Discourse of otherness in a Universally Designed undergraduate mathematics course

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To meet the needs of the student diversity, universities have often implemented the principles of Universal Design in their instruction. However, previous literature knows little about the effectivity of these practices. In this study, two students with special needs are given a voice to share their experiences about a Universally Designed undergraduate mathematics course. The study uses the view of a Foucauldian discourse analysis in order to investigate how these students construct discourses on their position in the context of the course. According to the results, the students positioned themselves as the Others, constructing a discourse of “different learners”. The study implicates that there is a need to shift the existing discourses to open up alternative subjectivities.

Keywords: Discourse analysis, otherness, special needs, university mathematics, Universal Design.

Little is known about disabled students’ perceptions of their studies in the field of postsecondary mathematics. Indeed, disabled students are often marginalized in mathematics educational research. These students are rarely seen as mathematical thinkers and doers rather than focusing on cognitive deficits (for a review see Tan & Kastberg, 2017). What is known about disabled mathematics students is that they are not encouraged in their studies (Feigenbaum, 2000) and that university staff might also be reluctant to change their teaching methods in order to take these students into account (Thurston, Shuman, Middendorf, & Johnson, 2017). It is also known that especially dyslexic students are shown to struggle in studying tertiary mathematics because of environmental barriers for learning (Perkin & Croft, 2007). In general, it is known that disabled students often struggle while participating in higher education. These students are less likely than others to persist until completing their educational program (Mamiseishvili & Koch, 2012). According to Weeber (2004) students might see their disability status as an undesirable factor in how they perceive themselves as the campus environment does not provide enough support. In a Finnish report, it was found that accessibility was rarely thought about when learning environments were designed (Laaksonen, 2005). However, in this study it was the staff who assessed the level of accessibility, and the disabled students themselves were never given a voice. I argue that there is a critical silence, in terms of Seale (2014), when it comes to researching disabled students in the field of postsecondary mathematics.

In this study, an undergraduate mathematics course was designed to be more accessible. By using Foucauldian discourse analysis on power, the voices of the students with special needs themselves were heard. The aim of this study is to examine how these students positioned themselves in this course that tried to promote inclusion for all through the framework of Universal Design.

Background of the study

Discourse and power as theoretical frameworks

This article draws on Foucauldian discourse analysis. Discourse analysis is not used simply as a research method; it serves as a broad theoretical framework for understanding discourse and its
importance in social life. According to Foucault, discourses are “practices that systematically form the objects of which they speak … [they] are not about objects, they constitute them and in the practice of doing so conceal their own invention” (Foucault, 1977, p. 49). Discourses, therefore, produce normality by constructing what can be taken as granted. By studying discourse, we can gather information on social organizations and identities, since they are constructed by rules about what is normal. The way language is used shapes reality - observing the ways in which social constructions form our world are the core of discourse analysis and form the theoretical base for this study.

Discourses produce meaning and knowledge, and these Foucault (1977) connected with power. Foucault (1977) proposed that in modern societies, we must move forward from analyzing dyadic relations of a ruler and a subject, and instead focus on finding these power relations in institutions that are so often labeled as ‘humane’. He defined the concept of disciplinary power, a form of power that is understood to be the body of knowledge and those discourses takes as the ‘truth’. According to Foucault (1982), personal identities are only produced through institutional or societal power and knowledge. In other words, subjectivity is constructed through the productive power of discursive practices. Various scholars have also emphasized the socially constructed nature of mathematical identity – how discourses construct mathematical identities and agency (Alderton & Gifford, 2018). Because discourses truly produce our social reality, they are all about power. Some voices are heard as meaningful and authoritative, while some others are not. When power and knowledge are combined, hegemonic discourses are constructed (Dant, 1991). By this, Dant means that certain socially constructed discourses are considered as facts.

**Universal Design**

Inclusive pedagogy has often been introduced as a way to promote positive discourses of students with special needs by promoting a view of disability as a social construction. While the traditional, medical model views disability as an abnormality that has to be cured and assisted, the social model emphasizes the idea that disability is constructed when the environment cannot account to the needs of the disabled (Seale, 2014). The social model is often fostered in higher education by using Universal Design (UD), an environmental design that is accessible for everyone (Burgstahler, 2015). According to Burgstahler, the learning environments create barriers for learning, and UD aims to reduce these by taking account the needs of the diversity of students. Often, UD is fostered by using the guidelines by the Center for Applied Special Technology: 1) engagement 2) representation 3) action & expression (CAST, 2018). These guidelines are tied into brain research on how people learn.

Another common and practical way to enhance inclusion in higher education is to implement the Principles of UD of Instruction (UDI) into learning environments: 1) equitable use 2) flexibility in use 3) simple and intuitive 4) perceptible information 5) tolerance for error 6) low physical effort 7) size and space for approach and use (Burgstahler, 2015). Often, two additional principles are used: 8) community of learners and 9) instructional climate (Shaw, Scott, & McGuire, 2001).

Although UD has been used as a base for legislation (e.g. the USA; Higher Education Opportunity Act 2008), we know surprisingly little about whether it works in higher education (for a review, see Roberts, Park, Brown, & Cook, 2011). The warm-hearted idea of supporting inclusion through UD is not to be judged, but there is a need for more research-based evidence. Also, the voice of disabled
students themselves is usually not heard in the research on UD in higher education (Seale, 2014; Griful-Freixenet, Struyven, Verstichele, & Andries, 2017). Griful-Freixenet and colleagues underline the fact that it is impossible to “tackle the need of all learners” and calls for a need of responsiveness. I argue that there is need for studies that would, at the same time, break the silence surrounding UD and also examine the power structures surrounding it. This study examines whether the framework of UD, aimed to promote the socially constructed view of disability, was able to promote discourses that would see students with special needs as an equal part of the learning community.

Aims of the study

In this study, the power relations in a Universally Designed university mathematics course are brought into light through students’ own voices. The objective of this study is to examine the subjective positions that the students with special needs have constructed during the course.

Methodology

Context of the study

The study was conducted on a proof-based undergraduate mathematics course with over 400 participants that lasted for 7 weeks. The course arrangements reflected the principles of UD - all of the three principles by CAST (2018) and the nine principles by Burgstahler (2015) and Shaw, Scot and McGuire (2001) were implemented in the course examined in this study. Each week, students were given a set of problems to solve, both pen-and-paper and digital. After that, they received various feedback on the tasks (peer feedback, automatic feedback, feedback from the teacher and the teacher assistants) and participated in mathematical conversation during active lectures. There was no exam, and the final course grade was self-assessed. Table 1 shows an overview of the course components.

<table>
<thead>
<tr>
<th>Engagement</th>
<th>Representation</th>
<th>Action and learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied tasks relevant to different majors</td>
<td>Course material been developed for years to be simple and intuitive</td>
<td>Various options for returning the tasks (LaTex, drawing...)</td>
</tr>
<tr>
<td>Accepting and supportive classroom climate</td>
<td>Materials in Finnish and in Swedish</td>
<td>Digital WhatsApp groups for group discussion</td>
</tr>
<tr>
<td>Active lectures based on discussion; minimizing the social demands</td>
<td>Mathematical discussion was one of the learning objectives</td>
<td>Anonymous discussion forum</td>
</tr>
<tr>
<td>Learning objective matrix</td>
<td>Concept maps about the relationship of concepts</td>
<td>Digital GeoGebra tasks</td>
</tr>
<tr>
<td>Formative assessment used to value process and effort</td>
<td>A guide for producing clear mathematical text was provided</td>
<td>Digital polls during lectures</td>
</tr>
<tr>
<td>An open learning space with tutor students offering support when needed</td>
<td></td>
<td>Digital Moodle environment as a “base” for the course</td>
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<td></td>
<td></td>
<td>Social interaction in the open learning space; students are</td>
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<td></td>
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<td>guided to tutor each others</td>
</tr>
</tbody>
</table>

Table 1 shows an overview of the course components.
Table 1: The course components through the lense of the principles of UD (CAST, 2018), linked with the elements of UDI (with superscript; Burgstahler, 2015; Shaw, Scott, & McGuire, 2001)

<table>
<thead>
<tr>
<th>Peer-assessment</th>
<th>Dynamic geometry (GeoGebra) offering multiple representations</th>
<th>Personal goal-setting through formative self-assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formative and summative self-assessment</td>
<td>Progressive information releasing; first simple, then more advanced tasks</td>
<td>Various kinds of digital feedback; automatic, from tutors</td>
</tr>
<tr>
<td>Flipped learning approach</td>
<td></td>
<td>Octave software for computing</td>
</tr>
</tbody>
</table>

Participants

All of the participants of the course were emailed an advertisement about the study. Six students, self-reporting as having some kinds of special needs during the course, were interviewed. Because of the page limit, only two of these six interviews were used in this study, the ones of Jesse and Nico; these two interviews were chosen as representative examples of the phenomenon. Jesse, aged 20, had been studying for two years and self-reported having difficulties with dyslexia. Nico, aged 23, was also studying their second year and told about their diagnosis of ADHD. Both of the participants could explain as much about their diagnosis as they wanted to, and their choice was respected. Self-report about the diagnosis was needed; no diagnostic documents were collected for this study. Jesse and Nico were both majoring in mathematics or related science. Both of the names are gender-neutral pseudonyms - gender of the participants is not reported in order to provide anonymization. Gender neutral pronouns they/them are used throughout the text. “Special needs” is the term used in this study to describe the participants. The purpose is not to label these students as one group and contribute in constructing a discourse of “students with special needs” as one subject. Instead, this label is used to underline that the students, usually neglected in studies, are given a voice here (Seale, 2014), even though mediated by the researcher.

Data collection and analytical process

Data was collected after the course using semi-structured interviews, with the questions concerning perceptions of the course components. The students were able to give feedback on the course arrangements and therefore participate in the development process of the course.

The first cycle of analysis consisted of careful familiarization with the data. The transcripts of the interviews were read through multiple times to gather a general understanding of the discourses of the students. The focus on the first cycle was on the position that the students created for themselves. Foucauldian concepts of discourse and power were used in order to unpack the ways students described themselves as participants of the course. This first part of the analysis was led by the question “do the students position themselves as included or excluded in the learning community, and how is that inclusion or exclusion created?” The analysis was guided by identifying hegemonic discourses.

The second analysis changed the view towards examining how the students constructed the discourses on their subjective position and how they contributed in building hegemonic discourses. The data was read through the lense on simplifications; when did the students choose to rely on simplifications over
complexity and contradictions? How were these simplifications made seem convincing (Dant, 1991)? The concept of naturalization (Fairclough, 1989) was used in the analysis as an ultimate form of simplification; this kind of a process happens when socially constructed discourses and practices are taken as natural and are even connected to the nature itself. The analysis of simplifications reconstituted as follows: when do the students see social orders arranged by the nature, and not by people, and how are these discourses justified? During the analysis it was noted that there is a need for a analytical tool that would frame the asymmetrical power constructed through naturalization. This is why the theory of otherness was implemented; as a part of the reliability of this study, I describe this process as it chronologically happened in my findings.

**Findings**

The first analysis cycle: The discourse of ‘a different kind of a learner’

The first notice, after getting familiar with the data, was that both of the students described a very lonely learning process. This loneliness was connected with the difficulties the students faced in this course. An evident part of this loneliness was that throughout the data, the students spoke almost entirely in the first-person point of view - as is evident through all of the citations used in this article. In the entire data, there were no references to *us*.

**Jesse:** When I am doing an exercise, the exercise number one. Everyone else have started that exercise at the same time as me but they are already doing the task number five when I’m moving forward to task number two. I just progress so much slower. --- I realized a long time ago that for me it is better to work on my own.

The clear, choiceless segregations made between *me* and *them* were seen as building blocks of the discourse about difference. The discourse was named by the researcher as ‘the discourse of a different kind of a learner’ after Nico’s feedback on the course:

**Nico:** I think it is good if there is a will to map out the needs of different kinds of learners.

One way of constructing difference between these students and the others was the discourse of different kinds of study methods. The students did not want to lean on to the ready-made methods, built for them by the teacher. On the contrary, they created their own study strategies by themselves, because they couldn’t make use of the normal ways of studying. This smaller discourse was seen as a legitimator for the stronger discourse of difference. Even these kinds of helper discourses might have some serious real life consequences.

**Jesse:** Well. I have been to small groups or so. Where you need to do group work with other people. These kinds of situations are always very bad for me since. I mean, goodness. You have to write very fast, just whatever comes to your head. And the answers to the tasks, they are what they are.

**Nico:** I tried to study in a way everyone else are studying and. In the end of the year I realized, that I wasn’t even getting. Grades from my courses. Now then, I built this learning strategy. So, maybe I don’t learn like other people, so I’ll just have to learn completely in my own way. --- I was using a timer with these exercises. For example, I decided that at 5 pm I’ll start doing these exercises.
The discourse of difference was also identified when the students gave feedback on the course. This was most clear with Nico, who told that they didn’t use almost any of the social course components, yet still they praised the existence of these arrangements. They told that they didn’t attend the lectures nor the open learning space, and neither wanted to take part on the digital discussion groups of the course. According to Nico, there was nothing wrong with the course components, designed with the principles of UD; they were just meant for someone else.

Nico: I would say that compared to last year. Well, this is. A hundred times better arranged, this course. So, keep going like this and it’ll be very good.

As shown, there was a hegemonic discourse of ‘a different kind of a learner’, a strong discourse that was obviously constructed way before attending this course. But how was this kind of a hegemony legitimised? For further analysis, a new tool was needed: the concept of otherness.

**A plunge back to the theory: Otherness and power**

Individual subjects construct their reality and identity under the supervisory of normalising practices that impose homogeneity and build discourses on norms (Foucault, 1977). This leads to monitoring one’s behavior, a process that is constantly judged. Fenwick (2003) uses the concept on internalisation to describe the process where identities are produced through following norms, thus leading to being dependent on the disciplinary power the subjects have directed on themselves.

When norms produce inclusion and exclusion through disciplinary power, they produce otherness. Staszak (2008) conceptualizes otherness as a discursive process which is produced by a dominant group by stigmatizing a difference. The creation of otherness thus constructs two different group: them and us. Asymmetry of power is the key feature in constructing otherness: only the more powerful group of them and us is able to maintain hegemonies and construct their own identity, while the identity of the other is only constructed in a relation to these powerful discourses. Discipline power is found when the others define themselves in relation to the dominant group, not having equal power to define themselves by their own means. When otherness is seen in a negative way through dominant discourse, the results tend to be very real and reflect the power structures (Okolie, 2003).

**The second analysis cycle: The discourse of otherness**

Because of the asymmetrical power structure that was found at the first cycle of analysis, the ‘discourse of a different kind of a learner’ was renamed as the ‘discourse of otherness’. It was kept up with simplifications; strong discourses that left no room for seeing things from different angles. Internalisation of norms created otherness when the students saw their differences as something that could not be taken account by the course or the university staff. The students positioned themselves as the others that cannot and therefore shouldn’t be helped by the course. This is a strong hegemonic discourse: This learning environment of university mathematics is not meant for them, even if it is constructed with the principles of UD. This is an obvious simplification, since the learning environments could, of course, be adjusted for these students too.

Jesse: It would have been nice if I would have bought the physical copy. And not just read the material from the screen of my computer, since there is that backlight. I always become so confused about the line I’m reading. –– It cost money. So no thank you.
Nico: I would say that if you are a different kind of a learner, then the most important thing you should do immediately after you start your university studies is to find out how you learn.

Naturalization was the key element in constructing otherness. This kind of a process was most evident in Nico’s interview. Nico referred to themselves as an ‘ADHD person’ and constructed otherness through neurology. Also, Jesse made references of dyslexia as a biological state that prevented them of studying in a normal way. These kinds of discourses can be seen as ultimate ways of asymmetrical power between them and me.

Jesse: Well. Always, it would be nice to get. Some kind of an assistance. When it comes to dyslexia. Which means more hours to a day, but that just isn’t possible.

**Discussion**

This study examined how students with special needs position themselves in a Universally Designed undergraduate mathematics course. Even though the theories of UD and UDI were reflected in the course design, it was found that the two students interviewed constructed a discourse of otherness (Staszak, 2008; Okolie, 2003). Asymmetrical power structures were found in the way they distanced themselves from the other students.

Mathematical identities are known to be formed through institutional power. As educators and researchers, we need to see our responsibility in how we create discourses - or silence. There is a growing need to admit there are students with special needs in undergraduate mathematics, both in research and practice. What we can do is to transform the experiences and possibilities of students with special needs (Alderton, & Gifford, 2018). This study showed how naturalization helped to build the discourse of otherness. If we normalize this kind of inequity, we are constructing a hegemonic discourse that legitimizes subordination through asymmetrical disciplinary power.

UD offers a way to change our view towards more equal mathematics teaching in higher education by challenging the medical model of disability. However, implementing the principles of UD into a course is not enough if discourses of otherness in mathematics are not shifted. The study suggests that that designing inclusive environments for disabled students is not enough, since, in the end, that would reflect the medical model of disability and not social. Seale (2014) sees participation, both in research and practice, as a way to truly foster inclusion. Maybe this would be a way to shift the discourse of otherness and truly include disabled students in the mathematical learning environments. In university mathematics, the first thing to do would be to listen to these students.

**References**


