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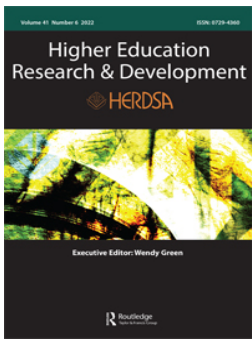
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Politicising inclusive learning environments: how to foster belonging and challenge ableism?

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ABSTRACT

Inclusive learning environments have been described as a crucial factor for fostering disabled students' sense of belonging in higher education. However, few empirical studies have elaborated on how learning environments contribute to disabled students' belonging. In this study, we have taken a socio-political approach and widen the theoretical understanding of 'belonging'. We analyse three Finnish disabled students' narrative interviews concerning their experiences of learning environments through a narrative approach. Our findings highlight the complex interplay of learning environments and belonging in the context of STEM and large class sizes. We discuss the role of active learning environments for supporting disabled students' belonging. The narratives show how *not belonging* might be more productive for these students, as the learning environments are often built on ableism. We redefined inclusive learning environment design and their research as socio-political endeavours: If teachers wish to promote belonging through learning environment design, such design needs to disrupt the broader ableist discourses of higher education.

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Sense of belonging; inclusive practices; learning environments; socio-political; learning disabilities

Introduction

It has been argued repeatedly that higher education (HE) needs to address the needs of diverse students through carefully designed learning environments (Stentiford & Koutsouris, 2020). Often, such arguments are backed up with statistical data on the increasing number of disabled students (e.g., dyslexia, mental health issues) (see Kunttu et al., 2016 for such data in Finnish HE). However, simultaneously, it has been noted that by its very nature HE has been designed to *exclude*: It is a modern idea that massified HE should inclusively educate all citizens (Dolmage, 2017). The ableist underpinnings of HE have been widely discussed in terms of inaccessible physical environments and teaching practices (see Dolmage, 2017). Indeed, modern HE institutions largely draw on accommodation models for disabled students, rather than on inclusive practices; such approaches have been claimed ableist as they frame disabled students as the problem to be fixed, not the inaccessible design itself (Nieminen, 2021). Further discussion is needed of 'what it means to

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have an “inclusive” HE system, who is in need of inclusion and why, what “exclusionary” practices need contesting, and what values should be promoted’ (Stentiford & Kotsouris, 2020, p. 13). We have answered this call by conceptualising ‘inclusion’ through the notion of belonging, which has been described as the main factor for promoting students’ well-being and preventing disabled students from dropping out (Leake & Stodden, 2014). We address learning environment design through a socio-political approach, seeing inclusion as an ethical process; not a project for our students but a project for ourselves (Allan, 2015).

Research has shown that inaccessible learning environments (in terms of physical, perceptual, and socio-emotional accessibility) can cause disabled students to drop out of courses (Nieminen & Pesonen, 2020) and even from HE (García-González et al., 2020; McKinney & Swartz, 2020). Yet while the barriers to *learning* for disabled students have been studied extensively in HE, until recently, the aspect of belonging has been understudied (Pesonen et al., 2020). Recent studies have advocated for learning environment design to support the belonging of all students; this idea has supplemented large campus-wide development programmes for belonging by promoting the importance of pedagogical design (Lahdenperä & Nieminen, 2020). For instance, Motta and Bennett (2018) discussed pedagogies of care, seeing teaching as an affective and embodied practice that holds the power to promote students’ belonging.

Thomas (2016) outlined accessible practices that could foster belonging in HE. Such practices would consist of group-based learning, interaction, learning by doing, work placements, field trips, and facilitation of social integration (Thomas, 2016, pp. 145–146). While Thomas calls for ‘being aware of factors that exclude students from participating fully’ (p. 149), the role of learning environments contributing to inclusion amidst the strong exclusionary discourses of HE (Dolmage, 2017; Nieminen, 2021), and societies more largely (Slee, 2019) remains undiscovered. While the importance of belongingness is recognised, ‘little has been written about how it can be used as a teaching philosophy in itself’ (Levin et al., 2019, p. 72). Furthermore, inaccessible teaching practices might lead to exclusion for disabled students (Pesonen et al., 2020): Might it be more desirable for disabled students *not* to belong in the learning environments?

We examined three students’ stories in the context of mathematics to understand how learning environments have contributed to their sense of belonging. We have supplemented earlier research by focusing on STEM and large-sized classes that have rarely been addressed in studies concerning disabled students (Fornauf & Erickson, 2020). Moreover, our study is situated in a context in which teaching culture has been radically developed, offering an encouraging base for analysing inclusive practices. We have taken a socio-political approach, widening the earlier theoretical understanding of belonging in HE (Liasidou, 2014; Pesonen et al., 2020). As Slee (2019) argued, the ethical quest for inclusion ‘in the age of exclusion’ has to be a radical one, as HE is not a vacuum but both renews and strengthens the broader societal discourses of ableism and exclusion. We have pointed out the affordances of learning environments for such a quest.

Sense of belonging and learning environments: toward socio-political approaches

Overall, sense of belonging refers to the need for acceptance, connectedness and respect from others in various social contexts (Hagerty et al., 1992). Traditionally, belonging has

been introduced as a basic human need: this view highlights that people want to be socially connected to other people and part of a group throughout life. Lack of belonging to the university setting might lead to issues with mental and physical health and HE retention (García-González et al., 2020; McKinney & Swartz, 2020; O’Keeffe, 2013).

We critically contest psychological and individualistic approaches to ‘belonging’. Such approaches infer a technico-scientific standpoint that sees belonging as a construct that can be measured, fostered and controlled (Pesonen et al., 2020). HE studies often focus on policies and interventions for promoting belonging of underrepresented student groups ‘at risk’ of not belonging (O’Keeffe, 2013). Such views might end up constructing risks rather than revealing them, as disabilities are not barriers to be overcome but they enrich HE and should be celebrated as such (Moriña et al., 2018).

Vaccaro et al. (2015) have called for a multidimensional understanding of the belonging of disabled students in HE. To answer their call, we take a socio-political approach to disabled students’ belonging (Pesonen et al., 2020). While we recognise the situated, sociomaterial aspect of belonging (Gravett & Ajjawi, 2021), above all, our approach is humanistic. Our analytical focus is on stabilised and strong exclusionary discourses of ableism that overshadow disabled students’ situated belonging (Nieminen, 2021; Dolmage, 2017; Slee, 2019). An important aspect of this endeavour is understanding the productive aspects of non-belonging: Not all university students want to belong to the university setting, nor take part in the social learning environments (Lahdenperä & Nieminen, 2020). Healy (2020) separated between non-belonging (loss of belonging) and un-belonging (removal of belonging), reminding us about the productive affordances of non-belonging to one’s well-being. Students share multiple communities, and the university context might be far from the most important setting for one to belong to (Solomon, 2007). Furthermore, not all barriers for belonging are specific to disabled students. Moriña et al. (2015) found that disabled students wished for participatory classrooms and practical teaching methods; of course, similar findings have been reported by non-disabled students too.

To bring forth the socio-political aspect of learning environment design and research, we have drawn on the analytical framework developed by Yuval-Davis (2006) and Antonsich (2010), as applied in the context of disabilities in HE (Pesonen et al., 2020). This framework for belonging concerns the dimensions of *affect*, *place*, *social relationships* and *politics*.

The dimensions of belonging

At its most proximal, belonging has an *affective* dimension. Antonsich (2010) defines this affective dimension as experiences of familiarity, comfort, security and emotional attachment and ‘feeling at home’. Affect does not only refer to cognitive-physiological terms, while embodiment is certainly an important part of affection, but to the social practices of doing belonging (Pesonen et al., 2020). Belonging is not something that is accomplished or achieved, but something that is felt (May, 2011); it is an on-going process that is manifested through embodied and affective practices. Earlier studies on supporting disabled students through learning environment design have pointed out that what matters is safety – being able to practise one’s belonging in a safe environment (Kubiak, 2017). Moriña (2020) calls for humanised teaching by using affective strategies

to effectively support disabled students' sense of belonging by, for instance, learning students' names and creating an emotional and emphatic bond with them.

The role of *place* for students' belonging emphasises the experiences of one's surroundings (Antonsich, 2010; Yuval-Davis, 2006) in physical and digital environments (Gravett & Ajjawi, 2021). The importance of students' living space and geographical and cultural location has been emphasised (Ahn & Davis, 2020), as well as the significance of embodied experiences of touch, sight, sounds, smell and taste (May, 2011). When it comes to learning environments (consisting of teaching and assessment practices, and the physical, social, and digital spaces where learning happens), place refers to the embodied experiences of university settings (Thomas, 2016). Moriña and Morgado (2018) analysed university surroundings and infrastructures from the viewpoint of accessibility and noted that they caused various barriers for disabled students; the access to physical learning environments might be blocked through the lack of ramps or through inaccessible classroom furniture. Autistic students might avoid crowded learning environments with overwhelming sensory overload (Pesonen et al., 2020). Digital places are important to consider; inaccessible digital environments might cause barriers for belonging in cases of dyslexia (Nieminen & Pesonen, 2020) and visual and hearing disabilities (Moriña & Morgado, 2018).

Perhaps the most often considered dimension of belonging is the one of *social relationships*. Antonsich (2010, p. 647) describes this relational dimension of belonging as varying from 'emotionally dense relations' (e.g., one's closest friends) to 'weak ties' (e.g., one's peers from a group project). HE studies have located both the academic and social domains of relationships, noting the importance of supportive academics, friendships, and hobbies (Ahn & Davis, 2020; O'Keeffe, 2013). Similar ideas have been increasingly applied to learning environment design (Motta & Bennett, 2018): Adding social elements (namely, opportunities for students to engage in both formal and informal social interaction; see Rämö et al., 2019) to learning environments can both support belonging and hinder alienation and exclusion by inviting all students into the community of learners (Solomon, 2007). Altemueller and Lindquist (2017) discuss Flipped Learning environments for inclusive learning through 'differentiation', 'self-pacing', 'mastery learning', and 'co-operative learning'. Elsewhere, accessible and active learning environments have been promoted for students with learning disabilities (Kubiak, 2017; Thomas, 2016). Overall, active participation and collaboration during lectures and course work have been introduced as ways to support belonging (Camacho et al., 2017; Levin et al., 2019). Open learning spaces with student tutors and informal support have been identified as supporting belonging for all students (Lahdenperä & Nieminen, 2020; Nieminen & Pesonen, 2020). Furthermore, teachers' warm and inclusive approach has been identified as an important factor for these students' learning (Camacho et al., 2017; Moriña et al., 2015). Finally, inclusive learning environments that have been designed to reduce the need for individual adjustments might support a sense of belonging (Moriña et al., 2015; Pesonen et al., 2020).

Finally, *politics* of belonging refers to the 'grids of power relations in society' (Yuval-Davis, 2006, p. 199) that manifest through discourses that separate populations through the unnatural oppositions 'us' and 'them, or, 'disabled' and 'non-disabled' (Liasidou, 2014; Nieminen, 2020). We used the concept of *dividing practices* that 'combine a scientific discourse with practices of segregation and social exclusion to categorise, classify,

distribute, and manipulate subjects who are initially drawn from a rather undifferentiated mass of people' (Tremain, 2017, p. 55). Through such pedagogical practices, students learn to conceptualise themselves as being substantially *different*. This is seen as learning environments are designed for 'normal' students, requiring 'special' students to seek adjustments (Nieminen, 2020). Even accessible learning environments might be unable to disrupt the broader ableist discourses of HE and societies at large, if students have learned to understand themselves as the 'others' (Nieminen & Pesonen, 2020). Through exclusionary discourses underpinned by a rhetoric of sameness, belonging often requires an individual to assimilate to the culture, values and behaviour of the dominant group to mask differences (Yuval-Davis, 2006).

The purpose of the study

RQ: How do learning environments contribute to disabled students' sense of belonging? We have answered this question by examining three students' narratives, and by interpreting the stories through the four dimensions of belonging (Antonsich, 2010; Yuval-Davis, 2006). Using a narrative approach, our aim was to understand the students' lived experience. We expanded on the theorisation of belonging and inclusive learning environments, and shed light on the understudied context of STEM and large-sized classes.

Methods

Context of the study

This study was conducted in the mathematics department of a research-intensive university in Finland. In Finland, the Non-discrimination Act (1324/2014) provides a legal base for students to gain access to 'reasonable adjustments' in HE institutions (15 §). Furthermore, the Universities Act (558/2009) states that every student has the right to a 'safe learning environment' that does not 'hinder progress during their studies' (41a§). The Act gives universities the power to adopt rules and regulations to build 'a pleasant university community'. In Finland, students must have documented reasons (e.g., a diagnosis) to access reasonable adjustments; however, policies differ between institutions in what counts as such a reason, and how adjustments are administered (Nieminen, 2021).

Mathematics has been characterised as a field that has failed to include all students in the learning community with its inaccessible teaching practices (Nieminen & Pesonen, 2020; Solomon, 2007). Recent contributions have advocated for socio-political approaches to address the prevalent issues of inequity (Adiredja & Andrews-Larson, 2017). While research in the mathematics context is scarce on disabled students, it has been suggested that traditional, inaccessible learning environments cause systemic barriers for students with learning disabilities (Nieminen & Pesonen, 2020). Yet in this mathematics department, the teaching culture has been widely developed. Rämö et al. (2019) outline the cultural change. Many courses draw on the principles of Flipped Learning. Lectures are often based on active participation. Most importantly, many courses draw on the Extreme Apprenticeship method (Rämö et al., 2019). These courses use a teaching team of a responsible teacher and a number of student tutors.

The tutors work in a collaborative open learning space located in the middle of the department. The learning space is not only for completing course work, but students use it for socialising and informal learning.

Participants and data production

The participants were recruited by sending an email to the mathematics department's student email list and to the associated student organisation's list. We invited students with any challenges in studying to participate; learning disabilities were offered as examples.

Ten students were interviewed (Nieminen, 2020); for the present study, we purposefully selected three participants for thorough narrative analysis. The inclusion criteria included: (1) The students needed to have a history of learning disabilities throughout their educational trajectory, and (2) The interviews needed to be suitable for narrative analysis through narrative elements (Riessman, 2008). We refer to the students with pseudonyms (Table 1), and with 'disabled students' to highlight the active role of learning environments in disabling students. All participants had a diagnosis of dyslexia. Although systematic data are not collected about disabilities, it has been indicated that dyslexia is amongst the more common learning disabilities in HE in Finland (Kunttu et al., 2016). We have not reported the students' gender and age to ensure anonymity; gender neutral pronouns they/them are used. Students' age varied from 25 to 35, and the participants represented both bachelor's and master's students. Participants could decide on how much they wanted to share about their personal information, and this choice was respected.

The interviews covered students' perceptions about studying at university with a focus on learning environments. The interviews were conducted in a distraction-free environment in a location of the participant's preference. At the beginning of the interview, each participant was offered a voluntary outline of a visual timeline concerning their time at university to aid their storytelling during the interview situation, and to further ease out the interview situation. Participants were instructed to jot down or draw the key moments and course experiences. This task was not used for the purposes of research. Interview duration ranged from 50 to 74 min.

Data analysis

We conducted a narrative analysis which provides a sense of what an individual's world is like through rich detail about how the actual life events have evolved. Narrative approaches enable us to discover individuals' experiences, actions and relationships with their environments. Narrative analysis consists of organising, synthesising and developing data into a coherent story (Polkinghorne, 1995). We followed the concept

Table 1. The participants.

Name	Disability status
Puro	Dyslexia
Kuisma	Dyslexia
Jalava	Dyslexia, self-reported ADD

of narrative analysis by Polkinghorne (1995, 2007) in constructing the first-person accounts, which consists of descriptions of (1) the context and setting (e.g., learning environments); (2) the person's attributes (e.g., learning disabilities); (3) people meaningful to the individual; (4) personal choices, interests, motivations and goals to achieve outcomes in a particular setting; and (5) the impact of meaningful events on the individual. Once these descriptions are coded from the data, generating the final coherent story using coded data extracts takes place. Finally, major themes in the stories are identified and interpreted (Polkinghorne, 2007).

First, the interviews were transcribed verbatim and anonymised. Each interview was coded and analysed to create three individual stories using the Atlas.ti 8 software. The research question was initially used in identifying the narrative extracts (sentences and paragraphs). This was followed by further coding the narrative descriptions (1–5). The stories were constructed by selecting coded data extracts that described the main idea of each narrative (e.g., meaningful people, events and personal attributes related to learning difficulties, personal interests and achievements). Furthermore, to create a coherent story, some words and phrases were added to improve readability. Finally, we conducted an interpretative analysis (Polkinghorne, 2007, p. 483) to identify and understand the patterns of belonging by contrasting each participant story to the dimensions of belonging.

To ensure trustworthiness, researcher triangulation (Patton, 2015) was used throughout the analysis. First, the author who initially analysed the data frequently discussed the coding process with the co-author. Second, the authors had three official data validation meetings at which the codes, the data extracts for each description and the constructed stories based on the data extracts were discussed and interpreted until consensus was reached. Finally, each completed story was approved by both authors. The Atlas.ti 8 software aided the systematic narrative analysis, as the assigned codes were constantly assessed in relation to other coded extracts, as well as the entire data set.

Findings and discussion

Here, we present each students' narrative, followed by the interpretation and discussion of the story (Polkinghorne, 2007; Riessman, 2008). The four dimensions of belonging were present in all stories, while each story had its unique emphasis.

Puro

Puro's narrative centred around the dimension of *affect*, as Puro's experiences reflected strong emotions of shame and embarrassment:

My university studying hasn't gone exactly as I would have liked. I had a small collapse in self-esteem at the beginning of my studies. Maybe I was not as good at mathematics as I thought. It was nice to be at the lectures, but the exams didn't go well. Overall, the first year was really difficult. I was directed to go to small group sessions where students do mathematical tasks together. You don't want to ask questions during the mass lectures, nor in these counting groups. Those are oppressive because the atmosphere is not such that one could ask questions. Despite the feeling of shame, I still tried to ask for help. I didn't get any individualized support or anything. I would have needed that. For example, if there

is an exam week, I can do the calculation tasks, but then I don't have time to read that much. I've received some support, but I've had to ask how this support is organized; for example, to obtain a separate quiet space for each exam. But I also thought that if I had the extra time I was in the same lecture hall with other students, and everyone else would leave the exam, and I stayed there, it would be embarrassing. I wouldn't like to draw attention. My support needs have not really been considered. I have had the same requirements as everyone else. It would be much nicer if I could explain about my support needs at the beginning of my studies and then support would be ongoing. On the other hand, it was also easy to talk to a few teachers and they could really help. One teacher even helped me how to read academic literature, and how to write maths. Those few teachers also had really clear and understandable lectures. I was also able to ask those few for advice after teaching. I have also done maths tasks with other students in small group sessions, during one course. It generally supported my studying in university. In the groups, it didn't feel so embarrassing to ask if everyone else asked for help, too.

Puro did not want to cause hassle with their dyslexia, connecting with earlier literature concerning assimilation (Yuval-Davis, 2006). Learning environments played a key role in how they were connected with both positive and negative experiences of belonging. Puro's belonging was thus largely affected by *place*; for instance, oppressive small group sessions, and warm socialising with teachers and tutors play a major role in their belonging. Mathematical abilities were connected with Puro's belonging, as access to the mathematics community was regulated through this abledness; an important disciplinary nuance of belonging in the mathematics context (Lahdenperä & Nieminen, 2020; Solomon, 2007). In fact, this is ableism in practice. Therefore, for Puro, acquiring studying skills to achieve in studies offers a pathway for belonging to the university community. Similarly, the lack of support, and continuous support more particularly, in terms of learning, affected Puro's sense of belonging. Puro needed more time with studying than friends did: this determined Puro's *social relationships*. However, the open learning space (Rämö et al., 2019) offered Puro an opportunity to be treated inclusively just like everyone else (cf. Nieminen & Pesonen, 2020). As Puro noted, every student has the same requirements; however, Puro's narrative showed many dividing practices in action that divided Puro from other students. The *politics* of belonging was seen as only some students needing to confront *hassle* in order to access support and adjustments. Assessment was the clearest dividing practice, as Puro had to disclose their disabilities separately for every teacher to access support. Also, Puro's experience of extra time in exams, and how the exam situation rendered Puro's abnormality visible for normal students, highlighted how teaching practices produced non-belonging (Nieminen, 2020).

Kuisma

Kuisma's narrative emphasised the role of the first university year for their sense of belonging:

The first year of university was really difficult. The courses were quite intensive. I failed for the first time in my life. I questioned if the university is the right place for me. It was hard to understand study contents at such a fast pace. I would have needed more time. It was a shocking start to my studying. In one course I liked that there were many small assignments and you got instant feedback. You were at the same table with the other students, and they had the same difficulties with the maths tasks. There was peer support and got help from the

small group instructor, too. Then there was this good maths course. There was a relaxed atmosphere, as usually during lectures the lecturers ask if everyone understands, and if it is quiet, then the teacher just continues. It was so teacher-led. But there is this one lecturer who always asks if we understood everything. If we didn't, the teacher started to go over the topic again. We also recapped the maths basics a lot. That teacher had a good attitude. The courses taught by doctoral students were good. I felt that they could better relate to students, which is apparent in the understandable way they taught. Of course, there were these more traditional courses, in which you were yelled at, if you went to do a maths calculation on the chalkboard, and it wasn't correct. It was almost distressing. The university really could be more active in trying to provide support, because if there are difficulties, it is not easy for all students to bring their issues forward. The support should be pushed for us a lot more. Because of my dyslexia, there's something wrong with me, my brain works differently, which causes that I'm not good enough. It's not that I'm lazy.

Kuisma thought that they would have needed more time and proactive support. These accounts highlight systemic issues beyond learning environments and question the role individual university courses could have while supporting disabled students (see García-González et al., 2020; Leake & Stodden, 2014). However, *affective* experiences of *social relationships* within learning environments framed Kuisma's narrative, as both negative ('I was yelled at') and positive (e.g., warm and relatable teaching practices) experiences had greatly contributed to Kuisma's sense of belonging when they were studying. Similar to Puro, Kuisma depicted their abilities to regulate their belonging, as their 'first failure ever' in an exam resulted in Kuisma questioning whether they were in the right place. Again, we note that this is a manifestation of ableism which might be stronger in the contexts of STEM where 'right or wrong' epistemologies of knowledge, and thus one-dimensional understanding of abledness prevail (Lahdenperä & Nieminen, 2020; Solomon, 2007). The open learning space (Rämö et al., 2019) played a role in Kuisma's narrative, as Kuisma was able to use the space for both learning and socialisation, which echoes the earlier literature on Flipped Learning and other active methods for the belonging of disabled students (e.g., Thomas, 2016).

Kuisma's dyslexia led to distancing from other students based on there being something *wrong* in Kuisma (*politics*). Thus, Kuisma's narrative confirms earlier findings of the importance of safe environments (Kubiak, 2017) and humanised teaching practices (Moriña, 2020) in the mathematics context as well. Kuisma's 'different kind of brain' enabled Kuisma to understand that they were not 'lazy' but neurologically different. Yet, as seen in Kuisma's narrative, these differences were only rendered abnormal through teaching practices. The open learning space (*place*) provided an inclusive space where Kuisma could 'study at the table with other students' (cf. Puro's narrative). Yet overall, teaching practices were not able to disrupt Kuisma's perception as being flawed and different. The way the issues concerning inaccessible learning environments were internalised by Kuisma to concern their neurological, individual flaws, represents academic ableism in practice (cf. Dolmage, 2017; Nieminen, 2020, 2021).

Jalava

Jalava's narrative emphasised the role of inaccessible teaching and assessment practices for belonging:

In the first year of university, I lived in that classroom where you can do maths calculations. I was there almost always until 8 PM. Because of my dyslexia I don't really have free time as I spend so much time doing homework. Many of my friends have said that I always have so much school stuff. I read everything so slowly. I've received extra time for my exams, but I can't be bothered to ask for extra time for each exam separately. But I have to. Otherwise, I am not able to complete them. Many exams I have not been able to complete, even if I had that extra time. If it's an easy topic then I might survive in the normal time frame. But often no one is able to beat me for being slow. During the first year at university, I dreaded going to the chalkboard to show a maths calculation. It resulted in a fear of performing in front of other people. I can't stand in front of an unknown group of people. I was terribly afraid of that chalkboard. I never did the homework so then I didn't have to go to show it in front of everyone. I've always been anxious about performing, even though it's a nice feeling after, that I won over this! Get confidence. I hope that there wouldn't be such demand for being in front of others. And there could be fewer tasks, as it takes such a long time for me to do them at home. Being slow in completing assignments doesn't go away. I'd appreciate some support, as sometimes you go at the expense of your health, you don't have time to exercise, sleep, eat ... Everything suffers at that point. I've also experienced shame in the mass lecture hall for an exam. I had extra time, but I was not in a separate classroom, but I was there with others, and the teacher said that the ones who are entitled to extra-time, stay in your seat, and the others can go. I'd need to process my thinking out loud. It's not possible work in the big lecture hall. It's also extremely difficult for me to get things on the paper briefly. Even though I've always liked maths, sometimes there is a feeling of despair. Lectures are full of formulas, clutter. The characters jump when I try to read them. Also, I don't participate in group work. It's pointless that the others have to wait as I am so slow. For me, it's a relief that I can do things in my own style. In my own peace. I've also been thinking that I have ADD: I get lost in my own world very often. So really the courses could have alternative ways to do them, but if there is any reduced amount of work, many others will take it. This is hard for me, as I am such a special case that you can't plan courses for me. Fortunately, there's one teacher who I dare to talk about these support needs, as for some reason I'm always a little anxious about everything and everyone.

Jalava did feel lonely and constantly referred to friends during the interview. Still, we analysed multiple occasions of exclusion. Similar to Puro's narrative, Jalava understood their slower pace in learning and studying as a defining feature for their belonging, which radiated to all the four dimensions of belonging: 'No one can beat me in slowness!' Inability to complete tasks at the same pace as their peers was something deeply *affective* and embodied in Jalava's narrative, connected with many issues such as physical health and *social relationships*. This was further connected to Jalava's abnormality, as they referred to themselves as a 'special case' (*politics*). What had caused this situation, this specialty? Assessment situations placed Jalava in the group of abnormal students (cf. Nieminen, 2020; Tremain, 2017). Thus, Jalava's narrative sheds light on the inaccessible premises of exams, as they produce abnormality and exclusion. Jalava describes shame and embarrassment about their condition (cf. Puro), and explained about benefiting from studying alone. Jalava pondered whether they might have ADD, as they referred to inaccessible teaching practices. This finding supplements earlier research by noting that in order to support the belonging of disabled students, the learning environments need to be physically accessible (*place*; Moriña & Morgado, 2018). These places included classrooms and chalkboards with 'jumping characters'. We identified the inaccessible learning environments as key dividing practices, as they demanded that Jalava draw on scientific, expert language ('it might be ADD') to distinguish themselves from other

students. While disability identities should be celebrated in their own right, there is a risk of exclusion if disabled students are only offered predetermined and often stigmatised concepts and categories to understand themselves scientifically (Nieminen & Pesonen, 2020; Tremain, 2017).

Limitations and implications for research

Future studies should consider disabilities beyond dyslexia. Our data consisted of single interviews; multiple interviews with additional datasets (e.g., documents) would have supplemented the narrative approach (Moriña & Morgado, 2018; Riessman, 2008). Future studies could analyse students' narratives in relation to policy documents, teacher perspectives and other students. Another major limitation is that our analysis did not draw on participatory approaches. One should note the politics of our choice to restrict students from the research process while interpreting our findings. Our study was conducted in Finland, and in the mathematics context in particular. Future studies could bring forth the disciplinary nuances of belonging in various contexts. Finally, research could focus on the affordances of technology to support belonging, especially in digital settings (Gravett & Ajjawi, 2021).

Conclusion: the politics of the quest for belonging

We have shown that through learning environment design, the ethical quest to promote inclusion becomes a project any teacher can take part in. In line with earlier studies (Camacho et al., 2017; Levin et al., 2019), we call for participatory and active learning environments to support the belonging of disabled students, especially in the context of STEM in which pedagogies of care (Motta & Bennett, 2018) might need to take alternative forms amidst large class sizes and fixed, one-dimensional ideas of knowledge and abilities (Lahdenperä & Nieminen, 2020; Solomon, 2007). We emphasise the importance of *preventing exclusion* through learning environment design, rather than only supporting belonging: These are different yet intertwined processes. While all the students preferred to study alone (non-belonging; Healy, 2020), inaccessible learning environments caused exclusion through various dividing practices (un-belonging). Thus, designing out exclusionary practices (e.g., exams) needs to be seen in the core of 'design for belonging'.

Situating our study in the recent socio-political uprise in HE (Pesonen et al., 2020) and in STEM research (Adiredja & Andrews-Larson, 2017), we note that fostering disabled students' belonging is not possible merely through pedagogical practices. Instead, *political* actions are needed to challenge systemic ableism, as belonging of marginalized student groups is never just 'complex' or 'situated' (see Gravett & Ajjawi, 2021) but inherently political. Thus, inclusive learning environment design cannot be a responsibility of individual teachers practicing 'pedagogies of care', as structural ableism needs to be challenged through systemic solutions from HE institutions (see Puro's story about helpful, individual teachers). The quest to support belonging (and to prevent un-belonging) through learning environment design shifts our gaze from overcoming individuals' disabilities to redesigning the ableist structures of HE: Inclusive learning environments need to challenge the dominant ableist discourses (Slee, 2019). This calls for a radical

restructuring of learning environments, of which the inclusive learning space (Rämö et al., 2019) in our study has been an example of. While waiting for such radical changes, it might be more desirable – and safer – for disabled students *not* to belong to the learning environments. In our study, Jalava had exactly made this decision. Socio-political approaches to belonging are crucial in the times of massified HE institutions that see an increasing number of disabled students while strongly holding on to their ableist accommodation models that try to fix disabled students, not ableist structures (Dolmage, 2017; Nieminen, 2021). The socio-political project to include disabled students in HE then becomes a project of reimagination that requires us to critically examine the actions of teachers, researchers and indeed higher education institutions – inclusion work is directed to ourselves, not to our students (Allan, 2015). What is needed to start such a quest is a *desire*. And, ‘since we can never fully satisfy desire, the ethical project of inclusion will remain a *work in progress*’ (Allan, 2015, p. 293; original emphasis).

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