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Higher education students with disabilities speaking out: perceived barriers and opportunities of the Universal Design for Learning framework

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ABSTRACT

The Universal Design for Learning (UDL) framework offers a promising strategy to address the needs of higher education students with disabilities; UDL aims to support access, participation and progress for 'all' learners, resulting in more accessible learning environments. The objective of this qualitative study is to explore whether UDL addresses the learning needs of students with disabilities effectively. Findings suggested that students' perceptions align well with UDL's principles, especially with the principle of multiple means of engagement. Additionally, we found that meeting the learning needs of some students may create barriers for others. To overcome these weaknesses, UDL needs to address the individual learning needs of students, not only through setting and curricular changes, but also in a direct way. Therefore, this study argues for responsive teaching whilst implementing UDL in a flexible way. Helping students to articulate their learning needs by asking them the right questions will be crucial.

Points of interest

- The Universal Design for Learning (UDL) framework aims to address students' learning needs efficiently regardless of their disability.
- The research found that the learning needs of higher education students with disabilities aligned well with the UDL framework, especially with the third principle (i.e. multiple means of engagement).
- Learning barriers when implementing UDL were also found, as meeting the learning needs of some learners created barriers for others. For instance,

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receiving all materials online ahead of class brought about more student passivity and less attendance in classroom instruction.
- In order to overcome UDL's barriers, the research recommends that the learning needs of students should be addressed individually and directly rather than only via setting and curricular changes.

Introduction

The number of post-secondary students who are confronted with disabilities is steadily growing (Newman et al. 2009; Snyder and Dillow 2013). However, the number of students with disabilities who obtain their final higher education degree does not match this increase (Eckes and Ochoa 2005; Shepler and Woosley 2012). Studies found that students with disabilities fall significantly behind grade-level peers in terms of academic success as they have double the risk for academic dropout compared with students without disabilities (Murphy 2006; Tinto 1994). Interestingly, the most important source of barriers to academic success that students with disabilities encounter actually relates to the current established model of 'identify, label, tutor and accommodate' that aims to provide optimal access to the general curriculum (Finn, Rotherham, and Hokanson 2001; Scotch 2000). A typical example of this approach requires the student to: self-identify as having a disability to faculty members; provide the required documentation of the disability to the campus disability office; request specific accommodations; and wait for the adjustments to be implemented (Scott, McGuire, and Shaw 2003). The accommodation model of disability services is a by-product of the medical or individual model of disability, which 'situates the disability within the individual and sees them as the root of the problem to be cured or treated and normalised' (Oliver 1996, 32). The accommodation approach also assumes that students have sufficient knowledge about their disabilities to properly communicate their needs, which is not always the case (Holloway 2001). In fact, more than half of all students with disabilities receive their diagnosis after the transition to higher education and, as a consequence, do not consider themselves to have a disability at the time they make this transition (Wagner et al. 2005).

Diversity brings pedagogical challenges and opportunities that go beyond accommodations (LaRocco and Wilken 2013; Oliver 2013). Many faculties do not tackle the learning needs of the students with disabilities because they feel ill equipped when teaching them (Mull, Sitlington, and Alper 2001). Moreover, the traditional model does not require that faculty members have the necessary experience in curriculum design and effective teaching methods (McGuire and Scott 2006), or other formal training regarding the needs of students with disabilities (Lombardi and Murray 2011). As a consequence, several studies documented scepticism among faculty members about whether it is fair to provide students with disabilities with reasonable accommodations. This was especially true for so-called

'hidden' or not immediately apparent disabilities, such as those of a psychological nature (e.g. learning disabilities, attention deficit hyperactivity disorder [ADHD]). Although it should be pointed out that there are large inconsistencies in identi- fication and classification rates of disabilities (Koretz and Barton 2004), findings suggest that the 'hidden' disabilities are the most prominent disability type among higher education students (OECD 2003). It is therefore unsurprising that, under the traditional higher education model, the majority (about 60%) of students with disabilities may choose not to disclose their disability (Brinckerhoff, McGuire, and Shaw 2002; Goode 2007). This phenomenon has been studied recently and find- ings suggest a role for the willingness of students with disabilities to fit into higher education; this includes the fear of not appearing 'normal' compared with peers (Kraglund-Gauthier, Young, and Kell 2014). Taken together, this points to an urgent need to design effective instructional methods that ensure equal access to educa- tion for all of the students who struggle to succeed in the actual traditional model based on a 'one-size-fits-all' curriculum approach.

Researchers have examined a variety of approaches and strategies that meet current student needs (Orr and Hammig 2009) and improve their outcomes (Hatch 2012). Learning communities (Smith 2012; Tinto 2000) and peer tutoring (Schuetz 2008) have proven to be successful approaches to a certain extent. However, these approaches are typically offered alongside the regular credit-bearing course, or students might need to ask actively for such assistance through the academic skills centre of the higher education institution (LaRocco, Anderson, and Archambault 2013).

As an answer to the critiques, the current study refers to a specific pedagogical framework called Universal Design for Learning (UDL). UDL has been defined as a framework that 'proactively builds in features to accommodate the range of human diversity' (McGuire, Scott, and Shaw 2006, 173), and encourages teachers to anticipate a variety of students' needs at the beginning of the lesson instead of modifying materials as an afterthought (Hitchcock 2001). UDL is currently seen as a means to move from the individual model to the social model of disability (Mole 2013). While the former positions disability in terms of individual deficit, the social model emphasizes the barriers within the physical and social environment that impose limitations on individuals (Barton 1999; Oliver 1981). The UDL model encompasses three broad principles: representation (the 'what' of learning), expres- sion (the 'how' of learning) and engagement (the 'why' of learning) (CAST 2011; Rose and Meyer 2002). Each principle has three related guidelines (see Table 1) that can be used as a rubric or tool to guide the implementation of UDL in education (McGuire and Scott 2006). UDL's roots are grounded in cognitive psychology and contemporary pedagogies such as differentiated instruction (DI). DI is a peda- gogical approach in which teachers need to be proactive and adjust the content, assessment tools and teaching methods in relation to the broad range of learners' learning profiles in the same class (Tomlinson 1999). Both DI and UDL recognize

Table 1. Principles and guidelines of Universal Design for Learning (UDL) (CAST 2011).

Principle I. Provide multiple means of representation	Guideline 1: provide options for perception • Options that customize the display of information • Options that provide alternatives for auditory and visual information	Guideline 2: provide options for language, mathematical expressions and symbols • Options that clarify the vocabulary and symbols • Options that illustrate key concepts through multiple media	Guideline 3: provide options for comprehension • Options that highlight patterns, critical features, ideas and relationships • Options that support transfer and generalization
Principle II. Provide multiple means of action and expression	Guideline 4: provide options for physical action • Options for accessing tools and assistive technologies • Options in the means of navigation	Guideline 5: provide options for expression and communication • Options in media for communication • Options in tools for construction and composition • Options in the scaffolds for practice and performance	Guideline 6: provide options for executive functions • Options that guide goal-setting • Options that support planning and strategy development • Options that enhance capacity for monitoring progress
Principle III. Provide multiple means of engagement	Guideline 7: provide options for recruiting interest • Options that increase individual choice and autonomy • Options that enhance relevance, value and authenticity	Guideline 8: provide options for sustaining effort and persistence • Options that vary levels of challenge and support • Options that foster collaboration and communication • Options that increase mastery-oriented feedback	Guideline 9: provide options for self-regulation • Options to guide personal goal-setting and expectations • Options that develop self-assessment and reflections

the learner as unique, bring elements of choice to the curricula, set clear goals and match assessment to instruction (CAST 2013).

Several studies found that applying UDL on higher education courses had a positive impact on students' academic performance (Burgstahler and Cory 2008; Scott, McGuire, and Foley 2003; Silver, Bourke, and Strehorn 1998), and supported better access, participation and progress (King-Sears 2009; Kortering, McClannon, and Braziel 2008; Rose and Meyer 2002). Although literature regarding the need of UDL in education is extensive, barriers, tensions and challenges to students' learning when applying UDL, to a lesser extent, have not been explored. This is astonishing, especially as various governments and other entities have implemented UDL by law (e.g. the USA; Higher Education Opportunity Act 2008). It is only recently that research started to explore students with disabilities' perspectives on UDL (Black, Weinberg, and Brodwin 2015; McGuire and Scott 2006), suggesting a resemblance between their learning needs and UDL principles. However, research focusing on the perception of UDL among students who are not yet familiar with the UDL approach remains unexplored. The perspective of individuals not familiar with UDL will enable the final validation of the UDL framework, as only such unbiased information will enable us to fully tackle potential existing barriers and opportunities. Taken together, research has yet to explore how students with disabilities who were taught within the traditional model perceive the UDL framework. These perceptions include potential barriers and tensions created by the UDL framework that these particular students might encounter.

The main goal of the present study is to explore whether or not the needs of the students with disabilities, taught within the traditional higher education model, are addressed effectively by the UDL principles. In order to answer this research question, students' perceptions about effective higher education courses, teaching methods, strategies, accommodations, challenges, tensions and barriers to learning will be explored in-depth through interviews and the findings will be contrasted and coded with each of the nine UDL guidelines.

Method

Population and sampling

A total of 40 higher education students with disabilities were contacted by the Flemish Support Center for Inclusive Higher Education (SIHO) from a list of participants of a previous workshop in 2014 aimed at higher education students with disabilities. From this original sample, a total of 10 students agreed to participate in this study. Participants consisted of two males and eight females; all originate from Flanders (Belgium). Students were given compensation for their participation in the form of a €30 gift card.

Disability type, educational status and received accommodations

Students with learning disorders (e.g. dyslexia, dyscalculia) made up the largest proportion of the sample of students with disabilities (see Table 2). The majority of the students had multiple disabilities or health problems. At least three students mentioned that they had depression, an anxiety disorder or a psychological addiction to games during their studies. All students were enrolled in higher educational institutions in Belgium. The student sample represents a broad range of disciplines ranging from first to last semester status of a bachelor's degree (BA), a bachelor after bachelor's degree (BAB) or a master's degree (MSc). The range of ages was 18–32. The most frequent accommodations students received were related to the assessment process (e.g. additional testing time).

Data collection procedures

In October 2015, a recruitment email was sent to students, including a brief introduction to the study, the study's main objectives, information about the researcher, contact information and a link to the survey. Students willing to participate were asked for their name and current and past higher education studies and institutions through an electronic survey. During the month of January 2016, students who replied to the recruitment email as willing to participate were again contacted by email in order to invite them for an interview during the month of February 2016. Students had to provide a mobile phone number and a place of the students' convenience to conduct the interview. Non-respondents to the second email received a series of reminder emails with a one-week interval until they all replied.

Instrument

To capture the students' perspectives, a semi-structured interview based upon an existing protocol on inclusive college instruction was used (Madaus, Scott, and McGuire 2003). The interview provided a sequential order for the interviewer, going from the informed consent and introduction to the purpose and the rules of the session into a deeper focus on different topical questions related to the research question. Interview questions were grouped into the following themes: 'personal information', 'usefulness of reasonable accommodations', 'positive attributes of a good class', 'effective teaching methods and strategies that promote learning', 'negative experiences and barriers to learning', 'attributes of good instructors' and 'advices and improvements to faculty to lower the impact of the disability'. Ten individual interviews of 90 minutes were conducted in English.

Table 2. Participant characteristics.

Student	Disability type	Higher education institution	Education status	Received accommodations
S1	Dyslexia, dyscalculia, developmental coordination disorder	University College 1	BA sculpture	Additional testing time Use computer for examination Spellchecker for the examination Separate room to take examinations
S2	ADHD, depression	University College 2	BA teacher education	Additional testing time Option of an oral examination Choose testing date Separate room to take examinations
S3	Visual impairment	University College 2	BA accountancy	Additional testing time Use computer for examination Choose testing date Receive the class notes ahead of class
S4	Dyslexia, psychological addiction	University College 3	BA electronics and IT	Additional testing time Spelling mistakes are not counted Separate room to take examinations
S5	ASD, ADHD, fibromyalgia	University College 4	BAB studies in autistic spectrum disorders	Additional testing time Use computer for examination Choose testing date
S6	Dyslexia	University College 5	BAB landscape development	Additional testing time A reader who can read the test items
S7	Dyslexia	University 1	MSc social and cultural anthropology	Additional testing time Choose testing date
S8	Cerebral palsy, epilepsy	University 2	MSc teacher education	Extension of time on assignments
S9	Hemiparesis, depression, anxiety disorder	University College 5	BA occupational therapy	Additional testing time Choose testing date
S10	Chronic fatigue syndrome, muscle dystrophy	University College 1	BA interior design	Additional testing time Option of an oral examination

Data analysis

Interviews were audio taped, transcribed and, subsequently, examined by content theme. The questions of the interview were initially used as a framework for analysis. Transcriptions were systematically analysed and themes were identified. Transcriptions of each theme were coded using the UDL framework and, more concretely, according to correspondence with one or more of the nine UDL guidelines. When the coding was finished for each of the 10 students, we analysed the data categorized in the matrix for each of the nine guidelines. Concepts that emerged in each guideline were described and evaluated for frequency and disability type in order to determine patterns and trends. To improve inter-rater reliability, a UDL expert reviewed the research coding to check internal consistency and agreement with the UDL principles.

Results

Guided by the main principles and guidelines of UDL, we explored the perspectives of students with regard to the most effective course they had during higher education, the faculty teaching methods and strategies that positively affected their learning, and the barriers they perceived in learning and accommodations. Because of the complex nature of teaching and learning, some perceptions captured more than one UDL principle.

Relation between students with disabilities' perceptions and the UDL principles

Principle I. Multiple means of representation

The perceptions of the students regarding class materials, learning tools, use of technology and effective teaching methods were generally aligned with the first principle. However, especially for Guideline 1 (options for perception), several elements perceived as effective to some students were perceived at the same time as barriers to others (see Table 3).

Guideline 1: provide options for perception
While describing the best course in higher education, several students mentioned courses where they did not have to write because class notes, lecture slides and materials were provided ahead of time. A student with dyslexia really benefited from the notes given by the teacher because she often made spelling mistakes that resulted in misunderstanding the concepts. In this case, providing options for perception increased the comprehension of the information. However, several students mentioned high dependence on the online platform: 'the professor did not upload the slides, so I had nothing else to rely on for the exam'. This resulted in a more passive attitude in class: 'you get so dependent on the online platform

Table 3. Students' perceived benefits and barriers with regard to the first UDL principle: multiple means of representation.

Principle I. Multiple means of representation	Benefits	Barriers
Guideline 1: provide options for perception	Class notes/lecture PowerPoint slides ahead of class (S2, S3, S9)	Written input (S2, S6, S7, S10)
	Online platform (S2, S3, S8, S9)	High dependence on the online platform (S2, S3, S9)
	Combination of sensory inputs (S2, S7, S9)	Ineffective use of PowerPoint (S2, S4, S5)
	Alternative format textbooks (ebooks) (S3, S8)	Combination of sensory inputs (S5)
	Material designed by the instructor (S1, S3, S5)	Use of the blackboard (S3)
	Class syllabus (S5, S6, S7, S9, S10)	
Guideline 2: provide options for language, mathematical expressions and symbols	Provide physical objects (S7)	
	Field activities (S1, S7)	
Guideline 3: provide options for comprehension	Outline prior class (S4, S6, S7)	Repeat content (S6)
	Structured content (S1, S3, S4, S5, S7, S8, S9)	Non-authentic examples (S5, S6)
	Repeat content (S1, S4, S7)	
	Set clear expectations (S1, S3, S7, S8, S9)	
	Provide templates (S3, S4)	
	Guide transmission of information (S1, S2, S3, S4, S5, S6, S8)	
	Demonstrate content with real examples (S4, S5, S9)	
	Deliver information progressively (S1, S4, S5, S7)	

Note: S = Student. See Table 2 for details.

to provide you with content that some of us don't really take notes during the lesson, and I'm guilty of that'. Students described courses using PowerPoint slides as being helpful and effective to integrate concepts and to extend oral information. The use of keywords, pictures, audio fragments, graphs, animations and especially videos and documentaries appeared in their descriptions. However, a student with autism spectrum disorder (ASD) expressed discomfort when instructors combined several sensory inputs.

Several students recognized that only a few teachers use PowerPoint efficiently: 'if the PowerPoint is used to project my course book, it is not useful'. Students mentioned materials such as syllabus, articles and books that were elaborated by the instructor as being highly useful. For a student with a visual impairment, an accessible class format and alternatives to written books (ebooks) were relevant elements to meet her learning needs.

Guideline 2: provide options for language, mathematical expressions and symbols

This guideline was especially meaningful for two students enrolled in sculpture and anthropology degrees. One described the most meaningful class activity as follows: 'we went to museums to see the real work, not just the image of it, because

the teacher said you cannot see a work through an image, you cannot see the size and the other sides of it'. Overall, emphasis on presenting information through multiple media (e.g. physical objects) and providing support decoding symbolic representations was relevant only for a few students.

Guideline 3: provide options for comprehension

Perceptions about effective teaching methods and strategies were highly related to this guideline. Several students mentioned instructional strategies where teachers activated their previous knowledge: 'courses that assume that there is knowledge you should know are not good for me'. However, one student experienced increased inattention when content was being repeated more than once. Courses where instructors clearly structured the content were perceived as highly effective: 'when instructors structure things clearly then you have a skeleton to hang everything you hear on, like key phrases, etc.'; this aspect was seen as being fundamental in order to be successful in the examination: 'I'm failing courses that are not well structured'. Instructors who set clear expectations and emphasized important ideas of the content were perceived as effective: 'what made a difference to me was that he [the teacher] got to the point. At the end, we had to take an exam and I liked to have it clear about what we should know'. Students mentioned instructional strategies where the information processing was clearly guided: 'going from the discussion to the content, this way I could connect and participate in the lesson'. Therefore, the students were able to categorize and remember: 'In the exam, I could always make a link with something from the lesson, which enabled me to work out a better discussion'. A particular student described effective instructors as 'storytellers'. Students spoke favourably about the teaching strategy based on demonstration with embedded models and scaffolds. The occupational therapy student mentioned: 'theory can sound good, but if you do not see it in practice it becomes less true'. Another aspect that students mentioned was to have enough time to process the content. Several students recognized the importance of receiving the information progressively: 'I really need time to understand, and once I get it, then I can move to another subject'.

Principle II. Multiple means of action and expression

Formal accommodations that students received in higher education institutions are related to this principle. Most of the students referred to formal accommodations as a crucial element to succeed in their courses (which are being taught under the 'one-size-fits-all' curriculum approach). Students' perceptions about the qualities of effective instructors aligned highly with this principle. However, preferences on evaluation methods differed notably among students (see Table 4).

Table 4. Students' perceived benefits and barriers with regard to the second UDL principle: multiple means of action and expression.

Principle II. Multiple means of action and expression	Benefits	Barriers
Guideline 4: provide options for physical action	Use of spellchecker for examinations (S1, S8)	Inappropriate AT devices (S1, S7)
	Use of computer for examinations (S1, S3, S5)	Motor demand tasks (S1)
	Extended time on examinations (S1, S2, S3, S4, S5, S6, S7, S9, S10)	
Guideline 5: provide options for expression and communication	Choice in assessment (S5, S7, S8, S9)	Written demand tasks (S1, S3, S4, S6, S8, S10)
	Several opportunities for assessments (S4, S5, S7)	Multiple examinations and assignments (S1, S2, S6)
	Writing laboratory (S1, S7)	Oral examinations (S4)
	Multiple-choice examinations (S9, S10)	Multiple-choice examinations (S6, S7)
	Small group discussion (S4, S5, S7)	General feedback (S2, S5)
	Extra exercises with solutions (S3, S4)	Minimal individualized guidance (S7)
Guideline 6: provide options for executive functions	Guidance to self-monitor and reflection (S1, S2, S3, S4, S7, S10)	Memorization teaching strategy (S4, S6, S7, S9, S10)

Note: S =Student. See Table 2 for details.

Guideline 4: provide options for physical action

The formal accommodations, especially the extended time for examinations that students received, were perceived as crucial in order to achieve the same academic level as the other students without disabilities. The use of assistive technologies (ATs), such as a spellchecker or computer for the examination, was also described as an essential accommodation for students with visual impairment, learning disorders and muscular disorders. The student with a visual impairment often had to deal with unreadable graphs, drawings and non-structured Word documents. However, she perceived her barriers as an individual problem that needed an individual solution. The same student mentioned that, due to the increased use of technology in day-to-day life, AT devices are no longer perceived as odd by peers: 'now everybody is allowed to use laptops. I'm not special anymore and I like that; no one is looking at you and it will be better in the future'. This guideline is highly aligned towards this reality. However, two students with dyslexia experienced barriers with some AT devices. One mentioned: 'the college offered me a text-to-speech program, but I don't really understand the voice so it is annoying, it does not work for me'. UDL recognizes these potential barriers in this guideline: 'digital synthetic Text-To-Speech is increasingly effective but still disappoints in its ability to carry the valuable information in prosody' (CAST 2011). The other student with dyslexia also perceived barriers: 'the university offered me different programs but I felt that it went against my instincts. For me, it was more an extra handicap than a help'.

Guideline 5: provide options for expression and communication

This guideline stresses the importance of offering learners with alternative modalities for expression. Several students perceived barriers when they had to write assignments or examinations. Some preferred oral or multiple-choice option examinations: 'In an oral exam, if you forget a detail the teacher helps you, but not in a written exam'. Another student with muscular dystrophy expressed: 'in a written exam, I have to focus so hard on my muscles that I cannot focus on the questions'. Other students mentioned barriers when they had to do presentations or oral examinations: 'I get very nervous when they ask me questions and I can't answer them; I have a lot of blackouts'. Other students with dyslexia perceived barriers in multiple-choice examinations and, therefore, someone had to read out loud the examination for her: 'they need to read the options for me because if I read it alone all the options seem the same for me'. Another student with dyslexia mentioned: 'I failed two times a multiple choice exam because it is all precise data, details, it is all memorization and I'm not good at this'. Several students communicated their preference for courses that use end-of-course assessment: 'I prefer to have one test and one date, then I know what I have to do and I organize my time; otherwise, if I have a lot of assignments this is more stressful for me'. However, one student found it important to have different assignments throughout the course: 'the exam was only weighted 40% and I like it better that way because it is not everything or nothing, otherwise it is a big pressure'.

The students' perceptions were particularly aligned with the guideline on effective instruction strategies. Most of the students appreciated instructors who provided scaffolds while practising and developing their independence:

> in one subject about how to write scientific papers, I told the teacher I had dyslexia and he told me this was no problem because he did not take into account the spelling, and that we were going to do this together.

A student of economics and Information Technology (IT) described an effective course where they needed to develop a real website: 'first, we copied the website of the teacher and then he gave us templates to construct our website and also, we followed the modules'. Several students mentioned the need to get extra exercises with the solutions: 'I need homework like in secondary school. It is a good system to know if you are doing it good or bad'. Seeing teachers more like mentors, and getting differentiated feedback that can be customized, was highly prominent in their answers: 'the teacher was always asking questions, letting us say things; he was also saying okay I can learn from you guys'. Another student mentioned: 'you could tell that the instructor had read the paper because he gave remarks like "this sentence is badly formulated". This type of feedback is not frequent; sometimes you get the same score like everybody else in the class'. However, several students acknowledged that instructors have little time to meet students and they do not give a lot of individualized support: 'you have first to realize you need help before you can get help'.

Guideline 6: provide options for executive functions

This guideline encourages expanding the students' executive functions capacity in order to set long-term goals, plan effective strategies for reaching those goals, monitor their progress and modify strategies as needed. Students' perceptions about effective instructors were aligned with this guideline. Therefore, instructors who set appropriate goals and guided students to self-monitor and self-reflect were perceived as highly effective. Referring to his mathematics lessons, one student mentioned:

> [the teachers] need to explain the content several times in other ways before I can do it in my own, they don't need to act like I am a child; they just need to be there and correct me if I do something wrong.

Several students verbalized strong barriers when the teaching strategy was mainly based on memorizing content: 'I have problems with memorizing; when I see the big pile of stuff I have to memorize, I start having panic attacks'. A student with dyslexia mentioned: 'I really struggle with the factual and conceptual knowledge, all the courses that I am failing it's because of the memory'.

Principle III. Multiple means of engagement

Perceptions of the students about effective class activities were highly aligned with the third UDL principle. Common characteristics of good instructors were those that applied elements from this principle, especially with Guideline 8: 'options for sustaining effort and persistence'. However, substantial differences among students' preferences appeared such as the degree of autonomy and guidance provided by the instructor (see Table 5).

Guideline 7: provide options for recruiting interest

Students' perceptions regarding the degree of teacher guidance and freedom of learning differed remarkably. Some students perceived effective instructors as those who offered choices with unmasked consequences related to their progress: 'the participation and the attendance in class did not count, but then you could not write the paper if you were not in class because it was something that was said in class' and 'you didn't have to go to her lessons, but she wrote down always who attended; if you were there you had a lot of help from her but otherwise not'. These students felt pride in accomplishment that increased the degree of involvement with the subject. On the contrary, other students described the best course in relation to the broad freedom they received. A student with cerebral palsy mentioned: 'I could plan my work with everything else that was going on in my life, however, the majority of my peers missed structure or guidance in this subject'.

Another aspect described in this guideline is to design activities that provide authentic outcomes and communicate to real audiences. This aspect was clearly aligned with students' perceptions. A student of IT who has dyslexia gave a good

Table 5. Students' perceived benefits and barriers regarding the third UDL principle: multiple means of engagement.

Principle III. Multiple means of engagement	Benefits	Barriers
Guideline 7: provide options for recruiting interest	Class attendance incentives (S1, S2, S3, S4, S7) Guest lecturers (S5, S7) Class discussions (S1, S2, S3, S7, S8, S9) Small class format (S1, S2, S6, S10) Tasks with real outcomes (S4, S5, S10) Low physical effort (S1, S2, S6, S8, S10)	Compulsory class attendance (S5, S8, S9, S10) Crowded classrooms (S1, S2, S6, S10) Faculty without experience in the field (S6) Low physical effort (S2)
Guideline 8: provide options for sustaining effort and persistence	Approachable professors (S1, S2, S3, S4, S6, S7) Positive climate in the class (S1, S2, S3, S7) Cooperative exercises (S1, S4, S5, S6, S10) Peer evaluation (S2, S4, S10) Mastery-oriented feedback (S1, S2, S6, S7, S10) Communication with fellow students (S1, S3, S5, S6, S7, S10) Problem-based learning (S6, S7, S8)	Communication issues with faculty (S3, S5)
Guideline 9: provide options for self-regulation	Encourage self-reflection (S1, S2, S4, S5, S6, S8, S9) Teachers as mentors (S1, S2, S4, S5, S7)	Unguided internships (S5, S8, S9, S10)

Note: S =Student. See Table 2 for details.

example: 'we had to construct a real item and to try to sell it. I could explain the project very well; I did not notice any barriers or any disabilities because I like doing it'. Students mentioned being engaged in courses where instructors involved all learners in class discussions: 'if they don't involve you, after one hour you don't listen anymore'. Having guest lecturers during the course was described as highly positive, especially for the student of landscape development: 'they know the real field, what is useful, common, or not useful'. In order to provide these strategies, the class format appeared to be highly important for the students with disabilities. Lectures in small class format (maximum 30 students) could easily 'reach everyone with the teacher's questions and keep everyone involved'. In contrast, large lecture halls were described as a difficult class format in which to apply the effective strategies and inclusive methods: 'usually what happened in the classroom is that I was in the back left alone and only the students in the first two rows were paying attention'.

Guideline 8: provide options for sustaining effort and persistence
When asked to describe the best course they ever had, many students described courses more in terms of how they felt during the course and the degree of the teacher's involvement, rather than the content of the subject: 'if the professor

knows your name you will ask them something, but if not the distance is a lot bigger'. The students perceived promoting cooperative learning exercises and group work very positively as 'everyone had to prepare a part of the content and then we sat in groups and we shared the information so everyone gets the full picture'. Peer evaluation was found useful by several students: 'after the presentations we did peer-evaluation, and you get different scores and you get a middle ground and you see another way of viewing your work'. However, for some students it was difficult to compromise in group work due to personal health problems: 'I had a lot of hospitalizations during my master's and when you are in a group, people are counting on you and it is kind of annoying when suddenly you are out of communication for a week'. One student suffering from chronic fatigue syndrome perceived the same barrier; therefore, she stopped her studies and enrolled on a blended learning programme. For other students, low physical activities were important; a student with hemiparesis mentioned: 'when I have courses all day where you have to be too involved I get very tired, I prefer courses where you just have to listen'. The student with ASD perceived the biggest barrier while working in groups: 'I can work in groups, but the other students don't know how to communicate, how to understand what I'm saying. At a certain moment, the group told the teacher that they did not want to work with me anymore'. In that case, the instructor intervened as a mediator and proposed to develop a 'contract' in order to show how to work with fellow classmates.

Mastery-oriented feedback received in a frequent, timely and specific manner was perceived as highly important for all of the students, and crucial for a student with ASD: 'I have difficulties understanding feedback; during the internship, my mentor provided me with really vague feedback. I need them to refer to concrete behaviour, and then I can adjust'. Students acknowledged the need for feedback that focuses on self-awareness and encourages strategies to face challenges: 'sometimes I struggle with my confidence not knowing, where this feedback came from and the reason for the critique makes me feel insecure'.

Guideline 9: provide options for self-regulation

This guideline recognizes the importance of students' intrinsic abilities to regulate their own emotions and motivation. Students were often referring to intrinsic aspects while describing the best course they ever had. In order to promote realistic expectations and optimize motivation, it was particularly useful for the student to use rubrics to self-regulate and set appropriate goals: 'the teacher provided rubrics with the evaluation criteria with examples of what is expected, or needs improvement, and she based the final mark on that'.

Several students encountered barriers in practical courses and training. A student-teacher mentioned 'the staff from the university really had to battle to find a school willing to accommodate a teacher using a wheelchair'. Several students expressed that they suddenly felt their disability was more prominent and they perceived a strong emphasis on their weaknesses rather than on their strengths.

In order to tackle these barriers, this guideline and the wishes of the students claim the importance of offering students more scaffolds, models and feedback in order to manage frustration, seek external emotional support and develop coping skills. While describing the attributes of a good instructor, the occupational therapy student referred to her mentor saying: 'you shouldn't be scared to cry when it gets hard in the internship, they have to listen to you and be supportive'. Overall, the students' perceptions about the barriers in the training were aligned with this guideline.

Discussion

Using a qualitative study design, we investigated whether the proposed educational framework of UDL meets the learning needs of students with disabilities being taught in the traditional model. In general, we found substantial evidence that students with disabilities perceive advantages, barriers and challenges as conceptualized in the UDL guidelines. Interestingly, we found that the third UDL principle (i.e. multiple means of engagement) aligned best with how students with disabilities perceive their needs for engagement. This was especially true for Guideline 8 (i.e. providing options for sustaining effort and persistence), as all of the students gave particular importance to a positive instructional climate open for communication, formative feedback provided in a frequent, timely and specific manner, and feeling engaged in cooperative learning exercises and group discussions. Many students also rated activities that provide authentic outcomes (in line with Guideline 7) or feeling supported at coping with their environment (especially during the internships: in line with Guideline 9) as essential, again pointing towards a prominent perceived need to keep engaged in learning. This is logical, as we found that about half of the students in our sample did not finish the first or even the second degree for which they were enrolled, and about two-thirds were one, two or even three years behind in their studies. Previous studies have documented a negative relationship between having a disability and degree attainment, as students with disabilities take twice as long to obtain a degree in comparison with students without disabilities and have higher rates of academic dropout (Mears and Aron 2003; Murphy 2006). We propose that this (realistic) fear of academic dropout is the main reason why all students in our sample put particular importance on offering strategies to keep motivated towards academic success.

We also found evidence for the importance of the first (i.e. multiple means of representation) and second (i.e. multiple means of action and expression) UDL principles, as most of the students advocated for materials that were highly structured and for expectations that were set in a clear and concise manner (Guideline 3), were in favour of alternative modalities for examination (Guideline 5) and highly appreciated that they are monitored and encouraged to self-reflect in order to know that they are 'on a good track' (Guideline 6). In contrast, we found that the other guidelines (i.e. Guidelines 1, 2 and 4) were only applicable for some students.

Guideline 1 (e.g. options for perception) and Guideline 4 (e.g. options for physical action) can be explained by their disability-specific character. For example, only students with (hand)writing difficulties mentioned lectures where there was no need to write as effective (in line with Guideline 1) and only the student with visual impairment mentioned AT devices as being helpful (in line with Guideline 4). In a similar way, Guideline 2 (e.g. options for language, mathematical expressions and symbols) was found to be highly study specific, as only two students who studied arts found it important that instructors provided support for the decoding of symbolic representations. Importantly, we did not find any evidence for UDL guidelines to be in conflict with perceptions of students with disabilities, and even disability-type or study-type specific guidelines are potentially relevant for a high number of students, when applied on the student population level.

In this study, we found important individual differences regarding learning needs and preferred learning approaches between all of the students. In fact, we found these differences to exist between those labelled with the same disability type. Therefore, the traditional model of providing retrofitting accommodations depending on the student's disability type is proven to be inefficient. This study advocates counteracting this adverse process by incorporating right from the start a high number of accommodations into the design of the curriculum for all students, regardless of disability. Given the high alignment between UDL and the students with disabilities' learning needs, UDL has great potential to eliminate these current barriers and improve practices in higher educational institutions (Edyburn 2010; Orr and Hamming 2009).

It is important to mention that although perceptions of each individual student aligned well with the proposed framework of UDL, we found evidence that the implementation of UDL for the whole student population may become problematic, as meeting the learning needs for some can create barriers for others. Descriptions of the students illustrating this controversy occurred frequently in the interviews. For example, students with handwriting problems mentioned that it is crucial to receive all materials online. However, other students stated that receiving this kind of learning support brought more student passivity and less attendance in classroom instruction. Students with health problems gave another example and mentioned the need for courses to provide individual freedom and non-compulsory attendance. Students with ADHD contrasted this and expressed the need for clear structured courses that reward attendance and participation. Regarding the freedom in choosing alternative modalities for examination, all students perceived barriers in one or more modalities (oral, multiple choice and writing). However, some students mentioned that after having confronted oral examinations or presentations several times, the fear and stress decreased, leading to improved self-confidence. If freedom of choice had been offered in that situation (Guideline 5: options for expression and communication), some of the students would probably have avoided confronting those types of assessments. Taken together, our study contributes to the existing literature on controversy

while implementing UDL principles to meet the learning needs of students with disabilities, 'what was deemed acceptable or accessible for one student may have fallen short for another' (Catalano 2014, 27). Findings suggest that it is almost impossible to achieve a curriculum that tackles the needs of all learners without the co-occurring generation of barriers.

Another example of the potential inefficiency when implementing the UDL approach is the application of AT in every piece of the curriculum (Rose et al. 2005). UDL states that all aspects of the curriculum should be designed from the outset to meet the needs of all learners. However, ATs such as computer-screen enlargers were only found useful for a student with a visual impairment and spellcheckers were only found crucial accommodations for individuals with learning disabilities as they enabled them to compensate some very specific limitations. The student with visual impairment even expressed the need for more specific (and potentially expensive) designed devices in order to increase her capabilities. This leads to the statement that a pure UDL solution such as the universal building-in of accommodations such as AT would be inefficient and overly expensive. Literature supports this finding (Rose et al. 2005; Schwanke, Smith, and Edyburn 2001), and claims to differentiate between 'access to information' and 'access to learning needs' (Rose and Meyer 2002). Therefore, UDL cannot exclude AT because AT makes universal designs more accessible, effective, powerful and cost-effective. However, other students perceived barriers in some AT devices (e.g. text to speech) because they matched inappropriately with their learning needs. Therefore, it is necessary to provide a more balanced and integrative view on highly specific needs versus the universal implementation of UDL guidelines.

Similar barriers have been identified when relating it to the social model of disability as an all-embracing framework. When the model is approached as a 'one-size-fit-all' model to be used in any given context, it treats people with disabilities as one unitary group. However, some proponents of the social model claim to operate with a less rigid approach, conceiving the social model as a flexible 'tool to improve people's lives' (Oliver 2013, 1025). Importantly, they also acknowledge that the individual model of disability should not be discarded (Shakespeare and Watson 2001). Comparably, the findings of this study argue strongly for the implementation of UDL as a paradigm, an ideal to aspire to (Bryson 2003; Burgstahler and Cory 2008). Bryson proposes implementing Universal Design by 'start[ing] small and go[ing] slowly' (2003, p. 118); this means that educators may start by altering their behaviours gradually, adopting first the UDL principles that adapt more easily to their particular situations, and then slowly, as they feel more comfortable, starting to incorporate others rather than adopting the framework unilaterally.

Overall, findings show clearly that in order to overcome UDL's weaknesses there is a real need to monitor student progress while implementing adjustments. Several researchers arrived at the same conclusion and encountered a complementary nature between UDL and DI that could potentially bring more flexibility and accessibility to the lesson (Hall, Strangman, and Meyer 2003; Stanford and Reeves

2009; Tomlinson and McTighe 2006). Overall, results from this study suggest that weaknesses of UDL arising from the perceptions of the students with disabilities could be compensated for when combined with DI.

Limitations and future research

In the present qualitative study, the sample size was rather small (n = 10); as a consequence, some disability types that are frequently found in the higher education student population were not represented, including hearing impairments, speech impairments and cognitive impairments. It is important to note that the assessment of student disability was conducted by self-report, which may be prone to self-report bias. However, all students with disabilities received accommodations, which indicates that a professional assessment of specific disability type was performed at some time, granting validity to the disability types discussed in this study to some extent. Also, only two students were male, in line with participation rates generally being higher among female students (Curtin, Presser, and Singer 2000). Another limitation was that only one method for data collection was used (i.e. an interview). However, to increase the validity of our findings, future studies could use the triangulation method and/or contrast interview material with other types of data such as lecture materials, video, class observation, focus groups, educational outcomes of the students and surveys. Future studies may include students without disabilities, to explore how those students perceive UDL, and contrast results with our findings. In addition, more exploration regarding the compatibility of UDL and DI in higher education settings is needed.

Conclusion

In this study, we provide substantial evidence that the traditional model of providing retrofitting accommodations depending on the student's disability type is inefficient. Given the high alignment found in this study between the UDL framework and students with disabilities' learning needs, we believe that UDL has great potential to counteract this adverse process and improve practices in higher educational institutions. However, as some governments (e.g. the USA) and other entities have already implemented UDL by law, it is critical that evidence-based research focuses on uncovering potential barriers to students' learning when applying UDL. This study has contributed to previous calls for this type of research (Al-Azawei, Serenelli, and Lundqvist 2016) and detected potential barriers for some learners when the implementation of UDL was considered only through curricula and setting. Therefore, this study argues for teachers to be responsive to students' learning needs whilst implementing UDL in a flexible way. In order to achieve this, teachers need to help 'all' students articulate their learning needs and challenges by asking them the right questions. Training and education for the higher education faculty, aimed at meeting the students' learning needs

through the UDL framework, is necessary. Importantly, all of the students' voices should be included in multiple (in)formal ways. Therefore, it is essential to search for mechanisms to raise self-advocacy and self-awareness amongst all incoming students (Goodley and Moore 2000). Finally, this study assumes that a class design which conceives every possible student-learning barrier is utopian; therefore, it is primordial to acknowledge UDL as a process of ongoing improvement rather than the final destination.

Disclosure statement

No potential conflict of interest was reported by the authors.

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