



“Mathematics is a battle, but I’ve learned to survive”: becoming a disabled student in university mathematics

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Abstract

In university mathematics education, students do not simply learn mathematics but are shaped and shape themselves into someone new—mathematicians. In this study, we focus on the becoming of *disabled* mathematical subjects. We explore the importance of abilities in the processes of being and becoming in university mathematics. Our interest lies in how teaching and assessment practices provide students with ways to understand themselves as both able and *disabled*, as *disabilities* are only understood with respect to the norm. We analyse narratives of nine university students diagnosed with learning disabilities or mental health issues to investigate how their subjectivity is constituted in discourse. Our analysis shows how the students are shaped and shape themselves as *disabled* mathematicians in relation to *speed* in mathematical activities, *disaffection* in mathematics, *individualism* in performing mathematics, and *measurability* of performance. These findings cast light on the ableist underpinnings of the teaching and assessment practices in university mathematics education. We contend that mathematical ableism forms a watershed for belonging in mathematics learning practices, constituting rather narrow, “normal” ways of being “mathematically able”. We also discuss how our participants challenge and widen the idea of an “able” mathematics student. We pave the way for more inclusive futures of mathematics education by suggesting that rather than understanding the “dis” in *disability* negatively, the university mathematics education communities may use *dis* by *disrupting* order. Perhaps, we ask, if university mathematics fails to enable accessible learning experiences for students who care about mathematics, these practices should indeed be disrupted.

Keywords Ableism · University students · Disabilities · Equity · Subjectification

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1 Introduction

I've never considered that the courses in mathematics would be badly arranged. I've just assumed that I am not good enough to study on them. (Pii)

Mä en jotenkin oo ikinä suhtautunu matikan kursseihin sillein et ne ois jotenkin erityisen huonosti järjestetty, Mä oon vaan ajatellu, et mä en vaan oo ollut tarpeeks hyvä käymään niitä. (Pii)

Pii, one of the participants in our study,¹ decided to accept our call to participate in an interview aimed at exploring the experiences of students with learning difficulties. Pii struggled with learning mathematics in university, yet despite their struggles, Pii *loved* mathematics (Pii's own words). Only in the interview situation did Pii realise that their self-understanding may be related to “badly arranged courses”. The way Pii refers to themselves captures the core of our paper in only two sentences. This example shows how teaching and assessment practices in university mathematics are *practices*—collectively accepted and repetitive ways of doing—through which students are shaped and shape themselves as certain kinds of mathematical subjects.

In university, mathematics students learn about matrices, vectors, and linear spaces while simultaneously *becoming mathematicians* (e.g., Beccuti et al., 2023; Wood et al., 2012). In this article, we are interested in how students with diagnosed difficulties—learning disabilities such as dyslexia and different mental health issues—come to understand themselves as “disabled” mathematical subjects as they take part in the teaching and assessment practices in university mathematics. We want to problematise the effects of these practices on individuals, particularly those who, despite their love and effort for mathematics, learn to live on the verge of being discarded. Pii's quote shows how profound the idea of perceived mathematical abilities (and indeed *disabilities*) is for one's inclusion in university mathematics (Lahdenperä & Nieminen, 2020; Solomon, 2007).

The question of who gets to become a mathematician has received plentiful attention in research. In recent years, university mathematics education research has opened towards sociopolitical, equity-oriented approaches (Adiredja & Andrews-Larson, 2017; Hauk et al., 2021). The teaching practices and learning environments of university mathematics have been examined from the viewpoint of inclusion and exclusion (e.g., Kersey & Voigt, 2021; Lahdenperä & Nieminen, 2020; Laursen et al., 2014; Reinholz et al., 2022). Nevertheless, *disabled* students have thus far remained at the margins of this research. Research on disabilities in mathematics education has focused heavily on the special educational viewpoints of intervention and remediation (Tan et al., 2019, 2022; Yeh et al., 2020). As Padilla and Tan (2019) note, little attention has been given to how mathematics education itself may contribute to *disabling* students (see Nieminen et al., 2023). This is the critical silence in the existing knowledge base we contribute to.

We explore how notions of the *disabled* student are formed in relation to notions of the able student that circulate in university mathematics teaching and assessment practices. In other words, our research objective is to explore how subjectivities as *disabled* mathematicians are shaped in the discursive space of ableism in university mathematics. We approach the process of subjectivation through the stories of mathematics students who

¹ The nine participants in the study were given pseudonym gender-neutral Finnish names. In the writing, the gender-neutral pronouns they/they are used.

have medically documented difficulties with learning stemming from learning disabilities (e.g., dyslexia) or mental health issues (e.g., depression). Our findings do not only tell about students' stories and experiences—as vital as they are—but cast light on the ableism in the teaching practices of university mathematics. Finally, we discuss the counter-conduct that our participants showed towards such ableism to pave the way for more inclusive futures of mathematics education.

2 Why focus on disabilities in university mathematics?

We locate university mathematics within the wider societal changes in higher education. As higher education has widened access to historically excluded students, many disabled people have gained access to pursue a university degree. Universities provide disabled people with opportunities to “rebuild their identity, which might have been construed more negatively during other stages of their education” (Moriña, 2017, p. 223). Nonetheless, disabled students face multiple constraints, stemming from inaccessible physical environments to the wide stigmatisation of disabilities (Dolmage, 2017). By and large, disabled students remain at the margins of higher education: it is the global norm to accommodate disabled university students through *extra* adjustments (Nieminen, 2022).

In mathematics, these problems are exacerbated by the particular discourses that position mathematics as rational, logical, and perfect (Garcia et al., 2018). Mathematics is a signifier of intelligence and intellectual ability. It is precisely this set of assumptions that has been used to justify exclusions of disabled people from educational settings through segregation, tracking, and eugenics (Anders, 2013; Stoskopf, 2002). Given this historical context, the university mathematics context is one in which we would expect the marginalisation of disabled learners to be profound. Although these issues have received limited attention in research, there is emerging evidence considering the (in)accessibility of university mathematics (Lewis & Lynn, 2018; Perkin & Croft, 2007).

However, mathematics has always been a space for “odd people” and “nerds”. Characters such as Srinivasa Ramanujan and John F. Nash did not exactly fit the “norm” regarding accepted behaviour. Wong and colleagues (2023) studied students' conceptions of “typical” mathematics students and found that they are considered to be “antisocial, logical, nerdy and technical, aligning with popular stereotypes of mathematicians” (p. 10). One might hypothesise that mathematics could be a safe haven for disabled, neurodiverse students. Nonetheless, many kinds of disabilities might still be marginalised in these spaces. Indeed, Reinholz (2021) poses the “Goldilocks conundrum” in university mathematics: How come disabled people need to adjust to external norms to be “just right” in mathematics—to be seen as normal—even though mathematics is a space where these notions do not align with the rest of the world?

The notion of a “good mathematician” is known to be rather narrow (Good et al., 2012; Hall & Suurtamm, 2018; Solomon, 2007). There is a risk of wasting potential if students who are accepted to join and who are *able* in multiple ways are forced to opt out of mathematics and pursue other career opportunities. This is a tragedy from both the viewpoints of the individual and the society. People who love mathematics and can learn—just in a slightly different way—are given a false opportunity to study at university if they are soon after sorted out because their assessed mathematical competence does not fit a narrow definition of being a mathematician. This poses a predicament in the face of the global desire to increase the number of students in STEM disciplines and the many substantial resources

invested in supporting the mathematical competencies of citizens (Nieminen et al., 2023). Access to university may set false hope, as disabled people may be able to reach university mathematics, only to notice that studying in these spaces would likely end up excluding them.

3 Understanding the disabled subjectivity in university mathematics

Positioned at the discursive end of mathematics identity studies (Darragh, 2016; Radovic et al., 2018), we understand “disability” neither as an intrinsic attribute of a subject nor as a static identity category. We conceptualise “identity” as a dynamic relationship that emerges as people become subjects in culturally and historically constituted discursive frameworks of practice (Beccuti et al., 2023; Black & Williams, 2013; Hall & Suurtamm, 2018; Hernandez-Martinez, 2016; Stentoft & Valero, 2009). While we acknowledge the various conceptualisations of disabledness—ranging from medicalised to sociopolitical (Nieminen et al., 2023)—we take a discursive approach by investigating how students become “disabled” subjects in university mathematics education. This approach allows us to unpack the discursive effects of the teaching practices in mathematics on student subjectivities.

3.1 Subjectification

We draw on Foucault’s concept of subjectification (Foucault, 1985, 1990, 1991). Foucault was concerned with the problem of how humans are made subjects as effects of power:

This form of power applies itself to immediate everyday life which categorizes the individual, marks him by his own individuality, attaches him to his own identity, imposes a law of truth on him which he must recognize and others have to recognize on him. It is a form of power which makes individuals subjects. There are two meanings of the word ‘subject’: subject to someone else by control and dependence, and tied to his own identity by a conscience or self-knowledge. Both meanings suggest a form of power that subjugates and makes subject to. (Foucault, 1982, p. 781)

Subjectification is constituted within discourse, which can be understood as the organisation of what can be said and thought about a practice and its participants. Discourses “structure institutions and constitute individuals as thinking, feeling and acting subjects” (Walshaw, 2016, p. 47). Becoming a subject always happens in relation to something or someone, and it includes both the aspects of being subjectified as a certain kind of person by others and by oneself. It implies an effect of truth on who one is—in relation to who others are—that becomes attached to one’s recognition of one’s individuality.

Subjectification processes are inherently social, discursive, and ethical since, as phrased by Radovic and colleagues (2018), “identities develop in relation to others (...) during a process in which individuals position themselves and are positioned by others as certain kinds of people” (p. 437). To understand how teaching practices shape student subjectivities, we conceptualise them as discursive practices: “...practices of knowledge formation” that focus on “how specific knowledges (‘discourses’) operate and the work they do” (Bacchi & Bonham, 2014, p. 174). Teaching and assessment practices lead a student to “observe herself, analyze herself, interpret herself, and recognize herself as a domain of possible knowledge” (Stewart & Roy, 2014, p. 1877). In university mathematics, Wood et al. (2012) and Burton (2004) have examined how

pedagogical approaches enable students to shape and reshape their subjectivities. For example, Wood et al. (2012) noted how a curriculum that is "outward looking" incorporates "the use of mathematics as an approach to life, a way of thinking, acting and being" and thus uses mathematics for "investigating, understanding, and even changing the world" (p. 127). Here, the curriculum is seen not only as a matter of learning but a matter of how students become mathematicians.

3.2 Disabled subjectivities and ableism

Being labelled as "a person with a disability"—whether legally, medically, or socially—has historically been a powerful way of categorising, sorting, and indeed *knowing* people (Hacking, 2007). Knowing students through their varying abilities is particularly striking in mathematics, which is characterised by testing, measurement, and ability-tracking systems more than perhaps any other school subject. As Llewellyn (2018) notes, mathematical competence has been historically seen as an elitist measurement of individual intelligence. Likewise, abilities provide a watershed for knowing students in universities. Acquiring disability adjustments requires one to be labelled as "a person with a disability" through a fine-detailed and bureaucratic application process (Nieminen, 2022, 2023). These categorisation processes are social, legal, medical, and material. They are at the same time abstract and very much real.

Thinking with Foucault, we focus on the construction of *disabled* subjectivities *in relation to able ones*. This explains our use of the term "disabled students" rather than "students with disabilities". Often, disability studies refer to "disabled students" to denote the disabling effects of environments and practices (see, e.g., Whitburn, 2017). In this study, notions of "ability" and "disability" are constructed in tight relation to each other. We use the term *disabled* to "forefront power imbalances inherent in constructing and identifying disability" (Padilla & Tan, 2019, p. 316). As Padilla and Tan explain, this concept emphasises that neither of these ideas exists without the other, as the disabled is only "disabled" in relation to the "able"; the "dis and the able are always working in tandem as simultaneous processes" (Goodley & Runswick-Cole, 2016, p. 4). The prefix *dis* does not occur in itself, but it has to be attached to something. This prefix indicates negation, or "to deprive something of its power" (Goodley & Runswick-Cole, 2016, p. 5).

Ableism denotes practices and processes that place value on the "dis" in relation to a norm of ability:

Ableism (...) instead of situating disability as bad and focusing on that stigma, positively values able-bodiedness. In fact, ableism makes able-bodiedness and able-mindedness compulsory. (...) Ableism renders disability as abject, invisible, disposable, less than human, while able-bodiedness is represented as at once ideal, normal, and the mean or default. (Dolmage, 2017, p. 7)

Rather than focusing on the formation of individual disability categories, such as "dyslexia", "depression", or "ADHD", the concepts explained above allow us to focus on how *disabledness* emerges in the discursive practices at the intersection of mathematics and university education, and how ableism renders disability (or what appears as *disabled*) as something separate though always abject and connected to ability (or what appears as *abled*). In other terms, these two sides are always distinct but inseparably related.

3.3 Normalising and dividing practices

It is necessary to understand abledness as the *norm*. The idea of normality is never neutral nor apolitical but under constant construction by various actors and in certain spaces (Cryle & Stephens, 2017). Following Foucault, Walshaw (2007) argues that education maintains a “normalising function” through, for instance, remedial classes, extension groups, and examinations: “The gaze differentiates and compares. The tiniest deviation from normal practice is noted” (p. 130). The history of disabilities is a history of normalisation as the bodies and minds of *disabled* people have been subjected to projects of fixing, remediation, and interventions (Anders, 2013). Mathematics education has historically played a key role in shaping the public understanding of able minds and bodies (Nieminen et al., 2023; Yolcu & Popkewitz, 2019). Ableism, as a characteristic of the practices, teaches students to subjectify themselves in relation to “normality” and value the process accordingly. In this sense, “the *disabled student*” is only known in reference to the norm—the able (Goodley & Runswick-Cole, 2015; Whitburn, 2017).

What, then, separates *disabled* subjectivities from able subjectivities? Here, we rely on Foucault’s (1982) concept of *dividing practices* that “categorize, classify, distribute, and manipulate subjects who are initially drawn from a rather undifferentiated mass of people” (Tremain, 2017, p. 55) into objectifying themselves and being objectified in relation to the available categories in discourse.

3.4 Counter-conducts

At the heart of Foucault’s concept of subjectification is the idea that people may show *counter-conduct* towards the practices that produce information about their subjectivity. While people might be made subject by further excluding themselves from “other” people as pathologised, othered subjects, the same processes of subjectification could be resisted and reshaped (Foucault, 1982, 1985).

Disabled people may actively refuse, adopt, and alter ableist discourses and practices (Tremain, 2017). Disabled students have historically, actively resisted their “othered” subjectivity by fighting for equal rights in education (Bacon & Lalvani, 2019). This may create counter-narratives (Tarvainen, 2019), as disabled people themselves counter the pathologised and negative subjectivities often assigned to “the disabled”. Subjectivities are messy: bringing forth this messiness by showing what gets lost in the dichotomy of *disabled* may itself constitute counter-conduct (Llewellyn, 2018). This messiness manifests in the intersection of multiple disabilities and subjectivities (Sins Invalid, 2019).

Counter-conduct may also occur not by resisting “otherness” but by embracing. Disabled people and organisations have historically used their otherness to resist what is taken as the standard, ideal body and mind as a collective (Loja et al., 2013; Tarvainen, 2019). Such resistance is emphasised in the ideas of disability pride and justice, rooted in a celebration of human diversity (Sins Invalid, 2019). The neurodiversity and disability justice movements have emphasised that disabilities are not merely deficits but also strengths (Lambert and Harriß, 2022).

4 Context and methods

This study derives from a research project concerning the inclusion of disabled students in university mathematics (Nieminen, 2020; Nieminen & Pesonen, 2022). The study was conducted in the mathematics department of a major research-intensive university in Finland. This mathematics department provides an intriguing research context for our study due to its unique teaching arrangements. The learning environments have been developed intensively. Most notably, the department has a collaborative open learning space (Rämö et al., 2019, 2021), in which all students are welcome to participate. On the other hand, most courses are taught via more traditional methods, relying on lecturing, weekly task sheets, and final examinations.

When it comes to disability rights, this university relies on disability adjustment policies rather than on inclusive pedagogies (Nieminen, 2022). To access disability adjustments, students must acquire medical documentation of their condition.

4.1 Participants and data material

Our data material consists of interviews conducted in 2018 with nine university mathematics students. We sought participants with documented difficulties in learning, ensuring an access to disability adjustments (whether they had used them or not). An invitation letter was sent to various student e-mail lists of the mathematics department.

The interviews were conducted in Finnish by the first author. There was no teacher–student relationship between the interviewer and the interviewees. The study followed the ethical guidelines of the university where it was conducted. The purpose of the interview was to invite participants to openly narrate their experiences of being students in the mathematics department. These narratives were not considered to be only about the students themselves but as discursive and cultural stories (Andersson et al., 2015; Stentoft & Valero, 2009). The students were explicitly asked to participate in practices of subjectification, which is not a neutral act (Tamboukou, 2008). The interview situation itself was seen as “a site in which ‘individuals’ are incited to acknowledge themselves as particular kinds of subjects” (Bonham & Bacchi, 2017, pp. 669–670). The interviews focused on students’ narration (guided by the researcher) of what they thought was most meaningful for their experiences and stories (guided by the participants). The format allowed unexpected counter-narratives to occur. The interviews lasted from 34 to 74 min, averaging 56 min. The interview transcripts were conducted by a professional transcription service.

The nine participants were Uni, Honka, Emi, Pii, Halla, Tiira, Sumu, Lupiini, and Yö. All participants reported having medical documentation that enabled them access to disability adjustments; however, three chose not to use these adjustments. Six of the students had a dyslexia diagnosis. Dyslexia is a learning disability that is traditionally characterised by difficulties in reading, writing, and spelling. However, the neurodiversity movement has reframed dyslexia as a cognitive difference with various strengths such as visual spatial reasoning (Lambert & Harriss, 2022). Three participants had a diagnosis of conditions characterised as mental health issues (e.g., depression, panic disorder). In Finnish universities, learning disabilities and mental health issues are the most common reasons for providing disability adjustments: these conditions represent typical disabilities in academic settings (Nieminen, 2023). All students majored in mathematics or mathematics education, representing both bachelor’s and master’s degree students. Their ages varied between 20

and 40. Due to anonymity issues, we do not report any additional information about the participants.

4.2 The analytical process

We followed the six-stage guideline for Foucault-informed interview analysis by Bacchi and Goodwin (2016) (see also Tamboukou, 2008).

The first stage of the analysis consisted of noting “what was said”. We focused on the participants’ statements about themselves. Since the data material was in Finnish, the first author was responsible for this first step. The first author identified the narratives from each interview participant and summarised them in English. The summaries were discussed dialogically in research meetings. It was noticed that disability was a central part of the students’ identity narratives.

From the second stage on, all authors took part in the analysis, with the first author leading the process. In the second stage, we analysed what was *sayable* in the students’ narratives: how it was possible to come up with these specific narratives and “how they are considered to be legitimate or “truthful” things to say” (Bacchi & Goodwin, 2016, p. 116). The focus was on how it became “truthful” to consider oneself as “disabled”. Here, we analysed *how* the “dis” was separated from the “able”. When the students spoke about their *disabledness*, they simultaneously did this in relation to *abledness* (Goodley & Runswick-Cole, 2016; Whitburn, 2017). We thus analysed enunciations of “the able” student subjectivity. We were inspired by Wong et al. (2023) and Davis and Hersh (1981), who have characterised conceptions of “typical” and “ideal” mathematicians. Davis and Hersh (1981) outlined the “ideal mathematician” as an “impossible pure specimen” (p. 34), not *real* but still present in the ways we are subjectified by others and subjectify ourselves. As we analysed the *disabled* student subjectivity, we necessarily formulated an idea of the “able” student subjectivity and brought this as the focal point of our analysis. As the students described themselves as *disabled* students, the imaginary yet productive notion of the “able” student was also constructed. Following Davis and Hersh (1981), we formulated these ideas on paper.

Next, we analysed the key discursive practices in our data material. We highlighted the teaching and assessment practices that shaped students’ subjectivities in their narratives and produced speaking positions by establishing “the limits of ‘who we are’ and ‘who we can be’” (Arribas-Ayllon & Walkerdine, 2008, p. 120). The “things said” were “analysed in terms of the practices that give rise to them” (Bacchi & Goodwin, 2016, p. 116). First, we analysed how teaching and assessment practices could be seen as normalising practices through which the disabled student subjectivity was formed as “the abnormal”. Second, we focused on how, in the students’ narratives, these practices could be seen as dividing practices that separated the “dis” from “the able” from each other ontologically. Through this analysis, we could understand *how* the disabled student subjectivity was formed (stage 4).

Finally, we shed light on those practices of counter-conduct that the students used to reframe and redefine their subjectivities. We analysed counter-narratives through which people “deconstruct (consciously) oppressive practices”, producing “alternative” narrative resources to the cultural stock of stories” (Tarvainen, 2019, p. 295). Such a move allowed us to interrogate the production of the disabled subject and to explore the transformative potential for other types of subjectivities (stages 5 and 6). By analysing students’ counter-conducts, we hope to open up spaces for disruption and hope: there is much we can learn from our participants’ resistance towards seeing disability as something negative and avoidable (see Bacchi & Goodwin, 2016, p. 119). In the final section, we discuss how the

'dis' in disability could *disorder* university mathematics education. This section should be read as a part of our analysis, not as recommendations for practice.

5 Becoming the *dis/abled* mathematical subject

We identified four characteristics of teaching practices around which *disabled* subjectivities were organised: *speed* in mathematical activities, *disaffection* in relating to mathematics, *individualism* in performing mathematics, and *measurability* of performance. In these four characteristics, we identify the statements of truth around an able mathematics student as *fast*, *stoic*, *individualistic*, and *measurable* and the related statements of truth around the disabled student as *slow*, *emotional*, *communal*, and *intangible*. We do not see these sets as opposites or dichotomies but as different densities around which the notions of the *disabled* and *abled* mathematical subjectivities are organised.

All participants had a deep, lifelong interest in mathematics: many talked about their love towards mathematics. Nevertheless, each described significant struggles in their studies. The students framed disability through their medical diagnoses, seeing disability as something that hindered them from learning mathematics. Stigma and shame characterised these stories. Enunciations of disability pride or disability communities were rare.

We start each section by introducing the notion of the "able" student subjectivity. We then show how the *disabled* subjectivity was constructed in relation to "abledness". Finally, we emphasise the students' counter-conducts. As vital as the counter-conducts are, these enunciations of resistance were marginal in our material. We provide multiple data excerpts that the first author has translated, alongside with the original quotes in Finnish.

5.1 Speed in making the fast/slow student

The fast student completes their courses on time, hands over the assignments before the deadlines, and graduates within the given timeframe with no extensions. The speedy mathematician leaves the examination hall much before the test is over.

All participants expressed *being slow* and needing *extra* time in their studies. Uni characterised themselves as "twice as slow as anyone else", which is why they needed extra time with assignments and assessments. The students were constantly building their subjectivity in relation to the "fast student" who operated within a linear timescape, unlike students such as Pii, who referred to their studies as "a zig-zag".

The fast pace of mathematics courses was a significant dividing practice. As Honka phrased it, the courses "always move so fast". Many students described how the tightly packaged courses introduced weekly tasks and lectures quickly, without proper time to engage with the mathematical concepts. This was the *norm*. The students had come to understand themselves as lesser students who cannot keep up with the pace and were thus separated from "the geniuses":

There are those geniuses who move on soooo fast. In those situations, I tell myself that I'm slower. I have my own pace. (...) I just cannot keep the pace. This is a true fact. So I shouldn't compete with those students. I just keep on at my own pace. (Yö)

Niitähän on neroja opiskelijoita. Ne menee niiiiiin nopeesti. Mut sit vaan sanon, että mä oon hitaampi. Mä tuun omaa tahtii. (...) Mä en pääse samaa tahtii. Et se

on vaan niinku tosi fakta. Et, ei pysty. Et siinäähän ei edes pidä alkaa kilpailee sel-lasten kaa. Että menen vaan omaa tahtii. (Yö)

Perhaps nowhere was the normalising and dividing role of the fast pace seen as clearly as in Sumu's narration. Sumu constantly referred to "norm" and "normalcy" by using these explicit terms repeatedly. Sumu studied mathematics with the cost of living:

I wonder if it might be possible to consider dyslexia in the workload. You could get an easement to your coursework. Because, for me, it is a fool's errand [to study without such an easement]. I study with the cost of health, sports, all of it. Sleeping, eating... Everything suffers at that point. (...) My life's been all about studying. (Sumu)

Toisaalt niinku tämmöne ajatus et voisko sen huomiodia sen lukihäiriön jotenkin myös siinä työmääräs, et sais jotenkin vähä helpotuksii kursseist. Koska tosiaan se on niinku mulle ihan hullun hommaa se. Välillä menee ihan terveyden kustannuksel, et kaikki just nää terveys, liikunta. Nukkuminen, syöminen, kaikki niinku... Nää just on se mikä kärsii siinä kohtaa. (...) Koulua vaan on mun elämä ollu. (Sumu)

Another practice that constituted the dis/abled student was *the summative examination*. Examinations created their own timescape with new standards for the "normal time" in mathematics. At the mathematics departments, *normal* examinations were two hours long. This is why *extra* time in examinations was used by six students. The constitution of dis/abled is seen as the "extra" refers to something to be ashamed of:

If you finish your exam in the same hall as everyone else, and everyone else leaves [when the exam is over] but you stay [with the extra time], that is kind of embarrassing. I don't like to draw attention that way. (Uni)

Et sekin on aika, se että jos siellä joutuu samassa tenttisisä olemaan, et kaikki muut lähtee ja sitten ite jää sinne ni se on ehkä semmosta noloo. Et en haluis herättää semmost huomioo. (Uni)

However, the students also described counter-conduct using *slower* and less linear timescapes. Sumu found it helpful to incubate their mathematical ideas over an extended period of time, even when this did not fit the dominant course structure. Drafting and doodling ideas were described as critical practices for such counter-conduct. Emi shared:

You shouldn't demand too much from yourself. The math courses can be pretty intensive. If you cannot do too many, you should just slow down. It is better to do less and invest more time in those courses rather than to try to do too many and then end up failing half of them. (Emi)

Ei pidä vaatia iteltään liikaa. Nää kurssit on aika intensiivisiä ja sit jos tuntuu että ei kykene käymään niin montaa, nii sit käy niit hitaammin koska se on parempi et käy vähemmän ja panostaa niihin ku että yrittää käydä hirveen monta ja sitte feilaa puolet sen takia. (Emi)

Pii brought up the idea of a complete time-out as a form of counter-conduct:

Sometimes, when I have started to feel worse [because of depression], I have needed to drop courses for the sake of my well-being. (...) When it's going downhill, it's better to take a time-out. So you could somehow slow down and pile yourself up. (Pii)

Jos on sit olo huonontunu, nii sit on vaa pakko ollu jättää kesken kursseja ihan vaan sen voinnin takii. (...) Et sit ku alkaa menee alamäkee, sit on parempi vaa ottaa aikailisä. Et saa pysähdyttyä ja saa ittensä kasaan ja pystyyn. (Pii)

The students' ongoing, life-long interest in mathematics was seen as counter-conduct towards the fast-paced and linear timescapes of university mathematics. All students explained being highly interested in mathematics for their whole lives—despite all the trouble and struggle that the participants also described. Mathematical learning then was not narrated to occur primarily within the timescapes of university studies but within the timescapes of the students' lives. For example, Yö explained that mathematics had offered Yö their "own pathway" throughout Yö's lifelong interest in the subject: "I really liked mathematics before, but at university, the relationship has gotten even more positive".

5.2 Disaffection in making the stoic/emotional student

The stoic mathematics student shows no feelings. Whatever emotions may arise do not influence their mathematical identities. When a tutor yells at them, the stoic mathematician remains silent and unmoved. When the stoic student fails, they learn from their mistakes and move on without stalling.

Emotional stories of success and failure characterised the students' narration. Whereas the resilient, controlled, and rational "stoic student" approached such experiences by being detached, the *disabled* student let the occasions affect their very self. The abject, the "dis", then was constituted as weak, emotional, and irrational. All students referred to their mathematical identities negatively, such as by describing "feelings of despair" (Sumu) and "negative image of myself as a mathematician" (Lupiini).

Eight students described experiences of unfriendly and even aggressive learning environments. These were analysed as normalising and dividing practices constituting irrational student subjectivities. Uni described the tutorial sessions' atmosphere as oppressive: "No one wants to ask any questions because no one would risk having to be there for more than those two hours". Words such as tension, fear, and anxiety characterised students' narration of learning environments.

A tangible normalising practice in students' narration was *the chalkboard* in the tutorial sessions. Emi described a typical tutorial session in traditional mathematics courses, in which the chalkboard played a key role: "You got yelled at if you had to present your solution on the chalkboard, if the answer was incorrect. That's quite distressing" (Emi). Sumu's narration shows how such distress was normalised and how certain students were seen as the irrational ones:

I had a huge fear of presenting my work at the chalkboard. I was like, I would never go there, I cannot do it. I got stage fright, in front of strangers. (...) I was so afraid of that chalkboard. (Sumu)

Mä ihan siis kammoksuin sitä tauluu, mä oli ihan et en ikinä mene, en pysty. Tuli esiintymispelko, tuntematont porukkaa ja silleen. (...) Et mä pelkäsin sitä tauluu ihan hirveesti. (Sumu)

Similarly, *unfriendly and cold teachers* played a substantial role in students' identity narratives. Honka shared a story of approaching a professor with a mathematics-specific question after a lecture. According to Honka, the professor refused to answer, stating that

Honka should read the course material if they did not understand the mathematical concepts: “He completely turned me down. It was so rude. I almost cried”.

The beginning of university studies was described as a cumbersome part of everyone’s studies. All students explained having a “shock start” at university, as Emi phrased it. That was the first time for many to experience major failures in mathematics: “It was so abstract and theoretical. I thought about quitting” (Emi). The “shock start” was analysed as a dividing practice since it was the *norm*, yet not the same for “the irrational students”:

When transitioning from secondary education to university, the system changed utterly. You have to adjust. I mean, everyone has to find their own pace and ways of studying when they transition to university from, for example, high school. But if you have dyslexia, more pieces need to fall into place. (Halla)

Kun tuli yliopistoo ni tietyllä tavalla systeemit ja kaikki, miten toimii, niin muuttu ihan täysin. Siihen pitää sopeutuu. Sanotaanko näin, et kaikillahan on silleen, et kun ne tulee esmes lukioista, niiden pitää löytää että se oma rytmi ja oma tapa tehdä. Mut sit tavallaa jos sul on lukihäiriö, niin sit sul on vähän enemmänkin mitä sun pitää saada tavallaan lokahtaan paikoilleen. (Halla)

Perhaps the most suitable representation of the irrational subjectivity is Tiira’s narrative, which revolved around *panicking*. When the environment caused a panic, Tiira “got completely stuck”. The chalkboard was, again, a critical dividing practice: “Even when all my tasks were solved correctly, I was in a panic. I couldn’t write down anything”. Similarly, examinations were identified as dividing practices: “During exams, I might have run to the bathroom to cry. I cannot remember anything from exams. I cannot do anything. I just sit there in panic. I might sit there for an hour with tears in my eyes”. Tiira’s narrative shows that the “irrational mathematician” had an emotional relationship with mathematics:

I have never gotten rid of mathematics. (laughs) I have always been mathematically gifted. Or something. At the same time, I have kept on failing. It’s a love–hate relationship. (...) Mathematics is a battle, but I’ve learned to survive. (Tiira)

En mä matikasta oo ikinä eroon päässy. (nauraa) Oon tavallaan ollu aina matemaattisesti lahjakas. Tai jotain. Ja sitten siin on vaan epäonnistunu. Se on semmone viharakkaussuhde. (...) Matikka, kyl se on semmost niinku taisteluu. Mut mä oon oppinu selviytyyn. (Tiira)

Some students drew on failure itself as a form of counter-conduct. For example, Sumu *intentionally failed* by hiding their mathematical solutions in the tutorial sessions, thus avoiding presenting their solution on the chalkboard. This seemingly irrational strategy was helpful for Sumu’s learning. Honka described having *opted out* by dropping courses. In such occasions, irrational “failure” was reframed as a successful strategy:

The lecturer was unwilling to answer any questions, so I had a feeling that, okay, I’d thrown in the towel already during the first five minutes. (...) I just thought that, no, this course is not for me even though the topic interests me. I never went back there! (laughs) (Honka)

Ja sit kun se luennoitsija oli haluton vastaamaan kysymyksiin, nii mulle tuli sellanen tunne et okei, että mä oon tippunu kärryiltä jo ekan viiden minuutin aikana. (...) Et aattelin että ei, ei tää kurssi oo mulle vaikka tää aihe kiinnostaiskin. Niin mä en sitte menny enää sinne takasin! (nauraa) (Honka)

5.3 Individualism in making the solitary/communal student

The solitary mathematics student needs no help, support, feedback, care or scaffolding: this student thrives alone. When failures occur, the individualistic mathematician takes full responsibility for them. At the time of success, the individualistic student celebrates their solitary achievements.

Here, the able mathematics student was constructed as someone individualistic and capable of studying by themselves. The "dis" was seen as someone communal: someone needing help, support, and scaffolding.

Lack of support was a discursive practice that divided students into individualistic/communal. Seven students explicitly stated they had not received the support they would have needed. Sumu hoped for "special educational services", but nothing like that was available: "You are on your own".

Asking for help was another dividing practice that separated dis/abled students from each other. Uni summed this up by stating: "It is so hard to ask for help... to say out loud that you need something, that there is something you haven't understood". Asking for clarification of mathematical concepts was framed as abnormal and *disabled*:

I wouldn't dare to ask anything at the mass lectures. That was the case, particularly at the beginning of my studies. (...) The tutorials were the only place to ask for further information or clarification. But it's tricky because you wouldn't dare to ask for help there. At that point, everyone knows you should have already mastered the content. (Uni)

Sit on nää massaluennot, missä ei sitte kehtaa kysyä. Tai varsinkaan sillo alussa mä en kehdannu kysyä. (...) Laskarit oli se ainoo mistä sitten sai jotain tietoo lisää, tai selvennystä niihin asioihin. Mut kylhän se oli tosi vaikeet koska ei siel sit enää kehdannu mitään siin vaihees kysyy. Kun kaikille oli ihan selvää et siinä vaiheessa piti jo ymmärtää ne asiat. (Uni)

To be seen as a "normal" student, many participants explained that they did not intentionally seek help or support. This way, the students took part in normalising practices. For example, Emi had not sought disability adjustments even though their disability status would have allowed this: "Sometimes it's hard to ask for help. You'd rather just give up than ask for help".

The communal ideas of care and support were discursively connected with "dis": as a tragedy for the individual and as a weakness. Pii had also not sought disability adjustments because they might have been considered cheating: "I am afraid that they would ease my studies too much, that I would get off too easily". Pii's narration shows how "dis" was located in support and how the lack of support shaped their subjectivity:

Somehow, all these years here have left me feeling that no one really cares. No one talks about what it is like to be a student with, like, depression or learning disabilities or something. I don't think the purpose of the university is to cure students or to hold us up. Nevertheless, I would have needed someone who cared for me. (Pii)

Jotenkin mulle on jääny vähän sellanen fiilis ylipäätää näist vuosista et kukaan ei ota susta koppia. Missään ei niinku puhuta siitä, et millasta on opiskella jos on niinkun vaik masennus tai vaikka jotain oppimisvaikeuksii. En mä en ajattele et yliopiston tehtävä olis parantaa opiskelijoit tai kannatella niit, mut mä oisin hyötyny sellasesta, et joku ottais koppii. (Pii)

Friendly teachers were described as paving the way for counter-conduct. As described by Honka, some courses make you “feel welcomed”. Eight students appraised the open learning space at the mathematics department, as a site for counter-conduct. There, practices of help and support were *normalised*: it provided “a meeting place” (Honka). In this space, asking questions, failing, and receiving support were normalised. It was *abnormal* not to ask for help:

I was so scared of starting my studies at university. However, this Extreme Apprenticeship thing really saved me. I noticed that this is not so horrible after all. (...) It makes me feel like if you end up alone when you need help, you might look weird. Why wouldn't you ask for help? It's been funny to notice this. In high school, it was weird if you asked for help in mathematics classes. Here, it's a positive thing. (Halla)

Toi kisällioppiminen, et mä niinku pelkäsin tulla yliopistoon, mut se pelasti oikeesti mut. Huomas, et ei tää oookkaa niin kauheeta. (...) Ehkä sellanen fililis että jos sä jätät yksin siel pohtimaan kun sä tarvisit apua, nii ehkä sillon sua katottais, et sä oot outo. Et miks sä et pyytäis apua? Se on ollu jännä huomata. Esimerkiks lukiossa katottii hyvin outona, et jos sä pyydät niinku tunnilla apua. Mut täällä se ollu positiivinen asia. (Halla)

Three students identified disabled communities as a site for counter-conduct. Yö shared how they had met other students with dyslexia while completing examinations in a separate testing room. These students continued to work together, supporting each other:

As soon as you find someone else who also has dyslexia, you can immediately communicate much easier. We help each other a lot. Somehow, I've noted that I can notice the ones with dyslexia [at the mathematics department]. You somehow know them when you see them. (Yö)

Heti ku löytää jonkun kuka on kans lukivaikeuksinen, niin paljon helpommin pystyy heti kommunikoimaan. Me autetaan toisiaan. Ainaki mä oon jotenki sen huomannu että aina bongaa just ne lukivaikeuksiset. Et jotenkin tiedän, et no se on, kun nään ne. (Yö)

5.4 Assessment in making the measurable/intangible student

The quantifiable mathematics student possesses mathematical abilities that can be turned into numbers. Assessment practices, such as examinations, thus offer representative information about the degree of their abilities.

Whereas the able student was quantifiable, the “dis” denotes something *intangible*, something that repels measurement and quantification. The abilities of the disabled, an intangible student subject, were thus impossible to measure on a one-dimensional scale. These characteristics denote the importance of quantification practices for student subjectivity.

Various *numbering practices* provided the mechanism for normalising and dividing students with respect to their dis/abilities: examinations, grades, tests, quizzes, scores, and credits. These numbering practices provided a precise system for knowing oneself. The grading scale used in Finnish universities was the most notable normalising/dividing practice (0–5). Dis/abilities could be quantified and compared with this scale. The division

was seen in how the students used this quantified knowledge to build their subjectivity objectively and precisely in relation to the able student. Tiira narrated their mathematical dreams, hopes, and new beginnings through numbering practices:

I used to be the person who always got straight A's. (...) Recently, I had a huge success. I was able to complete so many credits last autumn. I did... 30? 37 credits, I think. This year has been completely different to the previous ones as I have received special adjustments. I've received support from a study psychologist. You can see it clearly; I have all these one's and two's [grades, on a scale from one to five] here. (refers to a printed study report) (...) Previously, I had to retake all my courses [after failing them] and I got all these one's and two's from them, but this year I have gotten six five's. That is a significant difference. (Tiira)

Olin aina ollut kympin oppilas. (...) Tässä oli hiljattain semmonen iso onnistuminen. Et mä sain yhtäkkii tosi paljo opintoja tehty viime syksynä. Mitähän mä tein... Kolkkyt? Kolkkytseitemmän noppaa, kai. Et tää vuosi on ollu ihan toista luokkaa nyt kun mä oon saanu niit erityisjärjestelyit. Ja sitte opintopsykologin tukee. Että näistäkin huomaa, et kun mul on ykkösii ja kakkosii täällä. (...) Kun mä jouduin uusiin kaikki kurssit ja sit mä sain niist ykkösii tai kakkosii. Nyt mä oon saanu kuus vitosta viime vuoden aikana. Niin se on iha huomattava ero. (Tiira)

Examinations were another dominant numbering practice the students used to shape their subjectivity. The students largely agreed that examinations were inaccessible and thus unsuitable for determining their dis/abledness. For example, Yö noted that "exams are not suitable for us dyslexics", and Lupiini stated that "alternative assessment methods would benefit everyone".

The textual format of mathematics assessment was another normalising and dividing practice here. The quantifiable mathematician was quantifiable with textual methods such as examinations. These materials divided students into quantifiable/intangible through their inaccessible nature. For example, the course materials were predominantly described as unhelpful and complex. While the course materials seemed to create accessibility barriers, they also played a role in how the students subjectified themselves as someone whose true mathematical skills could not be represented in a textual form:

Reading mathematics has been notably more tricky than I expected. (...) Mathematical analysis and topology courses have been the trickiest ones, and probability calculations since the book was easier to read. (...) I passed my mathematical logic course easily since there was little to read. (Uni)

Se matikan lukeminen oli kyl huomattavasti haastavampaa kun mitä mä osasin odottaa. (...) No ehkä ne vaikeimmat oli noi analyysit ja osittain topologiakin. Ja toi todari koska sen kirja oli vähä helpompilukunen. (...) Logiikan pääsin tosi hyvin läpi kun siin ei ollu niin paljoo luettavaa. (Uni)

Counter-conduct occurred in the students' narrations as they described their subjectivities in ways that celebrated the intangible, messy nature of mathematical abilities. Sumu openly challenged the prevailing assessment practices, claiming that Sumu's abilities cannot be rendered visible through them. The students shared stories about alternative spaces for presenting their abilities beyond the quantifiable and textual forms. Many students created their own study materials using practices not commonly used in mathematics, such as

colours, images, and audio files. Yö produced their learning materials that widened what mathematical (dis)abilities mean, using multimodal means:

Pictures and colours help us dyslexics a lot. Nowadays, I colour-code my materials, particularly if there's much mathematical yarn. I use green, turquoise... All the colours are in use. It's much easier to read than just black and white. (...) An image can be worth more than a thousand words. (Yö)

Kuvat ja värit, neidän auttaa meitä lukivaikeuksisia paljon. Nykyään mä värikoodaan tekstejä, et varsinkin jos on jotain pitkiä matikan sepustuksia. Niin tosiaan teen vihreällä, turkoosilla... Kaikki värit on käytössä. Niin paljon helpompi lukee sitä ku jotain mustaa valkosella. (...) Koska kuva kertoo kuitenkin enemmän kun tuhat sanaa. (Yö)

6 Final words: ableism in university mathematics education

No one has said anything directly. However, many teachers have indirectly made it clear... Perhaps they don't understand what dyslexia means. They are not aware of how it affects one's studies. It's not about laziness. I don't leave tasks undone because I'm lazy but because of my disorder. (Lupiini)

Kukaa ei oo sanonu suoraan. Mut jotkut opettajat on saattanu ehkä, tullut epäsuorasti ilmi että... Ei ehkä ymmärretä mitä tarkoittaa lukivaikeudet. Että eivät oo tietoisia siitä, miten se vaikuttaa opiskeluun. Et kyse ei oo laiskuudesta. Et mä en tahaltee jätä tekemättä tehtäviä, et mä en oo laiska. Vaan siis kyse on siitä että mulla on tämä häiriö. (Lupiini)

We started this study with the words of Pii, and we end it with a quote by Lupiini. Lupiini's words summarise what our study has examined about the formation of disabled subjectivities in university mathematics. In this paper, we have shown how the *disabled* and *able* student subjectivities in mathematics constitute each other. Indeed, Lupiini is subjectified as *disabled*, someone *with a disorder*: this was the statement of truth, validated with a medical diagnosis and renewed and shaped through teaching and assessment practices. This is a powerful way of being subjectified and subjectifying oneself through psychological discourse. The deficit view of disability overshadowed our participants' narration of their mathematical identities. This reflects the presence and pervasiveness of a strong medical discourse and the marginalisation of disabilities in the discursive spaces of higher education (Nieminen, 2022, 2023) and mathematics education (Padilla & Tan, 2019).

In our findings, teaching and learning practices were shown to act through their normalising and dividing functionalities in the discursive processes of subjectification. Lupiini's words indicate that “dis” is not seen by university mathematics teachers as something to be celebrated or nurtured. While our nine participants can be considered high-achieving students—they all studied mathematics in university and loved what they did—they were all subjectified and subjectified themselves as *disabled* students. This is a matter of ethics, equity, and injustice. As such, our study contributes to evidence regarding the processes of being and becoming of marginalised students in university mathematics by focusing on *disabilities* (see Burton, 2004; Good et al., 2012; Hall & Suurtamm, 2018; Herzig, 2004a, b; Solomon, 2007).

These findings cast light on the ableist underpinnings of the teaching and assessment practices in university mathematics education. In this study, we have heard disabled students' own perspectives on these issues. This is an important achievement in itself, given how marginalised the voice of disabled students is in mathematics education research (see Padilla & Tan, 2019; Tan et al., 2022; Yeh et al., 2020). A significant contribution of our findings is simply to hear and read the stories of these students. As can be seen from our analysis, many answers to the complex questions about inclusion, diversity, and equity can be understood by simply listening to students themselves.

We wish to re-direct the conversation from students' attributes and identity categories towards the practices of university mathematics. Our analysis has turned the mirror to the teaching and assessment practices in mathematics by asking: *Who are they for?* and *how weird are they!* As pondered earlier by scholars such as Burton (2004) and Wood et al. (2012), these practices do not only shape students' learning and studying processes but, indeed, their very understanding of themselves as learners. While the teaching and assessment practices are the same for all students, they have varying subjectifying effects for different students. Perhaps the stories of our nine participants could help us better understand the subjectification effects of daily mathematics practices, particularly from the viewpoint of diverse students. As Hauk and colleagues (2021, p. 63) phrased, "It is difficult to understand something one has never seen". We welcome further research to unpack these effects in university mathematics: such work would greatly benefit from intersectional analyses on (perceived) notions of ability and disability.

Based on these findings, teaching and assessment practices can be understood as normalising and dividing practices that regulate the spaces of belonging in university mathematics. This is an ableist agenda, yet not through "evil deeds" but through narrowing down the potential ways of being and becoming a mathematician. Our study has unearthed some functionalities of university mathematics practices that *disable* students and, in doing so, aims to provide tools for future research drawing on anti-ableist agendas. The effects of these practices are not abstract but real and material: our data materials were characterised by stories about struggle, pain, despair, panic, anxiety, and loneliness. Some stories reflected outright suffering and discrimination. Perceived mathematical competencies have been named as a factor that regulates belonging in university mathematics contexts (Good et al., 2012; Lahdenperä & Nieminen, 2020; Solomon, 2007), yet our study has shown that the teaching and assessment practices do not only reveal but *construct* dis/abilities. To become mathematicians, these *disabled* students needed to struggle and fight—despite their love for mathematics. Disabilities then became understood as individual disorders that do not belong in mathematical spaces: the "dis" became abjected from "the able" mathematical minds and bodies (Yolcu & Popkewitz, 2019). These ideas set profound barriers for inclusive agendas and warrant further investigation for less exclusive futures of university mathematics education.

6.1 Troubling the norm with dis

We do not want to end our study by adding negative baggage to *dis*. Instead, we want to shed light on the inspiring practices of counter-conduct as seen in the narratives of our participants. This work starts by making use of the *dis*. *Dis* is not only for negating, nullifying, neutralising, or making invalid, but it has the potential to "fundamentally destabilise things that we have taken for granted" (Goodley & Runswick-Cole, 2016, p. 3). It can be used to trouble the norm. From this perspective, the *disorder* that Lupiini describes may not be understood as an individual tragedy but as something that *disrupts order*. Lupiini's

narrative challenges us to rethink university mathematics education from the viewpoint of inclusion and access. Perhaps if university mathematics fails to enable accessible learning experiences, the inaccessible practices should be disrupted.

For us, the work of troubling starts from counter-conduct. In our data material, counter-conduct challenged the idea of “abledness” as something fast, stoic, individualistic, and quantifiable. Many of our participants narrated their mathematical abledness, but in different ways than what the normalised and dividing practices of mathematical learning environments might consider successful and normal. We see great potential in future research that would continue to unravel such counter-spaces and counter-narratives in university mathematics. What kinds of mathematical spaces and practices could powerfully make use of the *dis*? In the Finnish context, opportunities for counter-conduct were made possible by student-centred learning environments. Importantly, these spaces did not only enable mathematical learning to occur, but diverse mathematical identities to flourish. While intriguing, this idea is not a silver bullet for inclusion but needs to be critically explored in future work (see Reinholz et al., 2022). Finally, we ask: What might emerge from practices that centre—rather than repel and stigmatise—the ideals of slowness, emotions, communality, and intangibility? Such work would widen the idea of a normal mathematician and thus pave the way for more inclusive futures of university mathematics.

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Data availability Due to the sensitive nature of the data, the dataset is not available.

Declarations

Conflict of interest The authors declare no competing interests.

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