

Inclusive Science Teaching: Designing a Workshop for University Teachers

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Abstract

This paper details the process of designing a professional development workshop on inclusive science teaching for university teachers. To deepen participants' understanding of inclusion in science teaching and to promote reflection and action, we developed a two-session workshop that was context-specific, used conceptual vocabulary purposefully, and encouraged teachers to take action in their own context. We share the practical and theoretical considerations of designing a workshop that was rooted in our specific context, our varied pedagogical approach, and reflections on design and pedagogy. We hope that these examples and principles will be of use for designers seeking to work on justice and belonging in other contexts.

Amina used to be a physicist. She did a physics bachelor's in Turkey, did her master's and PhD in the USA, and was a lecturer in the Netherlands for four years. Then she quit. The reason for ending her physics journey was an accumulation of experiences of exclusion and a lack of sense of belonging. During her studies there were hardly any female students or teachers. Later she was often asked: "How come you study physics if you are Muslim? Aren't physicists atheists?" These are just two examples to explain why she felt she did not belong to the physics community despite her passion for the discipline. Quitting was not only a personal drama but also a loss of a role model for female, Muslim and people of colour interested in physics.

(summary of a case described by Avraamidou, 2020a, 2021)

Problem Statement

The need to make science education more inclusive is globally acknowledged as urgent. Inclusion is a topic of conversation, with the word echoing through policy, news articles, staff and student meetings, data on drop-out and graduation rates, research metrics, and questions around the past and future of science. In tertiary education, projects centered around an aim of equitable opportunities and inclusion in education are increasingly ubiquitous (e.g., equity, diversity, and inclusion committees; programs for first-generation

students; tools and focus groups to examine experiences such as belonging). The quantity of actions going on indicates that this is an urgent and widespread need; however, “inclusion” also runs the risk of becoming a blanket term for an intention to correct inequalities in how persons in marginalized categories are treated at the university. Such overuse of a term can disconnect it from meaningful action and obscure ongoing issues.

Research indicates that the university is a non-neutral space where students who are not part of the group that is perceived as the ideal student can easily feel excluded ([Rendón, 1994](#); [Smith, 2014](#)). Within the science faculty, the experiences of university students who belong to any minority group are different to those of the white, male majority-group students. Students report feeling excluded, from experiences of explicit racism, sexism, and ableism to more subtle discrimination and bias ([Avraamidou, 2020a](#); [2020b](#); [Dancy et al., 2020](#); [Danielsson, 2012](#); [Hurtado et al., 2009](#); [Williams & Johnson, 2011](#); [Kricorian et al., 2020](#); [van der Molen, 2020](#); [Rainey et al., 2019](#); [Stinken-Rösner et al., 2020](#)). The international prevalence of this practice of exclusion is reflected in lower enrolment rates, and even lower graduation, employment, and promotion rates, resulting in a more homogenous science workforce and student body, and continuing the cycle ([Fox et al., 2017](#); [Hill et al., 2010](#); [Korpershoek et al., 2013](#); [van den Brink, 2010](#); [van den Hurk et al., 2019](#)).

Research also indicates that teachers are a key part of the solution, as important actors who can have a real effect on inclusion in education ([hooks, 2003](#); [Hurtado et al., 2015](#); [Ladson-Billings, 1995](#); [Rendón, 1994](#)). Within our university’s science faculty, the only current initiatives supporting university teachers in inclusion in their teaching are those developed by individual teachers themselves. We wanted to develop a project in this space to connect people and start a conversation. This paper details the design considerations of a professional development workshop that we developed to improve participating university teachers’ understanding of inclusion in science teaching, how and why exclusion can occur in science education in our national context (the Netherlands), and then stimulate teachers to embark on the process of making their own teaching more inclusive. We hope that interested readers will find the way in which we tailored the workshop to our specific context useful for designing professional development workshops on EDI topics for their own specific contexts.

The Conceptual Landscape of Inclusion and Exclusion

In saying education needs to be more inclusive, we define *inclusion* very simply as an authentic feeling of belonging in the classroom ([Autar, 2017](#); [Hurtado et al., 2015](#); [Rendón, 1994](#)). In education, this authentic sense of belonging facilitates and enhances learning experiences and outcomes ([Kennedy et al., 2023](#); [Meeuwisse et al., 2010](#); [Porter et al., 2021](#)), while lacking a sense of belonging hinders learning and negatively affects one’s mental health and self-worth ([Allen & Kern, 2017](#); [hooks, 2003](#); [St-Armand et al., 2017](#)). In saying that education needs to be more inclusive, we are defining inclusion in opposition to exclusion, the experience of having this feeling of belonging taken away. These terms are dialectical ([Hilt, 2015](#)), which in practice means that working towards inclusion makes no sense if you do not understand and explicitly communicate the manifestations of exclusion you want to work against. In saying education needs to be more inclusive, we specifically mean that the university should be an environment where there are words for communicating experiences of exclusion, and structures and support for learning from these together, in order to make more people feel more included.

We also highlight that universities are currently experienced by many as an exclusive environment, which runs counter to the underlying aim of education. We can trace this exclusion back to constructs of Other and processes of othering that work through and within institutions such as universities ([Ahmed, 2007](#); [Fanon, 1986](#); [hooks, 2003](#); [Mignolo, 2014](#); [Spivak, 1985](#)). Experiences of exclusion can be due to the actions or words of another person, resources or materials present in a given space, or something else entirely ([Ferdman, 2013](#)). These can exclude on purpose, but also accidentally or subtly, such as jokes that rely on negative stereotypes ([Ogunyemi et al., 2020](#); [Sue, 2010](#)), or resources that only depict a certain cultural perspective ([Bang & Medin, 2010](#); [Hurtado et al., 2009](#); [Miller et al., 2015](#)). Both inclusion and exclusion describe subjective, personal experiences ([Ferdman, 2013](#)), and these subjective experiences are better placed on a spectrum of “more inclusive” or “less inclusive”, rather than a binary. A person’s sense of belonging can fluctuate in the short term, yet also sum to a longer-term sense of being included or excluded in a given context ([Papaikonomou & Bouchallikht, 2023](#)).

Though we have been drawing on international literature to describe the manifestations and effects of exclusion, and oppression in general, exclusion is also contextual ([Ahmed, 2007](#); [Rozas, 2007](#)). Exclusion is a relative term that implies a context: exclusion occurs in a particular space at a particular time ([Millar, 2007](#); [Tsakloglou & Papadopoulos, 2002](#)). Though processes of exclusion may be similar, the people who feel excluded and the ways in which they are made to feel excluded do differ in different contexts ([Millar, 2007](#); [Wodak, 2007](#)). Migrants in the US tell stories of “racialisation”, being ascribed to clearly arbitrary categories in a new country, and experiencing exclusion as a consequence ([Gnanadass et al., 2021](#)). In the Netherlands, what is known as “migration status” is formally defined, or constructed, by the Central Bureau of Statistics. Even Dutch-born children are classified as “second-generation migrants”, and until recently, categories of “Western” and “non-Western” were official terms that are also used informally, structuring the way people see themselves and others ([Bovens et al., 2016](#); [Essed & Trienekens, 2008](#); [van Schie et al., 2023](#)). When we consider exclusion in education, both experiences of and the discourse around exclusion in society are important considerations for our design context, as systemic exclusion also manifests in the classroom ([Kennedy & Melfor, 2021](#); [Merolla & Jackson, 2019](#); [Tielman et al., 2021](#)). To design for educational inclusion (cf. [Merry, 2019](#)), we therefore need to examine how exclusion manifests and functions in our specific context. In the following sections, we discuss exclusion in the Netherlands as a whole, and within our university’s science faculty in particular.

Processes of Exclusion in the Netherlands

A complete overview of exclusion in the Netherlands is beyond the scope of this paper, but we wish to give readers without knowledge of our context a brief overview of current concerns. The Netherlands enjoys a stellar international reputation for tolerance, equality, and individual freedom, with an excellent track record on gay marriage and high ranking on the gender inequality index, for example. However, this international and internal reputation can also be seen as contributing to a lack of interest in interrogating how the Netherlands has a history of perpetrating harm to its minorities ([Essed, 1991](#); [Hurenkamp et al., 2012](#); [Wekker, 2016](#)). Recent evidence in fact indicates that systemic exclusion is caused by actors and structures in the Netherlands. For example, a 2019 report by the European Commission on Racism and Intolerance found that in the Netherlands, “the mainstream political discourse and media reporting continue to be strongly influenced by a xenophobic, fear-fueling rhetoric and politicians have openly expressed racist beliefs of

biological superiority” (ECRI, 2019). To highlight racism as an example, recent scandals provide examples of this systemic racism in the police, the tax institution, and universities (Autoriteit Persoonsgegevens, 2021; Eftting, 2022; Soudagar, 2022b). Racial exclusion exists, and seems deeply ingrained, as “Dutchness” is easily conflated with “whiteness” (Essed & Trienekens, 2008).

Furthermore, the effects of this systemic discrimination in the Netherlands are compounded by a lack of shared discourse with which to recognize and interrogate it. In fact, Essed and Hoving (2014) characterise this typical attitude as “the anxious Dutch *claim of innocence*: disavowal and denial of racism [that] may merge into what we have called *smug ignorance*” (p. 24). The Dutch privileging of tolerance but denial of racism is part of the paradox Wekker (2016) outlines, explaining how denying the existence of racism, despite evidence to the contrary, simply enables the discrimination it professes to preclude. Furthermore, if the Dutch are frequently blind to systemic racism, the way in which discrimination and exclusion is intersectional is even less well understood. The concept of privilege as existing on multiple, intersecting axes is an important part of the discourse around systemic exclusion (Cho et al., 2013). In the Netherlands, this idea of privilege has only recently gained some national attention, following the publication of a book by a journalist who identifies as a white male (Luyendijk, 2022). In a repackaging of work by predominantly black female scholars, he explains just how he has been afforded privilege on every possible axis (Remarque, 2022; Soudagar, 2022a). The book has attracted both criticism and praise; but, as it did not lead to any great interrogation of how privilege functions within Dutch society, smug ignorance can still be seen as the order of the day.

Exclusion, then, occurs systemically, and is supported by a general ignorance towards manifestations of this exclusion, as well as a lack of vocabulary with which to communicate experiences of exclusion. We highlight racism here, as a particularly charged topic in the Netherlands, the effects of which in the classroom are attracting increased media attention as we write (e.g., Bracke, 2023; Ramdjan, 2023). Overall, it is the effect that the Dutch self-image of a tolerant nation has on processes of exclusion that we take as most important for our design approach.

Experiences of Exclusion in Science Education

Given the difficulties of communicating experiences of exclusion that Dutch research literature highlights, we turn once again to a combination of Dutch and international literature to examine how students might feel excluded in tertiary contexts, and the role university teachers can play in preventing this. International literature indicates that students who may be marginalised due to identity characteristics such as their social class, religion, gender performance and ethnic status, among others, can experience exclusion in the university (Avraamidou, 2020a; Dancy et al., 2020; Kricorian et al., 2020; Rainey et al., 2019; Verbree et al., 2023). Within the field of science, the idea that the curriculum and learning resources students are exposed to can exclude certain students is gaining popularity (Avraamidou, 2020b; Bang & Medin, 2010; Hurtado et al., 2009; Miller et al., 2015). However, students can also experience exclusion at an interpersonal level. In communication with other students or with teachers, students can be subject to micro-aggressions, which are everyday, brief, low-intensity events of exclusion (Ogunyemi et al., 2020; Sue et al., 2007). Research on micro-aggressions highlights how the unintentional harm caused by comments such as “No, where are you really from?” or “You speak Dutch really well!” affects mental health through exacerbating feelings of invisibility and frustration (Ogunyemi et al., 2020; Sue & Spanierman, 2020). The micro-invalidation of

framing such statements as “jokes” leads to students feeling excluded and even unsafe in the learning environment ([Autar, 2017](#); [Verbree et al., 2023](#)). However, research on micro-aggressions also underscores the importance of the role of university teachers in creating inclusive classrooms ([hooks, 2003](#); [Hurtado et al., 2015](#); [Ladson-Billings, 1995](#); [Rendón, 1994](#); [Sue & Spanierman, 2020](#)). The authority a teacher has over behavioural norms in a classroom, which they may not have over all aspects of the curriculum or classroom structure and organisation, means that a teacher can both model and enforce behaviour that fosters a sense of belonging in students ([Hurtado et al., 2015](#); [Ladson-Billings, 1995](#)).

The disciplinary context of science also affects how students might experience exclusion. Broadly speaking, this group of disciplines is positioned as objective and neutral in contrast to their humanities counterpart ([Adams & Weinstein, 2020](#); [Smith et al., 2022](#)). A consequent desire within science classrooms to remain “neutral, judgement-free and apolitical” ([Smith et al., 2022, p. 638](#)) can make it hard to acknowledge subjective experiences of not being taken seriously as a member of the science community, such as the experiences Amina describes at the beginning of this article ([Avraamidou, 2020a](#)). Across fields, the literature highlights how complex it is to collect data on micro-aggressions and similar subjective experiences of exclusion in general ([Sue & Spanierman, 2020](#)). Students in the Netherlands describe approaching making a comment or complaint about interpersonal experiences of exclusion with caution ([Autar, 2017](#); [Essed & Hoving, 2014](#); [Verbree et al., 2023](#)). A feeling that their complaints will not be validated can contribute to a sense that it is pointless to even mention experiences of exclusion ([Essed & Hoving, 2014](#); [Ogunyemi et al., 2020](#)), meaning that the frequency of an experience is often not represented in data on complaints. There is a lack of data on just how common experiences of interpersonal exclusion are for tertiary science students in the Netherlands, but we can conclude that it is easy in the sciences to be blind to exclusion. If we are to develop diverse science spaces ([Powell, 2018](#)), these barriers within science and structural inequalities within the Netherlands need to be recognised ([Smith et al., 2022](#)), and teachers need to be empowered to support inclusion in the classroom, especially at the level of interpersonal communication ([Autar, 2017](#); [hooks, 2003](#); [Hurtado et al., 2015](#); [Ladson-Billings, 1995](#); [Rendón, 1994](#)). This leads us to professional development as a first step in a lengthy process. This is a complex issue, and effective solutions need to be multi-faceted, but we think that a professional development workshop is a good way to achieve our preliminary aims: give university teachers who are interested in inclusion the time, space, tools, and opportunities to connect.

Inclusion and Professional Development

Concepts can be found within educational literature that characterise successful social justice education, providing designers with ideas about what to aim for. First, successful professional development workshops on EDI topics should cover challenging content in a way that connects to participants’ own lives, using real-life and context-specific examples and case studies ([Laur, 2013](#); [Rule, 2006](#)). Participants should be able to bring in and reflect on their own experiences in relation to examples given ([Milem, Chang & Antonio, 2005](#)). Second, this needs to occur in an atmosphere in which facilitators and participants feel safe and supported ([Arao & Clemens, 2013](#)). For participants to feel comfortable sharing experiences and co-creating knowledge, the literature indicates that learning experiences need to occur within a safe environment of trust, openness and vulnerability ([Sensoy & DiAngelo, 2014](#); [Schuck et al., 2008](#); [Vanderlinde et al., 2017](#); [Zembylas, 2015](#)). Third, pedagogical approaches that focus on discussions and peer work can support this. The literature suggests active learning ([Mayhew & Fernández, 2007](#); [Nagda et al., 2003](#); [Wright, 2015](#)), and learning from peers ([Griffin & Ouellett, 2007](#)) with novel discussion

formats (see [Bell et al., 2016](#); [Zúñiga et al., 2007](#)) to create an atmosphere of genuine collaboration. Facilitators can use approaches such as critical friendships ([Parkhouse et al., 2019](#)) in which participants can share their experiences and learn from each other ([Fink et al., 2020](#); [Parkhouse et al., 2019](#)). Fourth, topics should not be oversimplified ([Adams, 2016](#)), and conceptual frameworks and vocabulary are an important facet of this, as these can help participants to recognise the validity of subjective experiences, discuss them calmly, and take action ([Hartwell et al., 2017](#)). Finally, participants also need to be given time, space and support to reflect in order to translate content and ideas into action ([Bensimon, 2004](#); [Bianchini et al., 2002](#); [Fink et al., 2020](#)).

However, the literature also highlights that supporting tertiary teachers to make their teaching more inclusive through professional development also represents a considerable design challenge. We propose that there are two main reasons for this: first, the variety of prior knowledge, experiences, and openness to inclusive teaching among tertiary science teachers in the Netherlands makes tailoring content and approaches to participants' needs difficult ([Forscher et al., 2019](#); [Lindsey et al., 2019](#); [McDonald & Zeichner, 2009](#)). Second, a workshop on making one's teaching more inclusive involves personal and potentially upsetting content, both for those who have experienced exclusion and those who have not ([Arao & Clemens, 2013](#); [Cortez & Preiss, 2013](#)). This potential discomfort and emotions are challenging for facilitators to safely support. Though the literature provides useful ideas to consider when designing professional development workshops for social justice education, these feel less concrete, and more like broad guidelines—an observation often made in design research ([diSessa & Cobb, 2004](#)). When we attempted to make concrete design decisions based on these ideas, we saw tensions in this literature that we initially did not know how to resolve at a design level. For example, we needed to give time and space to covering complex content and not over-simplifying, but also give time and space to developing the relationships between participants that would enable them to trust and learn from each other. In shooting for the moon, as the literature seems to advise, we were worried that we would not succeed on any of the above points. The short timeframe of a one-off workshop is here a key design challenge, a limitation that can render the lofty aims of EDI education unachievable ([Chang et al., 2019](#)). As a consequence, most attempts to objectively measure the success of EDI education conclude that no positive effect can be detected, and negative effects are more commonly detected than positive ones ([Forscher et al., 2019](#); [Legault et al., 2011](#); [Lindsey et al., 2019](#); [Newkirk, 2019](#)). When positive effects are detected, these are the results of long-term, ongoing relationships ([Reinholz et al., 2023](#)).

Taken together, the literature indicates that experiences of exclusion are more common in our context than many might like to admit, and that opening university teachers' eyes to ways in which they can support inclusion in their own classrooms is a lengthy, ongoing process. In response, we frame our workshop as the start of a conversation, a learning experience for all involved. In designing and running a one-off workshop, we can test content and pedagogy, reflect on and learn from the experience, as well as deepening our understanding of how exclusion works in our context. In the following section of this paper, we explain how we took this literature and developed a workshop on inclusive science teaching, leading to concrete advice for fellow designers within their own contexts.

Inclusive Science Teaching Workshop

Institutional Setting

In its prior attempts to promote diversity and inclusion, Utrecht University's Faculty of Science had focused only on gender, and on staff recruitment in particular. For example, an equity, diversity, and inclusion (EDI) committee was established in 2014, but the committee's efforts focussed primarily on gender in staff recruitment. As outlined above, we proposed to design a workshop for teaching staff in the science faculty, which was granted one year of funding (2021–2022) by the university's Stimulation Fund for Education, and then a second year of funding (2022–2023).

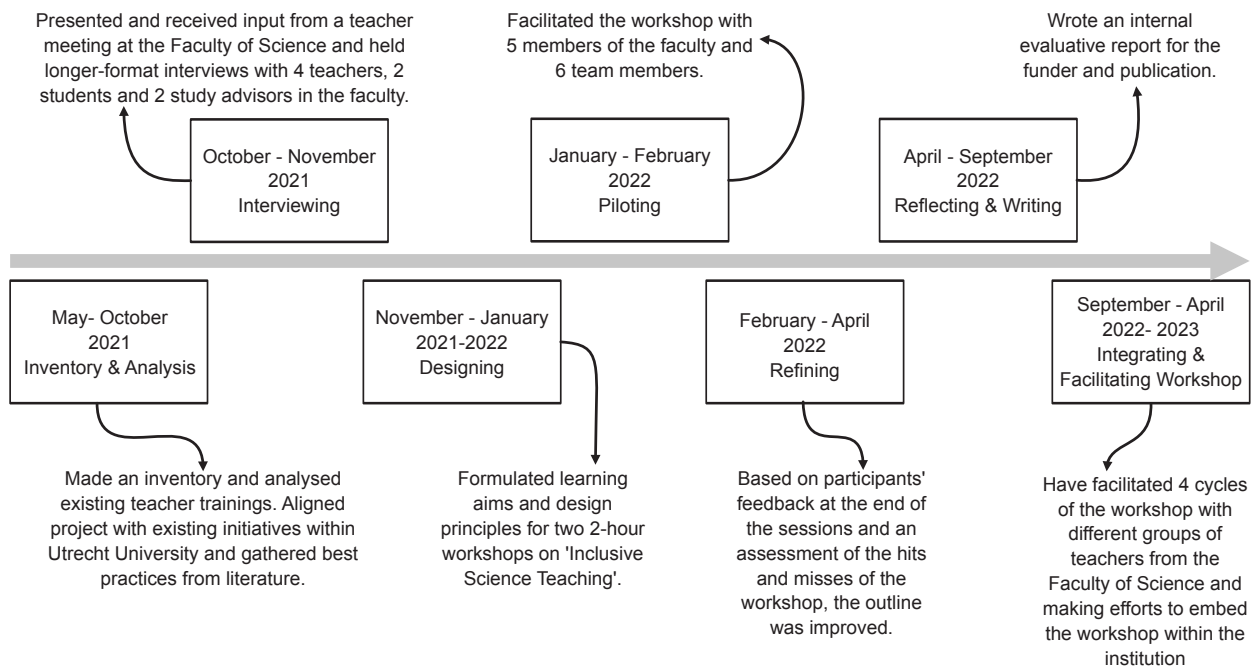
Team

The team was comprised of associate and assistant professors, a project coordinator, an education and research officer, an educational consultant, and student assistants (7 members in total). As a team, we read relevant literature but also exchanged personal experiences, which were diverse in line with our differences in gender, age, nationality, first- or second-generation migration background, religion, skin colour, physical ability, disciplinary background (arts, biology, education, history and philosophy of science, mathematics), academic position, and so on. Workshop sessions were initially facilitated by student assistants or junior researchers with more senior team members present as participants and discussion moderators. Later sessions were cofacilitated with senior members.

Process

Our aim was to design a workshop for university teaching staff about student experiences of exclusion. As depicted in the timeline ([Figure 1](#)), we started with a literature review and inventory of existing teacher trainings. From this, we concluded that we needed more information about manifestations of exclusion in our context. We started by presenting our project at teacher meetings in the faculty, and then we conducted interviews about student experiences of exclusion with four teachers from the faculty as well as two students and two study advisors. As we expected from the literature, the topic was uncomfortable at times, and both students and staff were sometimes hesitant to share experiences. Though this cannot be taken as an overview of all student experiences within the faculty, we heard anecdotes of exclusion in the curriculum, in the structure and organisation of the classroom, and predominantly in the form of micro-aggressions in interpersonal communication, with both fellow students and teachers described as perpetrators. Based on our research, we developed a workshop outline, which we piloted and then refined, before launching the workshop in the 2022-2023 academic year.

Figure 1 – Timeline of the workshop design process



Design Approach

Our key aim in this workshop was to provide interested university teachers with ideas about how to start making their own teaching more inclusive. In our take on social justice education, we did not want to simply inform interested individuals about ideas that were relevant to their context, or worse, ideas that were disconnected from their context. Instead, we wanted the workshop to connect ideas around inclusive education to participants' teaching practice. We therefore aimed to provide workshop participants with potentially challenging experiences whose familiarity would motivate participants to question how else they could handle particular situations, and ensure they had the tools to start to do so. Though we worked with learning outcomes, we also used design principles (cf. [Sandoval, 2014](#); see [Appendix A](#)) to capture these key aims. In this paper, we focus on two design principles:

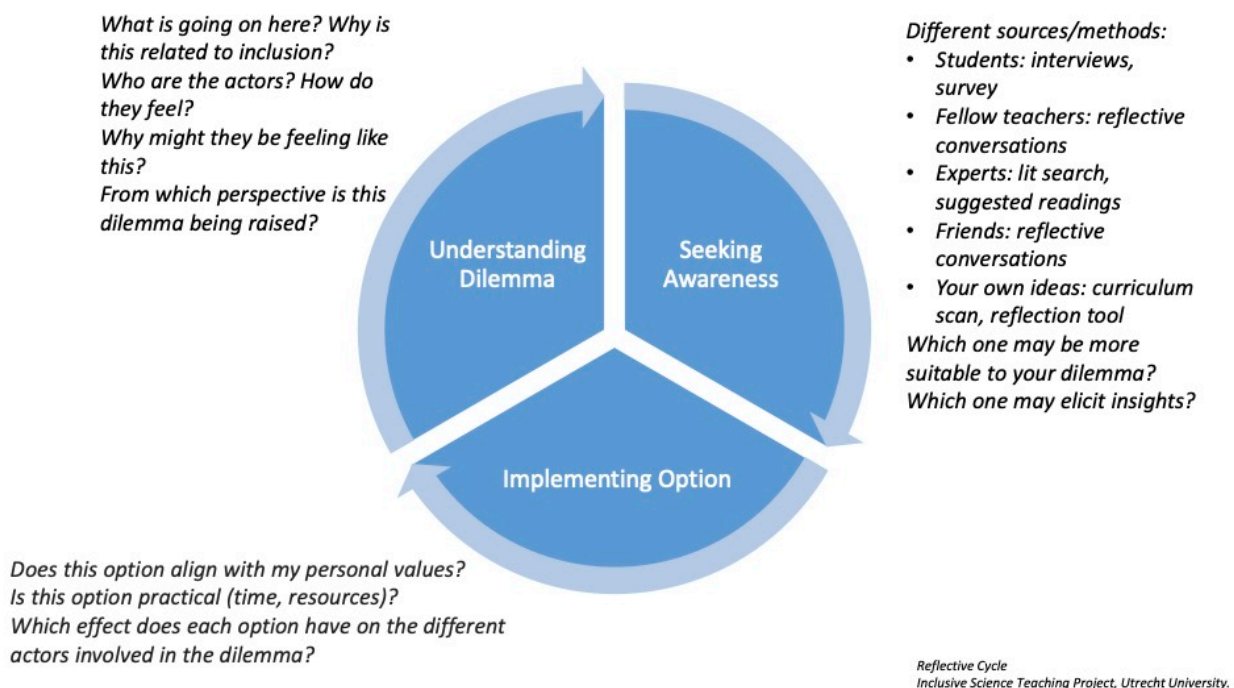
- “Make it real”. Use real examples, apply this to your own context, actually do something with the knowledge, ask hard questions, be honest, share personal things.
- “Vocab for change”. Effecting change by connecting people and giving them the vocabulary to understand experiences they might not have previously, and take this out into the world.

Within the workshop design, we would like to highlight three key aspects of our design approach. Each aspect of the design approach applies at least one design principle. In particular, we discuss applying the design principle of “make it real” with our use of authentic examples and our focus on taking action. We discuss applying the design principle of “vocab for change” with our varied pedagogical approach to theoretical concepts. In the next section of the paper, we give a brief explanation of the workshop structure, followed by a detailed description of our use of authentic examples, our pedagogical approach to concepts, and our incorporation of taking action.

Workshop Structure

The full workshop outline can be found in [Appendix B](#). The two sessions are structured around a reflective cycle we developed to help workshop participants step through making their teaching more inclusive ([Figure 2](#)). In response to the comments that the intended workshop participants wanted concrete information on how to make their teaching more inclusive, we adapted [Gibbs' \(1988\)](#) cycle of learning from experience through reflection to focus on teaching and inclusion (see also [Markkanen et al., 2020](#)). Our aim was to give participants something concrete and actionable, but also clearly state that the correct course of action is always context-dependent. We also hoped that reflection would help participants to *notice* exclusion in their context, which we thought was a key issue. The cycle has been very important in underpinning the design of the workshop and as content in the workshop. In the first session, we focus on understanding experiences of exclusion that you might observe or others might report, describing these as “dilemmas” from the teachers’ perspective. In an “assignment” between the first and second sessions, teachers are supported to seek awareness to better understand the exclusion at play in an exclusion dilemma they have experienced, which culminates in deciding on the best option for action to take, and then, depending on the feasibility, implement this option (see [Figure 2](#)). In the second session, we focus on participants’ experiences with this task, looking ahead to implementing options and taking action, and circling back to understanding dilemmas and more subtle experiences of exclusion that can be harder to recognise. This cycle works in our context, giving teachers concrete steps and the feeling that this is a process that leads to change. It is also useful for discussion moderators to remind participants of the importance of understanding a dilemma and seeking awareness before trying to develop options and taking action, or in other words, reflecting before acting. The cycle is an operationalisation of both “make it real”, with concrete steps, and “vocab for change”, by putting words to the process of experiencing dilemmas, seeking awareness, and reflecting.

Figure 2 – The reflective cycle informing workshop design and content



Authentic Examples

Given the context-specificity of manifestations of exclusion, and the danger of participants disengaging when professional development initiatives do not feel relevant to their context, we wanted our workshop to be tailored to our faculty and university setting. To achieve this, we based the first session around authentic examples of exclusion that students and teachers reported experiencing in our context, which we turned into “dilemmas” that were focused upon pedagogically shaped experiences of exclusion. This is the clearest application of the principle of “make it real” – focussing the workshop on authentic examples instead of theory. Our advice for designers in any context is that though authentic examples can provide meaningful learning experiences, it is important to set aside sufficient time to gather and pedagogically frame them. Essentially, authentic examples are not simple – authentic examples are complex.

Constructing the dilemmas took multiple iterations. Our original aim was to simply gather examples through interviews, but we were unable to gather examples of exclusion that were varied in the sense of areas of education (curriculum, classroom, and communication), identity characteristics (race, gender identity, ethnic background, religion, sexual orientation, neurodiversity, physical ability, parents’ educational level, language ability, as well as the intersection of these), and raised by different actors (students, but also study advisors and colleagues). To achieve the desired variety, we supplemented using examples from relevant literature. Another tactic that took multiple iterations was to change the details to leave it to the imagination of workshop participants which forms of diversity or exclusion were at stake. For example, in one dilemma we eventually described a student as “from a non-dominant background”, which is common terminology in the Netherlands. In the workshop, we gave participants the space to make this dilemma relevant to their context, and then asked them what they had defined as a non-dominant background and discussed why. We piloted several options for this dilemma, some of which specified the student’s ethnicity, but we found that a vague term enabled participants to connect the dilemma to their own experiences, better fitting our principle of making it real. Participants recalled students of different marginalized backgrounds that they had experience of interacting with, bringing the dilemma to life with a form of difference they found important. In turn, these discussions enabled us to gather more information about groups at risk of exclusion within our context, based on participants’ concerns about whom they might not have catered their learning environments to.

Another element that required extra design time was editing the examples to frame them as legitimate and complex dilemmas in the eyes of the actors involved. First, for pedagogical purposes, we wanted dilemmas that did not all rely on a student reporting a problem to a teacher. For example, in the literature and our interviews, we heard stories of students with Autism and ADHD feeling like they were struggling with class dynamics, but not feeling comfortable sharing this with their teachers. When turning this into a dilemma, we felt it was important to subvert any expectation that students need to take responsibility for raising this issue. Instead, we framed this as an issue mentioned in the teacher meeting where study advisors report that students are struggling ([Appendix C](#), dilemma 4). In the workshop, we asked participants to consider how they related to this issue when raised in the teachers’ meeting, and how they might respond differently were this to be raised by a first-year student. Second, we also wanted genuine dilemmas for which there was no clear ‘right answer’: dilemmas in which there was a clear experience of exclusion, but the teacher’s perspective was relatable and not villainised, again making these dilemmas “real”. For example, in an anecdote in which one student was invalidating another’s in-class contributions ([Appendix C](#), dilemma 8), we wanted to complicate the

teacher's attribution of blame in this scenario. We framed this anecdote with the hypothetical detail that the teacher was struggling to get students to contribute, and only one student seemed to be making an effort to participate in class; a white male whom other students felt invalidated by. In the workshop, we asked participants about moments when they might have struggled to engage a class, and linked this to the teacher's emotions in this scenario. As facilitators, we were careful to highlight that there was no simple right answer to these dilemmas, as the correct response to each dilemma will differ depending on the teacher experiencing it.

Finally, we wanted to incorporate these authentic, complex dilemmas into productive, open group discussions in the workshop. The design of this was simple: the longest activity in the first session is a small-group discussion in which two to four workshop participants discuss a dilemma, based on the steps in the reflective cycle, moderated by a facilitator. These discussions are generally productive, with some participants reporting in feedback sessions that they were still thinking about a dilemma they had discussed. However, we are still refining the steps we take to create a space for open discussion within the workshop, for discussion moderators as much as workshop participants. We want these discussions to be a space where teachers can learn and grow, which may mean expressing fundamental misconceptions about the nature of exclusion that they might hold. This has occurred in the small-group discussions. However, we also believe that for teachers with personal experience of exclusion, having to hear and confront these fundamental misconceptions can be tantamount to an experience of emotional or psychological violence, even if the discussion facilitator responds appropriately. In order to include teachers with and without personal experiences of exclusion, we begin the first session with an attempt to collectively define the workshop as a safe space. We are aware of the ways in which a so-called safe space can be anything but ([Wise, 2004](#), cited in [Arao & Clemens, 2013](#)). At the same time, we feel that when the intention is made explicit, participants seem to appreciate it and it eases the atmosphere. The statement we currently use can be found in [Appendix B](#). We state that, though we value freedom of speech, what people say can also hurt (see also [Cairo, 2021](#)). We give participants the option to take a time-out, and conclude by asking participants and facilitators to verbally agree.

To conclude, workshop participants have responded well to our focus on authentic and complex dilemmas. For some participants, these dilemmas stay on their minds – a rare indicator of a meaningful learning experience. In our context, we feel that these dilemmas work because they connect to teachers' genuine care for their students and commitment to making their classrooms more inclusive. We would advise designers to develop dilemmas representative of their own context for social justice education, and caution that these are time-consuming to develop. Authentic examples are complex ones, and will need to be carefully pedagogically framed, and discussed in open and productive formats, to provide meaningful learning experiences, stressing again the importance of our first design principle "make it real".

Pedagogical Approach to Concepts

Given the danger that too much terminology can be overwhelming, inaccessible, and distract from the concrete issues and effects of exclusion, we were deliberate in the theoretical concepts we covered in the workshop. When we used theory, we were conscious of our principle of "vocab for change", only using terminology that we felt people could use, and refining based on participant behaviour. Though we used theory extensively when designing the workshop, we used as few theoretical concepts as possible in the workshop

content, preferring to work with concrete examples. We used a variety of approaches when framing different concepts pedagogically in the workshop, from more to less participatory. Our advice for designers in any context is to focus on the usefulness of theoretical concepts when choosing what to incorporate and how, as the needs of your target audience will determine which concepts you include and how you pedagogically present them.

First, we took an approach of not including theoretical concepts as workshop content unless we thought these were essential. We started the design process asking ourselves if it was possible to do a workshop fully based on authentic examples, in which we never had to lecture participants on the meaning of “inclusion”. Though this proved impossible, we were careful to distinguish between concepts that were important in the design of the workshop, and concepts that were important to present to teachers. An example of a concept that was important in the design of the workshop but not explicitly presented is the distinction between the proactive and reactive sides of making teaching more inclusive. In our interviews, we noticed that teachers were only comfortable talking about what we described as the proactive side, including activities such as pre-planning, doing a curriculum scan, designing assessment to maximise inclusion. When we spoke to students and study advisors, they were able to give examples of exclusion occurring at the level of communication, such as micro-invalidations. We came up with the term reactive to capture this side of inclusivity that we thought was missing: recognising and responding to interpersonal exclusion, acknowledging that jokes and small comments people make towards other can be exclusionary, and that responding to these appropriately as a teacher. These elements form a key part of making a classroom a safe and inclusive space. We used this distinction to structure the workshop, with one session on proactive action and one session on reactive action, but did not refer explicitly to this framework in the workshop itself.

On the other hand, we also included some theoretical concepts as content in later iterations of the workshop. Intersectionality and frequency are two concepts from the literature that are useful for understanding the experiences of exclusion that feature in the dilemmas. As discussion moderators, we noticed that some dilemmas were being discussed as if they were isolated events, and in some dilemmas, participants chose to focus on one aspect of diversity to understand an experience. We thought that presenting these two terms as conceptual content might fulfil our principle of useful conceptual vocabulary. This is firstly to show the complexities of the experiences of actors depicted in each dilemma, provide more context and nuance, and secondly to provide participants with terms that could help them to pin-point relevant mechanisms of exclusion. Once these two terms have been presented, it is the role of the discussion moderators to use these terms in the small-group discussions. Moderators could ask questions that prompt participants to use these terms, such as, do you think this student has experienced a similar situation before but not said anything? Moderators could also model using the terms by asking questions such as, what role do you think frequency might play here? In keeping with the university teachers’ academic background, they responded well to useful terminology, and as moderators we noticed uptake in subsequent discussions.

Second, when we did include concepts, we were careful about how we framed these pedagogically. We used different pedagogical approaches for different theoretical concepts, depending on the level of prior knowledge and openness we detected in workshop participants. As we expected teachers to have some understanding of the terms inclusion and exclusion, we presented these in the first session in a more participatory manner. Though we shared a definition of inclusion as an authentic sense of belonging, as outlined in the introduction of this paper, we also asked participants to share their own

understandings and experiences of both inclusion and exclusion. We discussed literature on the topic, and the discussion covered theoretical ideas and personal experiences, which we felt heightened the sense of participation by levelling the traditional classroom hierarchy. However, we used a different approach when presenting the concept of micro-aggressions in the second session. Though this concept is widely recognised within the social justice sphere, we found that workshop participants were generally unfamiliar with the term. In presenting a novel concept that touches on subjectivity, our pedagogical approach was to present this concept in as objective a manner as possible. We highlighted research, gave examples from the literature and focused on the concrete effects on mental health that research indicates experiencing micro-aggressions can cause. We took this objective approach to this theoretical concept in light of a tendency we have observed in our context of those trained in science to question the validity of subjective experiences of exclusion. Essentially, we used a more participatory pedagogical approach to theory to validate participants' prior knowledge and engage them, while we used a more objective pedagogical approach to open participants' eyes to a subjective way of viewing classroom experiences that may not be familiar or comfortable for them.

To conclude, teachers have responded well to our less-is-more approach to theoretical content in the workshop, indicating in feedback sessions that they find the new terms useful. We are still improving our varied pedagogical approach to theory, with a focus on what our participants, with their diverse experiences of exclusion, might need and be able to use in order to make their teaching more inclusive. We would advise designers to follow the less-is-more approach, supplementing theory with authentic examples where possible, and to experiment with different pedagogical approaches to theoretical content. Questioning what your participants need, and checking to see what they are then able to use, will determine which concepts you include and how you pedagogically present them. In tandem, these two considerations help to achieve our design principle of “vocab for change”.

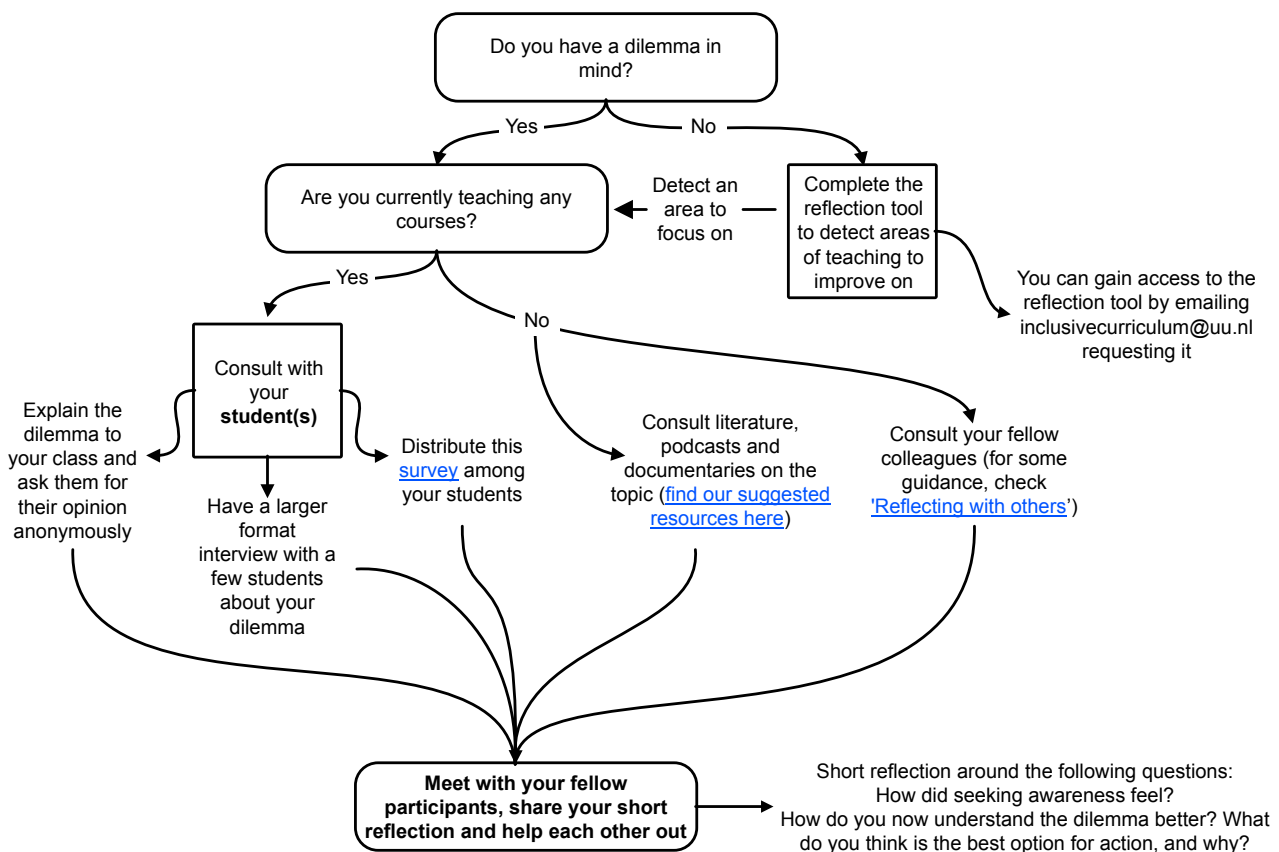
Taking Action

Given the danger of participants ending professional development workshops and asking “now what?” and the difficulty people experience in connecting theory around inclusion to taking action in their own context, we wanted “taking action” to be a part of the workshop. To achieve this, we incorporated an ‘assignment’ between the first and second sessions in which teachers had to identify an exclusion dilemma they had experienced and take action based on the reflective cycle ([Figure 2](#)): seek awareness to better understand the exclusion at play and consider implementing an option based on this. This seemed an obvious application of the principle of “making it real”. However, for workshop designers incorporating similar critical activities into professional development workshops, we caution that supporting and motivating participants to take action will require some careful design work.

First, it is challenging to design an activity that is both open and supportive enough to empower teachers to take action. During the design process, we made the aim of taking action more concrete in two specific ways. The first decision was to link this activity to the reflective cycle ([Figure 2](#)), and distinguish between implementing an option and seeking awareness. In the workshop, we make it clear that seeking awareness is the most important step, and that implementing the option is not obligatory. We support workshop participants to seek awareness by spending time in the first session discussing possible dilemmas, and provide tools such as a reflection tool, a curriculum scan, some informative resources, and a survey they can distribute to their students. The second decision was to encourage participants to talk to students as the ideal method for seeking awareness about

a dilemma they had experienced. We wanted participants to consult with other people in their work environment in a respectful and safe manner, and we realised that it was talking to students in particular that would give teachers the opportunity to apply ideas from the first workshop around taking students’ perspectives on inclusion seriously. In the current iteration of the workshop, we have developed a flowchart (Figure 3) in which consulting with students is presented as the obvious way to seek more information about a dilemma the participant has in mind. The flowchart gives participants the sensation of following concrete steps, which some teachers requested, but consulting with students is presented as the default way of seeking more information about an experienced dilemma. By giving the reader options for how to consult with students, the flowchart is still flexible, and by linking to resources such as the survey and the reflection scan, teachers are given even easier access to relevant resources.

Figure 3 – Flowchart given to teachers of recommended steps for taking action



Second, we wanted workshop participants to reflect on their own and others’ experiences, as some participants reported having valuable learning experiences completing this assignment. One teacher has given us permission to share their experience in this paper. An international student in their class had complained to the study advisor that they felt excluded because some extra course materials were in Dutch. For this teacher, raising a complaint to the study advisor felt like an insult to the teacher, an unnecessary escalation of a situation that could have been resolved in conversation. In carrying out the assignment, the teacher decided to speak to a current student of the same nationality to gain understanding of the cultural context around education. The teacher learnt a lot from the conversation: “I am now aware that there was a cultural mismatch between me and the student. I felt hurt by the fact [they] immediately wanted to file an official complaint, whereas this is the normal course of action for [them, in their cultural context]. [My current student] said that [they] feel quite comfortable to speak to me about problems [they] might have with the course or my teaching, but that that can differ per person. I think that I am aware now and will no longer feel hurt when this happens again”. In the

workshop, we wanted to give time and space in the second workshop session for participants to share such experiences of learning and connecting. Due to time constraints, the current iteration of this activity is a session in which one teacher's 'dilemma' is discussed in detail, and all participants are encouraged to consider ways to take action. Though this means that only one participant shares their dilemma in detail in the workshop, focussing on a single scenario means that we are able to consider it in depth, develop an inventory of options, and evaluate these. Further, as not every participant completes their assignment, this activity design enables all workshop participants to learn from each other.

Finally, an aspect of the activity design that we are iteratively improving is the intended learning outcome. When it comes to choosing a dilemma to focus on, we have noticed that participants either come to the first workshop with something already in mind, or never really enunciate a dilemma. For participants who have a dilemma in mind, this generally takes the form of a classroom experience in which they have a feeling that they did not respond adequately to a student who felt excluded. For these teachers, the assignment can prompt them to re-examine their dilemma, and speaking to students about this can give them a meaningful learning experience. For teachers who are unable to identify a dilemma of particular relevance within their own teaching, they may end up presenting a situation of exclusion in which they are happy with their own behaviour, do a scan of the course literature, or of course, not complete the homework assignment. As we feel that not being able to identify a true dilemma prevents workshop participants from completing the assignment as we intend it, we are discussing within the project team if we need to provide more support to help participants identify a dilemma or broaden our definition of the kind of action we want teachers to take. We currently support participants to choose a dilemma through discussion at the end of the first session, and in the flowchart ([Figure 3](#)). In future iterations of the workshop, we would like to improve this support, to better help participants take action safely and responsibly. We are aware of the potential power dynamics at play between teachers and students, and do not want to subject students to interviews with teachers who are not ready to hear what they have to say. Essentially, we would like this activity to become one in which teachers feel ready go out and discuss a dilemma they have experienced. Again, this speaks to a key challenge for social justice educators: tailoring activities to different contexts when aiming for knowledge transfer, but also tailoring activities to different levels of awareness and growth.

To conclude, we feel that taking action in one's own context is an important step to actively support within the workshop. For some participants this assignment and the resources around it support them to ask questions of students they are scared to ask and have meaningful learning experiences. However, we would caution designers that taking action is a challenging step, and activity design should take into account that workshop participants may not be ready to take action.

Discussion

Design Advice

In considering how aspects of our design approach might be more broadly applied across different contexts in EDI education and professional development, we wish to highlight three aspects of our workshop. We believe that these aspects could be applied in design for EDI education across contexts, but we have not yet had the opportunity to test this.

First, we suggest designing social justice education around authentic examples. Designing according to the principle “make it real” encourages participants to connect emotionally to these examples, and this emotional connection to content is what stays in people’s minds. We do not mean to conclude that every participant had a meaningful learning experience in our workshop, but for those who did, we believe that the authentic examples we framed as dilemmas were a key part. Though “authentic” can be a loaded term, we mean examples 1) that are based on real-life experiences as told by actors in your context, and 2) in which all actors have relatable intentions. Gathering and pedagogically framing authentic examples can be difficult, depending on the context. Within our university context, we gathered our examples from both interviews and research literature. It was not easy to find examples matching our context in the research literature, and it was not easy to find willing interview participants and earn their trust. Student assistants conducted the interviews, most of whom had some personal experience of exclusion that they could draw upon. Though this approach could work in different universities, it is likely that university teachers or other community members in positions of power by formal role or by demographic identities (e.g., older white men) would have to work harder to create an atmosphere of trust if they were to conduct interviews. For framing the examples pedagogically, we took the time to test examples in pilot sessions. We were able to clarify examples and remove examples that were too controversial. In the Netherlands, cultural norms around openness and directness mean that there were very few aspects of exclusion that we found too controversial. In other cultural contexts, balancing what is important to talk about with what might be safely supported in a discussion may be more complex.

Second, we only included theoretical concepts as workshop content when we were convinced of the added value of their inclusion, of their usefulness for participants in understanding and expressing experiences of exclusion, using concepts as a basis for action. Theoretical concepts are frequently presented in social justice education in a way that does not facilitate the connection of concepts to experiences; instead, they have the inverse effect of disengaging participants by associating what we are saying with overused and diluted forms of the concepts to which we are all exposed. We would encourage other designers to design based on the principle of “vocab for change”: take their own less-is-more approach to theory, and experiment with different pedagogical approaches. We believe that this approach could be particularly useful in similar disciplinary contexts to ours, when designing EDI education or professional development for people trained in science or a similar discipline. The research EDI education is based upon often differs epistemologically from the research a microbiologist has been trained to do, for example, meaning those trained in the sciences tend to find it difficult to accept subjective experiences of exclusion. It is important to account for this in content, but also on the level of a pedagogical approach. Furthermore, we think that uptake of theory – the degree to which a learner is able and willing to use the theoretical terms they have been exposed to – is an interesting avenue for measuring the effectiveness of workshops such as ours. We would like to see uptake of theory be used more in learning outcomes for EDI education, as well as formal assessments of the efficacy of EDI education.

Finally, we asked participants to take action in their own context as an assignment between the two workshop sessions. We know that talking to students about their experiences of exclusion is scary, which is why many participants do not do their “homework”. Ideally, our workshop would be one of many in which teachers are part of a Professional Learning Community that supports them as they start to seek more and more awareness and take action to make their teaching more inclusive. However, we still think it is important to include this assignment in the workshop: for those who are ready, it can also be a meaningful experience, and for us as designers, iteratively improving the balance

of support and freedom is a worthwhile experience. We think taking action is a learning activity that could be, and is, used in EDI education across contexts. However, our main caution is that when this involves relating to other, potentially marginalised people, designers need to be careful of what the principle of “making it real” should entail. Discussing experiences of exclusion can be uncomfortable or even harmful, and workshop participants should not be encouraged to go and talk to other actors until they are able to listen openly to what might be said and respond constructively. To resolve this challenge, a simplified version of the activity could be applied. For example, participants could be asked to discuss a dilemma from the workshop with a trusted co-worker, to see what they think and develop their own ideas further. This would work in professional development contexts at universities and organisations, and it could also work for younger students. We would encourage other designers to think about how to take the ideas raised in their educational experiences outside the classroom, turning engaging content and vibrant discussions into genuine social justice action.

Facilitation and Social Justice Pedagogy

As designers and workshop facilitators, this experience has also led us to reflect on effective pedagogy within the workshop, and the unique demands of being a social justice educator. Each workshop cycle was facilitated by a different pair of project members, creating a different mixture of age, experience, and identity in the facilitation team for each workshop. Other project members attended and acted as discussion moderators, enabling us to reflect on how different facilitators relate to and present the content differently.

A point of discussion among the team, as well as the complexities of making our workshop a so-called safe space, is the degree to which the workshop is a safe space for discussion moderators and facilitators. In the design process, when choosing examples and developing dilemmas, our personal experiences influenced the choices we made. We each felt it was most important to include experiences of exclusion that we could relate to in the dilemmas. As a consequence, the biggest difficulty that we as facilitators faced in this activity was responding to participants when they expressed fundamental misconceptions, invalidating the experiences of exclusion in the anecdote they were discussing. Gently pushing participants towards tolerance is difficult to do but was more difficult when the exclusion in question was one involving our personal experience. In the classroom, being able to speak to personal experiences can be a powerful didactic tool, but this does speak to a unique challenge faced by social justice educators: the need to represent both credible theoretical knowledge and authentic personal experiences. Pedagogical content knowledge ([Shulman, 1987](#)) for social justice education, we suggest, relies on both ([Dyches & Boyd, 2017](#); [Hahn Tapper, 2013](#); [Sensoy & DiAngelo, 2014](#)). This level of vulnerability can be challenging, and an ongoing discussion within the project team is the degree to which we feel comfortable using our personal experiences in the classroom, as well as the focus and depth of our theoretical knowledge. The question is to what extent we as facilitators need to model vulnerability and openness if we are asking this of participants, and then, whether to respond to an invalidation of our personal experiences by countering it theoretically or based on a personal anecdote. We are still working out what a brave space can look like, how to communicate that, and how to be the best social justice educators we can be, while also not feeling unable to commit mistakes and learn ourselves.

Conclusion

In this paper, we spelled out the main design considerations of a professional development workshop in which we aimed to improve participating university science teachers' understanding of inclusive science teaching. Instead of "just another bias training" (Reinholz et al., 2022), we took as a starting point teachers' passion for teaching their scientific disciplines and interest in understanding student experiences. The collaborative design process was a learning experience for all project members, and we appreciate the opportunity to grow collectively. This took time and commitment, and without the early months of exploration, this project would not have been the same. We have enjoyed the opportunity to reflect on social justice pedagogy, on the difficulties of conceptualising and measuring the success of social justice education, and on how best to design for justice and belonging. Our design principles of "making it real" and "vocab for change" have made their way into our own vocabularies, and we hope to take these with us into future projects.

The project has not been without its challenges. A key difficulty has been attracting participants, as the workshop is currently an optional activity for staff. Given the time pressure university staff are under, we do not think this will be resolved until university teachers are supported to take part in our workshop, either by having the time accounted for under professional development hours, or a similar benefit. A second difficulty has been the reliance on student assistants and research officers, which is common among innovation projects in Dutch universities, as more senior staff members are under considerable pressure and lack the time. Though the perspective of project members who were recently students has been informative and important for our project, student assistant and research officer roles are temporary positions that do not lead to fulltime job opportunities (Casual Academy, 2022), meaning that we lose project members and the expertise they have built up. In the future, we hope to attract the funding to continue running the workshop, and the support to be able to feed our design advice into the university's lecturer training program for university teaching qualifications or make the workshop obligatory to committee members recruiting new staff.

To conclude, the breadth of the EDI landscape means that far more than a single workshop is necessary to educate committed teachers about manifestations of exclusion in the curriculum, instruction and interpersonal relationships, and how societal issues and specific disciplines contribute to these. The effect of short-term initiatives such as our workshop is undoubtedly less than those of longer-term, relationship-based initiatives with permanent funding. We hope that more departments will think about how EDI issues manifest in their specific disciplines and educational programmes, and link inclusion work to experiences of exclusion. Moreover, we hope that workshops such as ours will become standard elements of programmes for school and university teaching qualifications. Finally, we wish to thank all workshop participants to date. We are grateful for your time and openness, and hope you see yourselves and your experiences reflected in this paper.

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Appendix A – Learning Aims and Design Principles

Learning Aims

- Appreciate the importance of inclusive science teaching within the Faculty of Science at the university
- Appreciate different and intersecting aspects of diversity
- Develop understanding of areas of the classroom (class, curriculum, communication) and how these can be more or less inclusive (not a binary)
- Analyse “situations” in depth and develop understanding of the underlying power structures at play within science teaching and knowledge creation
- Seek awareness to deepen your understanding of a “situation” you have experienced as a science teacher, developing the confidence to engage in this process
- Develop understanding of making your teaching more inclusive as a reflective cycle, as occurring both proactively and reactively, and with “more inclusive for more people” as the aim and resources that can support this
- Openly share experiences and connect with other teachers on this topic

Design Principles

- “Make it real”. Use real examples, apply this to your own context, actually do something with the knowledge, ask hard questions, be honest, share personal things.
- “Vocab for change”. Effecting change by connecting people and giving them the vocabulary to understand experiences they might not have previously, and take this out into the world.
- Students as partners, all participants in the learning experience able to be whole human beings, so everyone can ask for help, ask questions, and be a learner.
- Reflective continuous improvements, no right answers, so building confidence and motivation to trust your gut but not need to be an expert, be a confident learner.

Appendix B – Workshop Outline

Session 1

Time	Activity	Summary of Script
11:00 – 11:15	<p>Welcome</p> <p>Aim: connect participants, start thinking about experiences of exclusion, get everyone on the same page about the workshop, commit to safe space</p>	<p>Ice breaker question: Where does your name come from? Is there a meaning behind your name?</p> <p>Introduce purpose of workshop</p> <p>Safety statement: EDI related issues can be very sensitive topics because they relate to individual's emotions and identities. During this workshop we will be tackling some of these issues and we want to give you the space to share your own personal experiences and doubts. We want to acknowledge that some of these discussions might be uncomfortable because in wanting to be reflective, critical and making changes, friction is likely to emerge. However, our wish is to welcome this uncomfortableness and tackle it to learn from it.</p> <p>This is a safe space where we all collectively commit to being open to everyone's experiences without judgement. Feel free to share with the group whatever you wish. We value freedom of speech, but what people say can also hurt. We can all learn from each other; we have all made mistakes and have all approached situations differently. If at any point you would like to take a moment outside or step away from a discussion, don't hesitate to ask any of the facilitators for a time-out.</p> <p>Are you all willing to commit to work in this way? [ask everyone's yes?]</p> <p>Ask participants if they have any burning issues that they would like to bring up or specific reasons they wanted to come.</p>
11:15 – 11:30	<p>Definitions</p> <p>Aim: strengthen knowledge and understanding of inclusion in our faculty, what is occurring and why, and why inclusion is important for science</p>	<ul style="list-style-type: none"> Inclusive teaching <p>Explanation of inclusion, science, NL, tertiary education, our faculty</p> <p>Highlight inclusion and exclusion as subjective experiences, spectrum</p> <p>Highlight value of inclusion for science and for all members of the faculty of science</p> <p>Discussion</p> <p>Testimony: Facilitator shares with a participant a paper and asks them to read them out loud:</p> <p>Amina used to be a physicist. She did a physics Bachelor's in Turkey, did her master's and PhD in the USA, and was a lecturer in the Netherlands for four years. Then she quit. The reason for ending her physics journey was an accumulation of experiences of exclusion and a lack of sense of belonging. During her study there were hardly any female students or teachers. Later she was often asked: "How come you study physics if you are Muslim? Aren't physicists atheists?" These are just two examples to explain why she felt she did not belong to the physics community despite her passion for the discipline. Quitting was not only a personal drama but also a loss of a role model for female, Muslim and migrant people interested in physics.</p> <p>(This is a summary of a real case described by Avraamidou, 2020, 2021)</p> <ul style="list-style-type: none"> Frequency, intersectionality <p>Explanation</p>

Time	Activity	Summary of Script
11:30 – 11:45	<p>Reflective Cycle</p> <p>Aim: start to conceptualise how we are going to try to make your teaching more inclusive</p>	<p>Presentation and explanation of Reflective Cycle</p> <ul style="list-style-type: none"> • Experience and understand a dilemma <p>“A student of yours points out in the course evaluation that they believe the literature of the course is limited because it mainly represents one cultural perspective”</p> <p>Present questions to ask</p> <ul style="list-style-type: none"> • Seek Awareness <p>Present methods and questions to ask, discuss methods for example dilemma</p> <ul style="list-style-type: none"> • Consider options <p>Present developing options and questions to ask, discuss options for example dilemma</p> <p>Example options:</p> <ul style="list-style-type: none"> • In the first option where you consider it is not a generalised issue, the student in question feels their opinion is dismissed, not valued, less inclined to take and give feedback seriously in the future -> Future students will feel that research in other countries is less valuable and that technological innovations from abroad less worth researching. • The second option where you reconsider your literature list, student in question feels their opinion is valued, that their feedback is important and taken seriously. Future students will feel that research in other countries is valuable and that technological innovations from abroad worth researching.
11:45 – 12:00	BREAK	
12:00 – 12:40	<p>Enacting Reflective Cycle</p> <p>Aim: start to use the first steps in the reflective cycle, experience the step of understanding a dilemma with the support of fellow participants and discussion moderator</p>	<p>Integrating knowledge – activity around each step of the cycle, utilise the framework and vocab that corresponds to each step in the cycle</p> <p>Dilemma 1: You notice that students from non-dominant backgrounds in your class are repeatedly isolated and find it difficult to form groups for assignments.</p> <p>-> Non-dominant background left intentionally vague and raises the question of what is considered non-dominant in the field of science. Issues of gender inequality and discrimination may be more visible and/or easier to speak about because they have been further accepted than other issues for instance related to race, religion and neurodiversity.</p> <p>Dilemma 2: In a teacher meeting it is mentioned students who have Autism and AHDH experience struggle keeping up with class assignments and classroom dynamics but do not feel comfortable to share this with their teachers. Instead, they only discuss this with their study advisors, who are unable to make adjustments in class for them. This leads to these students not having the same learning opportunities as some of their peers.</p> <p>-> What is happening here? University has several ways in which it does gatekeeping and remains inaccessible for some people. Arguments such as "you need to keep up, otherwise maybe you should ask yourself whether you belong here" invalidate the individuals who are bringing this concern up. The reality is what for different reasons (in this case neurodiversity related struggles), students in your class struggle to keep up and in consequence, are having less learning opportunities, will gain less from a lesson than other students.</p>

Time	Activity	Summary of Script
		<p>-> Relevant questions? How do you conceptualise your role as a teacher? How far are you willing to go to accommodate for your students? What kind of consequences could this have on your students and future students? At which point are we no longer willing to make adjustments (if a student at the back of the classroom asks you to speak up, would you do it?). What do students need in order to learn?</p> <p>Step 1 Activity (15mins):</p> <p>Each group gets a different dilemma, and they work on the guiding questions using a flipboard (perhaps: visualising the different actors and how they feel, how they are impacted). These are open cases, you might have to assume things about it.</p> <p>Highlight role of ‘source’ in how different dilemmas come about.</p> <ul style="list-style-type: none"> • A student tells you... • You overhear students in class... • A colleague of yours who is an expert in inclusive biology suggests... • A study advisor tells you... • The head of your department tells you... <p>Harvesting at the end: Each small group does a small presentation with flipboard. Tell everyone to ask questions – you’ll need to understand this dilemma for next activity. The facilitators fill-in the blanks.</p> <p>Step 3 Activity (15 mins): Presentation of spectrum of options (alone/collab, do nothing/do everything), and guiding questions to ask when choosing options. Discuss potential drawbacks of making your teaching more inclusive. Introduce concept of frequency of a dilemma. If a given situation is an isolated event, your options might be different than if this is a situation that has occurred multiple times.</p> <p>Go back into groups, get given the third dilemma, and come up with at least three valid options. Then, present two of these to the group, two distinct but also valid options, and ideally, with different members of your group wanting to choose different options.</p> <p>Harvesting: Each small group shares their two options and why.</p>
12:40 – 12:50	<p>Assignment</p> <p>Aim: participants understand what they are being asked to do and feel prepared to go out and take action, seeking awareness.</p>	<p>Before the next session we would like to ask you to partake in a flexible project in which you chose an aspect of your own teaching to focus on and make more inclusive.</p> <p>Participants take a dilemma that they have identified in the first workshop and choose how to seek awareness (steps 1 and 2), based on relevance and feasibility.</p> <p>Participants will write a reflection about this process, answering the following questions: how did seeking awareness feel? How do you now understand the dilemma better? What do you think is the best option for action, and why? We will pair participants up, and ask them to share with their partner how they intend to seek awareness, meet to discuss this, and read each other’s reflection before the next workshop.</p> <p>Facilitator checks that everyone 1) understood the assignment 2) that everyone has a dilemma. If someone does not have a dilemma in mind, facilitator encourages to complete the reflection tool.</p>

Session 2

Time	Activity	Script
10 min 11:00 – 11:10	Icebreaker	<p>Last time: we did discuss definition EDI + testimonies and reflective cycle + people were seeking awareness on some real-life dilemmas on inclusive science teaching</p> <p>Safety: EDI related issues can be very sensitive topics because they relate to individual's emotions and identities. During this workshop we will be tackling some of these issues and we want to give you the space to share your own personal experiences and doubts. We want to acknowledge that some of these discussions might be uncomfortable because in wanting to be reflective, critical and making changes, friction is likely to emerge. However, our wish is to welcome this uncomfortableness and tackle it to learn from it.</p> <p>This is a safe space where we all collectively commit to being open to everyone's experiences without judgement. Feel free to share with the group whatever you wish. We value freedom of speech, but what people say can also hurt. We can all learn from each other; we have all made mistakes and have all approached situations differently. If at any point you would like to take a moment outside or step away from a discussion, don't hesitate to ask any of the facilitators for a time-out.</p> <p>Are you all willing to commit to work in this way? [ask everyone's yes?]</p> <p>Facilitator welcomes participants and addresses them by their names</p> <p>Facilitator introduces icebreaker, one facilitator starts and the other finishes</p> <p>What is a piece of advice regarding teaching that has stayed with you?</p>
15 min 11:10 – 11:25	Microaggressions	<p>Explanation of microaggressions: definition, effects, examples from our context</p>
45 min 11:25 – 12:10	Fishbowl discussion	<p>Facilitator explains the fishbowl design:</p> <p>We will make two or three groups that will be the inner circle, ie. The main speakers, on a particular dilemma. The inner circle will do the main discussion about a dilemma with some guiding questions from the moderator to get them into different realms</p> <p>The outer circle will all be listening to the inner circle and making mental notes of the points they agree with and anything the inner circle missed</p> <p>Once the conversation in the inner circle has started to slow down, the moderator will ask everyone to return to the outer circle So that everyone is on the same outer circle, and then invite input from the listeners</p> <p>Another round of dialogue involving all participants may take place</p> <p>Once this has slowed down, or time is up, the moderator will ask the harvester to give a summary and talk over any points that were missing/unsaid</p> <p>Then, if there is time, move to the next dilemma and repeat.</p> <p>Possible Dilemmas to use in fishbowl (2):</p> <p>"A group of four male students and one female student is giving a presentation on their finalized group project for your class. Part of the presentation is stating each group member's role in the project. The main speaker (male student) firstly states each male's student role, who – it becomes clear – were each in charge of a part of the mathematical coding. Finally, he states that the female student member of their group was "kind of their secretary," saying she took care of planning, communication, and the power point presentation"</p>

Time	Activity	Script
		<p>2. In a statistics class a student had to read a few articles from white western authors. in the tutorial student asks the teacher why the course did not offer any research from non-Western scientists? The teacher responded with: "Do you know who wrote these articles? They're famous."</p> <p>Guiding questions coming from the reflective cycle:</p> <ul style="list-style-type: none"> • What is going on here? Why is this related to inclusion? • Who are the actors? How do they feel? • Why might they be feeling like this? • From which perspective is this dilemma being raised? • Which method may be more suitable to your dilemma? • Which method may elicit insights? • What are the possible options to address this dilemma? <p>Main points:</p> <p>Dilemma 1</p> <p>Group roles were given according to stereotypes. The term secretary can imply activities that are less valued. Students might potentially be robbed of the opportunity to learn/practice other sets of skills. Even if female student is part of the decision of role division, we might want to ask ourselves, why might she only be comfortable within this role? Why did the male students not complete the secretary roles? Options included: ask members of the team how the role division was made and argue the reasons behind it? Reflect and interrogate yourself regarding the other actors involved not only the 'victim' role.</p> <p>Dilemma 2</p> <p>Student who brings this up is dismissed and put on the stop for raising a valid point. Student is less likely to be critical or at least to voice opinions in the future. This is also the case for witnessing students and future students.</p> <p>Option included: acknowledge students' emotional state and respond accordingly. Interrogate the notions of fame and whether this equates truth or quality. Asking students to be critical themselves of the materials they read. Turn it into a learning opportunity and ask students to bring other perspectives. Acknowledge the context, situatedness and history of topic discussed or read about.</p> <p>5 minutes discussion fishbowl</p> <p>5 minutes after talk</p> <p>5 minutes fishbowl II</p> <p>5 minutes after talk</p>
<p>10 mins 12:10 – 12:20</p>	<p>Break</p>	
<p>40 mins 12:20 – 12:55</p>	<p>Intervision Homework</p>	<p>Participants split into 2 groups. One facilitator moderates the InterVision in one group and the other with the other group.</p> <p>Facilitators explains the purpose of the activity: everyone is going to share the dilemma they focused on for their homework. Together we analyse and evaluate this dilemma in depth, to come to new approaches, solutions and insights. The goal of this InterVision is for teachers exchange experiences from educational practice with each other and to increase confidence to address dilemma.</p> <p>Facilitator asks each participant to read out/explain their dilemma from homework.</p>

Time	Activity	Script
		<p>Step 1: Selecting dilemma- Then in each group, participants will choose (will vote) which dilemma will be discussed based on recognizability among the other participants or based on feelings of urgency of the person who introduced the problem.</p> <p>Step 2: Informing and analysing dilemma: Participant whose dilemma has been chosen explains more about the situation and their results from the process of seeking awareness. Other participants get to ask questions to clarify.</p> <p>Step 3: Brainstorming about solutions – All participants individually think of solutions for the dilemma; - An inventory of solutions is made, without a discussion about these solutions.</p> <p>Step 4: Evaluation of the solutions – The participant who introduced the dilemma gives an opinion on the solutions that the group had come up with. Is there something that could help them?</p>
10 mins 12:55 – 13:00		<p>Recap the learning goals and what has been achieved:</p> <ul style="list-style-type: none"> • Appreciate the importance of inclusive teaching within the Faculty of Science at the UU • Appreciate the different and intersecting aspects of diversity • Develop understanding of areas of the classroom (class, curriculum, communication) and how these can be more or less inclusive (not a binary) • Analyse “situations” in depth and develop understanding of the underlying power structures at play within Science teaching and knowledge creation • Develop understanding of making your teaching more inclusive as a reflective cycle, as occurring both proactively and reactively, and with “more inclusive for more people” as the aim and resources that can support this • Openly share experiences and connect with other teachers on this topic

Appendix C – Dilemmas formulated for the workshop

1. A student of yours points out in the course evaluation that they believe the literature of the course mainly represents one perspective (“western”)
2. A student tells you in an informal conversation that grouping students based on nationality for team projects (Dutch vs. International) in order to support language abilities, makes non-Dutch students feel excluded
3. While grading a group assignment, you notice that a group of four split tasks so that the three boys did all the coding and more mathematical work, while the one female student in the group is described in the overview as the “secretary”, and her tasks included planning, communication, writing and formatting.
4. A study advisor tells you that you shouldn’t have a participation grade in your course because not all students feel comfortable speaking up in class: some have social anxiety, some aren’t used to it being acceptable to question a teacher in a classroom, some are simply introverted
5. A student comes to you and tells you that they are unhappy that a class discussion on evolution did not involve any recognition of religion. They felt that this harmed the quality of education, and made them feel personally excluded.

6. You notice that students from a non-dominant background don't seem to chat to white Dutch students during the breaks, don't seem to join in with their jokes, and struggle to form groups for group assignments.
7. From a focus group conducted with first-generation university students in the faculty, you hear that some students find your lectures hard to understand and jargon-heavy.
8. A student comes to you in the mid-class break and is worried about their participation grade/progress grade. They say that they always come prepared and do have things to say, and would like to say them, but it's always X that speaks and I don't feel comfortable talking over X. X is a male Dutch white boy who you have always seen as a good contributor, but this student experiences X as a dominator.
9. Whilst conducting an internship, a student grows increasingly disillusioned that the work they are producing will only contribute to a specific industrial sector, they notice that many other student projects and research groups in the department have also been earmarked for these purposes. How do you explain this way of doing science?
10. A female student asks you a question about an equation in a seminar but keeps interrupting you to say that she does understand when you are trying to answer her question. You don't understand why she is not accepting the help she asked for, and she doesn't engage for the rest of the lesson.

About the Authors

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Dr. Miriam de Boer (m.deboer@uu.nl) is an educational consultant and trainer at Utrecht University. Her areas of interest include (acquisition of) research skills in and outside academia. In her work, she hopes to support teachers and university staff to create an inclusive learning environment where all students feel they belong and can grow to their full potential.

Chahida Bouhamou is involved as a project leader in various projects aimed at supporting (future) first generation students from upper secondary education to higher education. Her areas of interest include inclusive education, hidden curriculum, equal opportunities in education and a sense of belonging.

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