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Abstract

Universal design for learning (UDL) is a pedagogical framework that utilizes the principles of equal access, flexibility, simplicity, perceptibility, and efficiency in the process of teaching and learning. This multi-institutional cross-sectional study examined instructional methods and designs that occupational therapy students identified to be useful or not useful for their diverse learning needs based on principles of UDL. The study also sought to determine if select methods or designs were perceived to enhance learning for those who are neurodivergent in contrast to other students. An online survey was distributed to students across four occupational therapy programs. The survey consisted of demographic questions, lists of instructional methods and designs framed by the Center for Applied Technology (CAST) domains, and two general questions about overall learning and self-efficacy. Data were analyzed using descriptive statistics and non-parametric comparison. Of the 81 participants, results indicated that nearly all perceived an instructor who is approachable, learning through real world activities, and practicing hands-on skills in the classroom to be useful for their learning. Students with neurodivergence identified six learning methods significantly less useful than not neurodivergent students including doing first with discussion to follow, being preassigned group membership by the instructor, flexible seating and classroom arrangement, and course requirements with flexible due dates. The CAST domain of engagement had the strongest impact on student preferences. This indicates that attention to engaging students and methods that draw students into the why of learning may meet all student needs in graduate occupational therapy education.

Keywords

Universal Design for Learning, pedagogical frameworks, occupational therapy student learning, CAST domains, neurodivergence

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ABSTRACT

Universal design for learning (UDL) is a pedagogical framework that utilizes the principles of equal access, flexibility, simplicity, perceptibility, and efficiency in the process of teaching and learning. This multi-institutional cross-sectional study examined instructional methods and designs that occupational therapy students identified to be useful or not useful for their diverse learning needs based on principles of UDL. The study also sought to determine if select methods or designs were perceived to enhance learning for those who are neurodivergent in contrast to other students. An online survey was distributed to students across four occupational therapy programs. The survey consisted of demographic questions, lists of instructional methods and designs framed by the Center for Applied Technology (CAST) domains, and two general questions about overall learning and self-efficacy. Data were analyzed using descriptive statistics and non-parametric comparison. Of the 81 participants, results indicated that nearly all perceived an instructor who is approachable, learning through real world activities, and practicing hands-on skills in the classroom to be useful for their learning. Students with neurodivergence identified six learning methods significantly less useful than not neurodivergent students including doing first with discussion to follow, being preassigned group membership by the instructor, flexible seating and classroom arrangement, and course requirements with flexible due dates. The CAST domain of engagement had the strongest impact on student preferences. This indicates that attention to engaging students and methods that draw students into the why of learning may meet all student needs in graduate occupational therapy education.

Introduction

Universal design for learning (UDL) is a pedagogical framework that can guide understanding of students' diverse learning needs regardless of disability. Similar to the more recognized concept of universal design, UDL utilizes the principles of equal access, flexibility, simplicity, perceptibility, and efficiency in both the learning environment and the process of teaching and learning (American Occupational Therapy Association [AOTA], 2015). Implementing UDL within higher education can reduce barriers and create a more equitable learning environment for all learning styles. The use of UDL allows educators to facilitate the achievement of instructional goals for a group of diverse learners, rather than placing an emphasis on labeling individuals or creating accommodations for specific learning disabilities (Murphy et al., 2020). By understanding students' learning preferences, educators can adjust teaching methodologies to meet the needs of all learners, regardless of whether they teach in an online, hybrid, or classroom format. Universal design for learning also includes the learner in the learning process, which supports the students in becoming experts in their own learning.

Universal Design for Learning Guidelines

The Center for Applied Technology (CAST) is a nonprofit educational research and development center that created UDL guidelines (CAST, 2023). A team of over 50 educational experts contributed to the iterative guidelines promoting equal access to education. According to CAST, UDL guidelines can be used as a tool to implement UDL in a variety of settings and can be applied to any discipline or domain to ensure that all learners can participate in meaningful, challenging learning opportunities. The three principles of UDL identify how educators can facilitate learning by providing multiple means of engagement, representation, and action and expression (Murphy et al., 2020). *Engagement* refers to the "why" of learning and includes elements of learning that engage and motivate students to learn. Educators can support learners in becoming purposeful and motivated by providing multiple options to recruit interest, sustain effort, and promote self-regulation. *Representation* relates to the "what" of learning and encompasses how learners' access and comprehend information. This includes providing a variety of opportunities to perceive and comprehend learning activities. *Action and expression* are the "how" of learning and include various methods to communicate and manage learning. This involves interacting with accessible materials, sharing ideas using tools that help attain learning goals, and developing and acting on plans to make the most out of learning (CAST, 2018).

Universal Design for Learning Within Occupational Therapy Education

Occupational therapy is a client-centered health profession concerned with promoting health and well-being by enabling people to participate in activities of everyday life (World Federation of Occupational Therapists [WFOT], 2012). Occupational therapy educators are tasked with preparing future occupational therapy practitioners to meet the diverse needs of clients across the lifespan in a variety of settings. The Occupational Therapy Education Research Agenda created by AOTA has highlighted the need to identify and evaluate signature pedagogies, such as UDL, that organize the fundamental ways in which future practitioners are educated for their new profession

(AOTA, 2018). There is a need to better understand the implementation and outcomes of UDL in higher education settings, including occupational therapy education. Given the limited evidence, examination of the use of UDL principles within occupational therapy education is warranted (Murphy et al., 2020). With consistent UDL implementation, there is potential to improve retention rates, grade point average (GPA), teaching effectiveness, and student evaluations of teaching (Bogdan & Pass, 2018).

Metacognition

Universal design for learning includes the learner in the learning process, by training students in self-efficacy to become experts in their learning. The theory of "metacognition" touts that learners can recognize their capacity and process of learning, which leads to more efficient and meaningful learning (Dunn et al., 2019; Flavell, 1979). The metacognitive learner is characterized by the ability to recognize, evaluate, and reconstruct what has been learned (Noushad, 2008). Metacognitive learners recognize their learning style and employ learning strategies that align with the content, which allows them to plan how to learn, self-monitor comprehension of learning, and self-evaluate learning progress (Medina et al., 2017). This is especially true of post-graduate students, where the learner has had years of successful learning to achieve and enter postgraduate study with knowledge of strategies that aid effective and efficient learning. Occupational therapy students implement metacognitive strategies, such as debugging (i.e., reviewing and correcting performance errors after a learning episode or assessment; Dunn et al., 2019) and occupational therapy educators implement a variety of metacognitive strategies to improve the development of higher-order thinking and learning outcomes (e.g., critical thinking, written reflection, self-directed learning, peer-led interactions, self-assessment; Robinson et al., 2022). There is an increasing need to examine the methods of teaching and learning due to an increase in students' self-awareness of their learning needs and heightened expectations of higher educational institutions to meet those needs.

Disability in Post-Secondary Education

Disabilities among the student population are increasing due to enhanced awareness of the general social structures and more accurate evaluation and reporting mechanisms (Griful-Freixenet et al., 2017; World Health Organization, 2022). According to the National Center for Education Statistics (NCES, 2023), 11% of graduate students reported a disability in the 2019-2020 academic year. Data from NCES indicated that a majority of students who reported a disability in high school did not report a disability in college. Of the 37% who did report their disability, approximately 85% received academic accommodations. The challenges of tracking accommodations and individualizing the educational experience increase faculty workload, albeit while contributing to success in teaching. Students with (learning) disabilities are likely to have negative experiences when supportive learning tools are not readily available (Clouder et al., 2020). These students perceive barriers to learning, including lack of appropriate learning materials, inaccessible learning spaces, inappropriate activity demands, and lack of environmental support (Black et al., 2015). Students with and

without disabilities reported having a variety of learning preferences and identified UDL principles, such as the provision of information in multiple formats, frequent faculty feedback, and allowing diverse assessment methods as useful in improving their learning (Black et al., 2015).

Neurodiversity and Neurodivergence

The term neurodiversity, first coined by Judy Singer (1999), is an emerging term that connects learning to brain function. The term suggests that brain variation exists within the human population which leads to differences in how people learn. Identifying as neurodivergent is not yet considered a formal diagnosis and there has been vast variation in the way that neurodiversity and neurodivergent have been defined. For the purpose of this study, we have chosen to adopt Cleveland Clinic's (2022) definition of neurodivergent: "...a nonmedical term that describes people whose brains develop or work differently for some reason." The standards set by neurodiversity extend beyond formal diagnoses to necessitate respecting others' traits and behaviors as natural to their neurologic makeup (Dallman et al., 2022). As such, challenges caused by autism spectrum disorder (ASD), attention deficit disorder (ADD), attention deficit hyperactivity disorder (ADHD), and other neurodivergent diagnoses can be received as a different way of thinking and behaving. Prevalence statistics on neurodiversity in higher education are not straightforward; however, given the number of individuals diagnosed with neurodivergent-related conditions in the global population, one can expect these numbers to be reflected across the board (Clouder et al., 2020). Educators must be aware of the neurodiversity that exists in students in the way they learn and understand the world and implement strategies in the classroom to support the diverse learning needs of all students (Carrington et al., 2020). Universal design for learning is intended to adjust instructional methods to be inclusive for all learners and to meet the unique needs of learners with disabilities and neurodivergence. There is a need to better understand the implementation and outcomes of UDL in higher education settings, including occupational therapy education. With consistent UDL implementation, there is potential to improve retention rates, GPA, teaching effectiveness, and student evaluations of teaching (Bogdan & Pass, 2018).

Study Purpose

This study aimed to answer the question, what instructional methods, as guided by UDL principles, do students perceive to be useful and not useful in learning? The secondary question sought to determine if preferred instructional methods differed between neurodivergent and not neurodivergent students. The purpose was to inform educators of the instructional methods that were perceived as useful or not useful for all students including those with neurodivergence. With this information, educators can select methods that meet the needs of all learners regardless if they teach in an online, hybrid, or classroom format.

Methods

Study Design

A multi-institutional cross-sectional quantitative survey study design was utilized to collect data describing overall graduate occupational therapy student preferences for learning and to compare learning preferences between those who identified as neurodivergent compared to those who identified as not neurodivergent. The Institutional Review Board (IRB) at the authors' respective universities approved the study as exempt prior to proceeding with participant recruitment.

Sample

The potential sample consisted of 463 pre-professional graduate masters and doctorate occupational therapy students enrolled in four universities across the United States, one Midwestern and three Western. Two of these programs were fully in person and two were hybrid. Participants enrolled in their first, second, and third year of study at these institutions were invited to be part of the study.

Instrumentation

A UDL online survey designed for occupational therapy students was developed by the research team drawing from instructional methods identified by CAST categorized by the three domains: engagement, representation, and action and expression. These items were compared to the items in the Murphy et al. (2020) study which looked at faculty implementation and the Black et al. (2015) study which looked at student preferences. The survey was piloted with seven individuals with experience in occupational therapy graduate education, including both occupational therapy graduates and instructors. Feedback was incorporated into the final survey.

The survey questions included demographic information, lists of instructional methods and designs used in occupational therapy graduate programs, and two general questions about overall learning and self-efficacy. Demographic information included year in program, type of program (e.g., fully in-person, hybrid), degree program (e.g., masters, entry-level doctorate), identification of disability, including self-identification as neurodivergent, and accommodations and type. Items did not seek information on opinion or private information beyond self-identification of disability status and preferred accommodation(s).

The 62-item Qualtrics survey was designed to assess learning preferences that students found not useful (1), somewhat useful (2), very useful (3), or not experienced (4) using a 4-point Likert scale. The Cleveland Clinic (2022) definition of the term "neurodivergent" was included in the item requesting self-identification of neurodivergent thinking.

Procedures

The 62-item Qualtrics survey was sent electronically to all graduate occupational therapy students across four institutions by department representatives to avoid bias. An electronic consent described the study and invited the student to participate. All occupational therapy students enrolled in these programs received an email notification

to voluntarily participate in the survey and gained access following review and agreement to an informed consent statement. Students were informed that the survey was anonymous, voluntary, and there would be no penalty for not participating or withdrawing from the survey. Students received three email notification reminders over a two-month period to improve response rate.

Data Analysis

A total of 85 surveys were received with 81 complete and appropriate for data analysis, resulting in an 18% response rate. For the purpose of data analysis, the two categories of self-identifying as neurodivergent (*n*=26) and those who did not self-identify but reported a formal diagnosis of ADHD/ADD (*n*=1) were merged to create the final neurodivergent category (*n*=27). The responses for "somewhat useful" and "very useful" were combined into a "useful" and "not useful" dichotomous variable. Items where the instructional method was not experienced were not included in the total numbers or percentages, reducing the sample size. The sample was split into those self-identifying as neurodivergent and not neurodivergent. Statistical Package for the Social Sciences (SPSS) was utilized to analyze the descriptive statistics identifying student preferences for learning and to differentiate neurodivergent and not neurodivergent student preferences. To analyze differences in responses between the two groups, a nonparametric comparison, Mann Whitney U, was applied to determine if the two groups identified an instructional method as useful or not useful and to determine if group responses were significantly different. To rule out age as a confounding variable between the neurodivergent and not neurodivergent groups, we evaluated the difference in age between the two groups and the association between age and each preference for learning using cross tabulations. A chi-square test was used to determine statistical significance which was set at $p<.05$.

Results

Demographics

Most of the 81 respondents indicated they were enrolled in an entry-level doctorate program (83%) with 17% in a master's program. Types of programs represented included in-person (55%), hybrid (42%), and on-line (2%). There was a fairly even distribution of reported year in degree track with 38% indicating they were in their second year of study followed by third year (33%) and then first year (29%). Self-reported age, race, and gender of respondents were reflective of typical U.S. entry-level occupational therapy programs with the majority (55%) in the 24-29 year age group, 80% describing their race as white, and 89% identifying as female.

Of the 81 respondents, 33% self-identified as neurodivergent, 32% reported they had a formal disability, 3% stated they self-identified as having a disability, and 6% reported as unsure. Of those who indicated they had a disability, 47% identified a psychiatric/emotional condition, 12% ADHD/ADD, 6% learning disability, 6% physical impairment, and 29% as other. While those who self-identified as neurodivergent were on average older, age was not significantly associated with learning preference; therefore, we did not control for age in our analyses (see Table 1).

Table 1

Characteristics of Students in Total Sample and Who Identified as Neurodivergent or Not Neurodivergent

Characteristic N(%)	Total Sample 81	Neurodivergent 27(33)	Not Neurodivergent 54(67)	p values
Age				.040*
Less than 24 years	16(19.8)	5(18.5)	11(20.4)	
24-29 years	45(55.6)	10(37.0)	35(64.8)	
30-34 years	10(12.3)	6(22.2)	4(7.4)	
35-39 years	4(4.9)	2(7.4)	2(3.7)	
Over 40 years	6(7.4)	4(14.8)	2(3.7)	
Gender				.934
Female	72(88.9)	24(88.9)	48(88.9)	
Male	6(7.4)	1(3.7)	5(9.3)	
Self-identify	3(3.7)	2(7.4)	1(1.9)	
OT degree program				.074
Masters	13(16.0)	7(25.9)	6(11.1)	
Entry-level clinical doctorate	67(82.7)	19(70.4)	48(88.9)	
Year in Program				.836
1st year	25(30.9)	10(37.0)	15(27.8)	
2nd year	30(37)	6(22.2)	24(44.4)	
3rd year	26(32.1)	11(40.7)	15(27.8)	
Predominant format of program				.261
In person	43(53.1)	17(63)	26(48.1)	
Online	0(0)	2(2.5)	2(3.7)	
Hybrid	36(44.4)	10(37)	26(48.1)	

Ethnicity				
	White non-Hispanic	70(86.4)	22(81.5)	48(88.9)
	Hispanic or Latino	4(4.9)	2(7.4)	2(3.7)
	American Indian Alaskan or	2(2.5)	0(0)	2(3.7)
	Asian	10(12.3)	2(7.4)	8(14.8)
	Black or African American	1(1.2)	1(3.7)	0(0)
	Native Hawaiian or Pacific Islander	2(2.5)	0(0)	2(3.7)
Disability				<.001*
	Formal diagnosis	26(32.1)	18(66.7)	8(14.8)
	Self-identify	2(2.5)	1(3.7)	1(1.9)
	No disability	48(59.3)	5(18.5)	43(79.6)
	Unsure	5(6.2)	3(11.1)	2(3.7)
What is your disability?				
	Autism or ASD	0(0)	0(0)	0(0)
	ADHD or ADD	2(2.5)	2(7.4)	0(0)
	Learning disability	1(59.3)	1(3.7)	0(0)
	Psychiatric/emotional	8(9.9)	3(11.1)	5(9.3)
	Physical impairment	1(1.2)	0(0)	1(1.9)
	Other	5 (6.2)	1(3.7)	4(7.4)
Are you registered with university student services for accommodations?				<.001*
	Yes, for a neurodivergent diagnosis	10(12.3)	9 (33.3)	1(1.9)
	Yes, for something else	10(12.3)	5(18.5)	5(9.3)
	No	61(75.3)	13(48.1)	48(88.9)

**Note. p< .05*

The survey results indicated that of the total sample, roughly 12% were registered with university student services for accommodations. While over half of the neurodivergent group were registered, 11% of the not neurodivergent group were also registered. Of those who reported they were receiving official accommodations for learning, extended test time (30%) was the most common, followed by a separate testing environment (20%), and ability to take breaks or leave class as needed (14%). Other accommodations were identified as extended assignment time (8%), note taking services (6%), recorded lectures (2%), copy of notes ahead of class (4%), live captioning and/or transcripts (2%), and other (12%). The neurodivergent group used standard accommodations including extended test time (41%), separate testing environment (30%), and ability to take breaks or leave class as needed (19%). The not neurodivergent group used accommodations at a lower rate (see Table 2).

Table 2

Accommodations of Total Sample, Neurodivergent, and Not Neurodivergent Students

Accommodation	Total sample n (%) (n=81)	Neurodivergent n (%) (n=27)	Not Neurodivergent n (%) (n=54)
Are you registered with university student services for accommodations?	20(24.7)	14(51.9)	6(11.2)
Extended test time	15(18.5)	11(40.7)	4(7.4)
Extended assignment time	4(4.9)	3(11.1)	1(1.9)
Note taking services	3(3.7)	3(11.1)	0
Separate testing environment	10(12.3)	8(29.6)	2(3.7)
Recorded lectures	2(2.5)	2(7.4)	0
Live captioning and/or transcripts	1(1.2)	1(3.7)	0
Ability to take breaks or leave class as needed	7(8.6)	5(18.5)	2(3.7)
Copy of notes/slides ahead of class	2(2.5)	2(7.4)	0
Other	6(7.4)	2(7.4)	4(7.4)

Perceptions of All Students

The authors of the study determined that student perceptions of what is useful in their learning can be better identified when the student responds “very useful” vs. “somewhat useful” to distinguish those methods deserving of consideration. The survey revealed that over 95% of students found that having an instructor who is approachable, learning through real world activities, and practicing hands- on skills in the classroom setting were deemed to be very useful. Other instructional methods that were found to be “very useful” were activities frequently applied in higher education (see Table 3).

Table 3

Top Twelve Instructional Methods Perceived by All Students as Very Useful Categorized by UDL Domain (N=81)

Learning Method	n(%)	UDL Domain
Instructor who is approachable	81(100)	Engagement
Learning through real world activities	79(97.5)	Engagement
Practicing hands on skills in the classroom setting	77(95.1)	Representation
External reminders of course due dates and requirements	64(78.8)	Representation
Notes and slideshows provided ahead of the presentation	63(77.8)	Engagement
Learning in the classroom with peers	62(77.2)	Engagement
Viewing demonstration of skills (live demonstration, videos)	62(76.5)	Representation
Flexible seating and classroom arrangement Engagement	61(75.3)	Action & Express
Study guides provided by the instructor	61(75.3)	Representation
Immediate feedback on exams	59(72.8)	Action & Express
Extensive feedback on assignments	59(72.8)	Action & Express
Low stakes pre-tests	58(71.6)	Action & Express

Table 4 identifies the responses to the survey that students identified as not contributing to or even detracting from their learning.

Table 4

Top Ten Instructional Methods Perceived by All Students as Not Useful Categorized by UDL Domain (N=81)

Learning Method	n(%)	UDL Domain
Being called on to provide input in class	47(58.0)	Action & Express
Fix seating and classroom arrangement	42(51.9)	Engagement
Learning through virtual classes online	35(43.2)	Engagement
Reading a physical textbook	34(42.0)	Representation
Timed exams	29(35.8)	Action & Express
One time grading of assignments	28(34.6)	Action & Express
High stakes post-tests	27(33.3)	Action & Express
Being graded on synchronous virtual presentations	24(29.6)	Action & Express
Listening to a text-to-speech or audio textbook	24(29.6)	Representation
Listening to an auditory script or lesson	22(27.2)	Representation

Comparison of Preferences Between Groups

The results in Table 5 list responses of the comparison between neurodivergent and not neurodivergent for all 62 items under each domain categorized by CAST. Results indicate that the rating of learning preferences between the two groups was relatively consistent across all items.

Table 5

Comparison of Responses between Neurodivergent Students and Not Neurodivergent Student Preferences for Learning

	Neurodivergent n=27 n(%)		Not Neurodivergent n=54 n(%)		
	Useful	Not Useful	Useful	Not Useful	*p* values
CAST Domain: Engagement					
Learning through authentic real world activities	27(100)	0(0)	53(98.1)	1(1.9)	1.000
Learning using simulated activities (simulation lab, standardized patient encounters, high fidelity manikins)	24(88.9)	1(3.7)	53 (98.1)	1(1.9)	.574
Doing first with discussion to follow	20(74.1)	6(22.2)	50(92.6)	4(7.4)	.049*
Creating and discussing in the moment	22(81.5)	4(14.8)	50(92.6)	3(5.6)	.156
Using self for application and example	23(85.2)	3(11.1)	51(94.4)	3(5.6)	.344
Using a hypothetical person for application and example (i.e., case studies, role playing)	23(85.2)	4(14.8)	52(96.3)	2(3.7)	.074
Working alone and then meeting in a group	24(66.7)	2(7.4)	49(90.7)	5(9.3)	.817
Working in a group and then working alone	18(33.3)	9(33.3)	43(79.6)	10(18.5)	.153
Choosing the members of your group from the class	24(88.9)	3(11.1)	52(96.3)	2(3.7)	.194
Being preassigned group membership by the instructor	17(63.0)	10(37.0)	51(94.4)	3(5.6)	<.001*
Learning in the classroom with peers	26(96.3)	1(3.7)	53(98.1)	1(1.9)	1.000

	Neurodivergent n=27 n(%)		Not Neurodivergent n=54 n(%)		
	Useful	Not Useful	Useful	Not Useful	*p* values
Learning through virtual classes online	15(55.6)	12(44.4)	31(57.4)	23(42.6)	.875
Being assessed using pass/no pass grading	20(74.1)	5(18.5)	44(81.5)	6(11.1)	.359
Being assessed by A-F grading	20(74.1)	7(25.9)	47(87.0)	7(13.0)	.148
Course requirements with fixed due dates	23(85.2)	3(11.1)	52(96.3)	2(3.7)	.178
Course requirements with flexible due dates*	16(59.3)	9(33.3)	49(90.7)	3(5.6)	<.001*
Viewing closed captioning on the screen	23(85.2)	1(3.7)	50(92.6)	2(3.7)	.947
Listening to an auditory script or lesson	15(55.6)	8(29.6)	35(64.8)	14(25.9)	.596
Notes and PowerPoints provided ahead of the presentation	26(96.3)	1(3.7)	51(94.4)	3(5.6)	.719
Notes and PowerPoints viewed in real time during the presentation	22(81.5)	5(18.5)	46(85.2)	8(14.8)	.671
Flexible seating and classroom arrangement	23(85.2)	2(7.4)	53(98.1)	1(1.9)	.038*
Fixed seating and classroom arrangement	10(37.0)	17(63.0)	4(44.4)	25(46.3)	.319
Instructor who is approachable	27(100)	0(0)	54(100)	0(0)	1.000
Instructor who is distant yet has expertise	13(48.1)	14(51.9)	20(37.0)	34(63.0)	.340
Learning with peers	26(96.3)	1(3.7)	53(96.3)	1(1.9)	.615
Learning independently	26(96.3)	1(3.7)	52(96.3)	2(3.7)	

	Neurodivergent n=27 n(%)		Not Neurodivergent n=54 n(%)		
	Useful	Not Useful	Useful	Not Useful	*p* values
CAST Domain: Representation					
Listening to classroom lectures	25(92.6)	2(7.4)	52(96.3)	2(3.7)	.471
Listening to recorded lectures	19(70.4)	8(29.6)	47(87.0)	7(13.0)	.070
Practicing hands on skills in the classroom setting	26(96.3)	1(3.7)	54(100)	0(0)	.157
Viewing demonstrations of skills (live demonstration, videos)	27(100.0)	0(0)	54(100)	0(0)	1.000
Reading a physical textbook	18(66.7)	9(33.3)	29(53.7)	25(46.3)	.268
Listening to a text-to-speech or audio textbook	19(70.4)	6(22.2)	27(50.0)	18(33.3)	.180
Manipulating the text in a digital textbook (font size, background color, highlighting)	19(70.4)	8(29.6)	34(63.0)	9(16.7)	.412
External reminders of course due dates and requirements	25(92.6)	1(3.7)	51(94.4)	1(1.9)	.615
Self-organizing course due dates and requirements	20(74.1)	3(11.1)	50(92.6)	2(3.7)	.144
Notes provided by instructor for each classroom session	25(92.6)	2(7.4)	40(74.1)	3(5.6)	.350
Self-written notes taken during the classroom session	25(92.6)	2(7.4)	52(96.3)	2(3.7)	.471
Written description of the course content	24(88.9)	2(7.4)	47(87.0)	6(11.1)	.618
Graphics, pictures, or charts of the course content	26(96.3)	1(3.7)	53(98.1)	1(1.9)	.488
Study guides provided by instructor	26(96.3)	1(3.7)	52(96.3)	2(3.7)	.165
Study guide created with peers	19(70.4)	6(22.2)	45(83.3)	6(11.1)	.172

	Neurodivergent n=27 n(%)		Not Neurodivergent n=54 n(%)		
	Useful	Not Useful	Useful	Not Useful	*p* values
CAST Domain: Action & Expression					
Fixed due dates for assignments and exams	25(92.6)	2(7.4)	53(98.1)	1(1.9)	.215
Flexible due dates for assignments and exams	18(66.7)	5(18.5%)	46(85.2)	8(14.8)	.461
Low stakes pretests	24(88.9)	1(3.7)	49(90.7)	1(1.9)	.615
High stakes posttests	13(48.1)	10(37.0)	31(57.4)	17(31.5)	.516
Creating and giving oral presentations	24(88.9)	3(11.1)	49(90.7)	5(9.3)	.794
Submitting written papers	25(92.6)	2(7.4)	50(92.6)	4(7.4)	1.000
Being called on to provide input in class	11(40.7)	16(59.3)	23(42.6)	31(57.4)	.874
Raising hand to offer input in class	26(96.3)	1(3.7)	2(96.3)	2(3.7)	1.000
Being graded on in-person classroom presentations	21(77.8)	5(18.5)	45(83.3)	9(16.7)	.779
Being graded on synchronous virtual presentations	15(55.6)	7(25.9)	29(57.7)	17(31.5)	.681
Being graded on pre-recorded presentations	13(48.1)	7(25.9)	35(64.8)	10(18.5)	.283
Timed exams	15(55.6)	12(44.4)	37(68.5)	17(31.5)	.254
Untimed exams	21(77.8)	2(7.4)	51(94.4)	3(5.6)	.034*
Closed book exams	22(81.5)	5(18.5)	41(75.9)	10(18.5)	.908
Open book exams	23(85.2)	2(7.4)	48(88.9)	1(1.9)	.222
Team exams	12(44.4)	4(14.8)	35(64.8)	4(7.4)	.163

	Neurodivergent n=27 n(%)		Not Neurodivergent n=54 n(%)		
	Useful	Not Useful	Useful	Not Useful	*p* values
Immediate feedback on exams	22(81.5)	1(3.7)	51(94.4)	1(1.9)	.551
Extensive feedback on assignments	27(100)	0(0)	52(96.3)	1(1.9)	.475
Concise feedback on assignments	23(85.2)	4(14.8)	46(85.2)	7(13.0)	.844
Opportunity to redo an assignment for an improved grade	25(92.6)	2(7.4)	4(81.5)	1(1.9)	.456
One time grading of the assignment*	11(40.7)	16(59.3)	41(75.9)	12(22.2)	.001*

**Note.* $p < .05$

To analyze differences in responses between the two groups, a nonparametric comparison, Mann Whitney U, was applied. Results comparing the responses between neurodivergent and not neurodivergent students yielded six items that were statistically significant (see Table 6).

Results indicate those who identified as neurodivergent found these six items as “useful” but less so than their not neurodivergent peers. They were less likely to find unstructured learning approaches (i.e., flexible due dates, flexible seating, and untimed exams) as useful compared to their peers. They also wanted opportunities to choose their group members and have assignments graded more than once to give opportunities for improvement. This indicates out of 62 learning preferences, only six differentiated the two groups. This indicates that for all other learning methods, there were no significant differences in the likelihood of the two groups choosing one preference as useful or not useful.

Table 6

Significant Differences Between Neurodivergent and Non Neurodivergent Student Preferences for Learning

	Neurodivergent n=27		Not Neurodivergent n=54		
Instructional method	Useful	Not Useful	Useful	Not Useful	*p* values
Doing first with discussion to follow [E]	20(74.1)	6(22.2)	50(92.6)	4(7.4)	0.049*
Being preassigned group membership by the instructor [E]	17(63.0)	10(37.0)	51(94.4)	3(5.6)	<0.001*
Course requirements with flexible due dates [E]	16(59.3)	9(33.3)	49(90.7)	3(5.6)	<0.001*
Flexible seating and classroom arrangement [E]	23(85.2)	2(7.4)	53(98.1)	1(1.9)	0.038*
Untimed exams [AE]	21(77.8)	2(7.4%)	51(94.4)	3(5.6)	0.034*
One time grading of the assignment [AE]	11(40.7)	16(59.3)	41(75.9)	12(22.2)	0.001*

Note. *p<.05; E = Engagement domain; AE = Action & Expression domain

Discussion

Considering the current landscape of higher education, tailoring classroom practices to incorporate accommodations is becoming increasingly complex. The growing prevalence of disability and neurodivergence in higher education warrants the need to examine instructional methods, including UDL that support the learning needs of all students. The aim of this study was to inform educators of instructional methods, based on the principles of UDL that students perceived to be effective, including those with disability and neurodivergence. Within our sample across four institutions, nearly a quarter reported having accommodations and a third self-identified as neurodivergent. Several students who self-identified as being neurodivergent indicated they had a formal diagnosis of a disability but half of the identified disabilities did not relate to diagnoses often associated with neurodivergence. Of the neurodivergent group, more than half were registered for accommodations. This is reflective of the low number of students who report having a disability to postsecondary institutions (NCES, 2022).

Access to a healthcare provider or stigma may further limit the true prevalence of post baccalaureate students with a disability. Nearly half of the students who indicated they had a disability identified as having a psychiatric/emotional condition. Although not examined in this study, future research in UDL and student preferences for learning should consider those who identify has having these conditions.

The findings of this study reflected minimal differences between participants who self-identified as neurodivergent and not neurodivergent, indicating that UDL can address all learners' preferences without having to consider individual diagnoses. This is similar to previous studies examining student perceptions of UDL, where all students expressed that they learned best when a variety of learning preferences were addressed and that applying UDL principles could create a more inclusive learning environment (Black et al., 2015; Kennette & Wilson, 2019).

In this study, the UDL principle that had the strongest impact on student preferences was in the *engagement* domain. This was also the strongest domain for significant differences between the neurodivergent and not neurodivergent groups, where the neurodivergent group were less likely to find doing first with discussion to follow, being preassigned group membership by the instructor, course requirements with flexible due dates, and flexible seating and classroom arrangement useful. This differed from previous studies, where the highest rated learning preferences fell within the expression domain (Black et al., 2015; Kennette et al., 2019). Of note, 100% of participants preferred an instructor who is approachable, which aligns with the findings of other studies identifying the importance of faculty communication and a positive instructional climate (Black et al., 2015; Griful-Freixenet et al., 2017; Kennette et al., 2019).

With varied expectations of instructors in academia across teaching, scholarship, and service, implementing UDL principles can support inclusive teaching practices for all students rather than altering practices for the needs of different types of learners. In addition to reducing workload, instructor level implementation of UDL instructional methods may reduce the burden on university accommodations offices, decrease inappropriate accommodations, and alleviate student experiences navigating the educational institution's accommodations policies and processes. Results revealed in this study give insight into occupational therapy graduate student preferences, whereas other studies have examined undergraduate student perceptions of UDL implementation and occupational therapy educators' use of UDL in occupational therapy education (Black et al., 2015; Kennette & Wilson, 2019; Murphy et al., 2020). These studies indicate discrepancies in UDL methods that faculty believe they are implementing and student perceptions of what they are receiving. For instance, faculty may believe they are providing more hands-on activities than students report experiencing (Kennette et al., 2019). For the most part, students in this study believed their learning needs were being met; however, less than half of the participants believed that they could alter their program expectations or requirements.

Implications for Occupational Therapy Education

The results of this study illustrate that students want to know why they are learning and prefer an instructor who is approachable. Educators have a responsibility to be intentional in providing the rationale for the content and instructional methods used in courses. Universal design for learning is one strategy that could address the learning needs of all students and be implemented to improve student confidence in their program's ability to meet their learning needs. Future research should examine the accessibility of accommodations offices for students with a variety of disabilities who do not have accommodations support when having to navigate these university processes.

Limitations

The small sample size and response rate of less than 18% indicates the risk for potential response bias. Analysis of preferences within the types of OT programs (i.e., master's vs. doctorate, in-person vs. hybrid) was not compared, which could differentiate instructional methods found useful or not useful based on type of program. The timing of the distribution of the surveys was challenging, as the surveys went out to two of the institutions at the end of the academic term, a time when students are in the midst of finals and transitioning between terms. Age was ruled out as a confounding variable in this study; however, further analysis could delve into the impact of age on learning preferences as it was found to be significantly different between the neurodivergent and not neurodivergent groups.

Conclusion

Guiding educational practices by UDL principles can provide greater inclusion for students who learn differently. This study highlighted the instructional approaches that all students found useful and not useful. Fifty-six out of the 62 methods surveyed found no differences between those who self-identify as neurodivergent and others. Of the instructional approaches students identified as useful, four of the top six were in the *engagement* domain. This indicates students are interested in the "why" of education that motivates and connects them to the subject matter. The action and expression domain had a stronger representation in those instructional approaches students found as not useful. This domain seeks more action and accountability from the student. Educators need to reflect on how they incorporate student actions into assessment of learning and diversify opportunities for students to demonstrate competency and mastery of the material. Occupational therapy educators must apply a student-centered approach to teaching and learning. In other words, model what is taught in occupational therapy practice and be approachable.

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