinions are also an important source of information for relevant stakeholders seeking to understand the quality of the education received by these students. Studies have shown that a measure can be used to examine students' perceptions of instructors' use of UDL practices. For example, following a faculty training program, Schelly et al. [13] and Davies et al. [14] administered a questionnaire to students to examine a faculty training program's effectiveness. Their results showed that the UDL training programs for faculty were highly effective based on students' responses on the questionnaire. Similarly, Gawronski et al. [15] used 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 that these practices—especially course modifications and inclusive assessments—were rarely implemented by instructors. Gawronski et al. [15] demonstrated that, to some degree, students' attitudes and perceptions reflected the effectiveness of the teaching strategies used by instructors. It is important to note that only a few such studies have exclusively recruited students with disabilities as participants. Future studies could invite students with disabilities to discuss how to make education more accessible.

4. Study Purpose and Research Questions

The present study utilized an online survey to examine the implementation of UDL teaching practices, specifically focusing on the practices of multiple means of representation and multiple means of engagement based on participants' perceptions in their classrooms. The online survey also asked about how participants' disabilities influenced their learning experiences at the university. Therefore, the following questions guided the present study:

- How do students' disabilities impact their learning at the university?
- What UDL practices do students with disabilities perceive instructors or faculty members to be using and not using?

5. Method

5.1. Research Design

This study used an online survey to explore participants' perceptions of UDL practices. Online surveys have been an increasingly common method in research because of the variety of purposes they can serve [16]. One reason for using an online survey—one motivating this use in the present study—is that such a survey can help researchers to understand participants' concerns and attitudes. In addition, considering issues of cost-effectiveness and applicability, an online survey can be used in research situations in which the direct manipulation of variables may not be possible. Given that the present study's purpose was to examine participants' perceptions of instructors' teaching practices, the direct manipulation of variables—or any experimentation—was not necessary.

5.2. Survey Instrument Development

The online survey was developed on the basis of the existing survey from Schelly et al. [13]; the researcher obtained permission to modify and use the survey in the present study from the originating authors through an email. According to Schelly et al. [13], the survey was developed on the basis of the UDL principles. Since the original survey was administered to students in a specific course, we modified some survey questions to make them more general and straightforward to all students. For example, in Question 16, the original statement was "In this course I feel interested and motivated to learn". The researcher rephrased the question to: "I feel interested and motivated to learn". Before we distributed the survey to students with disabilities, we invited a group of fellow doctoral students, two faculty members, and personnel from the Office of Disability Resources to review the survey questions again after their modifications.

The first section of the survey sought participants' demographic information (nine questions). The second part of the survey queried perceptions of UDL teaching practices. In the first part, questions pertained to participants' demographic information. This information included the following: Academic years (0–2 years, 3–4 years, 5–6 years, or 7 years or more), Primary affiliated 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 [including blindness], ADHD, temporary disabilities, multiple disabilities, and/or 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 pertained to UDL teaching practices. There were 23 questions in the second part of the survey. Participants responded to the questions based on their observations regarding the implementation of UDL teaching practices by their instructors. The 5-point Likert-type scale was used to design the response format for questions. Participants were asked whether their courses' instructors had implemented each practice in the classroom by indicating: *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, or 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 provide their email for the purpose of entering a gift card drawing. Following their response, participants were directed to a final web page introducing UDL resources and the action model for self-determination (Field and Hoffman, 2015). The UDL resources included the web links to Think College, UDL in Higher Ed, DO-IT, and CAST, websites offering 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 outcomes and learn. The model was presented at the end of the survey to inform participants that they could use it to advocate for themselves and to communicate the UDL practices with instructors.

5.3. Setting and Participants

This study was conducted at a large, research-oriented public university located in the south-central United States. The inclusion criterion for participation in the study was being a student with a disability or disabilities at the university. Students who self-identified as having one or more disabilities were eligible to participate in the study and voice their opinions. A total of 160 students with disabilities participated in the online survey. Details of participants' demographics are presented in Table 1.

Table 1. Participants' demographic information.

Measure	n (%)
Gender	
Male	34 (21.3)
Female	113 (70.6)
Other	8 (5.0)
"I prefer not to answer"	4 (2.5)
No response	1 (0.6)
Academic years	
0–2 years	122 (76.3)
3–4 years	31 (19.4)
5–6 years	6 (3.8)
7 or more	0
No response	1 (0.6)
Accommodation request	
Yes	121 (75.6)
No	32 (20.0)
I do not know I can apply for accommodations	6 (3.8)
No response	1(0.6)
Primary affiliated academic department	
College of Agriculture and Life Sciences	19 (11.9)
College of Architecture	1 (0.6)
Mays Business School	5 (3.8)
College of Dentistry	0
School of Education and Human Development	23 (14.4)
College of Engineering	32 (20.0)
College of Geosciences	5 (3.1)
Bush School of Government and 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 and Biomedical Sciences	9 (5.6)
Texas A&M University at Galveston	12 (7.5)
Other	2 (1.3)
No response	1 (1.3)

Table 1. *Cont.*

Measure	<i>n</i> (%)
Disability category	
Autism	14
Deaf-blindness	3
Mental health	40
Hearing impairment/deafness	5
Intellectual disability	7
Orthopedic impairment	8
Other health impairment	37
Specific learning disability	17
Speech or language impairment	2
Traumatic brain injury	1
Visual impairment (including blindness)	2
ADHD	0
Temporary disability	0
Multiple disabilities	18
Other	5

Note. *n* = 160.

5.4. Recruitment and Data Collection Procedures

This study was approved by the institutional review board (IRB) of the university. Following IRB approval, data collection began. The survey was sent out twice through a campus-wide email—once each in early September and early November. In order to reach a broader pool of participants, the researcher 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 study's 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. Recipients 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 could read an informational cover sheet providing detailed information about the study. If they were interested, they could go to a second page, which presented an informed consent letter. On this page, participants could click on an "I agree" button if they were willing to participate, whereupon they were taken to the survey. Because of 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 a participant clicked "No", the survey ended and the student was thanked for their time.

5.5. Data Analysis Procedures

To answer Research Question 1, we coded the open-ended responses. The open-ended question asked participants to briefly describe how their disabilities have influenced their learning. The first author and the third author were the coders. We used open coding to sort and organize excerpts of raw data into groups [17]. Codes were created to capture the aspects that are relevant to the research question within a group of data. First, each person independently coded the responses using open coding. Initial codes were created to each response, and then they met to compare, discuss, and cluster initial codes to establish consensus.

To answer Research Question 2, we used descriptive statistics to answer the research question. All data were analyzed using IBM SPSS Statistics Version 26 to run descriptive statistics. Descriptive statistics (i.e., mean, percentage, and standard deviation) were used to present participants' demographic information and their perceptions regarding each UDL teaching practice. To analyze what UDL practices were being used by instructors on the basis of the perception scale results, the researcher drew on Cook et al. [18], who used a four-Likert-type-scale to assess faculty attitudes toward accommodations and universal

design-related teaching practices, combining *very important* and *important* to fully represent the importance score for each practice. The researcher also combined the percentages of *more than half of my instructors use the practice* with *all of my instructors use the practice* to obtain a cutoff point. Again, the researcher also used a grand mean of all practices as another cutoff point.

6. Results

6.1. How Do Students' Disabilities Impact Their Learning at the University?

Students' disabilities had various impacts on their learning at the university. In this study, participants described the following issues they experienced in their learning due to their disabilities: attention issues, slow processing, absence, accessibility issues, reading and writing challenges, mental health challenges, and social interaction challenges.

6.2. Attention Issues

Most participants who had disabilities experienced attention and focus difficulties. One participant stated, "I have a difficult time focusing on class and have a hard time staying on task". Another participant described how the attention issue impacted their productivity, stating, "It's difficult for me to sit in a chair for long periods of time, which affects my ability to go to class/study in a productive manner". Due to the attention issue, it was hard for students with disabilities to get work done in a reasonable time frame.

Other participants described how their conditions, such as traumatic brain injury (TBI) and diabetes, caused attention issues in their learning. One participant stated, "Disease flare-ups affect memory and concentration". Another participant who suffered from TBI said, "A TBI from a car accident left me with chronic migraines, which make concentration difficult on many days". Many other participants suffered from diabetes, and their blood sugar levels could cause attention issues as one participant indicated, "If my blood sugar goes low or high, I can have trouble taking tests or paying attention". Similarly, another participant described, "With ranging blood sugars that are out of my control, it can become difficult to pay attention in class or continue my learning with a high or low blood sugar".

6.3. Slow Processing

Participants with slow processing need more time to understand lessons, take quizzes, and complete assignments. One participant described how slow processing had a negative impact on their understanding of materials, stating, "It takes me longer to learn and understand the same material. I did not pass tests for medical school prior to getting accommodations". Another participant described how slow processing affected taking tests, stating, "It inhibits me to be efficient with my time and taking tests adds a lot of stress, because of timing and reading questions several times".

Other participants described how they coped with the slow processing issue. One participant stated, "I process things slower, have to work around physical sensitivities, and sometimes have to think about what is being requested of me". Another participant described their experience using disability services to deal with the slow processing issue and the struggle they faced due to the attitudes of their peers, indicating,

It makes work take longer and classmates struggle to understand that my extended time is equivalent to their regular time. I am constantly trying to keep myself in time with my assignments and love using my extended time on tests.

6.4. Absence

Participants described how their disabilities impacted their attendance in class. They may experience unexpected urgent sickness, and they had to run to the emergency room or stay home for rest. One participant stated, "My disabilities influence my learning because I have to miss a lot of school due to chronic illness, unexpected ER trips, or sickness keeping me from the classroom and in bed". Another participant described how they had to stay out of class because of seizures, stating, "I sometimes have seizure-like symptoms. I end

up missing classes". Chronic conditions, such as migraines, also impacted their attendance, as one participant indicated, "Chronic migraines—cannot come to class and complete assignments on some days, including exams—miss crucial in-class information due to the medical disorder".

6.5. Accessibility Issues

Accessibility issues typically arise when a learning environment fails to consider the needs of people with disabilities. Students who use wheelchairs encountered accessibility challenges when navigating the campus or classrooms. One participant described their accessibility issues, stating,

Because I am in a wheelchair, it can make it difficult to access certain classrooms. And even if I can make it to a classroom, many of them place disability seating in the very back, without any way of going to the front. Not only does being confined to the back of the classroom affect my overall engagement in the class, but it also makes it impossible to physically communicate with the professor. It also makes socialization with other students difficult, which is vital to success in some classes.

The participant not only described the difficulty of moving around in a classroom but also the social interaction barrier caused by the accessibility issue. The point about the impact on their overall engagement in class is important because it highlights the urgent need for greater awareness and action to create inclusive environments in educational institutions.

Some students disclosed how they experienced accessibility issues due to hearing loss and visual impairment. One participant who had hearing loss described, "I have a hearing loss which makes hearing the professor in large classrooms very difficult". Similarly, another one stated, "I struggle to catch what professors are saying even if I sit right in front of them during lecture". A student who had a visual impairment indicated how modified learning materials mattered to them, saying, "My eyes do not work well in certain lights. I read with purple paper or a blue overlay to correct this issue". Students with disabilities may experience various accessibility challenges. This serves as a reminder for instructors to consider the needs of students with disabilities and ensure that learning materials, services, and instruction are accessible to all students.

6.6. Reading and Writing Challenges

Students with dyslexia had difficulties in reading and writing as one participant described, "My dyslexia make learning from a textbook extremely hard. I take longer to learn when reading. With my writing, I use different tenses, and often my grammar and spelling skills are not strong". Another stated, "I have Dyslexia and to this day spelling, especially in an academic setting, can be a stumbling block for me". Due to their reading and writing capabilities, academic learning in postsecondary education can be extremely difficult. They often require additional time to complete assignments due to the extended processing time required for reading and writing tasks.

6.7. Mental Health Challenges

Students' mental health problems can cause multifaceted learning challenges, such as energy levels, motivation, and sensitivity to the learning environment. These challenges hinder their performance. One student stated their mental health led to multiple learning issues, saying, "Bipolar makes me inconsistent. Sometimes I do better with different learning styles. It is hard to be consistent. Also, my schizophrenia makes me very sensitive to any sounds". Another student highlighted that both their anxiety and depression impeded their performance, saying,

My anxiety causes me problems in classes where I must speak in front of others or work in group projects. My depression sometimes makes it hard for me to find the motivation to come to class or even get out of bed when I am having a really awful mental health day.

Similarly, one student described a lack of motivation due to mental health problems. Although they used medications to alleviate these issues, the medication's side effects could cause additional learning problems. The student said,

I'm currently dealing with multiple mental health issues ranging from severe depression and anxiety. The lack of a consistent mood and the desire at times to do nothing makes learning very difficult. As a result of my medications, sometimes it's extremely difficult to fall asleep, which has aggravated my mental health issues, making learning a real challenge.

6.8. Social Interaction Challenges

Students with autism expressed challenges in forming relationships and engaging in social interactions. One student who had Asperger's Syndrome described their social interaction challenges and how they overcome them, saying,

I suffer from what is known as Asperger's Syndrome. This makes it difficult to interact with other students and often times professors as the social side of my life are lacking due to this disability. Group projects also suffer along with my understanding of certain lectures. I overcome this by reading over notes on my own and trying my best to interact with students outside of the classroom to understand them better.

Another student who also had autism highlighted the challenges of communication and social skills, saying,

I have mild to moderate autism spectrum disorder. It impedes my ability to communicate with other people. As a result, I have become isolated in class. Furthermore, during clinical events, I have been barred from volunteering or working at HEB or Baylor Scott & White due to my poor social skills.

Social interaction and communication pose significant challenges for students with autism. These difficulties further impede their opportunities to participate in events and form relationships with peers and professors, and often lead to feelings of isolation.

6.9. What UDL Practices Do Students with Disabilities Perceive Instructors or Faculty Members to Be Using and Not Using?

The perception scale was scored using a 5-point Likert-type scale (1–5). Mean scores ranged from 2.35 to 4.36, with higher scores indicating participants considered that the practice has been fully implemented by their instructors. For example, the question item 4 (Instructors often speak while facing audiences) had a mean of 4.36. It means that the participants perceived that most of their instructors often spoke while facing students.

To be specific, an average of 21.5% of the participants perceived that all their instructors used the practices described in the 23 question items. The range of the percentage of *all of my instructors use the practice* was from 6.0% to 52.6%. For example, only 6% of the participants perceived all their instructors used strategies to motivate them to learn in the courses (item 16), and 52.6% of the participants perceived all their instructors often spoke while facing audiences (item 4). An average of 31.6% of the participants perceived that more than half of their instructors used all practices. The range of the percentage of *more than half of my instructors use the practice* was from 14.1% to 50.4%. An average of 24.0% of the participants perceived that half of their instructors used all practices. The range of the percentage of *half of my instructors use the practice* was 11.1% to 35.8%. An average of 19.9% of participants perceived that less than half of their instructors used all practices. The range of the percentage of *less than half of my instructors use the practice* was from 3.7% to 48.9%. Finally, an average of 3.9% of participants perceived that none of my instructors used the practices described in all items. The range of the percentage of *none of my instructors use the practice* was from 0 to 20.7% across all 23 question items.

To interpret the data more clearly, the researcher combined the percentages for *more than half of my instructors use the practice* and *all of my instructors use the practice*. The combined percentage was 52.1% (21.1% + 31.0%). A UDL practice was then considered as being 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 practices with means above 3.38 were considered as being *used*. The results demonstrated that applying the two criteria generated the same practices that were being used by instructors. On the basis of participants' perceptions, 14 items in total were fully used by instructors (i.e., Items 1, 2, 4, 7, 8, 9, 11, 14, 15, 18, 19, 21, 22, and 23). The range of the percentage was from 53.7% to 85.9%. For example, item 14 was fully used by instructors because the combined percentage (53.7%) was higher than 52.1% and the mean (3.5) was higher than the grand mean, 3.38. On the contrary, items 3, 5, 6, 10, 12, 13, 16, 17, and 20 were not fully used by instructors. The range of the percentage was from 19.3% to 48.5%. For example, item 10 was not fully used by instructors because the combined percentage (19.3%) was lower than 52.1% and the mean (2.35) was lower than the grand mean. Item characteristics for the perception scale are presented in Table 2.

Table 2. Items and response frequencies for the perception scale.

Item	None <i>n</i> (%)	Less than Half <i>n</i> (%)	Half <i>n</i> (%)	More than Half <i>n</i> (%)	All <i>n</i> (%)	<i>M</i> (<i>SD</i>)
1. Instructors present information in multiple formats (e.g., lecture, text, graphics, audio, video).	1 (7.0)	23 (16.9)	34 (25.0)	55 (40.4)	23 (16.9)	3.56 (0.99)
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 (0.84)
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)
4. Instructors often speak while facing audiences.	0	4 (3.0)	15 (11.1)	45 (33.3)	71 (52.6)	4.36 (0.80)
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)
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)
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 (0.84)
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)
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)
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)
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 (0.99)
12. Students were allowed 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)
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)
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)
15. Assignments can be submitted electronically.	1 (0.7)	12 (8.9)	16 (11.9)	60 (44.4)	46 (34.1)	4.02 (0.94)
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 (0.98)

Table 2. Cont.

Item	None n (%)	Less than Half n (%)	Half n (%)	More than Half n (%)	All n (%)	M (SD)
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)
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 (0.99)
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 (0.94)
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)
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)
22. Instructors are highly approachable and available to students.	0	8 (6.0)	38 (28.4)	59 (44.0)	29 (21.6)	3.81 (0.84)
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)
Overall average	5.2 (3.9)	25.6 (19.0)	32.3 (24.0)	42.5 (31.6)	28.8 (21.5)	3.38 (0.54)

Note. The total number of the participants is 160, and the participants with missing data were kept.

7. Discussion

This study used an online survey to explore how students' disabilities influenced their learning at the university. We also used the survey to investigate whether students with disabilities perceived that their instructors had implemented UDL teaching practices. As previous studies have shown [19,20], student voices can be a valuable source of feedback about UDL teaching practices. Dallas et al. [11] also suggested that students should be surveyed to evaluate the effectiveness of UDL teaching practices. Before evaluating if they perceived that their instructors had implemented UDL teaching practices, students with disabilities described how their disabilities impacted their learning. In many cases, a disability label, such as autism or intellectual disability, cannot fully convey individuals' learning challenges and the strategies instructors can use to address their learning needs. On the basis of students' responses, we found that disabilities influenced their learning in various aspects. These various aspects of learning could be interconnected, meaning that a student with disabilities probably may struggle with multiple learning issues. For example, a student struggling with mental health issues may have low attendance in class. This student can also experience difficulties with processing information and staying focused during lectures. Dymond et al. [21] argued that students with disabilities have unique characteristics and thus need unique combinations of support. We suggested that instructors or faculty members should be attentive to students' challenges across different learning aspects. Once instructors or faculty members receive students' accommodation letters from disability services or directly from students, they should actively schedule a meeting with the students to discuss potential learning challenges and determine appropriate accommodations to help them overcome these challenges.

Students with disabilities in this study completed a survey to show their perceptions as to whether their instructors used UDL practices. On the basis of the survey results, we found there were 14 items perceived to be used by instructors (i.e., items 1, 2, 4, 7, 8, 9, 11, 14, 15, 18, 19, 21, 22, and 23). The remaining nine items were perceived to not be fully utilized by instructors. However, these items were found to be effective practices for addressing students' learning needs (CAST, 2018). The following is the discussion of items that were perceived to not be fully utilized by instructors:

Questions 3, 5, and 6 mainly focus on key lecture points and course objectives organized and summarized by instructors. Based on the results of this study, some students with disabilities experienced difficulties staying focused and processing information efficiently.

Other students with disabilities expressed that they either missed class or had to leave class early due to illnesses. Practices from Questions 3, 5, and 6 can help students organize the learning content efficiently. A study conducted by Boyle et al. [22] described how key lecture points and summaries can help students with disabilities to take notes. Learning materials such as guided notes should be provided to students to support them in quickly grasping the learning content. Additionally, key lecture points or summaries can be presented on handouts which allow students with disabilities who struggle with low attendance to utilize them for self-study.

Another teaching practice that was perceived by most participants as not having been fully implemented is described in Question 10, which emphasizes using technology to increase accessibility. Some students with disabilities encountered accessibility issues based on the results of this study. It is suggested that technology should be extensively incorporated into instruction [23]. Technology can help instructors to create an accessible classroom in various ways; however, its application has not been fully implemented, as many instructors are largely unaware of how to develop a technology-rich classroom [24]. For students with visual disabilities, digitized content should be accessible to allow them to use screen readers for converting text to speech [24]. Similarly, students with dyslexia can benefit from technology tools. Throughout the writing and reading processes, various technology tools serve different purposes, including formatting and editing for writing, as well as text-to-speech for reading [25]. Technology can also support relationship-building between students and instructors. Some students with autism struggle with in-person interactions. Technologies that replicate in-person learning experiences can facilitate interactions between students and instructors [26].

In terms of assessments and assignments, students with disabilities in this study scored low on both Questions 12 and 17. Assessments and assignments play a crucial role for instructors in assessing students' understanding. Many students with disabilities have difficulties in completing assessments and assignments. For example, those with dyslexia may struggle with reading and writing for assessments and assignments, while students with autism may find group assignments challenging. Cai et al. [27] discussed that students with autism prefer not to participate in group discussions or assignments due to the interpersonal communication challenges they experience. It is important for instructors to provide alternative modalities for students to express the knowledge and skills they learn in class [7]. Additionally, students should have the flexibility to work on assignments either individually or in groups [9]. We suggest that instructors allow students with disabilities to demonstrate their understanding of materials through nontraditional methods such as projects, portfolios, or videos. This approach can help students find the assessments and assignments more meaningful compared to traditional assignments.

Related to assessments and assignments, it is important to provide students with meaningful feedback to help them improve their learning. However, Question 13 on the survey showed that students with disabilities did not often receive feedback from their instructors. Li et al. [26] discussed missing feedback with students with disabilities. Without effective feedback, students will not have the opportunity to reflect on what they are doing correctly and incorrectly. Pietruszewski [28] suggests a feedback plan for instructors. The plan begins with compiling common comments, which should be centered around the learning goals of the assignments. The feedback should be tailored to each student's strengths and weaknesses. Then, instructors should consider what students need to learn from an assignment and what they should learn through feedback. Using a feedback plan can save instructors' time and assist them in prioritizing the most important learning focus for students.

Last, Question 16 pertains to instructors' use of strategies to motivate students to learn, and Question 20 highlights the value of explaining the real-world importance of course content. Both practices are used to recruit students' attention and engagement [9]. Students with disabilities from Cai and Richdale's study [27] expressed that they wished they had someone to motivate them as they had lost interest in university for different

reasons. Although students with disabilities are expected to be independent learners, it is important to motivate and encourage these students as they navigate the learning challenges [28]. Such effort necessitates the provision of experiences allowing students to connect their classrooms to the real world; the fact that students with disabilities in this study perceived this practice as having not very often been implemented by instructors implies that students' learning may remain on a conceptual, as opposed to a practical, level.

Overall, this study has contributed to the current literature base by using a UDL questionnaire to survey students' perceptions of UDL teaching practices. It is important to further explore—from both student and faculty perspectives—why effective practices are not fully implemented. The results can inform approaches to the appropriate implementation of UDL practices in postsecondary education classrooms. Instructors can also use a questionnaire to evaluate the effectiveness of teaching on the basis of students' perspectives.

8. Limitations and Implications for Future Research

The present study had several limitations. The first major limitation of the present study is related to an issue inherent 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. This suggests that further inquiry regarding participants' thoughts on UDL teaching practices is needed. In addition, different participants may interpret survey questions from different angles. Future research could use focus groups or interviews to capture participants' in-depth learning experiences. Through participants' descriptions of their experiences, researchers could explore how UDL practices actually work for students with disabilities and identify ways to improve implementation. This study's second major limitation was associated with sample size. Although the researcher sent out the invitation twice and collaborated with the university's Office of Disability Resources to distribute the online survey, the sample size was small. Additionally, as this study was conducted during the time of the global pandemic, it could have been difficult to reach potential participants through email alone. Some potential participants might not have had stable internet services or consistent access to technology. Future research of this sort should recruit a large and diverse sample to run robust statistical analyses.

9. Conclusions

Many students with disabilities have encountered several challenges in studying post-secondary education due to their disabilities or physical illnesses. To support these students effectively, it is crucial for faculty or instructors to use inclusive teaching practices within the UDL framework. UDL provides flexibility in course materials, student engagements, and the design of assessments and assignments. This flexibility ensures that students have equitable access to an effective learning environment. This study explored how students' disabilities impacted their learning at the university and what UDL practices students with disabilities perceived instructors to be using and not using. Based on the responses from the participants, students with disabilities revealed several issues that impacted their learning, such as attention, slow processing, and accessibility issues. We also highlighted the practices that students perceived as not being fully utilized as a reminder for future instructors to incorporate them. We encourage instructors to use UDL teaching practices, as these not only support students with disabilities in learning but also benefit *all* students.

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